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VOLUNTARY GUIDELINES ON THE MARKING OF FISHING GEAR

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A framework for conducting a risk assessment for a system on the marking of fishing gear

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Preparation of the document

This document was prepared by the authors as a tool for assisting implementation of *Fishing Gear* (VGMFG; FAO, 2019)[1]. The document was developed as a result of a pilot project in Grenada funded by the Government of the Kingdom of The Netherlands through the project *Reducing Ghostfishing and Marine Litter in Latin America and the Caribbean* (GCP/GLO/018/NET-F). We would also like to thank Roland Baldeo of Grenada for organizing a workshop and participants of the workshop for their contribution for piloting the framework.

[1] FAO. 2019. *Voluntary Guidelines on the Marking of Fishing Gear*. Rome. Fao.org/3/ca3546t/ca3546t.pdf

Abstract

This document is a supplement to *Fishing Gear* (VGMFG; FAO, 2019)[2], and provides a framework for conducting a risk assessment to assist in determining the need for, and requirements of, a system for the marking of fishing gear. The development of this document was based on principles outlined in the Annex of the VGMFG and guided by the results of a pilot project for risk assessment on the marking of fishing gear conducted in Grenada. The marking of fishing gear contributes to sustainable fisheries, improving the state of the marine and freshwater environments by combatting, minimizing, and eliminating abandoned, lost or otherwise discarded fishing gear (ALDFG); it also facilitates the identification and recovery of such gear. In addition, fishing gear marking supports fisheries management and can be used as a tool in the identification of illegal, unreported and unregulated (IUU) fishing activities. This manual is intended to assist fisheries managers, fishing gear manufacturers and the fisheries sector to meet the relevant international, regional or national obligations for gear marking. More specifically, it enables all stakeholders to comply with the specific gear marking requirements outlined in the FAO Code of Conduct for Responsible Fisheries, as well as in other international instruments and agreements. Organizations or parties concerned with, or actively addressing the issue of ALDFG may also find the information in this publication useful.

[2] FAO. 2019. *Voluntary Guidelines on the Marking of Fishing Gear*. Rome. Fao.org/3/ca3546t/ca3546t.pdf

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Abbreviations and acronyms

aFAD	anchored fish aggregating device
ALDFG	abandoned, lost or otherwise discarded fishing gear
dFAD	drifting fish aggregating device
EEZ	exclusive economic zone
ETP	endangered, threatened or protected (species)
FAD	fish aggregating device
FAO	Food and Agriculture Organization of the United Nations
GGGI	Global Ghost Gear Initiative
IMO	International Maritime Organization
ISSCFG	International Standard Statistical Classification of Fishing Gear
IUU	illegal, unreported and unregulated (fishing)
MARPOL	International Convention for the Prevention of Marine Pollution from Ships
MCS	monitoring, control and surveillance
UN	United Nations
VGMFG	Voluntary Guidelines on the Marking of Fishing Gear

Abbreviations for plastic materials

PA	polyamide (nylon)
PE	polyethylene
PES	polyester
PP	polypropylene
PUR	polyurethane
PVC	polyvinyl chloride

1. BACKGROUND AND PURPOSE

1.1 Background

Fishing gears are marked to establish their ownership and legal use, to indicate their position as an aid for navigation, and to reduce conflicts between gears. They may also be marked to indicate a gear's origin when it becomes entangled in marine wildlife, or when drifting at sea, or beached as marine litter. Gear marking is considered an important tool for combatting, minimizing and eliminating abandoned, lost or otherwise discarded fishing gear (ALDFG); and by reducing the hazard to navigation caused by ALDFG it contributes to improved safety at sea, while also helping to identify illegal, unreported and unregulated (IUU) fishing (FAO, 2019).

The Food and Agriculture Organization of the United Nations (FAO) has been developing guidelines for the marking of fishing gears since the early 1990s. The Voluntary Guidelines on the Marking of Fishing Gear (VGMFG) were endorsed by FAO Members at the Thirty-third Session of the Committee on Fisheries, in July 2018. The VGMFG provide guidance on a risk-based approach for implementing a system for the marking of fishing gear. The principles for a risk assessment for the marking of fishing gear, contained in the VGMFG's Annex, are attached as Appendix I.

Fishing gear marking contributes to more sustainable fisheries by facilitating the reporting and retrieval of ALDFG in order to reduce marine litter and its impact on living marine resources and habitats. Applying a system for the marking of fishing gear is also intended to provide means of identifying the ownership and legality of fishing gears in the context of broader fisheries management measures; such measures support sustainable fisheries and healthy oceans by reducing plastic pollution, controlling fishing effort, ensuring fishing is legal, and combatting IUU fishing.

In this document, the definition of fishing gear as provided in Annex V of the International Convention for the Prevention of Pollution from Ships (MARPOL) is adopted:

> *A fishing gear is any physical device or part thereof, or combination of items that may be placed on or in the water or on the seabed with the intended purpose of capturing or controlling for subsequent capture or harvesting marine or freshwater organisms (IMO, 1978).*

Fish aggregating devices (FADs) are not strictly fishing gears, but an auxiliary gear that may increase fishing efficiency for the main gear they are associated with (He *et al*., 2021). Considering the importance and the quantity of FADs used in tuna purse seine and other fisheries, a risk assessment for the marking of fishing gear should include both anchored FADs (aFADs) and drifting FADs (dFADs).

Fishing gears that are abandoned, lost or discarded due to a variety of reasons are collectively referred to as abandoned, lost or otherwise discarded fishing gear (ALDFG). The *Voluntary Guidelines on the Marking of Fishing Gear* authoritatively define ALDFG as:

> "**Abandoned fishing gear**" means fishing gear over which that operator/owner has control and that could be retrieved by owner/operator, but that is deliberately left at sea due to force majeure or other unforeseen reasons.
>
> "**Lost fishing gear**" means fishing gear over which the owner/operator has accidentally lost control and that cannot be located and/or retrieved by the owner/operator.
>
> "**Discarded fishing gear**" means fishing gear that is released at sea without any attempt for further control or recovery by the owner/operator. (FAO, 2019)

The marking of fishing gear may reduce the loss of fishing gear and help identify and trace all types of ALDFG.

1.2 Purpose

The purpose of this document is to provide a framework for conducting a risk assessment to assist in determining the need for, and requirements of, a system for the marking of fishing gear. The development of this document was based on principles outlined in the Annex of the VGMFG (attached as Appendix I) and guided by the results of a pilot project for risk assessment

on the marking of fishing gear conducted in Grenada. This document provides examples of how to identify the risks associated with various fishing gears if they are not marked – or not adequately marked – both under normal operating conditions and once they become ALDFG. It also provides the means for estimating the likelihood of occurrence for the risks identified for different fishing gears. Additionally, a method for estimating scores for different impacts, as well as combined impact scores, has been developed. This allows the risks associated with different gears to be categorized according to their likelihood of occurrence and potential impacts. Based on these risk scores, the priorities for implementing gear marking, and the complexity thereof, can be identified.

2. GENERAL CONSIDERATIONS FOR A RISK ASSESSMENT

Based on the *Voluntary Guidelines on the Marking of Fishing Gear* (FAO, 2019), the determination of risk levels involves four primary steps:

- estimation of the consequence (impact) of the lack of a gear marking system (or an inadequate marking system) in the fishery under consideration;
- estimation of the likelihood of occurrence (probability) of the identified impacts/risk occurring as a result of the lack of a gear marking system (or an inadequate marking system) in the fishery under consideration;
- scoring the risk, which may be determined by the nature and design of the gear, and modified by the stakeholders' perceived importance of impact; and
- categorization of the risk.

Both actively fished gears and lost, abandoned or otherwise discarded fishing gear (ALDFG) should be considered for risk assessment. The parameters that need to be considered for consequences and impacts should include, but not be limited to:

- Ecological risks: plastic pollution, status of species impacted – e.g. ghost fishing, impact on endangered, threatened or protected (ETP) species, habitats vulnerability and fragility.Economic risks: replacement cost of lost gear, level of fishing effort, value of the fishery, economic nature of the fishery – e.g. subsistence, artisanal, small-scale, industrial, IUU fishing, and cost of implementation.
- Technological risks: gear types, number of gear units, number of vessels, method of operation.
- Safety and navigational risks: risks to the vessel operating the gear, other fishing vessels, and non-fishing vessels.
- Implementation risks: different users, language, level of organization, availability of information and the quality of information; international, regional and local expert support.

Determining a risk level requires estimates of the consequences (impact) and likelihood of occurrence based on best available science, local ecological knowledge, and stakeholder input. To be able to defend estimates, a clear

rationale be provided on how estimated levels were chosen so that the determination can be traced and verified. Regional standardization is desirable, but fishery- or location-specific criteria are possible if justifiable. A clear rationale also provides a basis on which future assessments can be made. The information, data and input of both experts and fishers, gathered and consolidated through the initial scoping exercise form the basis for that rationale, with additional information provided where appropriate and necessary.

2.1 Technology readiness

There are a variety of existing fishing gear marking technologies, and new technologies are being developed and/or introduced with the advancement of electronics and communication technologies and infrastructure (He and Suuronen, 2018). However, there are significant disparities between regions and nations. A risk assessment should therefore include an assessment of the feasibility of implementing a system for the marking of fishing gear with regard to the fisheries, region or nation(s) where the system will be implemented. Accordingly, the risk assessment should consider the following:

- Is the technology associated with the system feasible in the context of the fishery, region or nation(s)?
- Will the technology mature (or become obsolete) over time?
- Are there any technical barriers to integrating capacity within the system?

