GHOST GEAR: THE ABANDONED FISHING NETS HAUNTING OUR OCEANS

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Sea turtle entangled in fishing gear in the Mediterranean Sea
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A yellow buoy in the Great Pacific Garbage Patch with some line trailing behind has become the home for many gooseneck barnacles, several crabs, and has attracted a school of pilotfish.

EXECUTIVE SUMMARY

Pollution of the world's oceans is a growing and pervasive problem, and that is especially true of the increasing volume of ocean plastic. A staggering 12 million tonnes of plastic ends up in the ocean every year, the equivalent of emptying a rubbish truck into the ocean every minute. All plastic in the oceans can trap, entangle, smother or kill animals. However there is one particular type of plastic pollution that is especially deadly because it is specifically designed to catch and kill marine wildlife: Abandoned, lost or discarded fishing gear, or so-called 'ghost gear'.

Over the past few decades, the fishing industry worldwide has increasingly used plastic in ropes, nets and lines, as well as other fishing equipment. Plastic's lightness, buoyancy, durability and cheapness make it ideal for fishing. Unfortunately, the same qualities also make ghost nets and lines a fatal and growing threat to marine life, and the communities that depend on healthy oceans thriving with life.

Fishing gear can be lost by accident or abandoned at sea deliberately. Once there, nets and lines can pose a threat to wildlife for years or decades, ensnaring everything from small fish and crustaceans to endangered turtles, seabirds and even whales. Spreading throughout the ocean on tides and currents, lost and discarded fishing gear is now drifting to Arctic coastlines, washing up on remote Pacific Islands, entangled on coral reefs and littering the deep seafloor.

Key findings: the scale of the problem

- An estimated **640,000 tonnes of ghost gear enters the ocean every year**, equivalent in weight to **more than 50 thousand double decker buses**.
- **Ghost gear is estimated to make up 10% of the plastic waste in our oceans,** but represents a much higher proportion of large plastics found floating at the surface. Associated rubbish from fisheries, such as packing containers, tape and buoys also contribute to ocean plastic pollution.
- In some specific ocean areas, fishing gear makes up the vast majority of plastic rubbish, including **over 85% of the rubbish on the seafloor on seamounts and ocean ridges, and in the Great Pacific Gyre**.
- Around **300 sea turtles were discovered dead in a single incident** in 2018, entangled in a ghost fishing net in Mexican waters.
- 'Ghost fishing' effectively competes against fishers for their catch. **Ghost gear is also a hazard to ship navigation and safety at sea.**

Ghost gear is particularly prevalent from illegal, unregulated and unreported fishing, with overcrowded fisheries, excess fishing capacity and conflicting gear types also contributing to the problem. Moreover, poor regulation and slow political progress in creating ocean sanctuaries that are off-limits to industrial fishing allow this problem to exist and persist. Alongside a lack of proactive measures to address the problem at source, clean up is costly, complex and sometimes damaging, while there is limited ownership of the problem and not enough incentive to fish in smarter ways to avoid losing gear.

Even worse, in international waters there is currently no comprehensive legal framework in place to protect marine life and ocean health.**This leaves a fragmented system that is focused on exploiting rather than protecting the global oceans – including regional fisheries management organisations that have been slow and ineffective at addressing the problem of ghost gear, despite knowing about it since the 1980s.**

The United Nations has recognised this gaping hole in ocean governance and the world's governments are currently negotiating **a Global Ocean Treaty. Due to conclude in 2020, this treaty is an opportunity to put global rules in place that would enable governments to create effective ocean sanctuaries covering at least 30% of international waters by 2030.** This is the science-backed goal to protect marine life, preserve ecosystems and build ocean resilience to the impacts of climate change. While protected sanctuaries are still susceptible to pervasive ghost gear, heavily fished areas of the ocean place wildlife at a much higher risk.

