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GloLitter partnerships

Reporting & retrieval of lost fishing gear:

recommendations for developing effective programmes

Reporting and retrieval of lost fishing gear:
recommendations for developing effective programmes

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This report is one of the knowledge products contributing to GloLitter Outcome 1:

> Knowledge products and capacity building tools are developed in support of wider capacity building on the subject; and disseminated to expand global awareness and stakeholders' support in dealing with sea-based sources of marine plastic litter.

This report is based on work conducted by Ms Joan Drinkwin under the technical supervision and coordination of Mr Jon Lansley and Ms Amparo Perez Roda, Lead Technical Officer and project coordinator of the FAO components of GloLitter.

Abstract

Abandoned, lost or otherwise discarded fishing gear, also referred to as ALDFG or ghost gear, is the most harmful form of marine plastic litter for marine animals and habitats: it can impede safe navigation, damage beaches and reefs, and lead to economic losses for fisheries and other marine-dependent industries across the globe. While there are no current estimates of the amount of ALDFG in the ocean, a growing body of evidence has documented high rates of ALDFG in fisheries around the world. This state of affairs increases costs for fisheries, harms the environment, and presents significant safety risks. Given that most fishing gear has a significant number of plastic components, ALDFG also gives rise to a series of less direct but longer-term negative impacts associated with other plastic pollution and microplastics, including negative effects on biota, water quality and even human health.

Providing solutions to ALDFG on a global scale has gained momentum with the efforts of FAO, the United Nations Environment Programme (UNEP) and the IMO through their respective multilateral fora: Committee on Fisheries (COFI), United Nations Environment Assembly (UNEA) and Marine Environment Protection Committee (MEPC). Other significant initiatives and actions include: the endorsement and publication of the *Voluntary Guidelines on the Marking of Fishing Gear* (VGMFG; FAO, 2019a); the IMO action plan to address marine plastic litter from ships; the creation of the Global Ghost Gear Initiative (GGGI); and the establishment of the Joint Group of Experts on the Scientific Aspects of Marine Environmental Pollution (GESAMP) Working Group 43. These efforts reflect the growing understanding that ALDFG is a considerable and damaging source of marine plastic litter in the ocean. At the same time, the publication of the FAO VGMFG and the GGGI Best Practice Framework (BPF) for the management of fishing gear show that there are now references for how to prevent loss of fishing gear and prevent harm from ALDFG.

Focusing on two key recommendations outlined by the VGMFG and the BPF, this report describes systems for fisher-led reporting and retrieval of lost fishing gear. In doing so it identifies critical elements of successful programmes and recommends next steps for countries to develop such programmes in their turn.

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Abbreviations and acronyms

ACAP	Agreement on the Conservation of Albatrosses and Petrels
aFAD	anchored fish aggregating device
ALDFG	Abandoned, lost or otherwise discarded fishing gear
APFIC	Asia-Pacific Fishery Commission
ATLAFCO	Ministerial Conference on Fisheries Cooperation among African States bordering the Atlantic
BOBP-IGO	Bay of Bengal Programme-Intergovernmental Organization
BPF	Best Practice Framework for the Management of Fishing Gears
CBLT	Lake Chad Basin Commission
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CCSBT	Commission for the Conservation of Southern Bluefin Tuna
CECAF	Fishery Committee for the Eastern Central Atlantic
CIFAA	Committee for Inland Fisheries and Aquaculture of Africa
COFI	Committee on Fisheries
COPESCAALC	Commission for Fisheries and Aquaculture for Latin America and the Caribbean
CPPS	Permanent Commission for the South Pacific
CRFM	Caribbean Regional Fisheries Mechanism
CTMFM	Joint Technical Commission of the Maritime Front
FAD	fish aggregation device
FAO	Food and Agriculture Organization of the United Nations
FCWC	Fishery Committee for the West Central Gulf of Guinea
FFA	Forum Fisheries Agency
GESAMP	IMO/FAO/UNESCO-IOC/WMO/WHO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection
GFCM	General Fisheries Commission for the Mediterranean
GGGI	Global Ghost Gear Initiative
GIA	Global Industry Alliance
IATTC	Inter-American Tropical Tuna Commission
ICCAT	International Commission for the Conservation of Atlantic Tunas
IGO	Intergovernmental Organization
IMO	International Maritime Organization
INFOFISH	Intergovernmental Organization Marketing Information and Technical Advisory Services to the fishery industry in the Asia-Pacific
IOTC	Indian Ocean Tuna Commission
IUU	illegal, unregulated, and unreported fishing
IWC	International Whaling Commission
LPC	lead partnering country
LVFO	Lake Victoria Fisheries Organization
MEPC	Marine Environment Protection Committee
MPL	marine plastic litter
MRC	Mekong River Commission
NACA	Network of Aquaculture Centres in Asia and the Pacific

NAFO	Northwest Atlantic Fisheries Commission
NASCO	North Atlantic Salmon Conservation Organization
NEAFC	North East Atlantic Fisheries Commission
NGO	non-governmental organization
Norad	Norwegian Agency for Development Cooperation
NPAFC	North Pacific Anadromous Fish Commission
NPFC	North Pacific Fisheries Commission
OLDEPESCA	Latin American Organization for Fisheries Development
OSPESCA	Central American Organization of the Fisheries and Aquaculture Sector
PC	partnering country
PERSGA	Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden
PNA	Parties to the Nauru Agreement
PSC	Pacific Salmon Commission
RAA	Aquaculture Network for the Americas
RECOFI	Regional Commission for Fisheries
RFB	regional fishery body
RFMO	regional fisheries management organization
SEAFDEC	Southeast Asian Fisheries Development Center
SIOFA	Southern Indian Ocean Fisheries Agreement
SPC	Secretariat of the Pacific Community
SPREP	Secretariat of the Pacific Regional Environment Programme
SPRFMO	South Pacific Regional Fisheries Management Organisation
SWIOFC	Southwest Indian Ocean Fisheries Commission
UNEA	United Nations Environment Assembly
UNEP	United Nations Environment Programme
VGMFG	Voluntary Guidelines on the Marking of Fishing Gear
WCPFC	Western and Central Pacific Fisheries Commission
WECAFC	Western Central Atlantic Fishery Commission

Executive summary

This report is a product of the GloLitter Partnerships project phase I implemented by the International Maritime Organization (IMO) and the Food and Agriculture Organization of the United Nations (FAO). It was made possible thanks to 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. Ten countries, from five high-priority regions (Asia, Africa, Caribbean, Latin America and the Pacific) are participating as the lead partnering countries[1] (LPCs) to champion national actions in the context of supporting the IMO Action Plan to address marine plastic litter from ships and the FAO Voluntary Guidelines on the Marking of Fishing Gear (VGMFG). Based on the successes and lessons learned, the LPCs will support 20 selected partnering countries[2] (PCs) via twinning arrangements to address the MPL issues and build further regional support for the project. Twinning arrangements between countries that have similar priorities and challenges when addressing the issue of MPL from the maritime transportation and/or fisheries sectors will be established and will receive support from the GloLitter to implement selected joint initiatives.

The aim of this report, as one of the deliverables under Activity 1.1.1 of the GloLitter project, is to motivate the adoption and replication of effective fisheries management strategies for the fisher-led reporting and retrieval of abandoned, lost and otherwise discarded fishing gear (ALDFG). The report presents the results from a survey provided to LPCs and PCs, summarizing the status of ALDFG reporting and retrieval activities, and providing examples of effective approaches around the world that support ALDFG reporting and fisher-led retrieval. Finally, it considers several case studies of programmes that could be replicated in LPCs and PCs.

Abandoned, lost or otherwise discarded fishing gear, also referred to as ALDFG or ghost gear, is the most harmful form of marine plastic litter for marine animals and habitats: it can impede safe navigation, damage beaches and reefs, and lead to economic losses for fisheries and other marine-dependent industries across the globe. While there are no current estimates of the amount of ALDFG in the ocean, a growing body of evidence has documented high rates of ALDFG in fisheries around the world. This state of affairs increases costs for fisheries, harms the environment, and presents significant safety risks. Given that most fishing gear has a significant number of plastic components, ALDFG also gives rise to a series of less direct but longer-term negative impacts associated with other plastic pollution and microplastics, including negative effects on biota, water quality and even human health.

Providing solutions to ALDFG on a global scale has gained momentum with the efforts of FAO, the United Nations Environment Programme (UNEP) and the IMO

[1] GloLitter Lead Partnering Countries are: Brazil, Costa Rica, Cote d'Ivoire, India, Indonesia, Jamaica, Kenya, Madagascar, Nigeria and Vanuatu.
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through their respective multilateral fora (COFI, UNEA and MEPC). Other significant initiatives and actions include: the endorsement and publication of the *Voluntary Guidelines on the Marking of Fishing Gear* (VGMFG; FAO, 2019a); the IMO action plan to address marine plastic litter from ships; the creation of the Global Ghost Gear Initiative (GGGI); and the establishment of the Joint Group of Experts on the Scientific Aspects of Marine Environmental Pollution (GESAMP) Working Group 43. These efforts reflect the growing understanding that ALDFG is a considerable and damaging source of marine plastic litter in the ocean. At the same time, the publication of the VGMFG and the Best Practice Framework for the Management of Fishing Gear (BPF) show that there are now references for how to prevent loss of fishing gear and prevent harm from ALDFG.

Focusing on two key recommendations outlined by the VGMFG and the BPF, this report describes systems for fisher-led reporting and retrieval of lost fishing gear. In doing so it identifies critical elements of successful programmes and recommends next steps for LPCs and PCs to develop such programmes in their turn. The report also provides brief summaries of each LPC and PC fisheries, as well as the current state of their knowledge of ALDFG.

To gain a better understanding of the current ALDFG management practices in LPCs and PCs, a country questionnaire was developed and distributed to each national focal point. The questionnaire included questions relating to the reporting and retrieval of lost fishing gear, the marking of fishing gear, waste reception facilities, and the country's capacity for managing ALDFG. A total of 25 countries responded to the questionnaire, providing valuable insights into current ALDFG management practices and thus the potential capacity to support ALDFG reporting and fisher-led retrieval activities further.

The 25 countries that responded to the questionnaire answered all questions, with one exception. With regards to the reporting of ALDFG, 8 countries (33 percent) indicated that they require fishers who lose gear to report that loss in at least some of their fisheries, while 16 countries (67 percent) had no requirements in place to report lost fishing gear. With regards to requirements to retrieve ALDFG, 6 countries (24 percent) indicated that they require fishers who lose gear to attempt to retrieve it in at least some of their fisheries, while 19 countries (76 percent) indicated that no such requirements were in place. When asked to identify the predominant barriers preventing fishers from retrieving their own ALDFG and/or ALDFG encountered at sea, the most frequent barrier referred to was space on deck of the fishing vessels, followed by economic barriers, including the cost of disposing of retrieved ALDFG. When asked whether the marking of gear was required, 11 countries (44 percent) indicated that fishing gear marking was required in at least some of their fisheries, while 14 countries (56 percent) indicated that no fishing gear marking was required. When asked whether there were adequate waste reception facilities available to fishers for ALDFG disposal, only 21 countries answered this question. Of these, 4 countries (19 percent) indicated that adequate waste reception facilities existed for fishers to dispose of ALDFG, while 17 countries (81 percent) indicated that waste reception facilities were not adequate. Countries also provided details on potential capacity, structures, and existing programmes to support the reporting and retrieval of ALDFG.

The report provides seven case studies of effective reporting and fisher-led retrieval programmes from around the world. The Puget sound Reporting, Response, and

Retrieval Program involves a rapid response to mandated reports of lost fishing nets. The response process includes mobilizing a team of trained divers to retrieve lost nets. Norwegian Directorate of Fisheries ALDFG Reporting and Retrieval is led by the fisheries authority, which charters a fishing vessel for several weeks in order to retrieve ALDFG from areas where fishers have reported loss. The Fishing for Litter and the Mediterranean Cleanup programmes involve fishers in collecting and bringing back to port any marine litter and ALDFG they have encountered during active fishing. The Fishing Net Gains Africa project involves fishers in the collection and deposit of end-of-life and ALD nets to Fishing-HubNets: here, the nets are processed for disposal or upcycling into marketable items by community women. The Washington Coast Crab Tag and Area A Crab Association programmes both engage crab fishermen to retrieve lost crab pots.

The report provides guidance on the development of pilot ALDFG reporting and fisher-led retrieval projects. Aspects to be considered when developing pilot ALDFG reporting and retrieval projects include: the status of national programmes and potential partners, in addition to other key capacity criteria that have varying levels of importance. These capacity criteria include: the status of ALDFG reporting; the necessary level of effort or involvement from fishers, fisher associations, fisheries authorities and ports; costs and funding. Pilot projects can be designed to match the capacity available with the capacity required, as per successful project examples described in the Case Studies section. As with any effective fisheries management strategy, continual and upfront consultation and collaboration with fishers and fisher associations will ensure that pilot project designs are feasible and supported by industry.

In conclusion, the report includes the following recommendations to strengthen ALDFG reporting and fisher-led retrieval programmes in the LPCs and PCs:

- Create and strengthen requirements and incentives for fishers to retrieve gear that they lose, if safe to do so, and to carry appropriate tools and equipment on their vessel for the retrieval of lost gear.
- Support programmes and recycling initiatives such as Fishing for Litter to facilitate the collection and proper disposal of ALDFG encountered during active fishing and end-of-life fishing gear.
- Support the retrieval of gillnets lost at sea.
- Support the retrieval of lost traps and pots by participating fishers.
- Develop ALDFG reporting systems and registries that are appropriate to local fisheries in order to document the extent and location(s) of lost fishing gear, and to inform prevention and remediation activities.
- As members of RFMOs, promote binding measures around the reporting and retrieval of ALDFG.

Introduction

GloLitter Partnerships Project

This report is a product of the GloLitter Partnerships project phase I implemented by the International Maritime Organization (IMO) and the Food and Agriculture Organization of the United Nations (FAO); initial funding was provided by 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 achieves its objectives by focusing on several areas identified in the recently adopted IMO Action Plan to address MPL from ships, as well as in complementary actions as identified by FAO, such as supporting the provisions of the Voluntary Guidelines for the Marking of Fishing Gear (VGMFG).

Through its partnerships, GloLitter will spur global efforts to demonstrate and test best practices to deal with MPL and enhance global knowledge, management and information sharing. The partnership effort is three-tiered, involving global, regional, and national partners as represented by government, industry and non-governmental organizations. Private-sector participation will also be achieved through the development of a Global Industry Alliance (GIA) in collaboration with UN Global Compact, with partners from major maritime and fisheries companies. Ten countries, from five high-priority regions (Asia, Africa, Caribbean, Latin America and the Pacific) are participating as the lead partnering countries[3] (LPC) to champion national actions in the context of supporting the IMO Action Plan and the FAO Voluntary Guidelines for the Marking of Fishing Gear (VGMFG). Based on the successes and lessons learned, the LPCs will support 20 selected partnering countries[4] (PCs) via a twinning arrangement to address the MPL issues and build additional regional support for the project. Twinning arrangements between countries that have similar priorities and challenges when addressing the issue of MPL from the maritime transportation and/or fisheries sectors will be established and will receive support from the GloLitter to implement selected joint initiatives.

The aim of this report is to motivate the adoption and replication of effective fisheries management strategies for the reporting and fisher-led retrieval of abandoned, lost and otherwise discarded fishing gear (ALDFG). The report presents the results from a survey provided to LPCs and PCs, summarizing the status of ALDFG reporting and retrieval activities, and providing examples of effective approaches around the world that support ALDFG reporting and fisher-led retrieval. Finally, it considers several case studies of programmes that could be replicated in LPCs and PCs. The report describes systems for fisher-led reporting and retrieval of lost fishing gear,

[3] GloLitter Lead Partnering Countries: Brazil, Costa Rica, Cote d'Ivoire, India, Indonesia, Jamaica, Kenya, Madagascar, Nigeria and Vanuatu

[4] GloLitter Partnering Countries are: Argentina, Cabo Verde, Columbia, Ecuador, Gambia, Mozambique, Nicaragua, Panama, Peru, Philippines, Senegal, Sri Lanka, Solomon Islands, Sudan, United Republic of Tanzania, Thailand, Timor-Leste, Togo, Tonga and Viet Nam.

identifies critical elements of successful programmes, and recommends next steps for countries to develop such programmes in their turn.

Abandoned, lost or otherwise discarded fishing gear

Fisheries and aquaculture feed over 3.3 billion people globally. In 2018, an estimated 4.56 million fishing vessels operated across the globe. Marine capture fisheries production reached 84.4 million tonnes, a 5.4 percent increase over the previous three-year average (FAO, 2020a). With this fishing effort comes accidental loss and, at times, the intentional abandonment and discard of fishing gear. Abandoned, lost, or otherwise discarded fishing gear, also known as ALDFG or ghost gear, is the most harmful form of marine plastic litter for marine animals and habitats (Wilcox *et al*., 2016)determining the consequences of this debris on marine fauna and ocean health has now become a critical environmental priority, particularly for threatened and endangered species. However, there are limited data about the impacts of debris on marine species from which to draw conclusions about the population consequences of anthropogenic debris. To address this knowledge gap, information was elicited from experts on the ecological threat (both severity and specificity. It also can impede safe navigation, damage beaches and reefs, and lead to economic losses for fisheries and other marine-dependent industries across the globe. The VGMFG define ALDFG as follows:

- "Abandoned fishing gear" means fishing gear over which that operator/owner has control and that could be retrieved by owner/operator but 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 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, 2019a).

In this report, the term ALDFG or 'lost fishing gear' will be generally be employed unless specifically referring to abandoned or intentionally discarded gear. The term 'ghost gear' will only be used to refer to ALDFG known to be ghost fishing.

The often referenced estimate that 640 000 tonnes of ALDFG are lost annually to the world's ocean is likely originated from a now 45-year old study by the National Academy of Sciences (NAS) that examined marine litter, including litter from commercial fishing, as part of a larger study around assessment of ocean pollutants (Gilardi *et al*., 2020; NAS, 1975). A recent UNEP publication reported that, by volume, ALDFG accounts for 70 percent all macro-plastic marine litter in the oceans (UNEP, 2016). These numbers play out at regional scales with annual estimates of 38 535 tonnes of fishing gear lost in the Republic of Korea, 10 000 gillnets lost in the Baltic Sea, and more than 12 000 crab pots lost in the United States of America Salish Sea (Antonelis *et al*., 2011; Kim *et al*., 2014; Szulc *et al*., 2015). In the Western Central Pacific Ocean, estimates of the number of drifting FADs washing up (beaching) onto nearshore habitats every year, having been abandoned, ranges from 9 254 to 13 436 (Banks and Zaharia, 2020). This gear loss adds to the growing mass of plastics entering our oceans every year. Two other recent studies attempted a global estimate of rates of fishing gear loss:

Richardson *et al*. (2019b) estimated that 5.7 percent of fishing nets, 8.6 percent of traps and pots, and 29 percent of fishing lines used globally are lost, abandoned or otherwise discarded into the environment. Lively and Good (2018) estimated annual losses as 3–7 net panels/boat or 38 535 tons of nets/region, and 7–50 percent of traps and pots. Both studies were based largely on northern hemisphere records. The second interim report from the GESAMP Working Group 43 called out the need for a more robust estimate of global fishing gear loss (Gilardi *et al*., 2020).

The most common identified causes of ALDFG include: snagging on reefs, rocks and bottom obstructions; conflicts with vessels or other fishing gear; and bad weather (Gilardi *et al*., 2020; Macfadyen *et al*., 2009)lost or otherwise discarded fishing gear (ALDFG. Other causes in some fisheries include interactions with animals, long soak times, fishing in deep habitats, and deploying more gear than can be hauled in regularly (Brown and Macfadyen, 2007). The intentional discard of fishing gear is also a documented cause of ALDFG (Richardson *et al*., 2017), as is the loss or abandonment of fishing gear resulting from illegal, unreported, and unregulated (IUU) fishing. The latter is believed to contribute considerable amounts of ALDFG to the sea, as illegal fishers abandon or discard fishing gear to conceal their activities.

The causes of gear loss are closely linked to the types of fishing gear used, with gear that touches the bottom and gear that is not actively managed by fishers more likely to be lost. Trawl gear, traps and pots, and gillnets have all been identified as having high likelihoods of being lost (Gilardi *et al.*, 2020; Gilman *et al.*, 2021; Huntington, 2016; Richardson *et al.*, 2019a).

Gillnet fishing boats in Vietnam

© FAO/Ken Preston

The harm caused by ALDFG also varies by type of gear, its time in the water, the sea conditions, fishery and habitat. Negative impacts to harvests from ghost fishing have been documented in some fisheries (Antonelis *et al.*, 2011; DelBene *et al.*, 2019; Patterson Edward *et al.*, 2020). Navigational hazards, harm caused to marine animals through entanglements and ingestions, as well as damage to habitat, are all documented impacts of ALDFG around the world (Gilardi *et al.*, 2020; Hong *et al.*, 2017; Link *et al.*, 2019; Lively and Good, 2018; NOAA Marine Debris Program, 2016; NOAA Marine Debris Program, 2015; Richardson *et al.*, 2019a).