2.2 Economic considerations

In terms of economic considerations, the following questions may be considered:

- Is the technology (including any associated costs) fit for purpose?
- Do the countries, regions and/or regional fishery bodies in question have the administrative capacity and financial resources to implement and monitor the system?
- What capacity-building needs should be considered (both in terms of administrations and fishery operators) when implementing a system for the marking of fishing gear?

Due to disparities in the economic development of nations and regions, the implementation of a system of fishing gear should include capacity-building efforts and financial assistance where necessary for developing countries; this especially true for least developed countries (LDCs) and Small Island Developing States (SIDS).

2.3 Transparency and stakeholder involvement

Risk assessments and the associated decision-making (prioritization or exemption) should be carried out in a transparent fashion and follow written rules of procedure. Arrangements for conducting risk assessments and their consequent decisions should be carried out with balanced participation from independent technical experts, as well as the representatives of parties (stakeholders) interested in the system's development, revision and approval processes. Stakeholders for risk assessments – and the development of the gear marking systems that ensue from them – may include, but are not limited to:

- gear designers/manufacturers;
- fishers/fisheries organizations;
- port operators;
- fishery managers and inspectors;fisheries researcher;
- seafood certification holders;
- seafood companies;
- non-governmental organizations;
- development/funding agencies;
- fishing community/consumers.

Once a risk assessment has been completed, it should be published promptly and where possible be made available to the public electronically.

2.4 Assessing the impact of implementing a gear marking system

An impact assessment should examine the impact of implementing a gear marking system for different gear types, by fishery and region. Such impacts may include:

- Economic: The cost of implementing the system should be evaluated and the entity (or entities) responsible for different components of implementation should be identified. The cost and responsibility for the replacement of marks should be determined.
- Technological and operational: The technological risk of the proposed marking system should be assessed with respect to reliability, durability and user-friendliness. The effect of marks on fishing performance and gear operation should be evaluated. Technological readiness, maturity and advancement should also be assessed to identify whether the technology will become obsolete in the foreseeable future.
- Safety: The level of risk that proposed gear marks present to fishers' and/or other ocean users' safety at sea should be evaluated.

3. STEPS FOR CONDUCTING A RISK ASSESSMENT

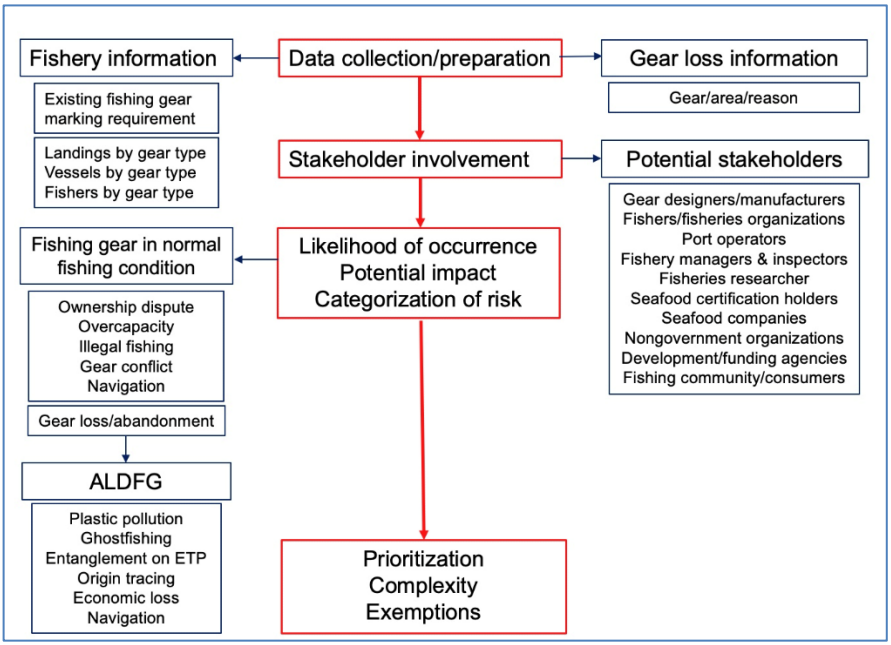
The process for conducting risk assessment for the marking of fishing gear should start with the identification of scope, area, fishery and gear to be assessed. Existing gear marking requirements in national and regional fishery regulations or laws should also be assessed, as well as any recommendations or requirements for gear marking that are relevant to the fisheries – i.e. measures adopted by regional fishery bodies (RFBs).

This should be followed by the collection of fishing gear data, landing data and gear loss data, in addition to where and when loss has often occurred (hotspot identification).

Thereafter, the process should involve a variety of stakeholders, often through stakeholder surveys, workshops or other similar mechanisms. Working on a consensus basis, and drawing on scientific and technical information as well as fishers' knowledge and experience, stakeholders identify the types of risks present when a gear is not marked or not properly marked. This applies both to fishing gears in normal fishing conditions and gears that have become ALDFG. One important aspect of stakeholder input and consensus is valuing the reduction of specific risks associated with specific gears relevant to the area, or the importance of reducing different types of risks. This is partly based on geographic location, ocean environment, economic conditions and personal or community perceptions. For example, stakeholders in different regions may value the economic consequences of losing the gear more than the ghost fishing that results from gear loss.

A risk assessment for the marking of fishing gear involves the four steps illustrated in Figure 1. The centre part outlined in red indicates these four major steps, while items on either side provide additional information and examples for the risk assessment.

Figure 1. Framework for conducting a risk assessment for a system on the marking of fishing gear



Source: Elaborated by author.

3.1 Data collection and preparation

The first necessary step for a risk assessment for the marking of fishing gear is to collect data relating to the fishery or fisheries in which the gear marking is to be implemented. This includes: the identification of types of fishing gear in use in the area; the number of vessels using different gears; landings from different gear types; and the number of fishers using the gears. This information determines the relative importance of different gear types in the region.

The total number of fishing vessels using a particular gear type, as well as the landings by gear type, may be obtained from fishery management authorities and listed as in Appendix III. However, gear specifications may need to be obtained from surveys of fishers and/or gear manufacturers.

Templates/forms for the data collection of different gear types are provided in Appendix IV (1–10). These forms provide for the collection of minimal data requirements for specific gear types that are to be assessed.

When identifying fishing gear types, the 2016 revised FAO International Standard Statistical Fishing Classification of Fishing Gear (ISSCFG) should be adopted. Guidance on classification and gear names is provided in the FAO report *Classification and illustrated Definition of Fishing Gears* (He *et al.*, 2021). Regional or national classification schemes may also be used if desired.

In addition, the dimensions and/or quantity of gear, as well as the types of plastic material used in the construction of each gear type, should also be collected.

When there is a large number of vessels using a particular gear type, the subsampling of a selection of vessels/fishers may be sufficient. Here the first step involves gathering data on the number of vessels/fishers in different regions/communities from the relevant competent authority. Subsampling may demand stratifications by region and/or vessel size, in order to ensure that data gathered for fishing gears are representative.

For example, when conducting the risk assessment for Grenada fisheries, nine types of fishing gear (including eight types of fishing gear and one type of FAD) were identified, and detailed data on these gears were collected.

Table 1 illustrates the ranking of importance (scaled from 1 to 5) of these nine fishing gear types on their operational characteristics (attended or unattended, Column B), and the types and amount of plastic in the gear during each operation (scaled from 1 to 5, Column E). The "overall plastic amount" (Column F) considers the importance of gear types, and is the product of Column C and Column E. The Column G rescales the data in Column F to 1 to 5, using the following formula:

$$Y = (X - X_{min}) \times (5 - 1) \div (X_{max} - X_{min}) + 1$$

Where Y indicates rescaled data (Column G), X indicates data before rescaling (Column F), while X_{min} and X_{max} are the minimum and maximum values in Column F.

Table 1. Types of fishing gears used in Grenada, their operational characteristics, relative importance, plastic material types and amounts.

A	B	C	D			E	F	G
Gear type	Operational characteristics	Relative importance (1–5)	Plastic materials			Plastic amount (1–5)	Overall plastic amount	Rescaled overall plastic amount
			Netting	Rope/line	Float/ buoy			
Beach seine	Attended	3	PA	PA, PP	PVC	5	15	3
Set gillnet	Unattended (1)	4	PA	PP	PVC, PUR	4	16	4
Pot	Unattended (1)	3	PE	PP	PVC	2	6	2
Handline	Attended	5	-	PA	PVC	2	10	3
Set longline	Unattended (2)	4	-	PA, PP	PVC, PUR	3	12	3
Drift longline	Unattended (2)	5	-	PA, PP	PVC, PUR	5	25	5
Vertical longline	Unattended (2)	2	-	PA, PP	PVC, PUR	3	6	2

A	B	C	D			E	F	G
Gear type	Operational characteristics	Relative importance (1–5)	Plastic materials			Plastic amount (1–5)	Overall plastic amount	Rescaled overall plastic amount
			Netting	Rope/line	Float/ buoy			
Trolling line	Attended	5	-	PA	-	2	10	3
Spear	Attended	1	-	-	-	1	1	1
aFAD	Unattended (1)	4	PE, PA	PP	PVC	3	12	3

Notes: [i]rescaled to 1–5.

Unattended (1): gears that are usually set overnight and not actively monitored.

Unattended (2): gears that are usually set for a few hours and actively monitored by the vessel.

3.2 Stakeholder involvement

Risk assessments for the marking of fishing gear should involve diverse stakeholders, beyond those fishers involved in the fisheries and fishery managers. Examples of stakeholders are provided in Section 2.3 and Figure 1.

Stakeholder involvement means, among other activities, collaborating in the data collection process, stakeholder surveys and workshops. Sometimes more than one workshop is required to accomplish the tasks in a risk assessment.