Recommendations

To address the impacts of abandoned, lost and discarded fishing gear, alongside the multiple and growing pressures facing marine life, Greenpeace calls on governments to:

1. Agree an ambitious Global Ocean Treaty by spring 2020 to provide comprehensive protection for marine life in international waters, which can establish a global network of fully-protected sanctuaries for critical habitats and put in place robust environmental impact assessment processes so that the risks of ghost fishing gear are considered before human activities are permitted to proceed
2. Adopt cross-sectoral solutions and best practice promoted by the **Global Ghost Gear Initiative**
3. Take effective action to address marine pollution, including ghost fishing gear, through relevant regional and global organisations

INTRODUCTION

It's becoming more and more obvious that our plastic habit is threatening the planet, and the wildlife we share it with. The oceans in particular are becoming choked with the plastics that humanity has used – often only once – and thrown away. But what about the ocean trash that was literally designed to kill marine life? The gear used by fishing fleets the world over has shifted towards plastic in recent decades, and huge quantities of that fishing gear end up abandoned, lost or discarded at sea. **Ghost fishing occurs when this lost gear continues to catch and kill marine life: No longer catching for human consumption, it goes on killing nonetheless, for many years, or even decades, to come.**

There are many reasons why fishing gear ends up abandoned, lost or discarded, but much of the ghost gear problem stems from overcrowded fisheries, excess fishing capacity and illegal, unreported and unregulated fishing (IUU).[1] Specific factors, sometimes in combination, include:

- Severe weather events
- Snagging on the seabed (rocks, corals, wrecks and seamounts)
- Entanglement with other fishing gear (often conflict between towed and static gear types)
- Theft and vandalism
- Gear breakage and tracking malfunction
- Poorly maintained or old gear
- Intentional abandonment and discarding

As fishing expanded to almost every part of the globe and the industry developed a wide range of synthetic, durable and buoyant gears, so have the amount, distribution and impacts of ghost gear.[2] Abandoned, lost and discarded fishing gear has been recognised as a major problem since the 1980s[3] and it is likely that this problem is increasing, although it's hard to quantify given the incomplete reporting of how much fishing gear is involved, the wide variety of gear types, and the difficulty in monitoring or retrieving ghost gear. **An FAO report estimated that 640,000 tonnes of gear is lost or abandoned in the oceans every year, and makes up around 10 % of the plastic in the oceans.[4] One study found that as much as 70 % (by weight) of macroplastics (over 20 centimetres in size) found floating at the surface of the ocean is related to fishing activities, 58 % of which was derelict fishing buoys.[5]**

Some ghost fishing gear is also highly mobile, and can accumulate in shocking quantities in remote areas due to ocean currents. A recent study of the Great Pacific Garbage Patch, an area of plastic accumulation within the North Pacific Subtropical Gyre, estimated that it contained 42,000 tonnes of megaplastics (over 50 centimetres), of which 86 % was fishing nets. Fishing nets made up 46 % of the total garbage in all size classes in the area.[6] Another recent expedition in the South Pacific found an estimated 18 tonnes of plastic debris on a 2.5 kilometre stretch of beach on the uninhabited Henderson Island, which is accumulating at a rate of several thousand pieces per day.[7] In a collection of 6 tonnes of garbage, an estimated 60 % originated from industrial fisheries. Some marked items such as plastic fish bins originated from New Zealand fishing companies some 5,000 kilometres away, including companies that ceased operations up to two decades ago.[8]

Illegal fishing exacerbates the problem of ghost gear.[9] Vessels fishing illegally often operate in more adverse conditions, for instance at night or without access to safe harbours in heavy weather. In addition, they may be adding further pressure and gear to fisheries already at full capacity, and using types of gear that conflict with other, authorised, fishing gears in an area. Finally, illegal fishers may 'cut and run' from gear to avoid detection by authorities, if they encounter problems, or if they require access to ports in which their gear is not permitted.

These figures provide yet another example of the impact of fishing activities on the marine environment globally and question the extent to which governments, individually or through the various organisations they are parties to, are effectively ensuring the conservation of our oceans. **There is an urgent need for effective measures to minimise the loss of fishing gear, ensure coordination among all existing organisations and swiftly move from words to action.**

A diver attaches a GPS tracker onto ghost fishing nets in the Great Pacific Garbage Patch. The buoy will send the position of the nets as they travel around the gyre, increasing our understanding of currents and how trash accumulates in the gyre.