Given that most fishing gear has significant plastic components, the negative impacts from ALDFG also include less direct but longer-term impacts associated with other plastic pollution and microplastics, such as negative effects on biota, water quality and even human health (Carbery *et al.*, 2018; Cera *et al.*, 2020; FAO, 2017; GESAMP, 2016, 2015). Once fishing gear is lost at sea, exposure to UV radiation, waves and other forces can cause fragmentation and degradation, producing much smaller pieces defined as microplastics (1 µm to 5 mm) (Cera *et al.*, 2020). Yet the harm caused by ALDFG in the context of its contribution to microplastic pollution in the ocean is not well understood.

Providing solutions to ALDFG on a global scale has gained momentum with the efforts of FAO, the United Nations Environment Programme (UNEP) and the IMO through their multilateral fora (COFI, UNEA and MEPC). Other significant initiatives and actions include: the endorsement and publication of the *Voluntary Guidelines on the Marking of Fishing Gear* (VGMFG; FAO, 2019a); the IMO Action Plan to address marine plastic litter from ships; the creation of the Global Ghost Gear Initiative (GGGI); and the establishment of the Joint Group of Experts on the Scientific Aspects of Marine Environmental Pollution (GESAMP) Working Group 43. The GESAMP Working Group 43 was established by IMO, FAO and UNEP to develop a report of sea-based sources of marine litter, identifying the extent, causes, impacts and recommended solutions to this global problem, including ALDFG. Its second Interim Report was presented to FAO's Committee on Fisheries (COFI) in June 2020 (Gilardi *et al.*, 2020).

These efforts reflect the growing understanding that ALDFG is a considerable and damaging source of MPL in the ocean. With the publication of the VGMFG and the Best Practice Framework for the Management of Fishing Gear (BPF), there are now references for how to prevent loss of fishing gear and prevent harm from ALDFG.

Voluntary Guidelines on the Marking of Fishing Gear

The Voluntary Guidelines on the Marking of Fishing Gear (VGMFG) were adopted by FAO's Committee on Fisheries (COFI) in July 2018 after an expert consultation (April 2016) and a technical consultation (February 2018), as well as the execution of pilot gear-marking studies. The VGMFG are specifically designed to combat, minimize and eliminate ALDFG, and to identify and recover lost fishing gear. Thus, the VGMFG do not focus only on marking fishing gear, but also include sections on the reporting and recovery of ALDFG.
Marking gear helps avoid gear conflicts, locate lost gear and distinguish legal fishing gear from illegal gear. As laid out in the VGMFG, gear marking should, among other things, provide a feasible and verifiable means of identifying the ownership and position of fishing gear, and establish its link with vessels and operators of the

fishing gear (FAO, 2019a). Traditional gear marking includes flags, reflectors, buoys, inscriptions, writing, and tags. Newer kinds of marking, such as electronic buoys, electronic devices and coded wire tags are being assessed in multiple fisheries to determine their usefulness (He and Suuronen, 2018). Satellite buoys are now commonly attached to drifting FADs so fishing companies can track their location. Where reporting of lost gear is mandatory, locating the owner of recovered lost gear who has not been reported its loss can trigger penalties. This is the case in Washington's Salish Sea, where reporting the loss of gear is mandatory, and fishers have been fined for failing to report the loss of gear that was subsequently recovered by removal teams and traced back to its owner (Richardson *et al.*, 2019a).

The VGMFG include recommendations to require the reporting of lost fishing gear to appropriate authorities. This reporting system should be linked to a record or register of reported gear that is maintained by relevant authorities, and shared with cooperating relevant organizations and stakeholders as appropriate. Reports should be shared with transiting vessels if the lost gear might pose a safety hazard.

The VGMFG includes recommendations to prioritize the recovery of ALDFG relative to its potential to create a navigational hazard, its impacts on sensitive habitats, and its likelihood of ghost fishing. The guidelines thus recommend identifying hotspot areas with elevated risks to navigation, habitats and species.

Best Practices Framework for the Management of Fishing Gears

The GGGI is a multi-stakeholder alliance of over 100 organizations, business and governments that brings seafood stakeholders together to address ALDFG at all points along the seafood supply chain; it is also a strategic partner in the GloLitter Partnerships project. The GGGI has published a Best Practices Framework for the Management of Fishing Gear (BPF) that provides management strategies to prevent harm from ALDFG; the framework is directed at ten different seafood industry stakeholders, including fisheries managers (Huntington, 2017).

The GGGI BPF was developed in 2017 and finalized through an extensive stakeholder engagement and consultation process. The BPF lays out management options to avoid ALDFG and mechanisms for the responsible use of fishing gear. The BPF explains which options are available to different industry stakeholders along the seafood supply chain (Huntington, 2016, 2017) and is divided into sections for each on strategies for prevention, mitigation and remediation. Actions laid out in the BPF fall into four main categories: voluntary guidance, third-party certification schemes, regulatory measures and building awareness.

Seafood industry stakeholders identified in the BPF include fishing gear designers, manufacturers and retailers; fishers; fisheries organizations; port operators; fisheries managers and regulators; fisheries control agencies; fisheries and marine environmental researchers; seafood ecolabel standard and certification programmes; seafood businesses; and non-governmental organizations. This approach recognizes that many drivers are at work in fisheries, from the natural environmental challenges that come from working in the marine environment to the market forces driving fishing activity. It also presents a clear picture of the many opportunities along the seafood supply chain, where actions can be taken that will help to prevent harm from ALDFG.

Importance of reporting and retrieval

Given the importance of fishers' actions in reducing the occurrence of gear loss, the BPF and VGMFG include clear options and recommendations for fisheries management to prevent and minimize harm from ALDFG. Many of these best practices may be implemented by fisheries managers for reasons other than to prevent the loss of fishing gear. Gilman (2015) summarized 16 fisheries management strategies available to fisheries managers to prevent and reduce the harmful impacts of ALDFG. Only six of the methods explicitly call out ALDFG; others, such as spatio-temporal restrictions, are generally implemented for different reasons but have the benefit of reducing gear loss.

Both the BPF and the VGMFG emphasize the important of reporting ALDFG. Reporting is important for two reasons: first, when gear is lost it can often be retrieved if its location is known; second, understanding the extent, locations and causes of gear loss is critical to developing effective prevention and management strategies.

The retrieval of lost gear is the only way to eliminate its negative impacts. For some fishing gear such as gillnets, retrieval is most effective as soon as possible after the gear is lost. Some nets may lose their structural integrity and fishing capacity over time, which means that waiting to retrieve the gear after weeks or even years may prove ineffective in reducing its negative impacts (Ayaz *et al*., 2006; Baeta, F., Jose Costa, M., & Cabral, 2009; Good *et al*., 2010). For other gear such as some shellfish traps and pots, harm to species is less immediate and retrievals conducted days or weeks after the loss can still eliminate significant negative impacts to species (Antonelis *et al*., 2011; Butler *et al*., 2018). Harmful impacts related to navigational safety and habitat damage can only be eliminated by removal.

In order to prevent gear loss and mitigate harm from ALDFG it is critical to understand the underlying causes and drivers of the loss as they relate to each fishery specifically. Accurate reporting of fishing gear loss is a crucial source of this information. Where reporting is required, common information gathered includes fisher/vessel identification, the location and time of gear loss, type of gear lost, in addition to an explanation of why the gear was lost (Marine Management Organisation, 2016; Richardson *et al*., 2019a, 2017). By documenting the reasons gear is lost, effective prevention and mitigation strategies can then be identified and implemented (Drinkwin, 2016; Richardson *et al*., 2018).

GloLitter participating countries

Participating countries in the GloLitter Partnerships project are either lead partnering countries (LPCs) or partnering countries (PCs) from five regions: Africa, Asia, Caribbean and Central America, Latin America and the Pacific. The LPCs are countries with a significant interest in tackling the issue of sea-based MPL and have committed a significant level of national engagement in the project; they also provide some level of regional leadership. These countries have reasonable capacity and have expressed the political will to engage meaningfully in the reduction of MPL in their region. Partnering countries are those for whom a reduction of sea-based MPL is important but who have limited capacity to engage proactively in regional or national level activities at the present time. These countries have committed to working closely with the regional LPCs and benefit from a programme of work under a twinning arrangement between LPCs and PC. GloLitter will provide support in establishing the twinning arrangements, and implement selected regional priority actions identified under the twinning partnership. All LPCs and PCs are shown in Table 1, by region.

Table 1
Participating countries

REGION	LEAD PARTNERING COUNTRIES	PARTNERING COUNTRIES
AFRICA	Côte d'Ivoire, Kenya, Madagascar, Nigeria	Cabo Verde, Mozambique, Senegal, Sudan, United Republic of Tanzania, Gambia, Togo
ASIA	India, Indonesia	Philippines, Sri Lanka, Thailand, Timor-Leste, Viet Nam
CENTRAL AMERICA AND THE CARIBBEAN	Jamaica, Costa Rica	Nicaragua, Panama
LATIN AMERICA	Brazil	Argentina, Colombia, Ecuador, Peru
PACIFIC	Vanuatu	Solomon Islands, Tonga

Fisheries summaries

The following brief summaries of fisheries in LPCs and PCs give a broad picture of the prevalent types of marine capture fisheries and the gear types used. This provides a basis from which to explore appropriate strategies addressing potential ALDFG linked to fisheries and gear types[5]. A general understanding of ALDFG issues in each country is also presented; this information was gathered from the authors' contacts with ALDFG networks as well as a literature search using the search terms "country name", "lost fishing gear", "marine litter", and "marine debris".

In this report fisheries are referred to respectively as "large-scale", which includes industrial commercial operations; and "small-scale", which includes artisanal and

[5] Unless otherwise referenced, the information in this section was gleaned from the FAO country profiles available at www.fao.org/fishery/countryprofiles/search/en.

traditional harvesting. While firm definitions of the different scales of fisheries are not well established, the following general definitions will be adopted. Large-scale or industrial fisheries are characterized by high-capacity vessels of greater than 24 m in length; these might include factory boats, purse seiners and trawlers (Gilardi *et al*., 2020). Small-scale fisheries, on the other hand, are generally characterized by vessels of less than 24 m in length and can include commercial and subsistence fisheries. The latter category includes artisanal fisheries, both commercial and subsistence, and undecked vessels of less than 12 m in length, which account for a majority of motorized fishing vessels globally (FAO, 2020a). Small-scale fisheries are generally "strongly anchored in local communities, reflecting often historic links to adjacent fishery resources, traditions and values, and supporting social cohesion"; they contribute about half of global fish catches and are critical to direct local food supplies (FAO, 2015b).

Global Fishing Watch information

Global Fishing Watch (GFW) data was accessed to provide a broad overview of industrial fishing capacity and gear types used in each country. The GFW generalizes global fishing efforts using a unique Maritime Mobile Service Identity (MMSI), registered to a unique vessel by country (U.S. Department of Homeland Security, 2021). With the MMSI number, Automatic Identification Systems (AIS) data can be gathered from vessels in different regions of the world. By analyzing track line patterns and matching track line patterns to different fishing types, GFW then categorizes fishing activity by gear type. However, not all gear can be categorized in this way, and when this occurs the gear is listed as "fishing". These vessel data are collated from over 30 registries, including public vessel registries from RFMOs and country-level vessel registries, as well as lists of vessels that have been provided by other organizations or manually reviewed by GFW. This database therefore includes approximately 70 000 of the world's estimated 2.8 million fishing vessels. Less than 1 percent of vessels under 12 m are represented by these data, with 14–19 percent of vessels from 12 to 24 m represented, and 52–85 percent of vessels over 24 m represented (Global Fishing Watch, 2021).[6]

Of the 30 GloLitter LPCs and PCs, 23 are included in data from GFW. These data were categorized by the number of unique MMSI by gear type (Table 2).

Ten countries from the Africa region were included in the GFW analysis: Cabo Verde, Côte d'Ivoire, Kenya, Madagascar, Mozambique, Nigeria, Senegal, United Republic of Tanzania, the Gambia and Togo. There were 62 vessels with unique MMSIs in Africa, with the majority being from Senegal (20) and Mozambique (17). The majority of these were categorized as tuna purse seines, followed by trawlers, drift longlines, generic "fishing", and pole-and-line.

[6] Global Fishing Watch has made every attempt to ensure the completeness, accuracy and reliability of the information provided on its site. However, due to the nature and inherent limitations in source materials for information provided, Global Fishing Watch qualifies all designations of vessel fishing activity, including synonyms of the term "fishing activity," such as "fishing" or "fishing effort," as "apparent," rather than certain. And accordingly, the information is provided "as is" without warranty of any kind.

Despite having a small fleet of vessels registered in AIS, fishing hours in in Cabo Verde, Côte d'Ivoire, Nigeria and Senegal amounted to 35 485 in 2019. Fishing hours were dominated by drift longlines and tuna purse seines, followed by trawlers, pole-and-line, and generic "fishing". There were no fishing hours from this database for the Gambia or Togo.

In Kenya, Madagascar, Mozambique and United Republic of Tanzania, there were 27 252 fishing hours, with trawling (Mozambique, Madagascar and Kenya), and drift longlines (Kenya, Mozambique) accounting for the majority of these.

Four countries from the Asia region were included in the GFW analysis: India, Indonesia, Philippines and Thailand. There were 404 unique MMSI in the region, with the most vessels from Indonesia (357), followed by Philippines, Thailand and India. Most vessels were categorized as squid jiggers (all from Indonesia), followed by purse seines and drift longlines. However, when looking at the sum of fishing hours (21 692), tuna purse seining had the most (14 658 from Philippines and 200 from Indonesia), followed by uncategorized "fishing", primarily from India, followed by trawling in Thailand.

Seven countries from the Latin America region were included in the GFW analysis: Argentina, Brazil, Columbia, Ecuador, Nicaragua, Panama and Peru. Latin America had the most registered vessels (519), and number of fishing hours (549 447) of all regions. Most vessels and fishing hours are from Argentina, with 265 vessels with unique MMSIs and 397 280 fishing hours, followed by Peru (127 vessels; 47 560 fishing hours). Of the vessels in Latin America, most were trawlers, followed by purse seiners (tuna and other). Trawlers accounted for most of the fishing hours, followed by purse seines, drift longlines, and generalized "fishing".

Two countries from the Pacific region were included in the GFW analysis: Solomon Islands and Vanuatu. There were 91 vessels with unique MMSIs in the Pacific region: 87 from Vanuatu and 4 from the Solomon Islands. The majority of vessels are drift longlines (70) followed by tuna purse seines (12), squid jiggers (6), trawlers (2), and pole-and-line (1). There were 279 162 fishing hours in the Pacific region, with the majority being from Vanuatu (276 054), followed by the Solomon Islands (3 108). Most fishing hours were categorized as drift longlines, followed by tuna purse seines, and squid jiggers.

Table 2
Number of unique Maritime Mobile Service Identity (MMSI) by region, country, and gear type for 2019.

REGION	COUNTRY NAME	DRIFT LONGLINES	FISHING	FIXED GEAR	OTHER PURSE SEINES	POLE-AND-LINE	PURSE SEINES	SET LONGLINES	SQUID JIGGER	TRAWLERS	TUNA PURSE SEINES
AFRICA	Cabo Verde	1									4
	Côte d'Ivoire	2									1
	Gambia		1								
	Kenya	2	2							1	2
	Madagascar									1	
	Mozambique	6	2					2		7	

REGION	COUNTRY NAME	DRIFT LONGLINES	FISHING	FIXED GEAR	OTHER PURSE SEINES	POLE-AND-LINE	PURSE SEINES	SET LONGLINES	SQUID JIGGER	TRAWLERS	TUNA PURSE SEINES
AFRICA	Nigeria									3	1
	Senegal	3	5			1				4	7
	United Republic of Tanzania	1	1								
	Togo	0	2								
ASIA	India	4	2								
	Indonesia	83	22			2	96	16	135		3
	Philippines	1	2								30
	Thailand	3	1							4	
LATIN AMERICA	Argentina		23	1				3	67	171	
	Brazil	16	5					1		2	
	Colombia		2								16
	Ecuador	6	2				1				51
	Nicaragua										3
	Panama	3	1		1			1			16
	Peru		7		58		23			1	38
PACIFIC ISLANDS	Solomon Islands										4
	Vanuatu	70							6	2	8

Source: Global Fisheries Watch (2019).

Africa region

Cabo Verde

Cabo Verde's fishing sectors are both large-scale and small-scale, industrial and artisanal. Of the 6 298 fishers in the sector in 2017, 5 078 were active in artisanal fisheries, yet industrial landings still account for 57 percent of total landings. Industrial fishing and semi-industrial fishing are practised by pole-and-line tuna vessels, purse seiners and lobster boats deploying traps: the length of these boats varies from 7 m to 26 m (González, J. A., *et al.*, 2020).

Artisanal fishing dominates Cabo Verde's fishing sector. Artisanal fishers operate most of the year, with daily trips from the coast within 3 nautical miles (5.556 km) of shore. They use small wooden open beam vessels, some motorized. The gear types used in the artisanal fisheries include, *inter alia*: handlines, diving, beach seine and purse seine.

Global reviews of elasmobranch and marine turtle entanglement in marine debris documented a nurse shark and a Loggerhead turtle entangled in ALDFG in Cabo Verde in 2001 and 2003 (Duncan *et al.*, 2017; Parton *et al.*, 2019). Fishers identified damage from ALD nets fouling their boat propellers as a concern in a study of perceptions of marine debris in two Cabo Verde fishing villages (Ferreira *et al.*, 2021). A suvery of marine debris in a remote island of Cabo Verde found that ALDFG

accounted for 69.1 percent of debris encountered (Fernandes, 2019). Since 2015, an NGO (Calao) has initiated the collection of more than 16 tonnes of marine debris from the Sal islands. The marine debris, which includes fishing nets and other debris from the international fishing industry, is driven by oceanic currents onto remote beaches of Cabo Verde. Another study of marine debris trajectories confirmed that ALDFG accumulating in Cabo Verde could be coming from Western Sahara, Mauritania and Senegal (Cardoso and Caldeira, 2021). A project supported by the GGGI is building a recycling unit to upcycle collected MPL into marketable items (GGGI, 2018). Cabo Verde and the NGO Calao participated in the FAO/GGGI Regional Workshop on Best Practices to Manage ALDFG held in Dakar in 2019 (FAO, 2020b).

Cabo Verde is a member of the following relevant IGOs and RFBs:

- Fishery Committee for the Eastern Central Atlantic (CECAF)
- International Commission for the Conservation of Atlantic Tunas (ICCAT)
- Ministerial Conference on Fisheries Cooperation among African States bordering the Atlantic (ATLAFCO)
- Subregional Fisheries Commission (SRFC).

Côte d'Ivoire

Côte d'Ivoire fisheries management includes an industrial sector and a coastal and lagoon artisanal sector. Capture fisheries production was estimated at 75 500 tonnes in 2017, with 7 800 tonnes originating from inland fisheries. The total number of marine and inland fishers was estimated at 9 140. A total of 11 377 undecked boats were estimated for 2017, with another 54 decked boats including trawlers and purse seiners. Artisanal fishing is mainly carried out by migrant fishers from neighbouring countries.

A unique factory built in Côte d'Ivoire by Conceptos Plasticos, a plastic recycling company, is turning plastic litter into plastic bricks for building schools. The project is funded by UNICEF and shows great promise in addressing the challenges of disposing of MPL (World Economic Forum, 2019).

Côte d'Ivoire's response to the country questionnaire notes that a new system for reporting hazards to navigation – including ALDFG – is being developed with a companion regulation stipulating fishing vessels must try to recover lost or damaged fishing gear.

Côte d'Ivoire is a member of the following relevant IGOs and RFBs:

- Committee for Inland Fisheries and Aquaculture of Africa (CIFAA)
- Fishery Committee for the Eastern Central Atlantic (CECAF)
- Fishery Committee for the West Central Gulf of Guinea (FCWC)
- International Commission for the Conservation of Atlantic Tunas (ICCAT)
- International Whaling Commission (IWC)
- Ministerial Conference on Fisheries Cooperation Among African States Bordering the Atlantic (ATLAFCO)

Kenya

Kenya's fisheries and aquaculture sector contributes approximately 0.54 percent to the country's GDP (2013) (FAO, 2015a). Marine fishing is mainly artisanal,

subsistence and inshore. In 2010 some 6 500 fishers operated 1 800 artisanal fishing craft in Kenya's marine and coastal waters.

Medium-sized trawlers and modern technological fishing equipment, including purse seine and FADs, are employed for industrial fishing. Ring nets are also used to exploit offshore fish resources far into the EEZ. Major gear used by the artisanal fishers includes, *inter alia*: gillnets, seine nets, cast nets, handlines, trolling lines, trammel nets, harpoons, hooked and pointed sticks, fence and basket traps, and bottom lines. Pots are used to harvest lobsters in the Lamu, Malindi and Kwale areas (McClanahan and Mangi, 2004).