Stakeholder workshops aim to accomplish the following tasks:

- Confirm and/or verify the data collected for the gear, the number of vessels and fishers using the gear, as well as the types and amount of plastic used in each gear, as seen in Table 1. This is especially relevant for gear designers and manufacturers, as well as fishers and fisher organizations (including fishing companies).
- Agree on the relative importance of the gear. A gear's importance may be ranked based on the quantity or value of landings from specific gear types, the number of vessels or fishers using the gear, or a combination thereof. The importance of the gear may be scaled from 1 (least important) to 5 (most important).
- Verify and agree on the relative amount of plastic material used in the gear. The relative amount of plastic material may be scaled from 1 (lowest amount) to 5 (largest amount). For vessels using multiple units of gear at any one time, such as gillnets, the total amount should be multiplied by the number of units.
- Identification of types of risks for:
    - gears being used in normal fishing conditions;
    - ALDFG (gears that have become ALDFG).
- Scoring, or verifying scores, for the likelihood of occurrence of different risks.
- Scoring, or verifying scores, for the level of impact should the risks occur.

A second workshop or focus group meeting may be necessary to verify or agree on the outcome of the risk assessment, as well as to prioritize which gears should be marked and the complexity of marking – or indeed their exemption from marking, if applicable.

For example, a stakeholder workshop on "Risk Assessment for the Marking of Fishing Gear" was held in St George's, Grenada on 11 November 2021, to gather stakeholder input and consensus. The workshop was attended by 24 participants representing a variety of stakeholder groups: fishers, fisher associations/cooperatives, fishing companies, fishery managers, fishing gear suppliers, fish exporters, and NGOs. The workshop provided an overview of fisheries and fishing gears in use in Grenada for participants to verify, an introduction to FAO's Voluntary Guidelines on the Marking of Fishing Gear to provide the background, and examples of gear marking technology to give some context for gear marking. A draft framework for risk assessment for the marking of fishing gear, with special reference to Grenada, was provided for discussion with participants. During breakout sessions stakeholders were given opportunities to discuss and score the importance of various impacts of fishing gears, both in normal fishing conditions and when they become ALDFG. The scores from individual participants were used as a basis to calculate impact scores.

3.3 Scoring likelihoods and impacts of risks of gears in normal fishing conditions

Fishing gears, and the risks associated with not marking, or not properly marking, depend on the type of gear, the fishery, fishery management regimes in place, sea conditions and any other activities being conducted in the same area.

Types of risk should be identified and/or verified by stakeholders. For example, the following six risks were identified when conducting the risk assessment for Grenada fisheries, when the gear is in normal fishing conditions:

- gear loss;
- ownership dispute and theft;
- capacity control and overcapacity;
- illegal fishing;

- gear conflict;
- navigational hazard.

Different risks may be identified when conducting a risk assessment in different regions or fisheries. The number of identified risks may also be greater or lower than the examples given here.

One of the primary purposes of gear marking at surface is to indicate the position of gear for its subsequent retrieval by its owner, and for guiding other fishers not to set or tow their gears in the same location. Proper gear marking reduces gear loss as a result of a fisher's inability to find their gear, as well as the damage and entanglement caused by gear conflicts. Effective surface gear marking also assists other mariners to stay clear of the gear for the purposes of safe navigation, especially in areas with heavy vessel traffic.

Scoring the likelihood of a risk occurring should be completed for each specific gear type, which is often related to gear design and operational characteristics. For example, it is usually agreed that unattended gears are more likely to be lost than attended gears, although the partial loss of attended gears is also possible, especially in poor weather and sea conditions. Fishing gears set near the surface are more likely to pose navigational hazards. Fishing gears containing multiple units are more likely to present overcapacity risks. The likely occurrence of various risks may depend on a gear's intrinsic characteristics and how it is operated, as well as other factors including:

- the scale (size) and number of gear units being fished;
- sea and weather conditions of the area where the fishing is conducted;
- area being fished, including water depth, seabed type and distance from the port;
- catch amount;
- operator skill;
- machinery malfunction; and
- legality of fishing: illegal fishing operators often abandon gear when approached by monitoring and enforcement agencies.

Determining likelihood of occurrence requires a combination of specialized knowledge of fishing technologists on fishing gear design and operation, and local knowledge and experience of fishers on how the gear is used in the region. It is important to highlight that the same or similar gears may be operated differently in different regions or countries.

3.3.1 Fishing gear loss

Effective surface gear marking facilitates the location of previously deployed unattended fishing gear, thereby reducing the risk of gear loss. Gear marking for capacity control also limits an excessive quantity of gear, which could lead to abandonment in poor weather and sea conditions. Good surface gear marking also reduces gear conflicts between stationary and mobile fishing gears, as well as between stationary gears set on top of each other, which may cause gear loss.

Generally speaking, unattended gears are more likely to be lost if they are not marked, or not properly marked. This includes a fisher's inability to find the previously deployed gear, or as a result of gear conflicts and an inability to avoid unmarked or improperly marked gear. By contrast, unattended gears set for a short period with the vessel monitoring nearby would reduce the likelihood of loss.

3.3.2 Ownership dispute

Many unattended gears are marked on the surface and sometimes also on the gear from the earliest times to ascertain ownership to deter theft and to avoid accidentally retrieving the gear not belonging to them. Surface buoys of pots, gillnets and longlines are often inscribed with names and/or unique numbers. Attended gear, and unattended gears with active monitoring have lower likelihoods of ownership dispute and theft, while unattended gears set overnight without active monitoring by the owner vessel have higher likelihoods of the risk of ownership dispute.

3.3.3 Overcapacity and effort control

One of the measures to control fishing effort, e.g., number of nets or pots that can be possessed or used by a fisher/a vessel, is through the issuance and application of marks or tags to gear.

More and more management regimes set limits on the number of gear units that can be used by fishers/vessels; this is done in order to control fishing capacity and avoid overcapacity, thereby protecting resources. A corresponding number of marks/tags, often issued by a legal authority, are assigned to a fishing unit or a corporation, and are attached to each unit of gear. Gear marking therefore reduces the likelihood of overcapacity.

3.3.4 Illegal fishing

While fishing gear marking cannot stop illegal fishing, a system of gear marking facilitates the monitoring, control and surveillance (MCS) authority ascertaining legality of fishing operations and compliance of fishing gear. Unmarked or insufficiently marked fishing gear that cannot be linked to its owner or authorization to fish in a specific area may indicate IUU fishing operations (FAO, 2019). Gear marking should therefore be considered an important mechanism for assisting in the prevention and deterrence of IUU fishing, and thus reduce its likelihood.

For example, the likelihood of illegal fishing by vessels of other nations in Grenada are higher for drift longlines. Spear fishing with scuba-diving gears are prohibited in Grenada, and the likelihood of illegal scuba spear fishing was therefore considered high.

3.3.5 Gear conflict

Gear marking plays an essential role in reducing and preventing gear conflicts between stationary gears, and between stationary and mobile gears. Properly marked gear indicates the position, direction and extent of the gear. Attended gear, and actively monitored unattended gears with active monitoring have lower likelihoods of gear conflict, while unattended gears without active monitoring by the owner vessel have higher likelihoods of the risk. Certain “fishing spots”, which are often characterized by upwelling, seamounts or reefs, may experience gear conflicts when numerous vessels are fishing in the same small area. In Grenada, for example, fishing around an aFAD is popular and this can cause gear conflicts.

3.3.6 Navigation hazard

One of the primary purposes of gear marking at surface is for positioning of the gear. Good gear marking also aids other marines to stay away from the gear for safe navigation, especially in areas with heavy vessel traffic.The hazards of improper marking on the surface are therefore dependent on location, and sometimes, season.

For example, during the pilot project on risk assessment for Grenada fisheries, the likelihood scores of gears in normal fishing conditions, as shown in Table 2 were estimated based on their design characteristics, their operation, and the local situation in Grenada. Scores were discussed and verified at the stakeholder workshop.

Table 2. An example of scoring likelihoods of occurrence.

Gear type	Gear in normal fishing conditions – Likelihood of occurrence (1–5)					
	Gear loss	Ownership dispute	Overcapacity	Illegal fishing	Gear conflict	Navigation hazard
Beach seine	1	1	1	1	2	1
Set gillnets	4	5	3	1	3	4
Pots	4	5	3	1	5	3
Handlines	2	1	1	1	1	1
Set longline	3	2	5	1	3	2
Drift longlines	5	2	5	5	5	4
Vertical longline	3	2	5	1	3	4

Gear type	Gear in normal fishing conditions – Likelihood of occurrence (1–5)					
	Gear loss	Ownership dispute	Overcapacity	Illegal fishing	Gear conflict	Navigation hazard
Trolling lines	2	1	1	5	1	2
Spear	1	1	1	5	1	1
aFAD	4	1	2	1	4	5

Note: Scores for different risks for Grenada fishing gears when they are in normal fishing conditions (where 1 is lowest and 5 is highest), based on their design characteristics, fishing mechanism, and operation.

3.3.7 Scoring of impacts or consequences

Scores of impacts or consequences should be discussed and verified by stakeholders during the workshop or other consultations. Discussions should take into account local and relevant conditions, the type of fishing gear, other fishing gears operating in the same area, and other ocean users in the area. The characterization or scoring of a given impact may also consider the primary purpose of gear marking as determined by the management authority, fishing industry, and/or other stakeholders.

The importance of reducing the impact or consequence for a particular risk is one of the important discussions and/or survey topics during stakeholder consultations. For example, the following questions were posed to Grenada workshop participants, and scores (from 1 to 5) were obtained through the survey (as shown in Table 3):

- Gear loss: How important is gear marking in preventing gear loss?
- Ownership disputer/theft: How important is gear marking in preventing or resolving ownership disputes?
- Overcapacity/fishing effort control: How important or useful is gear marking for the monitoring and control of fishing effort, and therefore preventing overcapacity?
- Illegal fishing: How important or useful is gear marking in fighting or preventing illegal fishing?
- Gear conflict: How important is gear marking in resolving or avoiding gear conflicts?
- Navigational hazard: How important is gear marking as an aid to navigational safety?

Table 3. An example of mean and standard deviation (SD) of impact scores for different risks.

	Impact score: Perceived importance of stakeholders (1–5)					
Risk type	Gear loss	Ownership dispute	Overcapacity	Illegal fishing	Gear conflict	Navigation hazard
Mean	4.5	4.9	2.6	4.1	4.7	4.9
SD	0.6	0.2	1.2	0.9	0.7	0.2

Note: Scores for the gear in normal fishing conditions (where 1 is lowest and 5 is highest) based on stakeholder surveys during the Grenada risk assessment workshop. Mean and SD were obtained from 17 respondents.

The impact scores in Table 3 are weighted by the relative importance of gear, as provided in Column C of Table 1 to provide weighted impact scores of different risks, and rescaled using:

$$Y = (X - X_{min}) \times (5 - 1) \div (X_{max} - X_{min}) + 1$$

Where Y indicates rescaled data (Column I, in Table 4), X indicates the data before rescaling (Column H), and X_{min} and X_{max} are the minimum and maximum values in Column H in Table 4.

Table 4. An example of scoring the impact of risks through stakeholder surveys on the importance or relevance of different risk types.

A	B	C	D	E	F	G	H	I
Gear type	Gear in normal fishing conditions – impact score (1–5)						Mean impact score	Rescaled mean impact score
	Gear loss	Owner. Dispute	Over capacity	Illegal fishing	Gear conflict	Nav. hazard		
Beach seine	2.7	3.0	1.6	2.5	2.8	3.0	2.6	3
Set gillnets	3.6	4.0	2.1	3.3	3.8	4.0	3.4	4
Pots	2.7	3.0	1.6	2.5	2.8	3.0	2.6	3
Handlines	4.5	4.9	2.6	4.1	4.7	4.9	4.3	5
Set longline	3.6	4.0	2.1	3.3	3.8	4.0	3.4	4
Drift longlines	4.5	4.9	2.6	4.1	4.7	4.9	4.3	5
Vertical longline	1.8	2.0	1.0	1.6	1.9	2.0	1.7	2
Trolling lines	4.5	4.9	2.6	4.1	4.7	4.9	4.3	5
Spear	0.9	1.0	0.5	0.8	0.9	1.0	0.9	1
aFAD	3.6	4.0	2.1	3.3	3.8	4.0	3.4	4

Note: Impact scores when the gear is in normal fishing conditions for Grenada fishing gears, considering the gear's importance as provided in Table 1. Mean impact scores are rescaled to 1–5.

3.4 Scoring the likelihood and impact of ALDFG

Once fishing gears become abandoned, lost or otherwise discarded, there are potential consequences (risks) for the environment, ecosystem and other ocean users, as well as replacement costs for fishers. The difference of consequences (impact score) is partially related to the gear's design, operation and intrinsic nature, as described below, and modified by recognized importance or relevance of the risk by stakeholders.

For example, when conducting the risk assessment for Grenada fishing gears, six types of risks were identified and verified through a stakeholder workshop. It is worth highlighting that different risks may be identified when conducting a risk assessment in different regions or fisheries. The number of risks identified may also be greater or lower than the example given here.

3.4.1 Plastic pollution

One of the most damaging outcomes of gear loss, abandonment and discarding is marine plastic pollution. While gear marking does not reduce marine plastic pollution once gears have become ALDFG, it does provide information about the fishery and region that ALDFG has come from; as such, it helps prioritize areas and gears that require measures to reduce gear loss and abandonment, and prohibit discarding.

The impact score for plastic pollution for each gear type is related to the amount of plastic material in the gear, and the number of gear units of gears that is operated at any one time. If a vessel operates multiple units of gears, such as gillnets or pots, the amount of plastic material should be multiplied accordingly.

3.4.2 Ghost fishing

Another negative outcome of ALDFG is ghost fishing. Some gears are more likely to ghostfish after becoming ALDFG, negatively impacting target fishery resources and dependent species. Gillnets, entangling nets and pots are a particular source of concern.

Both actively fished gear and ALDFG can impact endangered, threatened and protected (ETP) species, but their degree of impact may be species- and gear-specific.

The major differences between fishing gear in normal fishing conditions and ALDFG is that the former can be managed to reduce their impact through spatial and temporal closures, effort control and gear modification, while the later cannot be controlled once it becomes ALDFG, unless some design features can be incorporated before it becomes ALDFG (de-hosting technology).

Depending on the situations in different regions and fisheries, ghost fishing on fishery resources and ghost fishing on ETP species may be separated into two different risks or combined into one. In the Grenada pilot risk assessment they were combined and labelled as "ghost fishing".

3.4.3 Traceability of ALDFG

The proper and effective marking of fishing gear is essential to tracing the gear's region and fishery of the origin of the gear before becoming ALDFG. The design of fishing gear marking should take into account any national or regional, recommended or mandatory ALDFG reporting requirements. This is especially important on gear that has become entangled on large megafauna species, as the identification of its origin can help devise the measures required to reduce entanglement and animal mortality. The traceability of ALDFG also informs measures for specific fisheries for the proper management of gear to reduce loss and abandonment. The scores for ALDFG traceability are related to the mobility of ALDFG of specific gear types – floating ALDFG is more like to be carried by current to distant locations from where they were lost or abandoned.

3.4.4 Fouling the seabed

Abandoned, lost or otherwise discarded fishing gears can foul seabed habitats if they remain in or sink to the seabed. The likelihood of this risk is related to the type of gear and density of fishing gear materials. Heavy materials such as PA, PES netting and ropes are more likely to foul the seabed, while floating materials such as PE and PP are less likely doing so.

3.4.5 Economic loss

The immediate consequence of fishing gear loss is the replacement of gear, from purchase costs to lost fishing time. The impact scores for this risk are related to the size and scale of operation and gear characteristics. The loss of

some fishing gear, such as large-scale pound nets, may mean a loss of fishing for the entire season, as construction and deployment usually take a long time. The seasonal nature of many such nets also makes their replacement unfeasible. The impact scores of economic risks may also be higher in small-scale fisheries in developing states, where the ability to purchase additional gear may be limited.

3.4.6 Navigation hazards

The navigation hazards presented by ALDFG are largely dependent on the material of the gear. Floating gear materials such as PP and PE netting and ropes often float on the surface of water when they become ALDFG. Netting and ropes with functional floats and buoys also pose greater hazards to navigation; they therefore have higher impact scores. The impact scores for navigational risk are also related to area of operation: scores are higher when gears are operated in coastal areas with heavy vessel traffic, and lower on the high seas.

Table 5 provides an example of likelihood scores for gears in Grenada fisheries when they become lost, abandoned or discarded, based on their scale (size), material, design characteristics and operation. The risk scores can vary considerably between fisheries and should be determined through stakeholder inputs based on regional conditions, local ecological knowledge, and fishers' experience. The mean likelihood scores (Column H) are means of Column B to G in the formula:

$$Y = (X - X_{min}) \times (5 - 1) \div (X_{max} - X_{min}) + 1$$

Where Y indicates rescaled data (Column I, in Table 5), X indicates the data before rescaling (Column H), and X_{min} and X_{max} are the minimum and maximum values in Column H.

Table 5. An example of scoring likelihood of occurrence of ALDFG risks.

A	B	C	D	E	F	G	H	I
Gear type	ALDFG: Likelihood score (1–5)						Mean likelihood score	Rescaled mean likelihood score
	Plastic pollution	Ghost fishing	Traceability of ALDFG	Nav. hazard	Fouling seabed	Economic loss		
Beach seine	3	3	1	3	3	5	3.1	4
Set gillnet	3.2	5	3	3	5	4	3.9	5
Pot	1.2	5	2	2	4	4	3.1	4
Handline	2	1	1	1	2	2	1.6	2
Set longline	2.4	2	2	2	5	4	3.0	3
Drift longline	5	3	5	5	2	5	4.2	5
Vertical longline	1.2	2	5	5	2	3	3.1	4
Trolling line	2	1	2	1	3	2	1.9	2
Spear	0.2	1	1	1	1	1	1.0	1
aFAD	2.4	4	5	5	3	5	4.1	5

Note: Scores for Grenada fishing gears (where 1 is lowest and 5 is highest) based on their design characteristics and operation, and the amount of plastic material. Mean likelihood scores are rescaled to 1–5.

Value and importance of reducing or eliminating impacts

The importance or the value of eliminating or reducing each impact of identified risks should be discussed at the stakeholder workshop or other consultations and scored through the survey of workshop participants or other mechanisms. For example, the following questions were asked for each of the identified ALDFG risks at the Grenada pilot risk assessment workshop and scores (1 to 5) were obtained from each of the 17 participants, as shown in Table 6.

- Plastic pollution: How important or significant is ALDFG in contributing to marine plastic pollution in your region?
- Ghost fishing: How important or significant is ALDFG in ghost fishing?
- Traceability of ALDFG: How important is gear marking in tracing the origin of ALDFG in the sea (where it originate)?
- Navigation hazards: How significant is ADLFG in impacting navigation in your area?
- Fouling seabed: How significant is ADLFG in fouling seabed such as coral reefs in your area?
- Economic loss: How significant is the financial or economic impact of gear loss?