Marine litter assessments have documented ALDFG in numerous coastal areas of Kenya (Okuku *et al*., 2021, 2020) and studies of Kenyan coral reefs have noted damage resulting from ALDFG (Gilardi *et al*., 2020). Kenya is identified as a potential hotspot for the beaching of drifting FADs, which originate from the Indian Ocean tuna fishery (Imzilen *et al*., 2020). In one study of debris in Lake Victoria, gillnets constituted the majority of MPL, accounting for 86 percent of debris encountered at different depths in the lake. Longlines and hooks made up an additional 7 percent (Ngupula *et al*., 2014). Representatives from Kenya participated in a recent FAO/GGGI Regional workshop on ALDFG where they presented on the impacts of ALDFG on wildlife in Kenya (FAO, 2020b). Local NGO Watamu Marine Association and waste recycler Kwale Plastics Plus Collectors are collaborating with Enaleia (see case study) on the Bahari Safi Project in Kwale and Kilifi counties to engage fishers in collecting the MPL and ALDFG encountered during fishing activities.

In its response to the country questionnaire, Kenya noted that fishers who lose their gears because shrimp trawlers come in too close to shore, particularly in Malini-Ungwana Bay, should report this loss to the Kenya Fisheries Service through local Beach Management Units and be compensated by the trawlers.

Kenya is a member of the following relevant IGOs and RFBs:

- Committee for Inland Fisheries and Aquaculture of Africa (CIFAA)
- Indian Ocean Tuna Commission (IOTC)
- International Whaling Commission (IWC)
- Lake Victoria Fisheries Organization (LVFO)
- Southwest Indian Ocean Fisheries Commission (SWIOFC).

Madagascar

Madagascar has the largest EEZ in the Indian Ocean at 1.14 million km^2. Fisheries are mainly traditional artisanal fisheries. They include traditional canoes and artisanal boats as well as industrial vessels. In 2011, fisheries production was estimated at 130 000 tonnes/year, with artisanal fisheries accounting for 107 300 tonnes/yearr. During the 2000s, artisanal catches averaged 72 percent of total catches in Madagascar (Le Manach *et al*., 2012).

Traditional fishing gears include, *inter alia*: spears, spear guns, handlines, longlines, gillnets, shark nets, beach seine nets and hand nets or scoops. Anchored FADs have also been deployed in Madagascar. Industrial fishers use trawls and longlines (Global Fishing Watch, 2021; Gough *et al*., 2020; Karama and Matsushita, 2019).

Systematic marine debris surveys of three beaches in Madagascar's Diana Region found that ALDFG accounted for 15.44 percent of debris counted (Gjerdseth, 2017). Madagascar has been identified as a 'hotspot' for the beaching of drifting FADs originating from the Indian Ocean tropical tuna purse seine fishery (Imzilen *et al.*, 2020) with presumed coincident damage to its sensitive coral reef habitats (Balderson and Martin, 2015; Consoli *et al.*, 2020).

Madagascar is a member of the following relevant IGOs and RFBs:

- Indian Ocean Tuna Commission (IOTC) (Breuil and Grima, 2014).

Mozambique

Mozambique has three fisheries sectors: industrial, small-scale commercial and artisanal Total capture production in 2017 was around 329 320 tonnes, with about 232 300 tonnes from marine fisheries and the balance from inland water production. Large increases of marine capture production since 2003 are due to a new data collection system for artisanal fisheries. Artisanal fishers mainly operate using canoes and sailboats (dhows) (Jacquet *et al.*, 2010). Industrial fishing is carried out especially in the central part of the country (Sofala Bank), mainly through joint ventures between the Government of Mozambique and foreign fishing companies, which primarily target shallow-water shrimp. There is also a domestic fishery targeting shrimps.

Industrial fishing gears used in the country include longlines and trawls (Global Fishing Watch, 2021), while artisanal fishers target multiple species using several type of gear, *inter alia*: beach seines, gillnets, mosquito nets, handlines and spears (Darkey and Turatsinze, 2014; Reeves *et al.*, 2013; Samoilys *et al.*, 2019).

Conflicts between artisanal fishers and industrial trawlers operating too close to the shore have reportedly resulted in lost artisanal fishing gear (Jacquet *et al.*, 2010). Mozambique has been identified as a 'hotspot' for the beaching of drifting FADs originating from the Indian Ocean tropical tuna purse seine fishery (Imzilen *et al.*, 2020). Studies of Mozambique coral reefs have noted damage resulting from ALDFG (Gilardi *et al.*, 2020).

In its response to the country questionnaire, Mozambique highlighted that in Beira one fishing company used to keep ALDFG found during fishing and bring it to port (ports in Beira and Quelimane have containers for ALDFG). The questionnaire response also referred to a shrimp trawling company in Sofala province, which has implemented a programme for its vessel to bring any ALDFG encountered during fishing to port.

Mozambique is a member of the following relevant IGOs and RFBs:

- Committee for Inland Fisheries and Aquaculture of Africa (CIFAA)
- Indian Ocean Tuna Commission (IOTC)
- Southwest Indian Ocean Fisheries Commission (SWIOFC)

Nigeria

Nigeria's fishery sector includes industrial and artisanal fishers. Fishing is a major source of livelihood, and inland and marine capture are of almost equal importance.

More than 80 percent of Nigeria's total domestic production is generated by small-scale artisanal fishers operating in coastal and inshore areas, creeks of the Niger Delta, lagoons, inland rivers and lakes. For the industrial fleet, Global Fishing Watch data shows three trawlers and one purse seiner operating in Nigeria; these vessels target tunas and also use FADs (Global Fishing Watch, 2021; ICCAT *et al.*, 2017). The main species from marine capture fisheries are sardinella.

Artisanal fishers use canoes and operate in the brackish waters of lagoons, creeks and estuaries. Coastal artisanal fishers operate within 5 nautical miles (9.26 km) of shore, inside the trawling zone, and utilize multiple gears including, *inter alia*: gillnets, cast nets, hooks and line, traps, and trawls (Egesi, 2016; Solarin *et al*., 2009).

Negative impacts from ALDFG and proposed solutions involving international collaboration are noted in a review of marine pollution impacts on coastal resources in Nigeria (Elenwo and Akankali, 2015). Solarin *et al*. (2009) recommended the use of biodegradable materials in gillnet design to limit ghost fishing by lost gillnets. The Fishing Nets Gains project set up by SOFER is active in three coastal fishing communities (see case study). This project collects ALD gillnets and cast nets from fishers for upcycling into marketable crafts. Fishers participating in that project report that artisanal nets are sometimes destroyed by industrial trawlers with no compensation forthcoming[7]. Nigeria and SOFER participated in the FAO/GGGI Regional Workshop on Best Practices to Manage ALDFG held in Dakar in 2019 (FAO, 2020b).

Nigeria's response to the country questionnaire indicated that there is a newly constituted National Taskforce on Marine Litter. Its work will include the retrieval of ALDFG.

Nigeria is a member of the following relevant IGOs and RFBs:

- Committee for Inland Fisheries and Aquaculture of Africa (CIFAA)
- Fishery Committee for the Eastern Central Atlantic (CECAF)
- Fishery Committee for the West Central Gulf of Guinea (FCWC)
- International Commission for the Conservation of Atlantic Tunas (ICCAT)
- Lake Chad Basin Commission (CBLT)
- Ministerial Conference on Fisheries Cooperation among African States bordering the Atlantic (ATLAFCO).

Senegal

Fisheries in Senegal include industrial and artisanal fleets. In 2015 capture production amounted to 395 400 tonnes of marine fish, with 147 decked fishing vessels reported in the same year, most of which ranged from 30 m to 45 m in length overall. A significant artisanal, undecked fleet of 8 053 powered and 1 430 unpowered vessels was also reported in 2015. The artisanal fleet produces more than three times the production of the industrial fleet (Diedhiou, 2019).

Industrial vessels use trawls, purse seines (and FADs), longlines, traps and pole-and-line gear. Artisanal fishers use purse seines, surface and bottom gillnets and trammel nets, longlines and traps (Diedhiou, 2019).

[7] Emmanuel Sofa, personal communication to the authors, 5 May 2021.

A study of buried marine debris at two beaches in Senegal found that ALDFG comprised 3.2 percent of the items recorded in the urbanized beach site and 12.4 percent of items recorded in the non-urbanized beach site (Tavares *et al.*, 2020). A review of marine mammal entanglements from 1990 to 2011 reported a Minke whale entangled in a gillnet off the coast of Senegal in the 1990s (Reeves *et al.*, 2013). A study of marine debris trajectories suggested that Senegal could be one source of the ALDFG accumulating in Cabo Verde (Cardoso and Caldeira, 2021). A Senegalese NGO, Oceanium, has conducted ALDFG retrievals with divers since 2011. To date, 80 volunteer divers have participated in more than 60 dives, which have collected more than 5 tonnes of ALD nets (Oceanium, 2021). Senegal participated as host of the FAO/GGGI Regional Workshop on Best Practices to Manage ALDFG held in Dakar in 2019 (FAO, 2020b).

Senegal is a member of the following relevant IGOs and RFBs:

- Committee for Inland Fisheries and Aquaculture of Africa (CIFAA)
- Fishery Committee for the Eastern Central Atlantic (CECAF)
- Indian Ocean Tuna Commission (IOTC)
- International Commission for the Conservation of Atlantic Tunas (ICCAT)
- International Whaling Commission (IWC)
- Ministerial Conference on Fisheries Cooperation among African States bordering the Atlantic (ATLAFCO)
- Subregional Fisheries Commission (SRFC).

Sudan (the)

Sudan's fisheries may be divided into industrial and small-scale commercial and artisanal. Most of the fish production is from inland waters i.e. the Nile River, lakes and dams (Tesfamichael and Elawad, 2016). The marine industrial fishery principally includes purse seiners and trawlers targeting shrimp, threadfin bream, lizardfish and goatfish. A reported 2 000 marine artisanal fishers operated in 2019 in coastal areas and generally used non-motorized boats (Olsen *et al.*, 2019). Some artisanal fishing sambouk (launches) and felucca (wooden and steel boats) are motorized with inboard or outboard engines.

Marine artisanal fishers in Sudan use traditional gear such as pole-and-line, longline, cast nets, gillnets, beach seines, traps and spears (Olsen *et al.*, 2019).

Beach debris surveys conducted in 2019 at six locations on the World Heritage Sites of Dungonab Bay and Mukkawar Island National Park collected 51.4 items of ALDFG/100 m with a density of 12.03 kg/100 m. These items accounted for 8.5 percent of debris collected at all sites. The largest amounts of ALDFG collected by weight were found at fishing landing sites and fishing beaches with densities ranging from 7.03 kg/100 m to 32.06 kg/100 m. At the more remote Cleaning Area beach ALDFG was a more significant component, representing 39 percent of items collected and 57 percent by weight (Abeadallah *et al.*, 2020).

Sudan is a member of the following relevant IGOs and RFBs:

- Committee for Inland Fisheries and Aquaculture of Africa (CIFAA)
- Indian Ocean Tuna Commission (IOTC)
- Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA).

United Republic of Tanzania (the)

Fisheries in the United Republic of Tanzania consist of industrial and artisanal sectors. Inland fishing, mainly in Lake Victoria and to a lesser extent Lake Tanganyika, make up a major part of this, contributing 85 percent of fish production. In Lake Victoria, the fishery involves more than 100 000 fishers using primarily non-motorized boats such as canoes and sailboats (Jacquet *et al.*, 2010). Marine fisheries contribute 10–15 percent to national fish production. In 2009, fish exports from the United Republic of Tanzania were valued at USD 150 million (Breuil, C and Grima, 2014).

Artisanal fishers target multiple species using multiple gears including, *inter alia*: gillnets, handlines, longlines, traps, shark nets and cast nets. Traps are used in the reef fishery. Tuna and tuna-like species are targeted by the industrial sector fishing in the EEZ using purse seines and longlines. Beach Management Units (BMUs) and Fishing Village Committees (FVCs) are promoted in the United Republic of Tanzania and the United Republic of Tanzania, Zanzibar respectively, as part of a co-management initiative. The BMUs are organizations of artisanal fishers designed to empower fishers to monitor and take responsibility for local fisheries management (Breuil, C and Grima, 2014; FAO, 2020c, 2007; Luomba, 2014).

The United Republic of Tanzania has been identified as a 'hotspot' for the beaching of drifting FADs originating from the Indian Ocean tropical tuna purse seine fishery (Imzilen *et al.*, 2020) with presumed coincident damage to sensitive nearshore habitats (Balderson and Martin, 2015; Consoli *et al.*, 2020). In one study of debris in Lake Victoria gillnets constituted the majority of MPL, making up 86 percent of debris encountered at different depths in the lake. Longlines and hooks made up an additional 7 percent (Ngupula *et al.*, 2014). Some NGOs and BMUs have engaged in beach cleanups along the Indian Ocean shorelines, with some also gathering data on the prevalence of MPL on the beaches (Shilla, 2019; United Republic of Tanzania country questionnaire).

The United Republic of Tanzania is a member of the following relevant IGOs and RFBs:

- Committee for Inland Fisheries and Aquaculture of Africa (CIFAA)
- Indian Ocean Tuna Commission (IOTC)
- International Whaling Commission (IWC)
- Lake Tanganyika Authority (LTA)
- Lake Victoria Fisheries Organization (LVFO)
- Southwest Indian Ocean Fisheries Commission (SWIOFC).

The Gambia

The Gambia has a small industrial fishing fleet but the artisanal sector is the major fish producer, with around 90 percent consumed domestically, especially in coastal areas. In 2016, the number of unpowered small boats was estimated at 1 082 while powered, undecked vessels were estimated at 648 (wooden pirogues of about 10–15m in length) (Moore *et al.*, 2018). The industrial sector is dominated by foreign fleets: most of its catches are landed and processed outside the country. There are about 20 locally registered fishing companies.

Sole is a major target species in the Gambia and is harvested with bottom-set nets using motorized canoes (Cattermoul *et al.*,2013). Shrimp is also harvested using

trawls and nets in the estuary (Mbye, 2005). Fishers also use other gear, such as circling nets for small pelagics (Moore *et al.*, 2018).

In its response to the country questionnaire, the Gambia noted that while there is no lost fishing gear register or database, reports of gear lost as a result of industrial vessels trampling on artisanal fishing nets are recorded in order to ensure direct compensation for the fisher whose gear was damaged. This statement also implicates gear conflicts as a cause of ALDFG in the Gambia.

The Gambia is a member of the following relevant IGOs and RFBs:

- Committee for Inland Fisheries and Aquaculture of Africa (CIFAA)
- Fishery Committee for the Eastern Central Atlantic (CECAF)
- International Whaling Commission (IWC)
- Ministerial Conference on Fisheries Cooperation among African States bordering the Atlantic (ATLAFCO)
- Subregional Fisheries Commission (SRFC).

Togo

In 2017 it was reported that the Togo fisheries sector employed 9 215 fishers (3 700 of which operated in inland waters). The average annual marine capture fisheries production in the five years from 2013 to 2017 was about 18 600 tonnes. Togo's response to the country questionnaire reported that the fleet consisted of 378 artisanal boats and 5 larger fishing vessels.

Artisanal fishers use motorized and non-motorized canoes and boards, and operate from 25 fishing camps. They utilize multiple types of gear including, *inter alia*: beach seine, bottom and surface gillnets, longlines and purse seine. In Lomé, the most important fishing camp in Togo, all fishers use shark nets (Okangny *et al.*, 2020).

A review of marine mammal entanglements from 1990 to 2011 reported a baleen whale entangled in a gillnet off the coast of Togo (Reeves *et al.*, 2013). Togo participated in the FAO/GGGI Regional Workshop on Best Practices to Manage ALDFG held in Dakar in 2019 (FAO, 2020b).

Togo is a member of the following relevant IGOs and RFBs:

- Committee for Inland Fisheries and Aquaculture of Africa (CIFAA)
- Fishery Committee for the Eastern Central Atlantic (CECAF)
- Fishery Committee for the West Central Gulf of Guinea (FCWC)
- International Whaling Commission (IWC)
- Ministerial Conference on Fisheries Cooperation among African States bordering the Atlantic (ATLAFCO).

Asia region

India

Fish production in India reached an estimated level of 11.6 million tonnes in 2017. In that year the estimated production for capture fisheries was almost 5.4 million tonnes (3.8 million tonnes from marine and 1.6 million tonnes from inland water).

Indian fisheries are predominantly small-scale. In 2017 the estimated number of fishing vessels was 193 587, with just over 50 000 unpowered. Global Fishing Watch data showed six large-scale vessels operating in 2019 including four longline vessels and two engaged in general "fishing" (Global Fishing Watch, 2021).

Research has shown that gear loss in gillnet fisheries in India is high, costing fishers a considerable amount of their harvest income (Thomas *et al*., 2020). Marine debris beach assessments have found that fishing-related items constitute 39.8 percent of items found along beaches on the coast of Kerala, with fishing-related items four times more abundant at locations of higher fishing activity (Daniel *et al*., 2019). Experimental trawl fishing and net fishing along the coast of Kerala also revealed this problem, with nets and trawls collecting large quantities of MPL including ALDFG (Kripa *et al*., 2016). From 2018 to 2019, volunteer divers with the Olive Ridley Project removed 58 ALD nets from Indian waters (Olive Ridley Project, 2017). Diver surveys in the Gulf of Mannar also found that ALDFG constituted a significant portion of marine debris (43 percent) causing damage to corals (Patterson Edward *et al*., 2020). Fishing-related litter was found to make up 17 percent of the total weight of marine debris found in a study of 17 beaches in the Hooghly estuary (Mugilarasan *et al*., 2021). Based on a project conducted by WWF India, which interviewed hundreds of coastal fishers about the extent and causes of ALDFG, some fishers reported losing up to ten pieces of netting per year (Ocean Conservancy *et al*., 2020). Stelfox (2019) modelled the origins of the ALD nets impacting sea turtles in the Maldives, and found that some of the nets originate close to the Indian and Sri Lanka shorelines, suggesting that coastal and artisanal fishing could be a source of these. Indian fisheries were also identified as a potential source of ALDFG found on the coast of the Gulf of Carpentaria in northern Australia (Gunn *et al*., 2010).

India is a member of the following relevant IGOs and RFBs:

- Asia-Pacific Fishery Commission (APFIC)
- Bay of Bengal Programme-Intergovernmental Organization (BOBP-IGO)
- Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR)
- Indian Ocean Tuna Commission (IOTC)
- International Whaling Commission (IWC)
- Network of Aquaculture Centres in Asia and the Pacific (NACA).

Indonesia

Indonesia accounted for about 7.4 percent of the world's marine capture fisheries production in 2016 (FAO, 2016). The fishing industry accounted for 21 percent of Indonesia's agricultural economy and 3 percent of national GDP in 2012. The country's fishery production reached approximately 8.9 million tonnes in the same year.

In Indonesia marine fisheries can be grouped into two main segments: small-scale, consisting of artisanal and commercial, and large-scale industrial. Commercial fisheries are characterized by large vessels that employ medium-sized purse seines, Danish seines, and gillnets. About 95 percent of fishery production comes from artisanal fishers. In 2012 the marine fishing fleet comprised 620 830 vessels, 28 percent of which were unpowered boats and 39 percent out-board engine. An additional 184 900 vessels (of which 23 percent had engines) made up the fleet operating in inland waters.

Gillnets are used extensively in Indonesia; a 2017 study estimated that 30 000 pieces of gillnet were lost annually in the spiny lobster fishery (FAO, 2017). Lost fishing nets have also been documented harming coral reefs in Lambeh Strait (Hoeksema and Hermanto, 2018). Western Indonesia has also been identified as a 'hotspot' for the beaching of drifting FADs originating from the Indian Ocean tropical tuna purse seine fishery (Imzilen *et al.*, 2020). Indonesian fisheries may have also contributed to the volume of ALDFG washing up on the northern Australia coast of the Gulf of Carpenteria (Butler *et al.*, 2013; Edyvane and Penny, 2017; Gunn *et al.*, 2010; Wilcox *et al.*, 2015). A project to identify potential drivers for fishing gear loss in the Gulf of Carpenteria brought Australian and Indonesian fishers together, resulting in a better understanding of the fisheries management drivers that contribute to gear loss (Richardson *et al.*, 2018). The Indonesian government recognizes ALDFG as a concern and has collaborated with the GGGI and FAO on projects to trial net marking strategies in Java, as well as hosting a regional workshop on managing ALDFG in Bali (FAO, 2020b, 2018). Indonesia is continuing its partnership with GGGI to implement fishing gear marking at the manufacturer level and increase the recycling of fishing gear (GGGI, 2020). The country also participated with neighbouring Papua New Guinea on an end-of-life fishing net recycling initiative, as part of which 10 tonnes of discarded nets were collected and recycled. In Pekalongan, net producers are similarly participating in a project with fishers' cooperatives to recycle used nets. Building on these projects, and as part of its National Plan of Action on Marine Plastic Debris (2017–2025), Indonesia is currently supporting a "Pre-Feasibility Study on the Management, Retrieval and Recycling of Used and Abandoned, Lost and Discarded Fishing Gear, and Inventory of Plastic Use and Loss from Aquaculture" with funding from the World Bank.

Indonesia's response to the GloLitter questionnaire indicated that a Draft Regulation drawn up by the Minister of Marine Affairs and Fisheries – on Pollution Prevention, Damage Prevention, Rehabilitation and Improvement of Fish Resources – mandates the reporting of lost fishing gear to the Maritime and Fisheries Sector Authority. The regulation also prohibits the dumping of fishing gear into the sea and requires fishers to bring damaged and unrepairable fishing gear to port to be recycled.