Table 6. Mean and standard deviation (SD) of impact scores for different ALDFG risks**.**

	ALDFG impact score: Perceived importance of stakeholders (1–5)					
Risk type	Plastic pollution	Ghost fishing capacity	Traceability of ALDFG	Navigation hazard	Fouling seabed	Economic loss
Mean	3.5	4.8	3.6	4.1	3.8	4.6
SD	1.0	0.4	1.2	1.1	1.0	0.5

*Note***:** Scores based on stakeholder surveys (where 1 is lowest and 5 is highest), and overall impact score of all risks.The impact scores in Table 6 should be weighted by the importance of gear as provided in Column C of Table 1 to provide weighted impact scores of different risks, using the formula:

$$Y = (X - X_{min}) \times (5 - 1) \div (X_{max} - X_{min}) + 1$$

Where Y indicates rescaled data (Column I, in Error! Reference source not found.**),** X indicates the data before rescaling (Column H), and X_{min} and X_{max} are the minimum and maximum values in Column H.

Table 7 shows the mean impact score (Column H) and rescaled mean impact score (rescaled to values from 1 to 5, Column I) for different type of Grenada fishing gears as assessed in the Grenada pilot risk assessment as an example.

Table 7. Example of impact scores for ALDFG risks.

A	B	C	D	E	F	G	H	I
	ALDFG: impact score (1–5)						Mean impact score	Rescaled mean impact score
Gear type	Plastic pollution	Ghost fishing	Traceability of ALDFG	Nav. hazard	Fouling seabed	Economic loss		
Beach seine	2.1	2.9	2.2	2.5	2.3	2.7	2.4	3
Set gillnet	2.8	3.8	2.9	3.3	3.1	3.7	3.3	4
Pot	2.1	2.9	2.2	2.5	2.3	2.7	2.4	3
Handline	3.5	4.8	3.6	4.1	3.8	4.6	4.1	5
Set longline	2.8	3.8	2.9	3.3	3.1	3.7	3.3	4
Drift longline	3.5	4.8	3.6	4.1	3.8	4.6	4.1	5
Vertical longline	1.4	1.9	1.4	1.6	1.5	1.8	1.6	2
Trolling line	3.5	4.8	3.6	4.1	3.8	4.6	4.1	5
Spear	0.7	1.0	0.7	0.8	0.8	0.9	0.8	1
aFAD	2.8	3.8	2.9	3.3	3.1	3.7	3.3	4

Note: Impact scores for Grenada fishing gears considering stakeholder scores (from Table 6) and the gear's importance (from Table 1). Mean impact scores are rescaled to 1–5 (1 – lowest, 5 – highest)

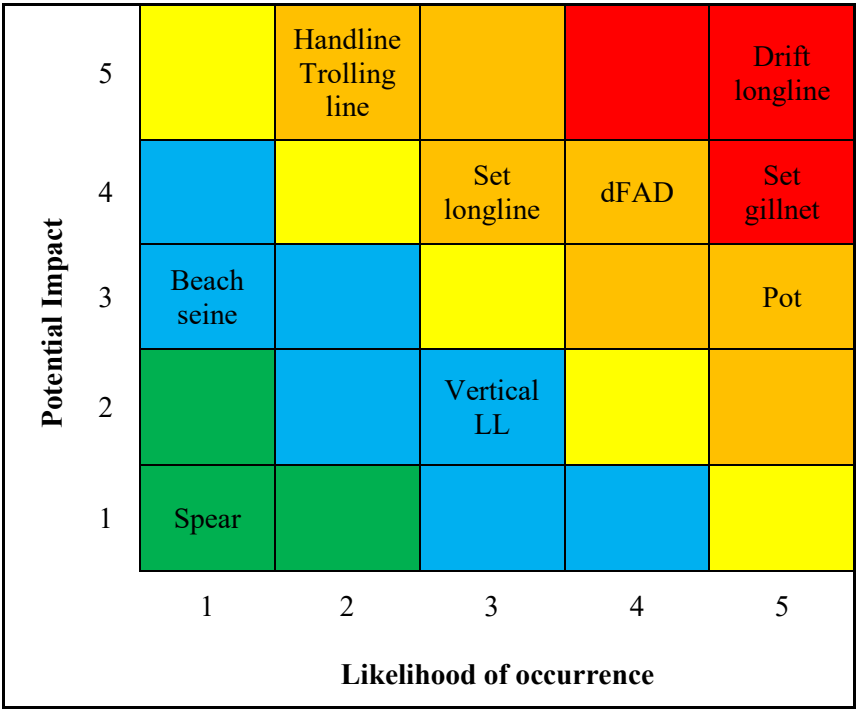
3.5 Categorization of risk

The categorization of risk involves assigning different gears to a specific risk or combined risk in a likelihood–impact table; such a risk applies either for the fishing gear in normal fishing conditions or once it becomes ALDFG, or the overall risk by combining both.

3.5.1 Fishing gear in normal fishing conditions

The likelihoods of occurrence for certain risks associated with fishing gears in normal fishing conditions as shown in and their impact as shown in Table 4 , as examples for Grenada fishing gears, can be used to construct likelihood - impact tables for a specific risk (e.g., gear loss Table 8) or combined risks (Table 9).

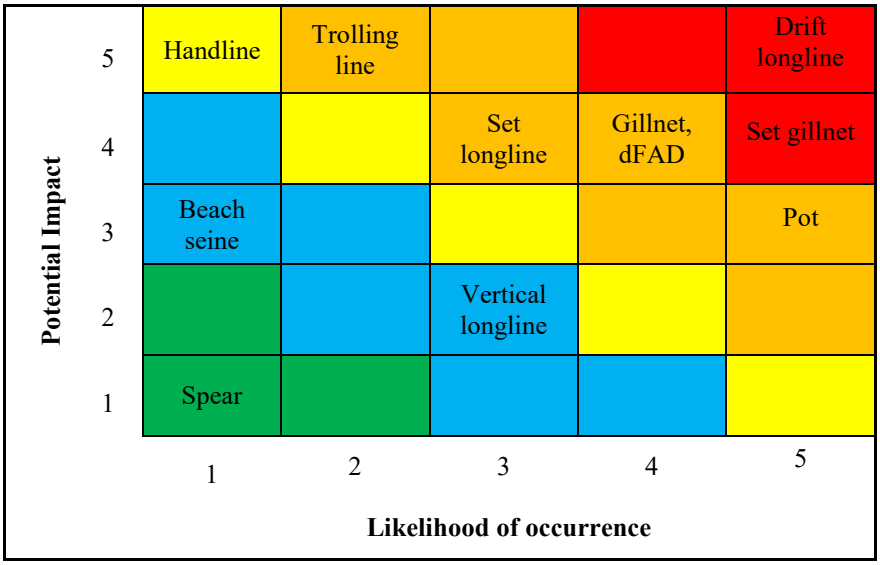
Table 8. An example of likelihood–impact table for the risk of gear loss.



Note: Example for gear in normal fishing conditions for Grenada fishing gears.

Colour shade: very low | low | medium | high | very high

Table 9. Likelihood - impact table for combined risks when the gear is in normal fishing conditions.



The risk score of a specific risk, or a combined overall risk, can also be calculated with the following formula:

Risk score = Likelihood of occurrence × Impact

so that they may be ranked, as shown in Table 10, as an example for Grenada fishing gears. The Drift longline has the highest combined risk score while handline has the lowest combined risk score.

Table 8. Risk scores for different gear types when they are in normal fishing conditions.

Gear type	Actively fished gear – risk score						Mean risk score
	Gear loss	Owner. Dispute	Over capacity	Illegal fishing	Gear conflict	Nav. hazard	
Drift longline	22.4	9.9	12.9	20.6	23.5	19.8	17.3
Pot	17.9	24.7	7.8	4.1	23.5	14.8	15.0
Set gillnet	17.9	24.7	7.8	4.1	14.1	19.8	14.1
Vertical longline	13.4	9.9	12.9	4.1	14.1	19.8	12.2
aFAD	17.9	4.9	5.2	4.1	18.8	24.7	11.6
Set longline	13.4	9.9	12.9	4.1	14.1	9.9	10.2
Trolling line	8.9	4.9	2.6	20.6	4.7	9.9	8.5

Gear type	Actively fished gear – risk score						Mean risk score
	Gear loss	Owner. Dispute	Over capacity	Illegal fishing	Gear conflict	Nav. hazard	
Spear	4.5	4.9	2.6	20.6	4.7	4.9	7.6
Beach seine	4.5	4.9	2.6	4.1	9.4	4.9	5.2
Handline	8.9	4.9	2.6	4.1	4.7	4.9	4.3

Note: Ranked from highest to lowest for the mean risk score.

3.5.2 *Abandoned, lost or otherwise discarded fishing gear (ALDFG)*

The likelihoods of occurrence for certain risks associated with ALDFG as shown in Table 5 and their impact as shown in .Table 7 for Grenada fishing gears as an example can be used to construct likelihood - impact tables for a specific risk (e.g., plastic pollution Table 11) or combined overall risk (Table12).

Table 11. Likelihood - impact table for the risk of plastic pollution when the gear became ALDFG.

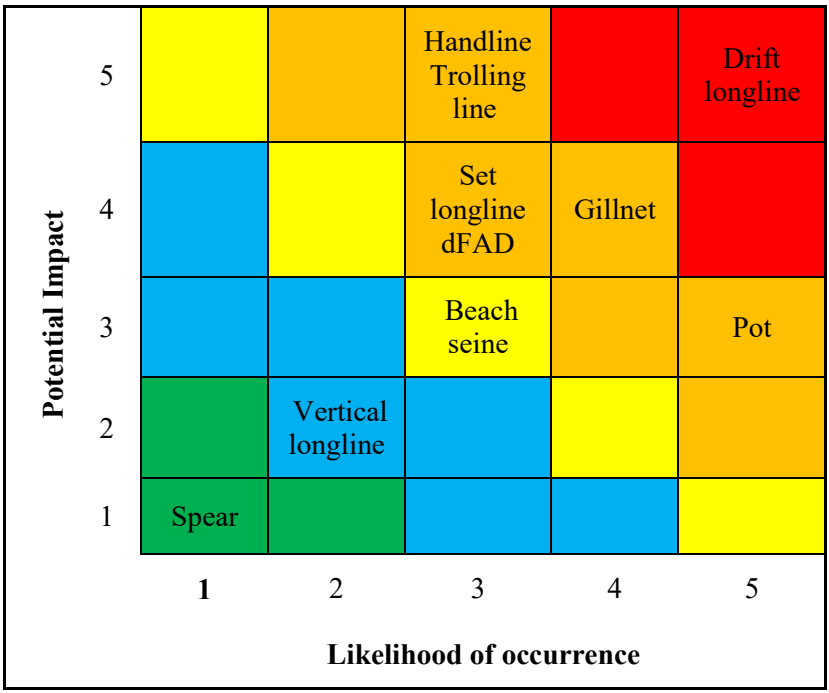
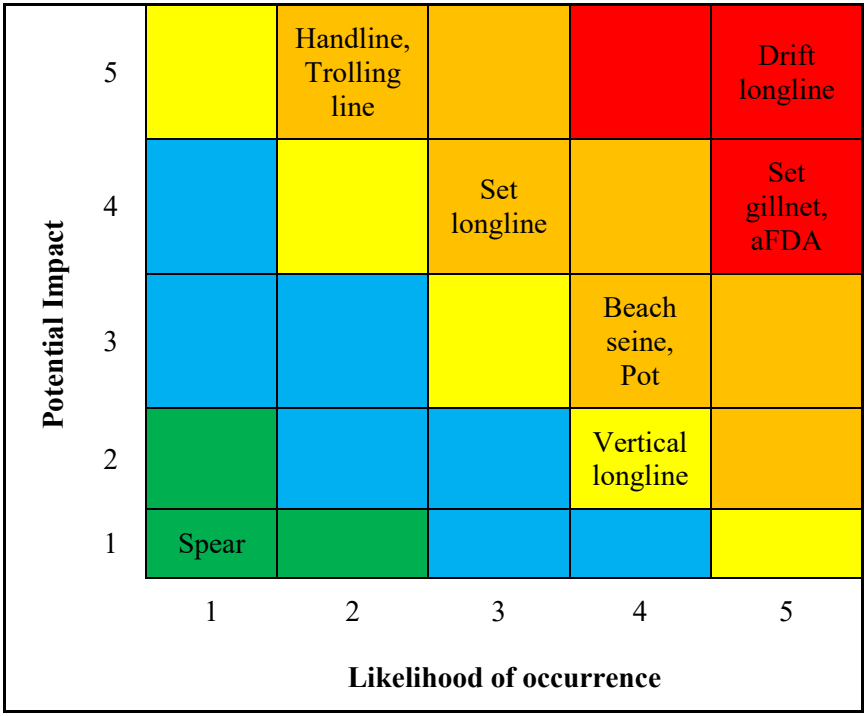


Table 12. Likelihood - impact table for combined risks when the gear became ALDFG.



The risk scores for the combined risks of ALDFG can also be calculated using the same formulae as for fishing gears in normal fishing conditions, so that they may be ranked as shown in Table 13 as in the example of Grenada fishing gears. It can also be seen that among Grenada fishing gears, the anchored FAD (aFAD) has the highest combined risk score, while spear has the lowest combined risk score**.**

Table 9. Risk scores for different gear types when they become ALDFG.

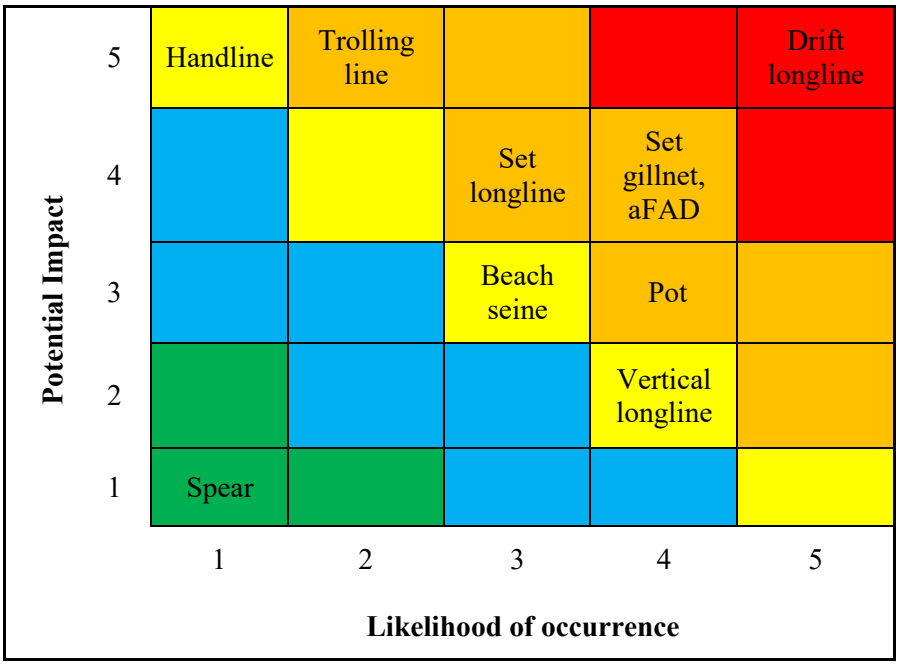
Gear type	ALDFG – risk score						Mean risk score
	Plastic pollution	Ghost fishing	Traceability of ALDFG	Nav. hazard	Fouling seabed	Economic loss	
aFAD	10.0	19.1	17.9	20.6	11.5	22.9	17.1
Set gillnet	12.4	23.8	10.8	12.4	19.1	18.3	16.8
Drift longline	17.6	14.3	17.9	20.6	7.6	22.9	16.4
Pot	6.5	23.8	7.2	8.2	15.3	18.3	13.3
Vertical longline	6.5	9.5	17.9	20.6	7.6	13.7	12.7
Beach seine	11.8	14.3	3.6	12.4	11.5	22.9	12.5
Set longline	10.0	9.5	7.2	8.2	19.1	18.3	12.2
Trolling line	8.8	4.8	7.2	4.1	11.5	9.1	7.9
Handline	8.8	4.8	3.6	4.1	7.6	9.1	6.6
Spear	3.5	4.8	3.6	4.1	3.8	4.6	4.1

Note: Ranked from highest to lowest for the mean risk scores.

3.5.3 Overall risk

The overall risk of a fishing gear – considering both when it is in normal fishing conditions and after it becomes ALDFG – may be evaluated by combining all likelihood scores and all impact scores for each gear type, as shown in Table 14, using Grenada fishing gears as an example. For Grenada fishing gears, the drift longline has the highest risk (red, the highest likelihood of occurrence and highest potential impact), while the spear has the lowest risk (green).

Table 10. Likelihood–impact table for overall risks combining risks when the gear is in normal fishing conditions and when it becomes ALDFG.



3.6 *Prioritization and complexity*

Based on the risk categories and scores for different gear types, the prioritization of gear marking may be recommended and its complexity determined, considering both when they are in normal fishing conditions and once they become ALDFG. In principle, gears ranked as having "very high" or "high" risks should be prioritized for marking and marked with sufficient information. Gears that have "low" or "very low" risks are given low priorities for marking – and if they are to be marked, minimal information such as ownership may be sufficient. For example, for Grenada fishing gears, drift longlines were ranked as having "very high" risks, while set gillnets, trolling lines, aFADs, set longlines and pots are ranked as having "high" risks. Accordingly, it was recommended that for Grenada fishing gears gear marking should be prioritized for drift longlines, set gillnets, trolling lines, aFADs, set longlines and pots. They should be marked with sufficient complexity to provide details on ownership, license/permit numbers and position when implementing a system of fishing gear marking. On the other hand, handlines, beach seines and vertical lines have "medium" risks, while spears have "very low" risks. Handlines, vertical lines and handlines should thus be assigned medium priority for marking, while spears low priority for marking. If they are to be marked, medium to minimal marking may be considered sufficient.

4. SUGGESTED OUTLINE OF A RISK ASSESSMENT REPORT

A risk assessment report should follow at the completion of a risk assessment. The risk assessment report should contain the following information, as a minimum:

Title

The title of the report should include the regional/national or fishery-specific purpose for which the risk assessment is being conducted.

Introduction

Background

The background should make reference to the FAO Voluntary Guidelines for the Marking of Fishing Gear and provide definitions of the key terms used in the report.

Scope

The scope should define the geographic region (local, regional, or national) or fisheries for which the assessment is being made.

Stakeholder engagement

The number and description of the different types of stakeholders that participated in the risk assessment

Description of fishing gear

This section should describe the fishing gears assessed, including landings by gear type, number of vessels using the gear, and number of fishers using the gear. Data collection methods should also be described, while the relative importance of the gear should be determined from the data collected. This section should also describe the amount and type of plastic materials in different gear types. The classification of fishing gears should generally follow FAO's International Standard Statistical Classification of Fishing Gear (ISSCFG) but may be grouped according to their design and operation.

Identification of risks

The identification and/or verification of risks associated with different gear types are provided. Methods for identification and/or verification should be described and include, among others, stakeholder involvement, workshops, surveys and other consultations. Risk identification should include both gears in normal fishing conditions (i.e. actively fished gears) and once they become ALDFG.

Scoring the likelihood, impact, and categorization of risks

The process of stakeholder participation and consultations such as workshops, surveys or other inputs should be described if they differ from the last section.