Indonesia is a member of the following relevant IGOs and RFBs:

- Asia-Pacific Fishery Commission (APFIC)
- Commission for the Conservation of Southern Bluefin Tuna (CCSBT)
- Indian Ocean Tuna Commission (IOTC)
- Inter-American Tropical Tuna Commission (IATTC)
- Network of Aquaculture Centres in Asia and the Pacific (NACA)
- Southeast Asian Fisheries Development Center (SEAFDEC)
- Western and Central Pacific Fisheries Commission (WCPFC).

Philippines (the)

The Philippine fishing industry comprises marine capture fisheries, inland capture fisheries and aquaculture. Marine capture fisheries can be further divided into municipal fisheries and commercial fisheries.

Municipal fisheries are dominated by non-motorized boats using handlines and gillnets. It is also typical for fishers to use bamboo rafts as FADs and fish around them with handlines. Motorized municipal fishing boats use gillnets, handlines, traps, small

ring nets and other small gear. Commercial fishing includes small and medium-sized boats using trawls, push nets, ring nets, lift nets and Danish seines. Large commercial fishing boats mainly engage in purse seining, with most catchers targeting tuna or seasonal small pelagic fishes. Purse seines are the dominant gear type used in the tuna fleet, with a significant reliance on FADs. Global Fishing Watch data show 30 purse seine vessels flagged to the Philippines in 2019 (Global Fishing Watch, 2021).

Philippines is a hub of successful social enterprise schemes engaged in the recycling and upcycling of end-of-life and discarded nets. The NetWorks programme started in 2012 in Danajon Bank and now operates under Coast4C. The project engages local fishers to collect discarded fishing nets and sell them to Coast4C, which then processes them for sale to recyclers. The proceeds are invested back into the community for resource protection (Coast4C, n.d.). While the Pasig River is documented as releasing large quantities of litter into the ocean (Lebreton *et al.*, 2017), little specific research has been done on ALDFG in the Philippines. Richardson *et al.* (2017) found that 10 percent of the pollution incidents, including ALDFG, reported by tuna fishery observers in the Western Central Pacific Ocean between 2003 and 2015 came from Philippine-flagged vessels.

The Philippines is a member of the following relevant IGOs and RFBs:

- Asia-Pacific Fishery Commission (APFIC)
- Commission for the Conservation of Southern Bluefin Tuna (CCSBT)
- Indian Ocean Tuna Commission (IOTC)
- International Commission for the Conservation of Atlantic Tunas (ICCAT)
- Network of Aquaculture Centres in Asia and the Pacific (NACA)
- Southeast Asian Fisheries Development Center (SEAFDEC)
- Western and Central Pacific Fisheries Commission (WCPFC).

Sri Lanka

The marine fishing fleet in 2016 was composed of 19 764 non-motorized vessels and 30 903 motorized vessels, mostly small vessels of less than 12 m. Around 2 000 boats operated in offshore fishing. Marine fisheries production reached about 422 600 tonnes in 2017, exceeding the catch levels prior to the destructive tsunami of December 2004.

Fisheries management is divided between brackish fisheries, coastal fisheries and high seas fisheries. Brackish fisheries operate in the lagoons and estuaries, whereas coastal fisheries operate within the continental shelf. Fishing gear used in the commercial sector includes: gillnets, fyke nets, drifting trammel nets and longlines. Traditional fishing techniques still in use include the beach seine, stilt fishing and cast net fishing. High seas fishing accounts for around 41 percent of Sri Lanka's marine fisheries catch, and targets tuna and other pelagic species using gillnets and longlines (Department of Fisheries & Aquatic Resources, 2021; Jones *et al.*, 2018; Lalith Amaralal Kariyawasam *et al.*, 2010).

A study involving fisher surveys at 11 fishing sites on the southern coast of Sri Lanka confirmed that fishing nets are the major source of ALDFG, followed by hook and line gear. The most frequently cited cause of abandonment and loss in the coastal and artisanal fisheries was poor weather, while the commercial fishers, who operate further offshore, indicated that conflicts with other vessels was

the major cause of gear loss (Gunarathna *et al*., 2019). Commercial fishing was identified as a source of MPL in recent studies of plastics pollution in the Madu-Ganga estuary and in coastal areas in southern Sri Lanka (Athapaththu *et al*., 2020; Praboda *et al*., 2020). Another recent marine debris survey of 22 coastal beaches in Sri Lanka found that ALDFG accounted for 20 percent of debris encountered (Jang *et al*., 2018). Stelfox (2019) modelled the origins of ALD nets impacting sea turtles in the Maldives and found that some of the nets originated close to the Indian and Sri Lanka shorelines, thereby indicating coastal and artisanal fishing as a source. Macfadyen *et al*. (2009)lost or otherwise discarded fishing gear (ALDFG reported bottom-set net loss in the spiny lobster fishery in Hambantota district but no specific data or loss rate was documented. Sri Lanka recently participated in a workshop with Cefas and GGGI to build awareness and explore solutions to ALDFG.[8]

Sri Lanka is a member of the following relevant IGOs and RFBs:

- Asia-Pacific Fishery Commission (APFIC)
- Bay of Bengal Programme-Intergovernmental Organization (BOBP-IGO)
- Indian Ocean Tuna Commission (IOTC)
- Network of Aquaculture Centres in Asia and the Pacific (NACA).

Thailand

Thai marine fisheries are classified into small-scale fisheries and commercial fisheries. A census survey of marine fisheries carried out in 2000 established the total number of fishing boats at 58 119, of which 80 percent were small-scale. The small-scale fisheries use boats that are less than 5 tons and are either unpowered or have outboard or inboard engines. Most small-scale fishermen use small trawls, gillnets, push nets, lift nets, set bag nets, traps, hook and line, and other stationary gears that operate in estuaries, bays and inshore waters. To preserve coastal fisheries resources, trawlers and push netters are not allowed to operate within 3 000 m from shore.

The commercial fisheries generally fish offshore and spend several days at sea in one fishing trip. The typical fishing gears employed are medium- to large-sized trawls, purse seines, encircling gillnets and large drift nets. Global Fishing Watch records over 2 000 Thai-flagged trawler vessels (Global Fishing Watch, 2021). Commercial fishing vessels contribute about 90 percent of total marine capture fisheries production.

A study interviewing squid trap fishers in Rayong province found that traps are lost due to bad weather, gear conflicts and material breakdown. Simulated lost squid traps deployed during the same project documented ghost fishing of target and non-target species (Sukhsangchan *et al*., 2020). Damage to corals from ALDFG – 75 percent of which were nets and 25 percent were other fishing gear – was documented around Koh Tao, a small island in the Gulf of Thailand (Valderrama Ballesteros *et al*., 2018). Thushari *et al*. (2017) found that debris from commercial fisheries and mariculture accounted for 48 percent of the debris found at Angsila beach on the eastern coast of Thailand. From 2018 to 2019,

[8] Hannah Pragnell-Rasch, personal communication to the authors, 20 May 2021.

volunteer divers with the Olive Ridley Project removed 19 ALD nets from Thai waters, while others report that diver companies organize the retrieval of ALDFG at popular diving sites (Olive Ridley Project, 2017; Valderrama Ballesteros *et al*., 2018). Thai fisheries were identified as a potential source of ALDFG found on the coast of the Gulf of Carpentaria in northern Australia (Edyvane and Penny, 2017; Gunn *et al*., 2010). In 2020, the Thailand Department of Fisheries supported the Environmental Justice Foundation Net Free Seas project to collect 3.5 tonnes of fishing nets from fishing communities and upcycle them into consumer products (EJF, 2020). Thai Union included promoting best practices for managing ALDFG with its Thai seafood suppliers as part of its Ghost Gear Work Plan 2018–2020 (Thai Union, 2018).

Thailand's response to the country questionnaire reported that a new programme is currently being launched to promote and facilitate the collection of marine litter and ALDFG by fishers and bring it to port. The goal of the programme is for all commercial fishing vessels to participate.

Thailand is a member of the following relevant IGOs and RFBs:

- Asia-Pacific Fishery Commission (APFIC)
- Indian Ocean Tuna Commission (IOTC)
- Mekong River Commission (MRC)
- Network of Aquaculture Centres in Asia and the Pacific (NACA)
- Southeast Asian Fisheries Development Center (SEAFDEC).

Timor-Leste

The Timorese fisheries sector is made up of subsistence, artisanal, commercial and industrial fishing. Timorese fishers participate in subsistence and artisanal fishing, which is mostly comprised of non-motorized boats (mainly double-outrigger canoes) using gillnets, cast nets, hook and line, fish traps, crab traps and spear guns. The fishery had 1 330 active licenses for artisanal motorized vessels in 2013. The use of anchored FADs has increased with a project focused on finding an appropriate design suitable to the challenging Timor-Leste coastal environment, which is characterized by great depths close to shore in some areas and strong currents. Only foreign fishers participate in the industrial and commercial sector (López Angarita *et al*., 2019; Pereira, 2017).

Limited beach cleanup studies indicate that ALDFG constitutes a component of MPL on Timorese beaches and could mostly originate from foreign sources (Lopes, 2017). This is consistent with findings that Timor-Leste receives ocean- and wind-driven marine debris from neighbouring Indonesia (Purba *et al*., 2021). Initial aFAD deployments in Timor-Leste quickly fell apart and were lost (Pereira, 2017). At the 2017 Our Ocean Conference, Timor-Leste promoted its Zero-Plastic Policy (IISD, 2017).

In its country questionnaire response, Timor-Leste suggested that an ALDFG reporting system might be integrated into its community-based IUU reporting and accident reporting systems. This same system could be used by local fishers who encounter ALDFG. Timor-Leste also highlighted the marine debris cleanup work of a local NGO, Ekipa Tasi Mos, that does regular beach cleanups. Data from their work showed that ALDFG makes up 5.6 percent of items cleaned in 2016 and 2019.

Timor-Leste is a member of the following relevant IGOs and RFBs:

- Asia-Pacific Fishery Commission (APFIC).

Viet Nam

Viet Nam has a fleet of more than 128 000 fishing vessels with 24 000 fishing in coastal areas (Van Truong and Chu, 2020). Most Vietnamese fishers are small-scale producers, and most fishing vessels use trawls, followed by purse seines, gillnets and longlines (Dung, 2003).

Beach surveys using established monitoring protocols were conducted at several beaches in Viet Nam during 2019. The composition of debris was different for each beach surveyed, with ALDFG accounting for between 1 percent and 35 percent of the number of debris items collected, and from 3 percent to 29 percent of the weight of plastic collected (Greenhub, 2020a). Greenhub is currently conducting another survey to characterize the type and quantity of beach debris at 36 coastal locations using established monitoring protocols (GreenHub, 2020b). Vietnamese fishing vessels are implicated in the discovery of large debris dumps of ALDFG in the northern South China Sea (Peng *et al.*, 2019). Harm to nesting sea turtles in Viet Nam from ALDFG has also been documented (Dung, 2003). Recognizing the damage caused by ALDFG, Viet Nam's 2019 National Action Plan for Management of Marine Plastic Litter by 2030 includes a goal to collect 50 percent of ALDFG. To kickstart the implementation of its companion Action Plan for Marine Plastic Waste Management in the Fisheries Sector (2020–2030), the country is currently working on a project to identify the drivers of ALDFG; the goal is to develop locally appropriate responses that are specific to each province (Ministry of Agriculture and Rural Development, 2020).

Viet Nam is a member of the following relevant IGOs and RFBs:

- Asia-Pacific Fishery Commission (APFIC)
- Mekong River Commission (MRC)
- Network of Aquaculture Centres in Asia and the Pacific (NACA)
- Southeast Asian Fisheries Development Center (SEAFDEC)
- Intergovernmental Organization for Marketing Information and Technical Advisory Services for Fishery Products in the Asia and Pacific Region (INFOFISH).

Caribbean region

Jamaica

Jamaica exports mainly lobster and conch, of which the combined value was USD 15 million in 2017. Jamaican fisheries are especially important for coastal communities, supplying local seafood and employment to about 40 000 people. In 2017, 22 469 fishers were registered in Jamaica. Industrial fisheries are mainly focused on conch and lobster, while artisanal fisheries operate in the high sea, banks and inshore areas, targeting lobster and fish (FAO, 2019). Artisanal vessels, mostly open boats, make up about 95 percent of fishing vessels. In 2014, Jamaica had 5 971 registered artisanal boats and 87 registered industrial vessels.

Predominant gear types are lobster traps in the industrial fishery, and lobster and fish traps in the artisanal fishery. The conch fishery involves divers. Drift nets

are prohibited but gillnets are used in the artisanal fishery (Jamaica Houses of Parliament, 2018).

Ghost fishing of target species has been documented in lobster and fish traps in the Caribbean region (Butler and Matthews, 2015; Renchen *et al.*, 2014).

Recent surveys of 60 fishers – conducted as part of a project to assess the current extent of ALDFG in Jamaica – revealed that the loss of traps is most often caused by bad weather, while the loss of gillnets is most often caused by wildlife interactions, bad weather and snagging on bottom obstructions (Antonelis and Drinkwin, 2021). During the 2019 International Coastal Cleanup 4 545 ALDFG items were recovered from local beaches, with most items collected from Red Cross Beach, Bond Fishing Beach, and an unspecified beach in Montego Bay (Jamaica Environment Trust, 2019). Jamaica is currently collaborating with the GGGI on a project to develop a predictive model of ALDFG locations, host an ALDFG workshop for fishers, and trial fishing-gear-tracking technology in the lobster fishery. Jamaica also participated in recent FAO/GGGI Regional workshops on best practices to manage ALDFG, in addition to a companion workshop on removal training for divers hosted in Panama in 2019 (FAO, 2020b).

Jamaica's response to the country questionnaire stated that regulations prohibit fishers from retrieving another fisher's gear at sea. The country's responses also indicated that there are no adequate waste reception facilities for fishers, which leads to fishers abandoning unusable fishing gear on fishing beaches.

Jamaica is a member of the following relevant IGOs and RFBs:

- Caribbean Regional Fisheries Mechanism (CRFM)
- Commission for Fisheries and Aquaculture for Latin America and the Caribbean (COPESCAALC)
- Western Central Atlantic Fishery Commission (WECAFC).

Latin America

Argentina

Argentina's marine capture fisheries are divided into two types: small-scale coastal fishing and industrial deep-sea fishing. Inshore fishing is carried out near the coast in boats with a small load capacity and without cold equipment. The production is mainly intended for fresh consumption in the domestic market. Deep-sea fishing is carried out offshore, in industrial vessels with greater load capacity and with cold rooms to store the catches. In 2018 total fisheries and aquaculture production was of 838 600 tonnes, with 97 percent from marine capture fisheries. The total number of fishing vessels reported to FAO by the country was 4 733 units in 2018.

Global Fishing Watch data for the industrial fleet from 2019 showed 171 trawlers, 67 squid jiggers, 3 set longlines, 1 fixed gear, and 23 "fishing" vessels (Global Fishing Watch, 2021). Small-scale and artisanal fishers, which make up the majority of fishing boats, ply coastal areas and estuaries, targeting a wide range of species.

The earliest documentation of ALDFG in Argentina was a South American fur seal found entangled with fishing net fragments and other MPL in 1986 (Laist, 1997). A 2016 survey of beach debris in Mar del Plata and Villa Gesell found that fisheries debris constituted the majority of debris collected in terms of mass (Becherucci *et al*., 2017). Impacts to flamingos, seagulls and raptors from recreational ALDFG has also been documented (Berón, 2019; Pon *et al*., 2018; Yorio *et al*., 2014). The Argentina Chamber of Shipowners of High Seas Fishing Vessels (CAABPA) is collaborating with the fishing net supplier Moscuzza Redes and Bureo to recycle end-of-life fishing nets. Argentina participated in the FAO/GGGI Regional Workshop on Best Practices to Manage ALDFG held in Panama in 2019 (FAO, 2020b).

In its country questionnaire response Argentina noted that in the case of its crab fishery there is a specific fishing section, approved by Resolution, in which lost gear must be declared.

Argentina is a member of the following relevant IGOs and RFBs:

- Agreement on the Conservation of Albatrosses and Petrels (ACAP)
- Commission for Fisheries and Aquaculture for Latin America and the Caribbean (COPESCAALC)
- Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR)
- International Whaling Commission (IWC)
- Joint Technical Commission of the Maritime Front (CTMFM)
- Aquaculture Network for the Americas (RAA).

Brazil

Fisheries and aquaculture represent little more than 0.5 percent of the gross domestic product (GDP) of Brazil. However, it is estimated that more than 5 000 000 Brazilians are involved in producing and marketing seafood, producing over USD 2.7 billion of products and services per year. In 2017, the fishing fleet was estimated at 108 346 vessels, with the large majority under 12 m and about one third non-motorized.

In the northern regions most industrial vessels use trawls, while artisanal fishers mainly use gillnets. In the northeast region fishing for crustaceans (lobster) is done with traps, while tunas and similar species are caught by pelagic longliners. Trawls are used in shrimp fisheries and gillnets are used for finfish. In the southern and southeast regions gillnets are used for finfish, and skipjack are caught mainly by purse seiners. Bottom trawls are used for shrimp, with pots and traps for octopus, and traps for deepwater crustaceans (mostly crabs).

In a review published in 2019, Link *et al*. (2019) consolidated the state of the country's awareness of ALDFG. The first records of impacts from ALDFG on animals appeared in the 1990s and several subsequent studies focused on plastic debris, which incidentally recorded ALDFG. The first reports specifically addressing ALDFG appeared in 2009, while documentation of the prevalent loss of gillnets and consequent animal impacts in Santa Catarina followed. Link *et al*. (2019) documented 32 studies recording presence and impacts of ALDFG in Brazil through simulation studies, beach surveys, diver surveys, retrievals, and side-scan sonar. Studies that focused on ALDFG concentrated on Sao Paulo and Santa Catarina, although other studies documented ALDFG in 12 of Brazil's 17 coastal states. The authors of this

study noted data gaps in offshore areas beyond 45 m depth and inland waters. After Link *et al*. (2019) review, Adelir-Alves *et al*., (2016) published results of a study on rocky reefs in Santa Catarina involving fisher interviews and in-water surveys of 28 sites. Gillnets made up 49 percent of the ALDFG encountered and the authors documented ghost fishing of commercial and non-commercial species. Fishers reported the most frequent causes of gear loss as sea conditions, accidental removal and user error. In a separate study involving fisher interviews in the state of Bahia, artisanal fishers reported encountering ALD nets and lower fishery yields due to ghost fishing, while also advocating penalties for using illegal gear (lobster nets) and ALDFG retrieval (Barbosa-Filho *et al*., 2020). Maufroy *et al*, (2015) documented the beaching of dFADs originating from the Indian Ocean as far away as Brazil. The country participated in the FAO/GGGI Regional Workshop on Best Practices to Manage ALDFG held in Panama in 2019 (FAO, 2020b).

Brazil is a member of the following relevant IGOs and RFBs:

- Agreement on the Conservation of Albatrosses and Petrels (ACAP)
- Commission for Fisheries and Aquaculture for Latin America and the Caribbean (COPESCAALC)
- Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR)
- International Commission for the Conservation of Atlantic Tunas (ICCAT)
- International Whaling Commission (IWC)
- Aquaculture Network for the Americas (RAA)
- Western Central Atlantic Fishery Commission (WECAFC).

Colombia

The Colombian fishing fleet includes industrial and artisanal fishers. Industrial fishers operate in the Atlantic and Pacific oceans while artisanal fishers also operate in inland waters as well as on both coasts. Marine fisheries include tuna, shrimp, white fish (snappers, groupers and chernas) and lobster. In 2017, 35 495 tonnes were harvested, of which 29.5 percent was harvested by artisanal fisheries (Selvaraj *et al.*, 2020).

Industrial fishers target tuna with purse seiners and shrimp with trawls (Marco *et al.*, 2021). Artisanal fishing gear includes, *inter alia*: beach seines, gillnets, longlines, spears and handlines (Castellanos-Galindo *et al*., 2018).

A project that involved interviewing experts in the Caribbean region about ALDFG also included participation from Colombia. The project found that most ALDFG in the Caribbean is comprised of traps (41 percent), followed by nets (14.9 percent) and hook and line gear (14 percent). Participating interviewees indicated that loss and abandonment, rather than intentional discard, is the source of ALDFG. Bad weather was named as the most frequent cause of both loss and abandonment in all fisheries (Matthews and Glazer, 2009)lost or otherwise discarded fishing gear (ALDFG. Colombia participated in the FAO/GGGI Regional Workshop on Best Practices to Manage ALDFG held in Panama in 2019 (FAO, 2020b).

Colombia is a member of the following relevant IGOs and RFBs:

- Western Central Atlantic Fishery Commission (WECAFC)
- Commission for Fisheries and Aquaculture for Latin America and the Caribbean (COPESCAALC)

- Inter-American Tropical Tuna Commission (IATTC)
- International Whaling Commission (IWC)
- Permanent Commission for the South Pacific (CPPS)
- South Pacific Regional Fisheries Management Organisation (SPRFMO)
- Aquaculture Network for the Americas (RAA).