Scoring the likelihood and impact of fishing gears in normal fishing conditions

Types of risks when the gears are in normal fishing conditions are identified. Likelihood scores are determined based on a gear's design, material and operation. The impact scores of the gears' particular risks are then determined. Risk levels are categorized based on likelihood and impact scores.

Scoring likelihood and impact of ALDFG

Types of risks once the gears have become ALDFG are identified. Likelihood scores are determined based on a gear's design, material and operation. The impact scores of ALDFG's different risks are provided. Risk scores/levels are categorized based on likelihood and impact scores.

Overall risk

Combined likelihood and impact scores for fishing gears in normal fishing conditions and once they become ALDFG are calculated from the above two sections. Overall risk scores for different types of fishing gears are categorized and presented in likelihood–impact tables.

Priority and complexity

Based on the overall risk levels of different gears, the priority for implementing fishing gear marking, as well as the complexity thereof – or indeed a gear's exemption from marking – are determined and provided, either in a table or graphically. This determination may also involve further stakeholder consultation, which should be described.

Feasibility and affordability

Decisions should also be informed by an assessment of the feasibility of implementing a system for the marking of fishing gear, taking into account the technological, economic and impact elements outlined in Sections 2.1–2.4 of this framework, and the list of basic questions provided in the "Feasibility and affordability" section of the Annex in the VGMFG (Appendix I).

Recommendations and next steps

Summary of recommendations and outline of next steps to guide implementation.

REFERENCES

FAO. 2019. *Voluntary Guidelines on the Marking of Fishing Gear. Directives volontaires sur le marquage des engins de pêche. Directrices voluntarias sobre el marcado de las artes de pesca*. Rome/Roma. fao.org/3/ca3546t/ca3546t.pdf

GGGI. 2021. *Best Practice Framework for the Management of Fishing Gear (C-BPF)*. Revised edition (Parts 1 & 2). Prepared by Tim Huntington of Poseidon Aquatic Resource Management Ltd for Global Ghost Gear Initiative.

He, P. & Suuronen, P. 2018. Technologies for the marking of fishing gear to identify gear components entangled on marine animals and to reduce abandoned, lost or otherwise discarded fishing gear. *Marine Pollution Bulletin*, *129*(1): 253–261.

He, P., Chopin, F., Suuronen, P., Ferro, R.S.T. & Lansley, J. 2021. *Classification and illustrated definition of fishing gears*. FAO Fisheries and Aquaculture Technical Paper No. 672. Rome, FAO. doi.org/10.4060/cb4966en.

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Appendix I

RISK-BASED APPROACH TO ASSIST RELEVANT AUTHORITIES IN DETERMINING THE NEED FOR AND REQUIREMENTS OF A SYSTEM FOR MARKING OF FISHING GEAR

(FAO, 2019)

A risk-based approach to implementing gear marking systems to mitigate against ALDFG can reduce the likelihood of loss and the impact of the loss if it occurs.

Many factors contribute towards ALDFG, including but not limited to: the type of fishing gear, weather, sea and bottom conditions, equipment failure, the level of fishing effort in a particular area, human error and safety considerations.

Before a full risk assessment is undertaken, a simple yes/no assessment may be conducted based on the type of fishing gear, marking methods and techniques and the area of operation. This will allow simple small-scale methods, usually hand-held fishing gears, to be assessed without the need for a full risk assessment.

The assessment should be devised based upon the best available information to determine the risk associated with the current level of gear marking in the fishery in question concerning:

a) ecological harm;
b) economic harm due to ghost fishing or illegal, unreported, and unregulated fishing;
c) safety at sea; and
d) the impact on fishing operations.

The determination of risk levels involves four primary steps:

a) Estimation of the consequences (impact) of the lack of a gear marking system in the fishery under consideration;
b) Estimation of the likelihood of occurrence (probability) of the identified impacts occurring as a result of the lack of a gear marking system in the fishery under consideration;

c) Scoring of the risk; and
d) Categorization of the risk.

The specific criteria addressed in the risk assessment should be based on the specific fishery conditions under consideration. As general guidance, the scope of a risk assessment should include parameters influencing consequences and impacts including, *inter alia*:

a) Ecological risks: Status of species impacted, habitats fished, vulnerability and fragility of the species and habitats where the fishery takes place and taking into account that ALDFG may drift long distances and settle in areas outside the fishery of concern, in areas beyond national jurisdiction or in another national jurisdiction;
b) Economic risks: Level of effort, the value of the fishery, economic nature of the fishery (subsistence, industrial) and the potential for ghost fishing or IUU fishing;
c) Technological risks: Gear type, amount of gear, numbers of vessels, method of operation;
d) Safety and navigational risks;
e) Social and cultural risks: Different users, language competencies, level of organization;
f) Availability of information and the quality of information; and
g) The synergies to be derived from harmonizing gear marking systems.

Determining a risk level needs defensible estimates of the consequences and likelihood. A clear rationale should be provided on how estimated levels were chosen, so that the process can be traced and verified. A clear rationale also provides a basis from which future assessments can be measured. The information, data and expert opinion collected and consolidated through the initial scoping exercise form the basis for that rationale, with additional information being provided where appropriate and necessary.

Further information to consider in the risk assessment process

Feasibility and affordability

In addition to the risk assessment, decisions should also be informed by an assessment of the feasibility of implementing a system for the marking of fishing gear and of the related cost/benefit issues. Accordingly, the assessment could address the following basic questions:

a) Is the technology associated with the system feasible, cost-effective and fit for the required purpose?
b) Will the technology mature over time?
c) Are there any technical barriers to integrating the capability within the current fishery system?
d) How would the gear marking system affect the efficiency of the fishery (i.e., reduced CPUE, added down time, associated costs, etc.)?
e) What measures would be necessary to assist the fleet in the implementation of gear marking?
f) What resources would be available to ensure successful implementation?
g) Does the gear marking system add potential hazards or interference to regular fishing activities?
h) Do the States in question have the administrative and economic capacity to implement and monitor the system?
i) What capacity building and/or funding needs should be considered (both in terms of administrations and fishery operators)?
j) Do language competencies, level of organization and different users have an impact on the implementation of gear marking systems?

Participation

Arrangements for conducting risk assessments and associated decisions should be carried out with balanced participation by independent technical experts and by representatives of interested parties in system development, revision and approval processes.

Transparency

Risk assessments and associated decision-making should be carried out in a transparent manner and follow written rules of procedure. Once a risk assessment has been completed, it should be published promptly and where possible be accessible electronically to the public.

Appendix II

INTERNATIONAL STANDARD STATISTICAL CLASSIFICATION OF FISHING GEARS (ISSCFG), Rev.1 (2016)

Gear categories (First tier)	Subcategory (Second tier)	Standard abbreviations	ISSCFG code
SURROUNDING NETS			01
	Purse seines	PS	01.1
	Surrounding nets without purse lines	LA	01.2
	Surrounding nets (nei)	SUX	01.9
SEINE NETS			02
	Beach seines	SB	02.1
	Boat seines	SV	02.2
	Seine nets (nei)	SX	02.9
TRAWLS			03
	Beam trawls	TBB	03.11
	Single boat bottom otter trawls	OTB	03.12
	Twin bottom otter trawls	OTT	03.13
	Multiple bottom otter trawls	OTP	03.14
	Bottom pair trawls	PTB	03.15

Gear categories (First tier)	Subcategory (Second tier)	Standard abbreviations	ISSCFG code
	Bottom trawls (nei)	TB	03.19
	Single boat midwater otter trawls	OTM	03.21
	Midwater pair trawls	PTM	03.22
	Midwater trawls (nei)	TM	03.29
	Semipelagic trawls	TSP	03.3
	Trawls (nei)	TX	03.9
DREDGES			04
	Towed dredges	DRB	04.1
	Hand dredges	DRH	04.2
	Mechanized dredges	DRM	04.3
	Dredges (nei)	DRX	04.9
LIFT NETS			05
	Portable lift nets	LNP	05.1
	Boat-operated lift nets	LNB	05.2
	Shore-operated stationary lift nets	LNS	05.3
	Lift nets (nei)	LN	05.9
FALLING GEAR			06
	Cast nets	FCN	06.1

Gear categories (First tier)	Subcategory (Second tier)	Standard abbreviations	ISSCFG code
	Cover pots/Lantern nets	FCO	06.2
	Falling gear (nei)	FG	06.9
GILLNETS AND ENTANGLING NETS			07
	Set gillnets (anchored)	GNS	07.1
	Drift gillnets	GND	07.2
	Encircling gillnets	GNC	07.3
	Fixed gillnets (on stakes)	GNF	07.4
	Trammel nets	GTR	07.5
	Combined gillnets-trammel nets	GTN	07.6
	Gillnets and entangling nets (nei)	GEN	07.9
TRAPS			08
	Stationary uncovered pound nets	FPN	08.1
	Pots	FPO	08.2
	Fyke nets	FYK	08.3
	Stow nets	FSN	08.4
	Barriers, fences, weirs, etc.	FWR	08.5
	Aerial traps	FAR	08.6
	Traps (nei)	FIX	08.9

Gear categories (First tier)	Subcategory (Second tier)	Standard abbreviations	ISSCFG code
HOOKS AND LINES			09
	Handlines and hand-operated pole-and-lines	LHP	09.1
	Mechanized lines and pole-and-lines	LHM	09.2
	Set longlines	LLS	09.31
	Drift longlines	LLD	09.32
	Longlines (nei)	LL	09.39
	Vertical lines	LVT	09.4
	Trolling lines	LTL	09.5
	Hooks and lines (nei)	LX	09.9
MISCELLANEOUS Gear			10
	Harpoons	HAR	10.1
	Hand implements (wrenching gear, clamps, tongs, rakes, spears)	MHI	10.2
	Pumps	MPM	10.3
	Electric fishing	MEL	10.4
	Pushnets	MPN	10.5
	Scoopnets	MSP	10.6