Costa Rica

The Costa Rican fishing fleet consisted of approximately 1 912 vessels in 2017, most of which were small-scale vessels of less than 12 m long. In the same year, FAO estimated marine catches at 14 700 tonnes. Small-scale artisanal fisheries operating in coastal areas make up 80 percent of Costa Rica's fisheries and contribute about 20 percent of landings. A small industrial fleet operating offshore contributes about 80 percent of landings.

Industrial fishers include tuna longliners. Artisanal fishers use gear including, *inter alia*, lines and hand ropes, and gillnets (Sabau, 2017).

Parton *et al.*, (2019) documented a manta ray entangled in ALDFG in Costa Rica in a 2019 review of social media posts. Even in the remote, deep waters of Isla del Coco National Park, ALDFG was found to be the most prevalent type of MPL (Costa *et al.*, 2018). Costa Rica participated in the FAO/GGGI Regional Workshop on Best Practices to Manage ALDFG held in Panama in 2019 and presented on the requirement for fishers in the longline fishery to report any lost gear (FAO, 2020b).

Costa Rica is a member of the following relevant IGOs and RFBs:

- Western Central Atlantic Fishery Commission (WECAFC)
- Central American Organization of the Fisheries and Aquaculture Sector (OSPESCA)
- Commission for Fisheries and Aquaculture for Latin America and the Caribbean (COPESCAALC)
- Inter-American Tropical Tuna Commission (IATTC)
- International Whaling Commission (IWC)
- Latin American Organization for Fisheries Development (OLDEPESCA)
- Aquaculture Network for the Americas (RAA).

Ecuador

The Ecuadorian fishing fleet can be broken down into industrial fishing and artisanal fishing. Tuna is Ecuador's main industrial fishery; its fleet operates mainly in the Eastern Pacific and along the coasts of Galapagos Islands. In recent years, tuna catch has stabilized at around 200 000 tonnes, which accounts for about 50 percent of total marine catch. The artisanal fishery includes both small-scale fisheries operating out of small boats in coastal areas and artisanal oceanic fisheries operating further from shore, sometimes with support from larger vessels. It is the largest fleet in the Southeast Pacific – in the 1990s it boasted approximately 15 500 boats and 56 000 fishers – and employs thousands of people in Manta alone (Menéndez Delgado *et al.*, 2021).

In 2009, the industrial fleet consisted of 159 vessels over 24 m, of which 83 were purse seiners. Global Fishing Watch data for 2019 registered 51 purse seiners, 6 drift longlines and 2 "fishing" vessels (Global Fishing Watch, 2021). Gear used in

the artisanal fishery includes, *inter alia*: surface gillnets, trammel nets, longlines, purse seine, handlines, and pole-and-line (Félix *et al*., 2011).

Underwater marine debris surveys of two rocky reefs in Manabi found that ALDFG (principally nets) made up 63 percent of the debris documented (Figueroa-Pico *et al*., 2016). Ecuador's artisanal gillnet *al*DFG has been involved in the entanglements of humpback whales and other cetaceans (Castro and Waerebeek, 2019; Félix *et al*., 2011; Haase and Félix, 1994). The country participated in the FAO/GGGI Regional Workshop on Best Practices to Manage ALDFG held in Panama in 2019 (FAO, 2020b).

In its country questionnaire response Ecuador noted that its environmental control authority carries out ocean clean-up campaigns, as do park rangers within marine protected areas on the country's coastline.
Ecuador is a member of the following relevant IGOs and RFBs:

- Agreement on the Conservation of Albatrosses and Petrels (ACAP)
- Commission for Fisheries and Aquaculture for Latin America and the Caribbean (COPESCAALC)
- Inter-American Tropical Tuna Commission (IATTC)
- International Whaling Commission (IWC)
- Latin American Organization for Fisheries Development (OLDEPESCA)
- Permanent Commission for the South Pacific (CPPS)
- South Pacific Regional Fisheries Management Organisation (SPRFMO)
- Aquaculture Network for the Americas (RAA).

Nicaragua

Nicaragua engages in industrial and artisanal fishing in the Pacific Ocean and the Caribbean Sea; the principal industrial fishery is the Caribbean spiny lobster fishery, though Pacific and Caribbean fishers also target shrimp. In the Caribbean, industrial fishers produce 29 percent of the catch while artisanal fishers provide 71 percent. Nicaragua also has a small tuna fleet. Finally, harvest divers also target queen conch and sea cucumbers. There are a total of 226 fishing communities in 40 municipalities in Nicaragua, and the most important industrial fishing sites are Corn Island, Corinto, Bluefields and Puerto Cabezas. The most important artisanal landing sites are Bluefields and Puerto Cabezas in the Caribbean, together with Pochote, Ostional, San Juan del Sur, Astillero, Casares, Masachapa, Miramar, and Corinto in the Pacific.

Shrimp fishers use trawls, while the tuna fleet uses purse seines and FADs (Baske *et al*., 2012). The Caribbean commercial lobster fleet is made up of steel boats with an average length of 19–20 m with ice or refrigerated holds deploying traps. Artisanal lobster fishers also use traps and also harvest lobsters by diving (MRAG Americas, 2014; Seafood Watch, 2018). Other gears deployed in Nicaragua, according to the country's response to the questionnaire, include, *inter alia*: gillnets, fish traps and longlines.

A study of lobster traps displaced or destroyed by Hurricane Felix found potential significant ghost fishing of these lost lobster traps (MRAG Americas, 2014). Ehrhardt (2006) found that spiny lobster harvests in Nicaragua were impacted by ghost fishing by lobster traps left out on the fishing grounds. Other authors have also pointed out that the impacts of ghost fishing in lost lobster traps need

to be addressed (Butler and Matthews, 2015; Ehrhardt *et al*., 2011). Nicaragua participated in the FAO/GGGI Regional Workshop on Best Practices to Manage ALDFG held in Panama in 2019 (FAO, 2020b).

Nicaragua is a member of the following relevant IGOs and RFBs:

- Western Central Atlantic Fishery Commission (WECAFC)
- Central American Organization of the Fisheries and Aquaculture Sector (OSPESCA)
- Commission for Small-scale and Artisanal Fisheries and Aquaculture of Latin America and the Caribbean (COPPESAALC)
- Inter-American Tropical Tuna Commission (IATTC)
- International Commission for the Conservation of Atlantic Tunas (ICCAT)
- International Whaling Commission (IWC)
- Latin American Organization for Fisheries Development (OLDEPESCA)
- Aquaculture Network for the Americas (RAA).

Panama

Panama has two marine fishing sectors: industrial and artisanal. Industrial vessels target shrimp and pelagic fish including herring, anchovy and tuna. Most of the herring and anchovy harvest is for fishmeal. Annual average catch is in the order of 120 000 tonnes. The main fishing area is in the Bay of Panama.

Industrial vessels include purse seiners using FADs, mid-water trawlers and longliners. Artisanal fishing utilizes, *inter alia*: gillnets, hooks and lines, traps and pots, reef nets, and spears (Drinkwin, 2019a; Gershman *et al*., 2015).

Panama was the first Latin American country to join the GGGI and has hosted two ALDFG retrieval training sessions for diver with regional partners (Drinkwin, 2019b). Panama also participated as the host country in the FAO/GGGI Regional Workshop on Best Practices to Manage ALDFG held in Panama in 2019 and presented on its programme to prevent ALDFG (FAO, 2020b). The Fisheries Resources Authority of Panama (Autoridad de los Recursos Pesqueros de Panamá, ARAP) accepts reports of lost fishing nets through a 311 telephone system and has trained divers to remove ALDFG as far as capacity allows. As of 2019, ARAP had removed 4 382.72 kg of ALDFG from seven regions of Panama. Animals found entangled in ALDFG in Panama include sharks, turtles and fish. Harm to coral reefs has also been documented (Drinkwin, 2019b).

Panama is a member of the following relevant IGOs and RFBs:

- Western Central Atlantic Fishery Commission (WECAFC)
- Central American Organization of the Fisheries and Aquaculture Sector (OSPESCA)
- Commission for Fisheries and Aquaculture for Latin America and the Caribbean (COPESCAALC)
- Inter-American Tropical Tuna Commission (IATTC)
- International Commission for the Conservation of Atlantic Tunas (ICCAT)
- International Whaling Commission (IWC)
- South Pacific Regional Fisheries Management Organisation (SPRFMO)
- Aquaculture Network for the Americas (RAA)

Peru

The Peruvian fishing fleet includes a larger-scale industrial fleet, featuring vessels with a hold capacity greater than 32.4 m^3 (approximately 30 metric tonnes), as well as a smaller-scale or artisanal fleet. In 2016, records of the demersal and coastal fisheries' landings reached 145 000 tonnes; within these species hake stands out, with landings of 72 000 tonnes. Artisanal shrimp trawling is permitted within 5 miles of shore, and over 44 000 fishers participate in the Peruvian artisanal fishery (Soto, 2019).

Industrial fishers mainly target anchoveta with purse seines, with tuna fishers also using FADs. There is also a bottom trawl fishery for hake, squid jigging and longlines (Fishery Progress, 2021; Gershman *et al*., 2015). Artisanal fishermen use a variety of fishing gear, which includes, *inter alia*: shrimp trawl, gillnets, purse seines, traps, longlines, hooks and line, and harpoons (Soto, 2019).

A review of ALDFG in Peru was commissioned by WWF in 2018. Through a literature review and interviews with fishers, the authors determined that major causes of gear loss in the artisanal fishery were the result of interactions with animals (sea lions, manta rays), snagging on bottom substrate, tides and weather, and vessel conflicts. Fishers also identified other pressures that drive them to fish in risky environments. Interviews with divers confirmed several locations where they had seen ALDFG, and the report summarized findings of clean-up activities where ALDFG had been recovered, including from the Galápagos Islands (Bernales *et al*., 2018). A study simulating lost nets in Peru confirmed the damaging impacts from lost gillnets: it identified areas along Peru's coastline where ALDFG is most likely to be damaging and identified the main cause of gear loss as gear conflict (Ganoza *et al*., 2014). A more recent study documented ALDFG encountered during trawl fishing in the Sea of Grau at Nuro, Los Organos, Parchique, and Cabo Blanco. Pots made up 51 percent of ALDFG, followed by trammel nets (23 percent) (Grados, 2021). Peruvian industrial and artisanal fishers have engaged in a collaborative partnership with Bureo to provide end-of-life nets to Bureo for recycling. Part of the collaboration involves WWF coordinating the collection of artisanal gillnets from two fishing communities (Ocean Conservancy *et al*., 2020). Peru also participated in the FAO/GGGI Regional Workshop on Best Practices to Manage ALDFG held in Panama in 2019 and presented on its programme to prevent ALDFG, which included the documentation of ghost fishing from ALDFG in marine waters (FAO, 2020b).

Peru is a member of the following relevant IGOs and RFBs:

- Agreement on the Conservation of Albatrosses and Petrels (ACAP)
- Commission for Fisheries and Aquaculture for Latin America and the Caribbean (COPESCAALC)
- Inter-American Tropical Tuna Commission (IATTC)
- International Whaling Commission (IWC)
- Latin American Organization for Fisheries Development (OLDEPESCA)
- Permanent Commission for the South Pacific (CPPS)
- South Pacific Regional Fisheries Management Organisation (SPRFMO).

Pacific region

Solomon Islands

The Solomons Islands have an industrial fishery and artisanal fishery. In 2014, the SPC estimated that fishing contributes 7.2 percent to the GDP of the Solomon Islands. Its industrial fishery is tuna-focused, with a fleet of purse seine and pole-and-line vessels that both utilize dFADs. Vessels flagged to the Solomon Islands generally operate domestically or in the waters of the Parties to the Nauru Agreement (Ganapathiraju, 2017).

Two of the important coastal commercial fisheries are: trolling for pelagic fish around anchored FADs, and diving for sea cucumber (Albert *et al.*, 2014). Fishers mainly use unpowered canoes or swim from the shore, with common fishing methods including hook and line, hand collection, various types of traditional netting, and spearing by both wading and diving.

In 2019 the Solomon Islands participated in a project with GGGI to assess its fisheries management policies against the VGMFG and the BPF, and develop a predictive model for ALDFG locations. Of the artisanal fishers from Solomons Island and Vanuatu interviewed during this project, 76 percent acknowledged losing fishing gear, with more than 40 percent of fishers reporting that they had lost gillnets, demersal nets, lines or poles, spear guns or hand spears. Drinkwin and Antonelis (2019) found that the most frequent noted cause of gear loss were animal interactions (24 percent) and weather and waves (15 percent). Richardson *et al.* (2017), meanwhile, analysed 10 613 pollution incidents reported by fisheries observers employed by the Secretariat of the Pacific Community/Pacific Islands Forum Fisheries Agency (SPC/FFA) between 2003 and 2015. Of those, 706 (7 percent) occurred in the Solomon Islands. Overall, 13 percent of the recorded pollution incidents were ALDFG, many of which were FADs or components of FADs. Escalle *et al.* (2019)over 30,000 drifting Fish Aggregating Devices (dFADs identified a high number of dFADs beaching on the Solomon Islands from the Western and Central Pacific Ocean as result of oceanic circulation. Banks and Zaharia (2020) estimated that the Solomon Islands was the terminal location for 29.33 percent of all beaching dFADs tracked by the PNA from 2016 to 2018. Beach surveys of marine debris conducted at 12 beaches in Solomon Islands in 2019 found that ALDFG accounted for between 0.5 percent and 13 percent of items encountered (Binetti *et al.*, 2020). The Solomon Islands participated in the FAO/GGGI Regional Workshop on Best Practices to Manage ALDFG held in Port Vila in 2019 (FAO, 2020b). Participants in that workshop also noted that another cause of gear loss in the Solomon Islands was low quality gear, as well as the provision of gillnets at no cost, which encourages irresponsible management (Drinkwin and Antonelis, 2019).

Solomon Islands is a member of the following relevant IGOs and RFBs:

- Forum Fisheries Agency (FFA)
- International Whaling Commission (IWC)
- Secretariat of the Pacific Community (SPC)
- Western and Central Pacific Fisheries Commission (WCPFC).

Tonga

Tongan fisheries include industrial and artisanal sectors, which include small-scale, subsistence and domestically marketed fisheries. The annual catch per unit effort of Tongan-flagged vessels has remained relatively steady in recent years. Tonga is the leading exporter of deep-slope bottom fish in the Pacific Islands. Tongan artisanal fisheries are typically small-scale, operating out of small, motorized vessels close to the shore. Artisanal fishers target lagoon and reef areas and catch around 70 percent of the nation's total catch (Webster *et al*., 2017). According to Charlton *et al*. (2016), 33 percent of Tongan households are engaged in fishingwith a high prevalence of household food insecurity and childhood micronutrient deficiencies, accompanied by a burgeoning increase in adult obesity, diabetes and heart disease. Methods: A systematic literature review was undertaken to assess whether increased availability of, and access to, fish improves a. The artisanal sector represented 70 percent of total reconstructed catch from 1950 to 2007 (Sun *et al*., 2011).

Artisanal fishers troll for tuna using small skiffs relatively close to the shore, with increased activity during periods when aFADs are in place. Artisanal fishers also use, *inter alia*: hand spears, gillnets, traps, and handlines (Sun *et al*., 2011; Webster *et al*., 2017).

Richardson *et al*. (2017) found that between 2003 and 2015 11 percent of pollution incidents from longline vessels reported by fisheries observers employed by the Secretariat of the Pacific Community/Pacific Islands Forum Fisheries Agency (SPC/FFA) came from Tonga-flagged vessels. Of the documented longline pollutions incidents, 17 percent were ALDFG. Tonga participated in the FAO/GGGI Regional Workshop on Best Practices to Manage ALDFG held in Port Vila in 2019 (FAO, 2020b).

Tonga is a member of the following relevant IGOs and RFBs:

- Forum Fisheries Agency (FFA)
- Secretariat of the Pacific Community (SPC)
- Western and Central Pacific Fisheries Commission (WCPFC).

Vanuatu

Vanuatu fisheries include an industrial division and a coastal/artisanal division. Industrial vessels target tuna while artisanal fishers target multiple species, including shallow and deep-water bottom snapper species and pelagic species associated with aFADs.

The industrial fishing fleet is dominated by drift longliners. Global fishing Watch data show 70 drift longline vessels as well as smaller numbers of pole-and-line (1), squid jigger (6), trawlers (2) and tuna purse seines (8) (Global Fishing Watch, 2021). Small-scale coastal fishers principally target shallow and deep-water bottom snapper species ("poulet") and pelagics associated with fish aggregation devices (FADs), using trolling and longlining techniques. The artisanal catches are often made on foot from shore, over fringing reef flats, or along reef drop-offs or lagoons from outrigger canoes. Cast nets and gillnets, freediving gear and spear guns, handlines and traditional methods (reef gleaning, spears, traps, etc.) are also typically used (Amos *et al*., 2014).

Vanuatu is currently continuing a partnership with GGGI to trial position-tracking technology on its aFADs and develop a response process to retrieve devices if they become separated from their moorings (Drinkwin, 2018). Vanuatu participated in a project with GGGI in 2019 to assess its fisheries management policies against the VGMFG and the BPF, and develop a predictive model for locations of ALDFG. Of the artisanal fishers from Solomons Island and Vanuatu interviewed during this project, 76 percent acknowledged losing fishing gear, with more than 40 percent of fishers reporting the loss of gillnets, demersal nets, lines or poles, spear guns or hand spears. The most frequently noted causes of gear loss were: animal interactions (24 percent) and weather and waves (15 percent) (Drinkwin and Antonelis, 2019). Banks and Zaharia (2020) estimated that Vanuatu was the terminal location for 0.47 percent of beaching dFADs tracked by the PNA from 2016 to 2018. Beach surveys of marine debris conducted at 12 beaches in Vanuatu in 2019 found that ALDFG accounted for between 1.3 percent and 8.1 percent of items encountered (Binetti *et al*., 2020). Vanuatu participated as the host of the FAO/GGGI Regional Workshop on Best Practices to Manage ALDFG held in Port Vila in 2019, presenting on its programme to track and manage aFADs (FAO, 2020b).

Vanuatu is a member of the following relevant IGOs and RFBs:

- Forum Fisheries Agency (FFA)
- Inter-American Tropical Tuna Commission (IATTC)
- International Commission for the Conservation of Atlantic Tunas (ICCAT)
- North Pacific Fisheries Commission (NPFC)
- Secretariat of the Pacific Community (SPC)
- South Pacific Regional Fisheries Management Organisation (SPRFMO)
- Western and Central Pacific Fisheries Commission (WCPFC).

ALDFG management in participating countries

To gain a better understanding of the current ALDFG management practices in LPCs and PCs, a country questionnaire was developed and distributed to each GloLitter national focal point. The questionnaire included questions related to the reporting and retrieval of lost fishing gear, the marking of fishing gear, waste reception facilities, and capacity for managing ALDFG. The country questionnaire is included as Appendix.

With 25 countries responding to the questionnaire, it provided valuable insights into current ALDFG management practices and the potential capacity to support ALDFG reporting and fisher-led retrieval activities further.

Responses to country questionnaire

The first four questions of the questionnaire addressed the reporting of lost fishing gear. All responding countries answered this question. Of these, 9 countries (36 percent) indicated that they require fishers who lose gear to report that loss in at least some of their fisheries, while 16 countries (64 percent) had no requirements in place to report lost fishing gear. Mozambique, Nigeria and Sudan indicated that all fishers are required to report lost gear. Other countries indicated that their more industrial fleets are required to report gear loss (Argentina, Colombia, Costa Rica, Tonga). Elsewhere, other countries indicated that reporting is required when

artisanal fishers' nets are damaged by trawlers or other marine activity (Kenya, the Gambia): this is so that artisanal fishers can be compensated for the loss of their gear.

Regarding reporting systems, 10 countries (40 percent) indicated that there was a system in place to receive reports of lost gear, while 15 countries (60 percent) indicated that there was no such system in place, as shown in Figure 1. Nicaragua noted that the number of spiny lobster pots set at the beginning of the season, and the number removed from fishing grounds at end of the season, are both recorded. Panama, meanwhile, encourages fishers to report lost gear through a 311 telephone line. Some countries indicated that reports are kept by the national fisheries authority, noted in logbooks, tuna fisheries observer reports or are registered as a remark in the vessel landing report (Argentina, Colombia, Costa Rica, Nigeria, Panama, Tonga).

Figure 1
A. Percent and number of countries that require fishers to report lost gear;
B. Percent and number of countries with reporting system in place to receive reports of lost gear

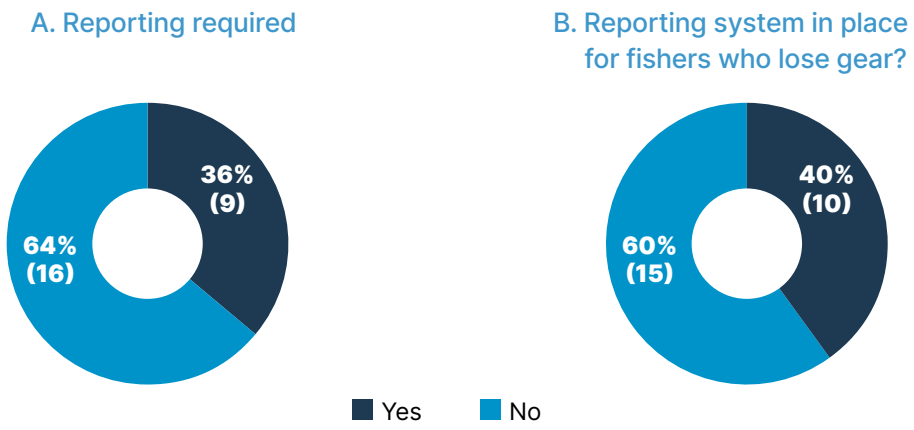
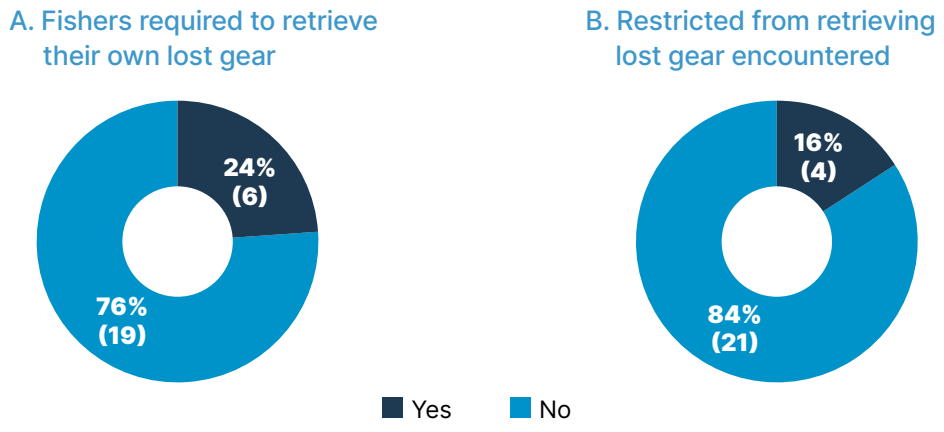


Figure 2
A. Percent and number of countries that require fishers to retrieve their lost gear;
B. Percent and number of countries that prohibit fishers from retrieving other fishers' ALDFG

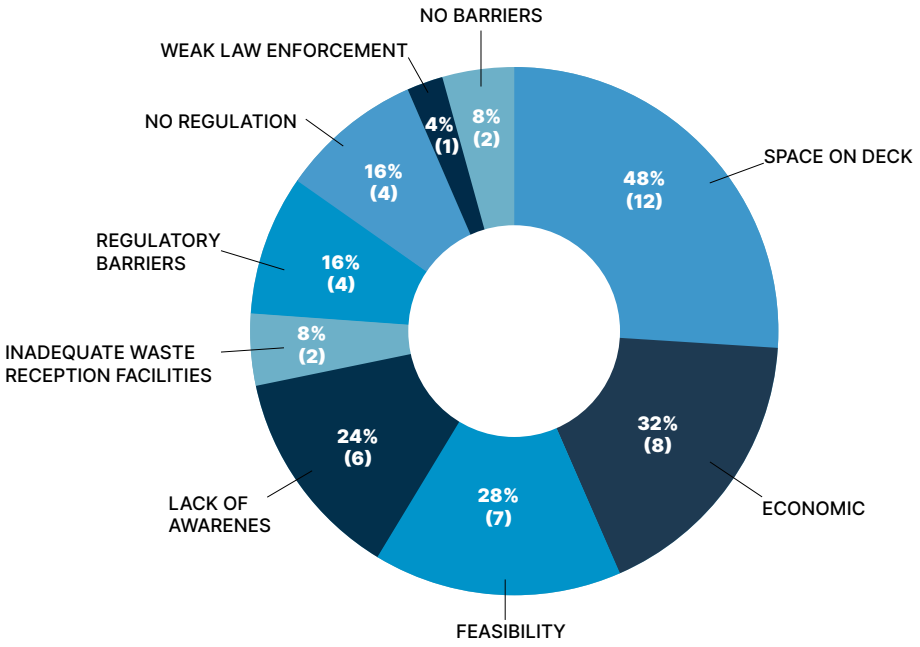


Countries were asked if fishers are required to retrieve fishing gear that they lose. Just 6 countries (24 percent) indicated that they require fishers who lose

gear to attempt to retrieve it in at least some of their fisheries (Colombia, Kenya, Nigeria, Sudan, Solomon Islands, and the Gambia), while 19 countries (76 percent) indicated that no such requirements were in place. Countries were also asked if fishers were prohibited from retrieving ALDFG that they encounter during fishing operations. As shown in Figure 2, 21 countries (84 percent) had no such regulatory prohibitions, while 4 countries (16 percent) indicated that there were regulatory prohibitions to fishers retrieving any fishing gear not belonging to them (Jamaica, Kenya, Mozambique, Sudan). These prohibitions are primarily in place to prevent gear theft.

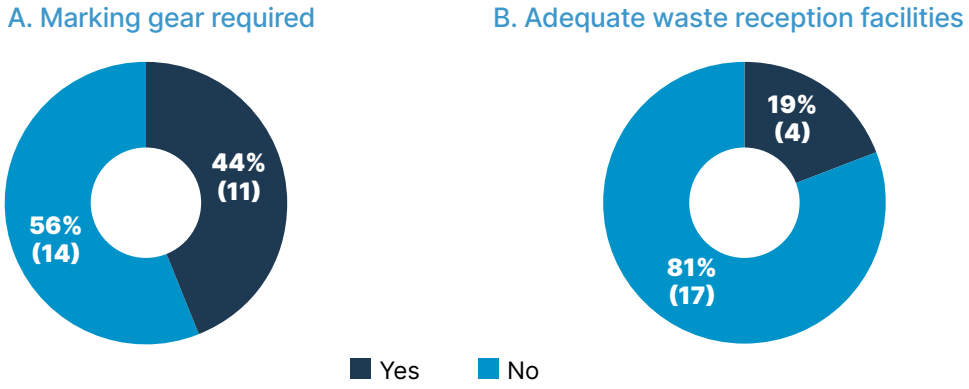
Countries were also asked to identify the predominant barriers that might be preventing fishers from retrieving their own lost fishing gear or ALDFG encountered at sea. Space on deck of the fishing vessels was the most frequent response, with 12 countries (48 percent) indicating that this was a barrier to fishers retrieving ALDFG. The second most frequently noted barrier was economic, with 8 countries (32 percent) indicating this was a barrier; within this, the most common economic barrier was the cost of disposing of retrieved gear. Feasibility was a barrier for 7 countries (28 percent), meanwhile, who cited challenging conditions at sea and the fact that it was sometimes not possible to retrieve ALDFG safely. Lack of awareness of the problems caused by ALDFG was also cited by 6 countries (24 percent) as a barrier to retrieval, while regulatory barriers were cited by 4 countries (16 percent). Conversely, 4 countries (16 percent) noted that the *lack* of regulations was a barrier to ALDFG retrieval. As shown in Figure 3, the least frequent responses on the barriers to ALDFG retrieval were: inadequate waste reception facilities (2 countries; 8 percent) and weak law enforcement (1 country; 4 percent). Only 2 countries (8 percent)responded that there were no barriers to ALDFG retrieval.

Figure 3
Percent and number of countries that identified specified barriers to ALDFG retrieval



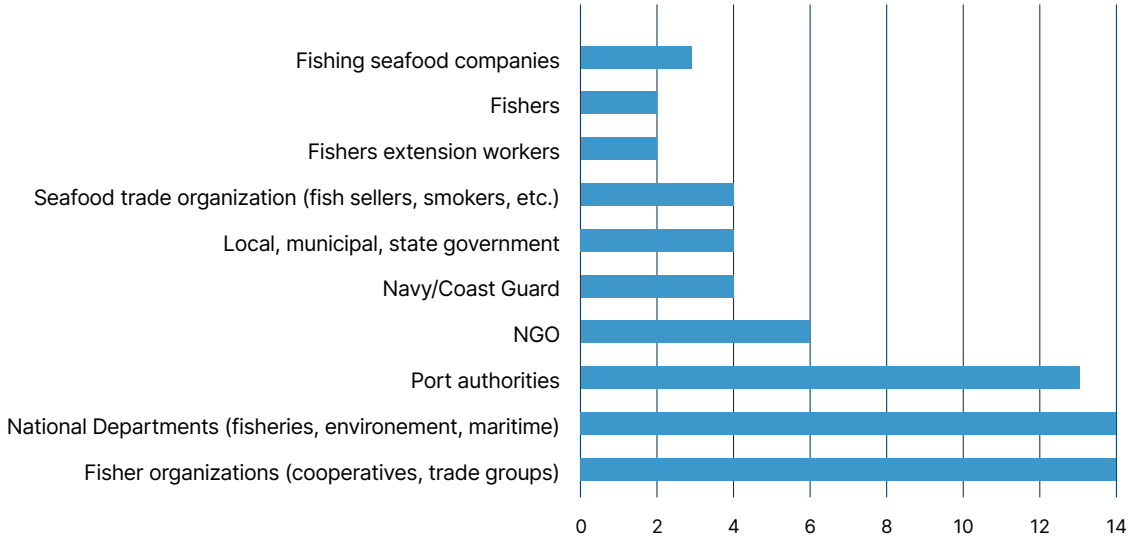
Countries were asked whether fishing gear marking is required and whether the marking identifies the fishing vessel, the owner of the gear, or both. As shown in Figure 4, 11 countries (44 percent) indicated that fishing gear marking is required in at least some of their fisheries; 14 countries (56 percent) indicated that no marking is required.

Figure 4
A. Percent and number of countries that require marking of fishing gear;
B. Percent and number of countries reporting adequate waste reception facilities for fishers to dispose of ALDFG



Countries were asked whether there were adequate waste reception facilities for fishers to dispose of the ALDFG they retrieve (either their own or any encountered at sea). Only 21 countries responded to this question: 4 countries (19 percent) indicated that adequate waste reception facilities exist for fishers to dispose of ALDFG, while 17 countries (81 percent) indicated that waste reception facilities were not adequate, as shown in Figure 4.

Figure 5
Types of support structures and organizations supporting the reporting and retrieval of ALDFG named by more than one country



To understand the capacity and available partners that could collaborate on an effective ALDFG reporting and retrieval programme, countries were asked what structures or organizations were in place that might support a lost fishing gear reporting and retrieval programme. All countries indicated that they had some capacity. Fisher organizations such as cooperatives or fisher associations, national fisheries departments or environment departments and port authorities were named by more than half of all responding countries as likely organizations to support ALDFG reporting and retrieval. Other organizations named more than twice were non-governmental organizations (NGOs), local governments or municipalities, and seafood trade organizations, as shown in Figure 5.

Countries were also asked whether any ALDFG retrieval activities had occurred in their country or region. Some countries reported that there have been at-sea clean-ups of ALDFG (Ecuador, Nigeria, Panama, Timor-Leste, Viet Nam). Mozambique reported that there is a shrimp trawling fisheries company that retrieves and returns to port all the ALDFG encountered during fishing. Several countries noted that beach clean-ups are a regular occurrence and that ALDFG is sometimes collected at those events (Kenya, the Gambia, United Republic of Tanzania, Togo). Argentina highlighted a recent cooperation agreement between the Argentine Chamber of Shipowners of High Seas Fishing Vessels and the private firm Bureo, which recycles plastic fishing gear collected from the fishing industry. Indonesia noted recent collaborations with the GGGI and FAO (FAO, 2020b).

Artisanal fishing boats in Panama City, Panama

Effective reporting and retrieval programmes

There are numerous examples of fisheries managing activities focusing on the reporting and fisher-led retrieval of ALDFG. The VGMFG recommends that reporting programmes include the maintenance of a record/register of fishing gear reported as found, abandoned, lost or otherwise discarded. Reporting should be made not only to the relevant fisheries authority (flag State), but reports should be forwarded to the state in which the gear was lost (coastal State) – especially if the lost gear poses a risk to navigation. Reports should include basic information including: gear ownership; type of gear; any marks or identifiers; date, time and position of gear loss; reason for loss; weather conditions; other relevant information about species impacts; and the status of the gear (retrieved/not retrieved, disposed of, etc.) (FAO, 2019a). Yet there is no 'one-size-fits-all' example that will work in all fisheries. Instead, the most effective programmes are fishery-specific and have been developed collaboratively with fishers, the fishing industry and fisheries managers. Ideal examples of ALDFG reporting programmes investigated for this report include the following characteristics:

- reporting is required by regulation;
- reporting is easy for fishers;
- ALDFG reporting integrates with other existing reporting systems;
- reports are stored in an electronic database for easy access;
- reports result in the subsequent retrieval of the reported lost fishing gear;
- reports are used to inform management actions.

Reporting systems and retrieval programmes are ideally linked, with fisher reports informing subsequent retrieval activities. The VGMFG calls for states to encourage fishers to retrieve their own ALDFG (where safe and feasible) and to encourage vessel owners to have adequate retrieval equipment available, as well as ensuring that all crews are trained in retrieval protocols. The VGMFG further recommends identifying areas most vulnerable to gear loss and to prioritize retrieving ALDFG that presents potential hazards to navigation and/or harm to vulnerable species and marine habitats (FAO, 2019a). While this report focuses on fisher-led retrieval activities, there are numerous programmes where ALDFG is retrieved by either fisheries management or control organizations, or by NGOs. In many of these cases, fisher reports are accessed to plan retrieval activities. Truly fisher-led retrieval programmes also operate in several fisheries. Ideal examples of ALDFG retrieval programmes compiled for this report include the following characteristics, as shown in Table 3:

- fishers lead the retrieval operations;
- the programme is developed collaboratively with fishers, fisher organizations, and fisheries management and control organizations;
- the costs of the programme are linked to fishery through license fees, association membership fees, or other means;
- programme funding is long-term and predictable;
- the benefits of the programme are linked to the fishery;
- the benefits of the programme are quantified;
- retrieved ALDFG is disposed of responsibly, and preferably reused or recycled.

Table 3
ALDFG Retrieval programme examples

PROGRAM	FISHERS LEAD RETRIEVAL	DEVELOPED WITH FISHERS	COST LINKED TO FISHERY	LONG-TERM FUNDING	BENEFITS LINKED TO FISHERY	BENEFITS QUANTIFIED	RESPONSIBLE DISPOSAL
PUGET SOUND RRR PROGRAM	X	X		X		X	X
NORWEGIAN DIRECTORATE OF FISHERIES	X	X	X	X	X	X	X
FISHING FOR LITTER	X	X			X	X	X
ENALEIA	X	X			X	X	X
SOFER NET GAINS NIGERIA	X	X			X	X	X
WASHINGTON COAST CRAB TAG PROGRAM	X	X	X	X	X	X	X
AREA A CRAB ASSOCIATION	X	X	X	X	X	X	X

The following examples and case studies exemplify the variety of approaches being taken to address the reporting and fisher-led retrieval of ALDFG globally. The case studies are not all-inclusive but focus on programmes that have been operating for some years, with some exceptions. They do not represent the breadth of ALDFG reporting and fisher-led ALDFG retrieval activities occurring around the world: they constitute a sample of effective programmes to inspire and inform LPCs and PCs as they continue their efforts to prevent harm from ALDFG in their fisheries.

These case studies all involve fishers as the lead in retrieving ALDFG. They are programmes that combine a lost fishing gear reporting system and registry with retrieval activities. They include programmes focused on retrieving gillnets, pots and traps, and multiple gear types, with some using fishing vessels for retrieval activities (trawlers, crab fishing vessels, artisanal boats) and one using divers.

Not considered for these case studies were the many programmes engaging non-fishers in retrieving ALDFG, such as NGO programmes (Ghostdiving, Myanmar Ocean Project) and those led by fisheries authorities or government agencies (ARAP, NOAA). Reporting systems for ALDFY (such as the GGGI's Ghost Gear Reporter App) were similarly not considered unless they had a direct link to fisher-led retrieval of ALDFG.

Case studies

Puget Sound Reporting, Response and Retrieval Program

In the Salish Sea in the American State of Washington (hereafter referred to as Puget Sound), salmon fishing has historically been an economic driver for the fisheries. The salmon fishery is co-managed by the State of Washington and sovereign tribal nations who have treaty fishing rights to harvest half the salmon. State and tribal fisheries management agencies have recognized the negative impacts associated with lost gillnets and taken steps to minimize and mitigate those impacts. From 2002 to the end of 2016 more than 5 591 derelict fishing net remnants that had

accumulated in the Puget Sound over many years were removed. This was achieved thanks to a comprehensive removal programme led by the Northwest Straits Initiative (NWSI) and supported by the Washington Department of Fish and Wildlife (WDFW), together with many Puget Sound treaty tribes. Of the removed nets 95 percent were gillnets, and the negative impacts of lost nets on species and habitats were severe (Drinkwin *et al.*, 2021; Gilardi *et al.*, 2010; Good *et al.*, 2010, 2009).

To facilitate the prompt retrieval of newly lost nest the fisheries authorities mandated the immediate reporting of lost nets (within 24 hours) in 2012. Coincidently, a Reporting, Response, and Retrieval (RRR) Program was developed by the Northwest Straits Foundation (NWSF) to respond to reports of lost nets and rapidly mobilize retrieval. Managed by the NWSF, the programme has three components, as per its title: reporting, response and retrieval. The response and retrieval components are contracted out to a private company (Natural Resources Consultants – NRC). Retrieval operations are usually conducted by subcontracted commercial dive teams, most of whom are harvest divers (sea urchin and sea cucumber harvesters).

From 2012 to 2019 the programme received 115 reports, most of which NRC responded to in less than four hours. Of these reports, 64 were verified as newly lost nets (loosely defined as lost within three years) and 50 were successfully retrieved through the RRR program: these accounted for an estimated 24–47 percent of nets lost in the fishery over those years. The locations of the remaining verified nets were not sufficiently established to attempt retrieval.

The programme's development was funded through a grant but it now has long-term funding that is unrelated to the fishery. The development included refining an existing reporting system and establishing a systematic response process that included the

Newly lost gillnet removed from Puget Sound, March 2020

notification of fisheries co-managers. Fishers were consulted on how best to promote the reporting system. The retrieval component had already been in place for some years and experienced dive teams are still employed in retrieval operations.

LOGISTICS:

- The programme is managed by the Northwest Straits Initiative, which also raises funds for the programme.
- The reporting system has online and telephone options and is advertised through the NWSI and fisheries authorities' websites.
- The reporting system is linked to Washington State Derelict Gear Database (DGDB).
- Response and retrieval are contracted out to a private company, Natural Resources Consultants (NRC), which receives reports and verifies them before mobilizing the contracted dive teams.
- Retrieval is usually conducted by contracted dive teams but sometimes by vessels of opportunity (fisheries enforcement, etc.).
- Data on retrieved ALDFG is stored in the DGDB.
- Retrieved ALDFG is disposed of at a landfill site or chemically recycled.
- If lost nets can be traced to owners, those fishers are penalized if they did not report the loss.
- All aspects of the programme are coordinated with fisheries authorities.

ALDFG RETRIEVED:

- salmon gillnets
- 50 newly lost gillnets removed from 2012 to 2016.

RETRIEVAL METHOD:

- diver retrieval
- retrieval from vessels
- beach removal.

FISHER INVOLVEMENT:

- programme development
- fishers report their own lost nets
- harvest divers make up the bulk of the subcontracted retrieval dive teams.

FISHER INCENTIVES:

- reporting is mandated through regulation
- fishers are fined from USD 100 to USD 200 if they do not report and a retrieved net is traced back to them.

BENEFITS TO FISHERIES:

- data on retrieved nets are collected and stored in accessible database
- prevents ghost fishing
- prevents navigational hazards.

COST:

- the programme currently benefits from long-term funding unrelated to the fishery;
- The funding is not linked to fisher licenses;
- the programme cost an average of USD 33 500 USD per annum from 2017 up to and including 2020, but actual costs varied from year to year depending on the number of retrievals required.

PROGRAMME DEVELOPMENT:

- the reporting system was refined to link to the statewide database and send alerts to contracted responders;
- the response process was developed collaboratively with fisheries authorities;
- the programme builds on a previously successful ALDFG retrieval programme that had established statewide retrieval guidelines;
- the programme requires trained dive retrieval teams.

Source: Kyle Antonelis, Natural Resources Consultants Inc., personal communication to the authors, 10 May 2021.

Norwegian Directorate of Fisheries ALDFG Reporting and Retrieval

Norway has been a leader in retrieving ALDFG and has extensively documented the negative impacts of ALDFG on its fisheries (Humborstad *et al.*, 2003; MacMullen *et al.*, 2002). For over 40 years, the Norwegian Directorate of Fisheries has used fisher reports of lost gear to search for and recover ALDFG from marine fishing grounds. Norwegian fishers are required to retrieve any fishing gear they lose. If they cannot retrieve it, they must report it to the Coast Guard Central.