Gear categories (First tier)	Subcategory (Second tier)	Standard abbreviations	ISSCFG code
	Drive-in nets	MDR	10.7
	Diving	MDV	10.8
	Gear (nei)	MIS	10.9
GEAR NOT KNOWN			99
	Gear not known	NK	99.9

Appendix III

DATA COLLECTION SHEET FOR NUMBER OF VESSELS/FISHERS AND ANNUAL LANDINGS

Gear categories & subcategory		Abbrev. & Code	No. of vessels	No. of fishers	Annual landings
SURROUNDING NETS		01			
	Purse seines	PS 01.1			
	Seine net without purse lines	LA 01.2			
SEINE NETS		02			
	Beach seines	SB 02.1			
	Boat seines	SV 02.2			
TRAWLS		03			
	Beam trawls	TBB 03.11			
	Single boat bottom otter trawls	OTB 03.12			
	Twin bottom otter trawls	OTT 03.13			

Gear categories & subcategory		Abbrev. & Code	No. of vessels	No. of fishers	Annual landings
	Multiple bottom otter trawls	OTP 03.14			
	Bottom pair trawls	PTB 03.15			
	Single boat midwater otter trawls	OTM 03.21			
	Midwater pair trawls	PTM 03.22			
	Semipelagic trawls	TSP 03.3			
DREDGES		04			
	Towed dredges	DRB 04.1			
	Hand dredges	DRH 04.2			
	Mechanized dredges	DRM 04.3			
LIFT NETS		05			
	Portable lift nets	LNP 05.1			
	Boat-operated lift nets	LNB 05.2			
	Shore operated stationary lift nets	LNS 05.3			

Gear categories & subcategory		Abbrev. & Code	No. of vessels	No. of fishers	Annual landings
FALLING GEAR		06			
	Cast nets	FCN 06.1			
	Cover pots/Lantern nets	FCO 06.2			
GILLNETS AND ENTANGLING NET		07			
	Set gillnets	GNS 07.1			
	Drift gillnets	GND 07.2			
	Encircling gillnets	GNC 07.3			
	Fixed gillnets (on stakes)	GNF 07.4			
	Trammel nets	GTR 07.5			
	Combined gillnet-trammel nets	GTN 07.6			
TRAPS		08			
	Stationary uncovered pound nets	FPN 08.1			
	Pots	FPO 08.2			

Gear categories & subcategory		Abbrev. & Code	No. of vessels	No. of fishers	Annual landings
	Fyke nets	FYK 08.3			
	Stow nets	FSN 08.4			
	Barriers/fences/weirs, etc.	FWR 08.5			
	Aerial traps	FAR 08.6			
HOOKS AND LINES		09			
	Handlines/hand-operated pole & lines	LHP 09.1			
	Mechanized lines and pole & lines	LHM 09.2			
	Set longlines	LLS 09.31			
	Drifting longlines	LLD 09.32			
	Vertical lines	LVT 09.4			
	Trolling lines	LTL 09.5			

Gear categories & subcategory		Abbrev. & Code	No. of vessels	No. of fishers	Annual landings
MISCELLANEOUS Gear		10			
	Harpoons	HAR 10.1			
	Hand implements	MHI 10.2			
	Pumps	MPM 10.3			
	Electric fishing	MEL 10.4			
	Pushnets	MPN 10.5			
	Scoopnets	MSP 10.6			
	Drive-in nets	MDR 10.7			
	Diving	MDV 10.8			

Appendix IV

GEAR-SPECIFIC DATA COLLECTION SHEETS

These are the minimum data required for the risk assessment of different types of fishing gears. Users may collect more data than suggested for other purposes.

(1). GEAR-SPECIFIC DATA COLLECTION SHEET: SURROUNDING NETS

Owner/operator:			Vessel name		
Gear type	Surrounding nets	Subtype			
Target species					
Vessel type		Vessel size		No. of crew	
Total annual landing (kg or tonne)					
Gear specifics	Purse seines:		Total length (m)		
			Total height (m)		
	Other surrounding nets:		Total length (m)		
	Materials – list up to 3:		Headline		
			Footrope		
			Netting		
			Floats		
	Total weight of plastic materials (kg)				

(2). GEAR-SPECIFIC DATA COLLECTION SHEET: SEINE NETS

Owner/operator:			Vessel name		
Gear type	Seine net	Subtype			
Target species					
Vessel type		Vessel size		No. of crew	
Total annual landing (kg or tonne)					
Gear specifics	Beach seines:		Total length (m)		
			Total height (m)		
	Boat seines:		Total length (m)		
			Headline length (m)		
	Materials – list up to 3		Headline		
			Footrope		
			Netting		
			Floats		
	Total weight of plastic materials (kg)				

(3). GEAR-SPECIFIC DATA COLLECTION SHEET: TRAWLS

Owner/operator			Vessel name		
Gear type	Trawls	Subtype			
Target species					
Vessel type		Vessel size		No. of crew	
Total annual landing (kg or tonne)					
Gear specifics	Beam trawls:		Total length (m)		
			Beam length (m)		
			Number of nets		
	Other trawls:		Total length (m)		
			Headline length (m)		
			No. of nets		
	Type of materials – list up to 3		Headline		
			Footrope		
			Netting		
			Floats		
			Otterboards (if used)		
	Total weight of plastics (kg)				

(4). GEAR-SPECIFIC DATA COLLECTION SHEET: DREDGES

Owner/operator		Vessel name (if any)			
Gear type	Dredges	Subtype			
Target species					
Vessel type		Vessel size		No. of crew	
Total annual landing (kg or tonne)					
Gear specifics	Boat dredges:	Dredge length (m)			
		Dredge width (m)			
		Number of dredges			
	Type of materials – list up to 3				
	Total weight of plastic s (kg)				

(5). GEAR-SPECIFIC DATA COLLECTION SHEET: LIFT NETS

Owner/operator		Vessel name (if any)			
Gear type	Lift net	Subtype			
Target species					
Vessel type		Vessel size		No. of crew	
Total annual landing (kg or tonne)					
Gear specifics	Boat-operated lift net:		Net length (m)		
			Net width (m)		
			Number of nets		
	Type of materials – list up to 3				
	Total weight of plastics (kg)				

(6). GEAR-SPECIFIC DATA COLLECTION SHEET: FALLING NETS

Owner/operator		Vessel name (if any)			
Gear type	Falling net	Subtype			
Target species					
Vessel type		Vessel size		No. of crew	
Total annual landing (kg or tonne)					
Gear specifics	Boat-operated falling net:		Net length (m)		
			Net width (m)		
			Number of nets		
	Type of materials – list up to 3				
	Total weight of plastics (kg)				

(7). GEAR-SPECIFIC DATA COLLECTION SHEET: GILLNETS AND ENTANGLING NETS

Owner/operator			Vessel name		
Gear type	Gillnets and entangling nets		Subtype		
Target species					
Vessel type		Vessel size		No. of crew	
Total annual landing (kg or tonne)					
Gear specifics	Net length (m)				
	Net depth (m)				
	Number of nets				
	Type of materials – list up to 3		Headline		
			Footrope		
			Netting		
			Floats		
	Total weight of plastics/net (kg)				

(8). GEAR-SPECIFIC DATA COLLECTION SHEET: TRAPS

Owner/operator		Vessel name (if any)			
Gear type	Traps		Subtype		
Target species					
Vessel type		Vessel size		No. of crew	
Total annual landing (kg or tonne)					
Gear specifics	Pots	Length x width x height (m)			
		Material			
		Number of pots used			
	Other traps	Length			
		Width			
		Height			
		Type of plastics			
		No. of traps			
	Total weight of plastics/trap or pot (kg)				

(9). GEAR-SPECIFIC DATA COLLECTION SHEET: HOOKS AND LINES

Owner/operator		Vessel name (if any)			
Gear type	Hooks and lines	Subtype			
Target species					
Vessel type		Vessel size		No. of crew	
Total annual landing (kg or tonne)					
Gear specifics	Longlines	Length (m)			
		No. of hooks/fleet			
		No. of fleets			
		Materials	Mainline		
			Snood		
			Buoy line		
			Buoy		
	Total weight of plastics (kg)				

(10). GEAR-SPECIFIC DATA COLLECTION SHEET: MISCELLANEOUS GEARS

Owner/operator		Vessel name (if any)			
Gear type	Miscellaneous gears		Subtype		
Target species					
Vessel type		Vessel size		No. of crew	
Total annual landing (kg or tonne)					
	Total weight of plastics (kg)				

Gear marking has been recognized since the 1990s as a tool to contribute to sustainable fisheries, to improve the state of the marine environment, to assist the management of fisheries and to prevent and reduce negative impacts related to abandoned, lost or otherwise discarded fishing gear (ALDFG) and ghost fishing. It also contributes to improved safety at sea and assists in identifying IUU fishing activities. The purpose of this document is to provide a process or framework for conducting a risk assessment to assist in determining the need for and requirements of a system for the marking of fishing gear. The development of this document was based on principles outlined in the Annex of the VGMFG (attached as Appendix I) and guided by the results from a pilot project for risk assessment for the marking of fishing gear conducted in Grenada. This document provides examples of how to identify different risks of various fishing gears if they are not marked, or not adequately marked, under normal operating conditions and after they become ALDFG. The document also provides means for estimating likelihood of occurrences of identified risks for different fishing gears. Additionally, a method for estimating impact scores for different impacts and combined impact scores has been developed so that the risks of different gears can be categorized according to likelihoods of occurrence and potential impacts. Priorities for implementing gear marking and complexity of marking can then be identified based on risk scores.

Voluntary Guidelines on the Marking of Fishing Gear can be downloaded through the above QR-code

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