Fishers can report by telephone or app, or by recording lost gear in their electronic logbooks. The reporting of lost fishing gear informs where annual clean-up activities are directed. The Directorate of Fisheries also uses VMS data indicating to map fishing intensity and plan retrieval operations. Between 70 percent and 80 percent of the fishing gear reported lost is retrieved during annual clean-ups. In 2018 and 2019, significant amounts of recovered gear were returned to fishers. The Directorate of Fisheries also publishes maps of locations of recovered gear so fishers can see if the gear they reported was recovered. This active communication between the fishing authority and fishers ensures that fishers know their reports are being used.

The annual clean-ups involve chartered fishing vessels going out on expeditions lasting several weeks. Vessels use modified grapnels to dredge for ALDFG. Since the first annual ALDFG clean-ups in the 1980s, more than 1000 tonnes of ALDFG have been retrieved from Norway's fishing grounds, including 22 000 gillnets measuring over 600 km. In 2018, 8 600 traps and 269 900 m of ropes were retrieved in an operation focused on snow crab fishing grounds.

The programme is funded by the government together with a research tax paid by fishers. The annual cost of the exercises is approximately 720 000 USD, and income from the research tax funds half of this. The Directorate of Fisheries has partnered with NoFir to recycle retrieved ALDFG for almost ten years.

LOGISTICS:

- fishers report lost fishing gear to the Coast Guard central through a dedicated smartphone app or telephone;
- the locations of lost fishing gear are stored in an accessible database;
- annual ALDFG retrieval trips are planned using reported lost gear locations and VMS data;
- a fishing vessel is chartered by the Norwegian Directorate of Fisheries;
- an ALDFG retrieval operation takes place every year, lasting several weeks;
- locations of retrieved ALDFG are mapped and available online.

ALDFG RETRIEVED:

- gillnets, pots and traps, trawls, lines, wire, ropes, anchors, buoys;
- 22 000 gillnets measuring over 600 km retrieved to date;

End-of-life gillnets cut out from ropes and bagged ready for recycling, Newlyn Harbour, Cornwall, United Kingdom of Great Britain and Northern Ireland

- over 9 000 pots and traps retrieved from 2014 to 2019;
- over 350 km of rope removed from 2014 to 2019.

VESSEL USED DURING RETRIEVAL:

- large trawl vessel equipped with specialized grapnel.

FISHER INVOLVEMENT:

- fishers report locations of ALDFG;
- a fisher vessel is chartered for retrieval activities.

FISHER INCENTIVES:

- chartered fishing vessels are paid to retrieve ALDFG;
- fishers are required to report lost fishing gear that they are unable to retrieve themselves;
- fishers are provided with the locations of where ALDFG has been removed, allowing them to plan fishing activities.

BENEFITS TO FISHERIES:

- data on ALDFG is collected and stored in an accessible database;
- prevents ghost fishing impacts on target species and other species;
- removes hazards to navigation;
- removes ALDFG that can damage fishing gear.

COST:

- 750 000 USD annually
- 50 percent paid by fishers through research tax.

PROGRAMME DEVELOPMENT:

- the fisheries authority is responsible for programme development;
- the programme has been going for 40 years with ongoing improvements and adaptive management.

Sources: Nordic Council of Ministers (2020); Gjermund Langedal, Norwegian Directorate of Fisheries, personal communication to the authors, 3 June 2021.

Fishing for Litter

Marine litter costs fishing fleets millions of dollars each year in vessel repairs and malfunctions, gear repairs and lost harvest (Antonelis *et al.*, 2011; Mouat *et al.*, 2010; Tschernij and Larsson, 2003). Trawl and net fishers catch marine litter and ALDFG in their gear during active fishing, sometimes causing damage to gear (KIMO International, 2021). The Fishing for Litter programme involves fishers in retrieving marine litter encountered during active fishing by providing waste storage bags and port disposal at no cost to the fisher. The programme also supports the fishing industry and participating fishers through promotional material and public communications, creating a positive public perception of fishers.

The programme operates 16 projects in 11 countries: Belgium, Croatia, England, Germany, Greece, Ireland, Italy, Netherlands, Norway, Scotland and Spain. Slovenia, Montenegro also participated in a pilot project from 2013 to 2016. The programmes are supported by KIMO (Kommunernes International Miljøorganisation, or Local Authorities International Environmental Organisation), an IGO with over 30 member municipalities in 8 countries in Europe run by individual organizations such as BIM (Bord Iascaigh Mhara) in Ireland. Each programme operates in multiple ports; it also recruits and supports its own fishers and the vessels that participate in the programme. A newly launched Fishing for Litter website highlights the many partner programmes and collaborators that have come together to ensure that marine litter encountered during fishing is collected and brought to port. Over 60 ports and 670 vessels are currently taking part. Most programmes involve trawlers, as they are very likely to encounter marine litter in their trawls during active fishing. The Irish programme supports 244 vessels, mostly trawlers but also some smaller fishing vessels of 18–24 m in length fishing for shrimp with traps.

The programme includes close collaborations with ports, waste haulers, fishers, and programme managers. Ports agree to participate, and then set up Fishing for Litter disposal sites where fishers can deposit the marine litter collected. Fishers are provided with large-capacity bags for storing collected waste on board. When marine litter is encountered during fishing it is separated out and placed in the bags; large items are set aside on deck. When the vessel returns to port, the waste is unloaded into the designated receptacles at no cost to the fishers. Some programmes or waste haulers further sort the waste for recycling. Most programmes include a monitoring aspect, whereby the weight and components of all the waste collected is noted for evaluation and reporting; the programme then pays for the waste disposal. In most programmes fishers receive no compensation but their participation is promoted and publicized on social media, through press coverage and in other ways, thereby providing positive public relations for the fishers and the fishing industry.

LOGISTICS:

- the programme is managed by various types of organizations (ports, fisheries authorities, NGOs, government);
- ports set up collection locations with bins for different types of materials if recycling is an option;
- fishers receive bags or bins from the programme;

- when marine litter and ALDFG are encountered in trawls, fishers separate the contents out and put them in the bags or leave large items on deck;
- at port, fishers unload bags and large items into port receptacles;
- some programmes further sort waste for recycling;
- the programme pays for waste disposal;
- weight and other metrics of the waste collected are monitored;
- the programme provides fishers with promotional items and publicizes its benefits through social media, earned media, and online.

ALDFG RETRIEVED:

- longline, nets, ropes, pots and traps
- more than 60 percent debris collected is ALDFG (Ireland)
- 600 tonnes removed in 2020 (all countries).

RETRIEVAL METHOD:

- trawling
- hydraulic lifting (pots and traps).

FISHER INVOLVEMENT:

- fishers collect marine litter during active fishing activities, store it on board and bring it to port for disposal;
- retired fishers help recruit participants (Ireland, United Kingdom of Great Britain and Northern Ireland).

FISHER INCENTIVES:

- positive public image for fisher and fishery
- modest promotional items are given to fishers (sweatshirts, etc.).

BENEFITS TO FISHERIES:

- removes hazards to navigation
- removes litter that can damage fishing gear.

COSTS:

- one full-time member of staff;
- different programmes have different costs depending on size;
- about EUR 150 000 (around USD 177 164) for a programme involving 12 participating ports:
- port receives funding
- waste disposal cost

- personnel
- promotional materials
- supplies (bags and bins);
- funded by government and sponsorship agreements;
- some income from selling recyclable materials (Nylon 6).

PROGRAMME DEVELOPMENT:

- build network of ports, authorities;
- recruit ports;
- set up waste reception and disposal strategy;
- work with fishers to recruit fishers;
- include programme promotion and communications as key components, in order to keep fishers motivated;
- KIMO has model guidance on programme development and management (Fishing for Litter and OSPAR Commission, 2017).

Sources: KIMO International (2021); Catherine Barret, personal communication to the authors, 16 February 2021; Jan Joris Midavaine, personal communication to the authors, 16 February 2021.

Enaleia Mediterranean Cleanup

Responding to an ageing fisher population and to the economic crisis in 2016, Greek entrepreneur and fisherman's son Lefteris Arapakis launched a fishing training school in Greece to provide employment opportunities for young people and carry on the family tradition. During this successful endeavour, participating fishers harvested not just fish but significant amounts of marine plastic litter, including ALDFG. The Mediterranean CleanUp project was initiated to address this problem. The project pays fishers to bring back to port the litter they have encountered during their fishing operations.

Working closely with individual ports and fishers, Enaleia builds relationships and hires staff to manage the project in each port. Enaleia currently works with 23 ports in Greece and Italy and approximately 250 fishing boats, mostly purse seiners and trawlers. A total of 65 percent of all Greek fishermen take part in the programme. In collaboration with the Watamu Marine Association and Kwale Recycling Centre, Enaleia has also begun a pilot clean-up programme in Kwale and Kilifi, Kenya, which began in the summer of 2021.

The programme collects an average of 1 tonne of ALDFG each week and 20–30 tonnes of end-of-life fishing gear annually. The amount of debris brought to port is strictly monitored, with Enaleia staff equipped with tools and means to track the debris from port to disposal. The debris is separated both at port and by the waste haulers. Metal is separated and retained for recycling as well. Netting is given to the Healthy Seas programme and other similar programmes, mainly in Europe, for its eventual recycling and upcycling into consumer goods. The small revenue stream generated by providing recyclable materials to upcycling and recycling partners partially covers the logistics costs, while other costs are paid through sponsorships and grants.

Enaleia pays fishers a fee averaging EUR 100/month (around USD 119/month), based on the weight of debris collected. Initially a voluntary programme, Enaleia found that paying this small fee resulted in a sevenfold increase in the amount of debris that fishers collected. Besides the nominal payment for collecting debris, fishers benefit by way of an improved public image and the intrinsic satisfaction of removing trash from their fishing grounds. Enaleia ensures these efforts are publicized through a strong communications programme with social media and earned media assets.

LOGISTICS:

- boats arrive in port every night;
- project staff unload collected debris from the boats into receptacles (pallets, containers);
- after separating out the metal, fishers separate out the nets;
- the remaining, mostly plastic debris is weighed and its deposit into container is documented through Enaleia's tracking app;
- once the container is full, a recycling company picks it up and replaces it with an empty container;
- net recycling involves spreading the net out to dry and preprocessing before nets are provided to recycling and upcycling partners;
- the separation and sorting of other debris happens at the recycling centre;
- fishers are paid every month.

ALDFG RETRIEVED:

- nets, traps, ropes and lines
- an average of 1 tonne of ALDFG each week;

Fishing nets collected by Enaleia cleaned and sorted for transport to recycling

©FAO/Enaleia

- programme also collects about 20–30 tonnes of end-of-life fishing gear per year;
- in addition to ALDFG, Enaleia also recovers 4 tonnes of marine plastic and 1 tonne of metal from the sea every week.

VESSEL USED DURING RETRIEVAL:

- trawlers
- purse seiners
- gillnet boats.

FISHER INVOLVEMENT:

- programme development;
- fishers retrieve gear using their own fishing vessels and equipment;
- total of 250 vessels participating from Greece and Italy;
- 65 percent of Greek fishermen participate.

FISHER INCENTIVES:

- fishers are paid for collected debris.
- positive public relations for fisher and fishery.

BENEFITS TO FISHERIES

- removes hazards to navigation
- removes litter that can damage fishing gear.

COST:

- Enaleia has 7 full-time and 12 part-time staff;
- initiating a project at a port can cost from EUR 2 000–30 000 (around USD 2 370 – 35 556) depending on the size and number of vessels participating;
- costs of retrieval are borne by fishers;
- some costs are recouped through the integration of recyclable materials into the circular economy.

PROGRAMME DEVELOPMENT:

- initial efforts involve building relationships with ports and fishers;
- liaise with local organizations who can represent the programme (this was done in Kenya);
- in collaboration with certified partners, Enaleia sets up the container and waste hauling agreements with haulers and ports;
- recruit fishing vessels, work with fishers to recruit fishers;

- develop collaborations with recyclers;
- set up waste tracking and fisher payment systems;
- maintain strong communications presence to keep fishers motivated.

Source: Lefteris Arapakis, "Enaleia", personal communication to the authors, 16 June 2021.

Fishing Net Gains Africa

Stand Out for Environment Restoration (SOFER) is a Nigerian community NGO with a mission to raising awareness and drive action on environmental issues. Its Fishing Net Gains Africa project operates in four coastal communities of Nigeria: Mkpanak and Uta-Ewa in Akwa Ibom State, Ilaje in Lagos State, and Akassa in Bayelsa. The project tackles ALDFG as part of a broader approach to aiding fishing communities. The project initially engages the community with workshops and meetings that cover a wide range of fisheries issues, including gear conflicts. By approaching community elders and working with community women and young people, the project establishes a community-wide awareness of the issues around ALDFG.

Central to the project is the operation of a network of Fishing-HubNets. These are buildings that are built to serve as disposal centres for recovered and end-of-life fishing gear. Fishers bring gear (gillnets and cast nets) to the Fishing-HubNet and receive payment for their efforts. After nets are deposited at the Fishing-HubNet, SOFER staff and community volunteers wash them, weigh them and separate their components. Cleaned nets are then given to the community women for use in craft-making.

As part of its work, SOFER provides crafting lessons and is working to create online markets for upcycled items to increase livelihoods for the communities involved.

Women upcycle recovered gillnets into items for sale

Currently, women crafters are making floormats, drawstring bags and decorative items. Once the crafts start to make a profit for the crafters, SOFER intends to charge them for the cleaned nets. The money paid by the crafters can then be used to provide incentive payments to fishers for bringing in the nets. In this way, the Fishing-HubNet can become self-sustaining.

While this case study project has only been operating since 2019, it shows great promise as a model to engage community artisanal fishing communities in a self-sustaining process of ALDFG collection and upcycling, providing a sustainable means of disposing of nets responsibly. Similar projects like this have worked well in the Philippines (Coast4C, n.d.) and in Pakistan (Ocean Conservancy *et al.*, 2020).

LOGISTICS:

- SOFER engages communities to learn about ALDFG and other fisheries issues;
- Fishing-HubNet sites are set up;
- fishers collect nets during fishing, as well as from the beach and intertidal areas, and bring them to the Fishing-HubNet;
- fishers are given incentives when they bring in nets;
- nets are cleaned, sorted and weighed;
- cleaned nets are given to crafters who make marketable items.

ALDFG RETRIEVED:

- artisanal gillnets and cast nets
- 693.3 kg recovered
- 535 visits to the Fishing-HubNets.

RETRIEVAL METHOD:

- captured during fishing
- retrieved from the sea during fishing
- hauling out of intertidal areas and off the beach by hand.

FISHER INVOLVEMENT:

- programme development
- 523 fishers involved so far
- fishers collect nets and bring them to the Fishing-HubNet
- fishers participate in community workshops.

FISHER INCENTIVE:

- payment for nets brought to the Fishing-HubNet.

BENEFITS TO FISHERIES AND COMMUNITY:

- prevents ghost fishing from nets
- income generation from crafts.

COSTS:

- no cost to fishers to bring nets to the Fishing-HubNet (other than personal transportation costs);
- SOFER administration and staff costs;
- incentives are paid to fishers to participate in workshops;
- the programme is currently funded through grants from NGOs and the Canadian Government.

PROGRAMME DEVELOPMENT:

- initial community engagement is crucial;
- hold community stakeholders' workshops;
- establish Fishing-HubNet site collaboratively with community;
- hold craft workshops for upcycling collected fishing gear.

Sources: SOFER Initiative (n.d.); Emmanuel Sofa, personal communication to the authors, 5 May 2021.

Washington Coast crab tag program

The Dungeness crab pot fishery on the West Coast of the United States of America is an important economic driver, with an average yearly landed value of approximately USD 36 million (Washington Department of Fish and Wildlife, 2018). It is also culturally important, providing significant economic benefit to coastal communities. The coastal crab fishery is co-managed by the State of Washington and four sovereign tribal nations within the portion of the coast where they have treaty fishing rights to harvest half the crab. The state-managed commercial fishery has over 228 active fishing licenses each year, with about 200 active fishers. Each vessel deploys 300–500 pots in strings, with approximately 90 000 pots deployed each year. An estimated 10 percent of those pots (or 9 000) are lost every season, mostly due to foul weather driving the pots off their deployment locations (Ayres, 2018). Vessels operate out of four ports on the Pacific coast. Since 1999 a Coastal Dungeness Crab Advisory Board, with about 15 active fisher members, has helped to guide the management of this fishery.

To help reduce derelict crab pot and line accumulation from the Dungeness crab fishery along the Washington Coast, in 2009 the state approved legislation for a crab pot removal permit for the removal of crab pots that remained on the fishing grounds after the close of the commercial Dungeness crab coastal harvest season. Coastal crab gear recovery permits may be obtained by individuals with a current commercial Dungeness crab coastal license. Starting from 15 days after the close of the primary harvest season, recovery permit holders may remove the Dungeness crab pots that remain in the coastal marine waters, regardless of the pot's owners. More recent developments in the programme since 2020 have allowed permitted fishers to retrieve

pots lost during the winter season during the summer crabbing season. These winter pots are identifiable from actively fished summer pots by a winter tag on their buoys. The programme was developed collaboratively with the fisher advisors.

The programme has been in effect since 2009 and the number of recovered pots has varied from a low of just 70 in 2011 to a high of 1 197 in 2016. In 2020, 47 participants removed 694 pots. As of June 2021, 36 fishers had already removed more the 700 pots (D. L. Ayres, personal communication, 2021). The development and establishment of the programme required several changes to legislation and regulations, including changes to the state's "found property" laws, which generally require property to be returned to its original owner.

LOGISTICS:

- Licensed commercial fishers receive permits from the fisheries management authority to retrieve lost Dungeness crab pots at specified times (generally during summer fishing and 15 days after the season ends).
- Permitted fishers then retrieve the lost crab pots they encounter during summer fishing or during off-season times where retrieval is permitted. Retrieval is accomplished by visual surveys and a hydraulic pot hauler.
- Retrieved pots are kept on board the retrieval vessel (fishing vessel) until inspected by fisheries authorities.
- When coming into port with retrieved pots on their vessel, fishers must contact fisheries authority to meet them at port.
- Fisheries authorities meet the vessel at port, inspect the retrieved pots and place a numbered 'retrieved' tag on the pot. They then record the tag number in a database, which indicates the pots were legally retrieved as part of the Crab Tag Program and now belong to the fisher who retrieved them.

Dungeness crab vessels from the Washington State fleet

ALDFG RETRIEVED:

- Dungeness crab pots and strings of pots
- 70–914 pots/year retrieved since 2009.

VESSEL USED DURING RETRIEVAL:

- Dungeness crab fishing vessel.

FISHER INVOLVEMENT:

- programme development;
- fishers volunteer to retrieve gear using their own fishing vessels and equipment;
- a total of 98 vessels participated from 2009 up to and including 2016.

FISHER INCENTIVES:

- fishers who retrieve pots can keep them.

BENEFITS TO FISHERIES:

- data on lost pots is collected and stored in accessible database;
- prevents the impacts of ghost fishing on target species;
- prevents potential whale entanglements, which can have a negative impact on the fishery.

COST:

- moderate fisheries authority staff time to inspect retrieved pots;
- costs of retrieval borne by permitted fishers.

PROGRAMME DEVELOPMENT:

- Coastal Dungeness Crab Advisory Board (fisher advisory body) active in development;
- fisheries authority responsible for programme development;
- necessitated changing the laws on "found property", as these pertain to ALDFG;
- programme authority and process required legislative and regulatory changes.

Sources: D. L. Ayres, personal communication to the authors, 15 May 2021.

Area A Crab Association traps retrieval

The Dungeness crab (*Cancer magister*) fishery is an important economic driver in British Columbia, Canada, representing 31 percent of the value of the province's wild shellfish products. The Area A commercial fishery is the largest in British Columbia, generally landing over a third of the commercially allocated Dungeness crabs in the province. In 2020, 35 vessels were active in the Area A crab fishery, deploying 28 200 traps (Paton, 2020). Most of the Area A commercial crab fishers are members of the Area A Crab Association, which represents them in a variety of forums.

Lost crab traps are a recognized problem for the Area A crab fishery. Data from 2003 to 2013 indicates that between 6 percent and 10 percent of traps are lost each year. In 2013, 2 533 traps were reported lost (Leslie Barton, personal communication, 2021). Fishery regulations require that each trap should include an escape hatch that is secured with biodegradable twine – designed to degrade over time if the trap is lost – thus allowing trapped crab to escape (Department of Fisheries and Oceans Canada, 2021). Trap loss is generally due to severe weather and sea conditions, and traps are usually lost when they are moved away from the location of deployment, after which the fisher cannot relocate them. Vessel traffic conflicts are also reported as a major reason for trap loss (Paton, 2020). Data from ALDFG retrieval activities in Area A show that even lost traps equipped with the required biodegradable cord on their escape hatches can continue to ghost fish after the cord releases the escape hatch (Drinkwin *et al.*, 2017). In addition to safety, liability, economic and environmental impacts, lost traps in Area A cause conflicts with other fisheries, particularly with salmon trollers in the northern part of the area and groundfish trawlers in the southeastern part.

Derelict crab trap removed during Area A ALDFG retrieval operations

To address the problems associated with lost traps, the Area A Crab Association has voluntarily paid for annual, post-season sweeps of lost crab traps since 2000. A commercial crab vessel is chartered every year to conduct three to five days of stray trap removal work in conjunction; softshell crab surveys (to determine harvest readiness) are also conducted annually. In 2015, the chartered vessel removed about 190 traps, though in other years as many as 500 traps have been removed. In 2020 the retrieval charter cost CAD 13 125 (around USD 10 418) (Paton, 2020). The retrieval charter is coordinated by the Association's electronic monitoring service provider, Ecotrust Canada: Ecotrust hires the chartered vessel and coordinates payment from fishers' fees.

Traps are located through visual surveys in areas where fishers have reported losing traps. Buoys are located on the surface and traps are hauled in using the hydraulic trap hauler. Retrieved traps are stored in a secure yard in Prince Rupert, before Ecotrust Canada then coordinates the return of the traps to their owners for a fee. In 2020, traps were sold back to their owners for CAD 50 each (around USD 40), earning CAD 5 800 (around USD 4 617). This revenue was used to help pay for the charter (Paton, 2020).

LOGISTICS:

- The programme is coordinated by Ecotrust Canada, the Area A crab fishery electronic monitoring service provider.
- Crab fishers note where they have lost gear or have seen lost traps throughout the year. This information is passed on to the captain of the chartered vessel.
- A fishing vessel is chartered to conduct 3–5 days of ALDFG retrieval in conjunction with a softshell survey, which is also chartered annually.
- Retrieval operations are planned in areas with high trap loss.
- Lost traps are located through visual surveys and retrieved using hydraulic trap haulers.
- Retrieved traps are brought to port and stored in a secured yard.
- Ecotrust Canada coordinates the return of retrieved traps to their owners, including contacting owners whose traps were retrieved.
- Trap owners retrieve their traps on a designated day, paying CAD 50 (around USD 40).
- Revenues are used to offset the cost of retrieval operations.
- All aspects of the programme are coordinated with fisheries authorities

ALDFG RETRIEVED:

- Dungeness crab traps;
- up to 500 traps have been removed in one year;
- 119 traps were recovered in 2020.

RETRIEVAL METHOD:

- location through visual surveys;
- hydraulic hauling using trap hauler.

FISHER INVOLVEMENT:

- fishers pay for the retrieval operations voluntarily;
- fishing vessel chartered for the retrieval operations;
- programme development;
- fishers keep records of lost traps during fishing season;
- fishers pay to get their retrieved traps back.

FISHER INCENTIVES:

- fishing vessel receives payment for retrieval operations.

BENEFITS TO FISHERIES

- data on retrieved traps are collected and stored in an accessible database;
- prevents ghost fishing;
- prevents navigational hazards;
- prevents gear conflicts with other fisheries.

COSTS:

- USD 2 000-6 000 per day of retrieval operations;
- retrieval cost of USD 13 500 USD in 2020;
- some costs are recovered when traps are sold back to their owners at USD 50 per trap;
- staff time for Ecotrust Canada to coordinate, generally absorbed in other staff duties.

PROGRAMME DEVELOPMENT:

- programme was developed in early 2000s by Area A Crab Association;
- requires cooperation and approval from fisheries authority, particularly for fishers to retrieve other fishers' traps.

Sources: Leslie Barton, Program Head, Shellfish Data Unit Aquatic Resources Research and Assessment Division, Pacific Biological Station, Fisheries and Oceans Canada /Government of Canada, personal communication to the authors, May 2021.

Considerations for the development of reporting and retrieval programmes

When developing pilot ALDFG reporting and retrieval projects, several aspects need to be considered, including: the status of national fisheries management programmes; potential partners; the status of ALDFG reporting; the necessary level of effort or involvement from fishers, fisher associations, fisheries authorities and ports; costs; and funding. New projects can be designed to match the available resources at hand with the resources required, as demonstrated by the examples of successful projects described in the Case Studies section. Table 4 outlines some of the key elements that make the case studies successful. Each case study was assessed qualitatively for level of effort or involvement (low, medium, or high) for each element that required local or national capacity for its successful implementation.

Table 4
Summary of key ALDFG retrieval programme criteria

RETRIEVAL PROGRAMMES ELEMENTS	PUGET SOUND RRR PROGRAM	NORWEGIAN DIRECTORATE OF FISHERIES	FISHING FOR LITTER	ENALEIA	SOFER NET GAINS NIGERIA	WASHINGTON COAST CRAB TAG PROGRAM	AREA A CRAB ASSOCIATION
SOURCE FISHERY/ GEAR TYPE	Salmon/ Gillnet	Various	Various	Various	Multi species/ gillnet	Crab/ trap	Crab/ trap
RETRIEVAL METHOD	Diving	Trawl	Trawl	Trawl	Gillnet	Trap	Trap
ALDFG LOCATION[A]	R	R	F	F	V, F	F, V	R, V
PROJECT LEAD[B]	NGO	FA	NGO	NGO	NGO	FA	FIA
KEY COLLABORATORS[B]	FA, FI	FI	FI	FI	FI	FI	FA,FI
EFFECTIVE REPORTING SYSTEM[C]	H	H	L	L	L	L	M
FISHER INVOLVEMENT[C]	L	L	H	H	H	H	H
FISHER ASSOCIATION INVOLVEMENT[C]	NA	NA	L	NA	NA	M	H
FISHERIES AUTHORITY INVOLVEMENT[C]	L	H	L	L	L	M	L
PORT INVOLVEMENT[C]	L	M	H	H	L	L	L
COST[C]	M	H	M	L	L	L	M
FUNDING[C]	P	FI, G	G	P	P	G	FI

[A] R=Reporting system, F=Fishers, V=Visual surveys
[B] NGO=non-governmental organization, FA=Fishery authority, FIA=Fishing industry association, FI=Fishing industry or fishers
[C] L=Low, M=Medium, H=High, NA=Not applicable, individual fishers, rather than associations are engaged
[D] P=Private, FI=Fishing industry of fishers, G=Government.

Naturally, each LPC and PC will have varying levels of capacity to engage in pilot projects. The most important thing is to build on existing, successful programmes and structures that work for each fishery. As in any effective fisheries management strategy, upfront and continual consultation and collaboration with fishers and fisher associations will serve to ensure that pilot project designs are feasible and supported by industry. This is true even if the project does not ultimately involve a high level of effort from fishers to implement.

Recommendations

The following recommendations are consistent with the VGMFG and the BPF and build on the successful case studies highlighted in this report. The recommendations relate to many of the responses received to the country questionnaires, acknowledging that some LPCs and PCs already have components of effective ALDFG reporting and retrieval programmes and are working towards adopting more practices, some with planned and newly drafted fisheries policies. For all the recommendations around ALDFG reporting and retrieval, upfront and continual consultation and collaboration with fishers and fisher associations will ensure that the programmes and systems put in place are feasible and supported by industry.

Recommendation:
Create and strengthen requirements and incentives for fishers to retrieve gear that they lose, if safe to do so, and to carry appropriate tools and equipment for the retrieval of lost gear on their vessel

Requiring fishers to retrieve gear if it is lost is a critical measure to avoiding impacts from ALDFG and is included in the VGMFG, the BPF, and other documents addressing overarching management of ALDFG (FAO, 2019a; Gilman, 2015; Gilman *et al.*, 2021; Huntington, 2017; Macfadyen *et al.*, 2009). It is clear from the responses to the country questionnaire that many fishers in LPCs and PCs do already retrieve gear that they lose. The purchase and maintenance of fishing gear is a major expense and investment for fishers, albeit a necessary one. Nevertheless, retrieval attempts can divert fishers from lucrative fishing and can cost time and fuel: in order to keep fishing, fishers might abandon gear when it could be retrieved. Requiring that fishers attempt retrieval is an important step. It is also important that appropriate retrieval equipment is kept on board the vessel. Different fishing gear requires different retrieval equipment based on the depth, bottom structure and gear type (Fundy North Fisherman's Association, 2016; Brown *et al.*, 2005).

Depending on the fishery, following this recommendation may involve creating new or building on existing fisheries management guidelines or policies, and establishing new regulations.

Recommendation:
Support programmes and recycling initiatives such as Fishing for Litter to facilitate the collection and proper disposal of ALDFG encountered during active fishing and end-of-life fishing gear

Retrieving marine litter, including ALDFG, during active fishing is a widely accepted strategy to reduce harm from ALDFG and was advocated as early at 1988 (Fjelstad, 1988). The logistics of various programmes like Fishing for Litter, Hawai'i Nets to Energy Program, and the South Korean buy-back programme all rely on fishers (generally trawlers but longliners in the case of the Hawai'i programme) to collect any ALDFG encountered during fishing and return it to port for disposal (Cho, 2009; KIMO International, 2021; NOAA Marine Debris Program, 2021).

Most of the Fishing for Litter programmes in Europe only offer public relations incentives to fishers, while providing them with waste storage bags and free disposal of recovered marine litter. Similarly, the Hawai'i programme does not compensate the

fishers financially. There is evidence that this approach builds support for the fishing industry and also influences fishers to improve their waste management behaviours overall (Wyles *et al.*, 2019). The South Korean programme compensates fishers by weight of litter brought back to port, as does Enaleia (Cho, 2009).

Fishing for Litter type programmes seem to work best with larger vessels as some smaller vessels are space limited. A pilot project in the Mediterranean also showed that strong governmental support and consistent laws and regulations around marine litter help to streamline the programme's management. The KIMO model – where multiple programmes are supported by an intergovernmental organization – helps to ensure management consistency and support. Funding, naturally is also a challenge (Ronchi *et al.*, 2019).

Depending on the fishery, supporting the retrieval of MPL and ALDFG encountered during active fishing might require establishing regulations or permits specific to this activity, and ensuring adequate waste reception facilities for proper disposal.

Supporting recycling initiatives – and providing accessible and cost-effective port reception facilities – provides a responsible, alternative means of disposal to discarding at sea for unwanted or end-of-life fishing gear.

Recommendation:
Support the retrieval of gillnets lost at sea

Gillnets and trammels nets are widely acknowledged to be the most damaging type of ALDFG. They are easily lost due to conflicts with other gear, vessels and animals, as well as through snagging on bottom obstructions, especially demersal types (Gilman *et al.*, 2016; Gilman *et al.*, 2021; Huntington, 2016). The negative impacts from ghost fishing ALD gillnets can be severe (Breen, 1990; Castro and Waerebeek, 2019; Drinkwin *et al.*, 2021; Gilardi *et al.*, 2010; Large *et al.*, 2009; Matsuoka, 2005; Tschernij and Larsson, 2003). While gillnet loss prevention should naturally be the priority some loss is inevitable, even in the most effectively managed fishery. Therefore, a systematic programme to respond to gillnet loss and retrieve lost nets is needed to reduce the harm caused by ALD gillnets.

Retrieval at sea can be complicated due to the nature of the net materials, which can break if hauled under excessive strain. Nevertheless, there are examples of programmes successful at locating and removing gillnets from the sea after they have been lost, using both divers and dredging techniques (Drinkwin *et al.*, 2021; Norwegian Directorate of Fisheries, 2021; Ocean Conservancy *et al.*, 2020).

Successful gillnet retrieval programmes generally include a robust location process, underpinned by an understanding of where gillnets are typically lost (Drinkwin, 2017). This is greatly aided by accurate and timely reporting of loss by fishers, as described in the Puget Sound RRR case study.

Depending on the fishery, supporting the retrieval of gillnets and trammels nets might require establishing regulations or permits specific to this activity. In some cases, a highly trained cadre of divers is necessary. These can include harvest divers or salvage and technical divers. Vessel requirements vary by fishery and ocean conditions. Drinkwin (2019b) has outlined the steps needed to develop a safe and effective ALDFG-removal dive programme, and model guidelines and

safety protocols are available from various organizations (Seadoc Society, 2009; WDFW, 2002). An accurate reported gear loss registry is also particularly helpful in order to plan targeted retrieval operations.

Recommendation:
Support the retrieval of lost traps and pots by participating fisher

The retrieval of lost traps and pots, especially those with surface buoys, has been successfully accomplished by fishers in several crab and lobster fisheries in North America and elsewhere (Ayres, 2018; Goodman *et al.*, 2019; Ocean Conservancy *et al.*, 2020; Paton, 2020; Scheld *et al.*, 2016). Because this type of ALDFG has a high potential for ghost fishing, and can also present a significant risk to navigation and marine mammal entanglement, its retrieval either after fishing season closures or at other appropriate times could be prioritized based on each fishery's risks (Antonelis *et al.*, 2011; DelBene *et al.*, 2019; Drinkwin *et al.*, 2017; Jeffrey *et al.*, 2016; NOAA Fisheries, 2020).

Engaging fishers from the source trap and pot fishery takes advantage of the fishers' knowledge of locations where gear is typically lost or found, as well as their fishing vessel's capabilities to both retrieve and store ALD traps and pots. Depending on the size of the fishery, some ALD trap and pot removal can occur during active fishing, with appropriate monitoring and communications in place (Paton, 2020). Otherwise, post- season retrieval operations conducted by a single vessel or fleet of vessels can be effective.

Depending on the fishery, supporting the retrieval of traps and pots might require establishing regulations or permits specific to this activity, as well as ensuring adequate waste reception facilities for proper disposal. As retrieved ALD traps and pots are often reusable, establishing a secure storage location or a process to return retrieved gear to its owners may be needed.

Recommendation:
Develop ALDFG reporting systems and registries appropriate to local fisheries to document the extent and locations of lost fishing gear, as well as to inform prevention and remediation activities

Accurate recording of fishing gear loss, which includes the identification and type of gear, location, time and reasons for loss, aids fisheries management in a number of ways.

First, keeping a record of gear loss – by way of a systematic reporting programme and storing those records in an accessible registry – will build a clearer picture of the extent and severity of ALDFG per fishery. This will help fisheries authorities to assess the risk of ALDFG to harvest, species and habitats, as well as navigation. The VGMFG recommends conducting a risk assessment to establish the appropriateness of implementing a gear marking system, but such a risk assessment can inform other fisheries management strategies as well (FAO, 2019a).

Second, gathering information on the timing and location of gear loss, sea conditions, as well as the reasons for the loss, can also paint a picture of its underlying causes or drivers. This information can inform preventive fisheries management strategies, such as the spatio-temporal separation of fisheries, seasonal closures, gear marking for visibility, and designated vessel traffic lanes (Gilman, 2015; Huntington, 2017; Richardson *et al.*, 2018).

Third, reporting accurate locations of where gear is lost also helps its efficient retrieval (Drinkwin, 2017; Gilman *et al.*, 2021; Morgan, 2019). By keeping an accessible registry of locations and types of lost gear, fisheries authorities can determine areas where ALDFG retrieval operations will likely be the most effective and cost-efficient. The VGMFG recommends prioritizing the retrieval of ALDFG that presents a hazard to navigation, poses risks to sensitive habitats, and poses a threat to marine wildlife or the potential to ghost fish (FAO, 2019a). Accurate reporting of lost gear can answer questions about the potential impacts of ALDFG on navigation and the environment.

Developing an effective reporting system and registry could involve building on existing systems such as emergency response systems, logbooks and observer reports. Information received through the reporting system should be shared with nearby vessels if navigation risks are present. Reciprocal arrangements with RFBs may be appropriate.

Recommendation:
As members of RFMOs, promote binding measures around ALDFG reporting and retrieval

Many LPCs and PCs are members of RFMOs, which have the authority to adopt binding conservation and management measures. These bodies play an important role in guiding regional fisheries policies and management.

Gilman (2015) found that none of the RFMOS with LPC or PC membership have binding measures around the detection and removal of ALDFG; this includes requiring retrieval equipment on board and requiring at least an attempt to retrieve lost gear. In fact, only three RFMOs do have binding measures relating to the detection and removal of ALDFG: NAFO, NEAFC and SEAFO. The need for binding measures to retrieve dFADs when no longer being used is of particular importance to LPCs and PCs with tuna fishing vessels that make use of these devices. Documented negative impacts of dFADs warrant special consideration for this type of fishing gear, notably because its current management is more complicated than other types of gear (Baske and Adam, 2019; Consoli *et al.*, 2020; Gilman *et al.*, 2018; Herrera *et al.*, 2019; MRAG Asia Pacific, 2016).

Of the RFMOs with LPC or PC membership, binding measures relating to ALDFG reporting through logbooks or observer reports are in effect in CCAMLR, IOTC, IATTC, SPRFMO and WCPFC. Required information also includes whether the ALDFG was from a different vessel (Gilman, 2015). Recommended binding measures around the reporting of ALDFG at the RFMO level should include the reporting of: gear type, identification number, locations, flag State, sea conditions, reason for loss, retrieval actions attempted, and current disposition of the gear. It is also recommended LPCs and PCs promote the integration of RFB reporting into national ALDFG reporting systems and registries.

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Appendix. Country questionnaire

GloLitter Activity 1.1.1

Participating Country Questionnaire on reporting of, and retrieving abandoned, lost, and discarded fishing gear (ALDFG)

Activity aim:

The aim of this activity is to prepare a report recommending effective management practices and incentives for fishing vessels to report and retrieve abandoned, lost and discarded fishing gear (ALDFG) and deliver it to port reception facilities. This report will be used for knowledge sharing, dissemination and capacity building purposes as well as planning of GloLitter Partnership phase II "pilot projects" to pratically implement the proposed management systems and incentives schemes.

The following questionnaire is designed to gather information from all participating countries (Lead Partnering Countries and Partnering Countries) on current status of ALDFG reporting, retrieval and management and insights around practical solutions consistent with each country's fisheries management program.

Please complete the questionnaire by March 19, 2021 and send your completed questionnaire to:

Joan Drinkwin at joan.drinkwin@fao.org

Please feel free to reach out to Ms. Drinkwin at any time with questions to discuss your answers.

Instructions: Please answer the following questions in a Word document and save the finished questionnaire as a Word document. We are interested in detailed answers, so please take as much spas as you need to answer each question. There may be multiple answers to each question for different fisheries (gillnets vs. trawl, artisanal vs. commercial).

Section 1. Background information

1A. Date of form completion
1B. Country name
1C. Contact information for person(s) filling out the form *(add rows if needed)*:

Name	Position	Organization	Email

1D. Fisheries Authority Organization *(ministry, department, etc.)*:

Section 2. Lost fishing gear reporting

Take as much space as you need to answer each question. There may be multiple answers to each question for different fisheries (gillnet vs. trawl, artisanal vs. commercial). Indicate which answers apply to different fisheries.

2A. Are fishers required to report if they lose any fishing gear components during fishing?
If yes, please provide details.

2B. Is there a system in place to receive reports of lost gear from fishers?
If yes, please provide details.

2C. Is there a system in place to receive reports of lost or abandoned fishing gear belonging to other fishers encountered during fishing?
If yes, please provide details.

2D. Does the fisheries management authority maintain a lost fishing gear register or database to collect and store information about lost fishing gear?
If yes, please indicate what data fields are included.

2E. Is there a system and/or requirement in place in your country or region for the marking of fishing gear?
Yes/No - if requirements differ between fisheries please specify which fisheries require marking.

2D. If yes to above does the marking enable identification of the owner or vessel?
Yes/No - if requirements differ between fisheries please specify.

Section 3. Lost fishing gear retrieval

Take as much space as you need to answer each question. There may be multiple answers to each question for different fisheries (gillnet vs. trawl, artisanal vs. commercial). Indicate which answers apply to different fisheries.

3A. Are fishers required to retrieve, or attempt to retrieve, any of their own fishing gear that has been lost or forcibly abandoned during fishing operations? If yes, please provide details.

3B. Are fishers required to carry retrieval equipment on their vessels for this purpose? If yes, please provide details.

3C. Are fishers restricted in any way from collecting, storing on board their vessel, and/or disposing of other fishers' lost, abandoned or discarded gear that they might encounter during fishing? If yes, please provide details and answer question 3C.1.

3C.1 Are fishers penalized in any way for collecting, storing on board their vessel, and/or disposing of other fishers' lost gear that they might encounter during fishing?

Section 4. Waste fishing gear disposal

4A. Are there adequate waste reception facilities available in or nearby ports or landing sites for fishers to dispose of recovered fishing gear? *If yes, where possible give examples.*

4B. Are there costs to the fishers associated to the disposal of their fishing gear after its useful life?
If yes, please give examples or an indication of the costs.

4C. Where there are costs, who bears the cost if fishers collect and dispose of lost abandoned or discarded fishing gear belonging to other fishers encountered at sea?

Section 5. Programmatic questions

5A. What are the barriers for fishers to collect, store, and dispose of ALDFG during fishing *(economic, space on deck, regulatory prohibitions, feasibility)*?

5B. What structures or organizations are in place that might support a lost fishing gear reporting and retrieval program *(fisher associations/cooperatives, fishing extension offices, port authorities, etc.)*?

5C. Are you aware of any programs implemented in your country or region where fishers retrieve lost fishing gear or work with other organizations to clean up lost, abandoned or discarded fishing gear? *If yes, please provide as much detail as possible, including contact information for program leaders.*

GloLitter partnerships

This document is part of the GloLitter Partnerships Phase I Knowledge Products Series. The GloLitter Partnerships project is implemented by the International Maritime Organization (IMO) and the Food and Agriculture Organization of the United Nations (FAO). GloLitter assists developing countries in reducing marine plastic litter from the maritime transport and fisheries sectors.

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