MAIN TYPES OF FISHING GEAR

There are a wide variety of methods and gear types used to catch fishes, crustaceans and cephalopods, depending on the size and species being targeted and where they live. These range from simple small-scale gear operated by hand from boats or the water's edge, such as spear guns, traps, handlines and small nets, through a variety of mechanically operated hook and line designs, to the top end of industrial scale bottom and mid-water trawls with nets big enough to contain large aircraft, and giant purse seine nets that could enclose several Olympic pools.[10] In addition, we have developed technologies that can seek out fishes efficiently and allow vessels to operate everywhere, from the Antarctic to the Arctic, and with longlines and trawls that can target deep-sea species a couple of kilometres below the surface.

Fishing gear can be classified in different ways. For the purpose of looking into how gear behaves when lost or abandoned, we will look into four main groups: nets, hooks and lines, pots and traps, and fish aggregating devices (FADs). Any and all of these gears can be lost, abandoned or discarded at some point, but there are some that are more commonly used, so more commonly lost, and others that have a great propensity to be lost due to how and where they are used. Losses for some gear types, like lines, are a mix of whole gears and fragments resulting from breakage, while others like gillnets and pots tend to be whole gears. Finally, the actual impact on the marine environment depends on the number, size, and type of gear lost.

The overall susceptibility of gear to being abandoned, lost and discarded, and the subsequent impact can be used to determine the overall risk posed by major fishing gear types to the marine environment (ghost fishing, the risk of entanglement with marine mammals, reptiles and birds, and habitat damage). One review using this method lists gillnets, traps and pots, and FADs as the worst of the ghost gears (Table 1).

Gear groups	Likelihood of loss	Magnitude of impact	Risk
Gillnets	5	5	25
Traps and pots	4	4	16
Fish aggregating devices	4	3	12
Hooks and lines	3	3	9
Bottom trawls	2	3	6
Midwater trawls	1	2	2
Seine nets	1	2	2

Table 1. The risk posed to the marine environment by major fishing gear types becoming lost or abandoned. Risk is determined by multiplying the likelihood of being lost or abandoned with the magnitude of environmental impact (each scored between 1–5, with 1 being very low and 5 being very high. Resulting risk scores can be in the range of 1–25).[11]

Nets

The main net types used in industrial fisheries are bottom and pelagic trawls, purse seines, and gillnets. Trawl nets scoop up fishes as they are dragged along the seabed or through the water column, purse seines encircle schools of fishes, like sardines and tuna, and gillnets are like a fence of almost invisible monofilament nylon netting that trap fishes around the gills as they try to swim through, or entangle them by their fins and tails. Gillnets can be anchored to the seabed, or left to drift freely or with one end anchored to a boat (known as driftnets). Nets are also used in many types of aquaculture, and like fishing nets these can end up as ghost gear if they are lost or abandoned. A net from a fish farm, weighing almost 3 tonnes, was recovered by divers in the Aeolian Islands in 2018.[12]

A 2019 study estimated that about 6% of all nets are lost annually around the world – 5.8% for gillnets and entangling nets; 1.2% for miscellaneous nets (includes mostly dip nets as well as unidentified and reef nets); 6.6% for purse seine net fragments; 2.3% for seine net fragments; and 12% for trawl net fragments.[13] Trawl and purse seine nets are less commonly lost and tend to be partial losses of torn nets. Average annual losses in terms of net numbers per vessel are: 47.4 gillnets and entangling nets, which was comprised of 6.2 drifting gillnets and 88.56 set or fixed gillnets; 3.5 miscellaneous nets (includes mostly dip nets as well as unidentified nets and reef nets); 51.49 purse seine net fragments/pieces; 6.88 seine net fragments/pieces; and 20.94 trawl net fragments/pieces.

Gillnets are the main villains of ghost fishing. Loss rates depend on where and how they are used, as do the impacts. For example, those that touch the bottom are more likely to be lost, as are those left unattended. Similarly, those used in shallow coastal waters (under 200 metres depth) have a lower loss rate and are easier to recover, while deep water (over 500 metres) gillets are the most problematic due to excessive net lengths, increased soak times and gear stress.[14] The United Nations (UN) banned the giant drifting gillnets of over 2.5 kilometres long from international waters in 1992, but in deep-sea, bottom-set gillnet fisheries where shorter nets of 50–100 metres are used, a single vessel can still set many hundreds of gillnets in one area.[15] In a 2005 study, deep-water fisheries in the northeast Atlantic accounted for more than 25,000 of the total 33,038 gillnets reported lost.[16] Adding to their deadly impact, deep-water fish species tend to be slow growing, live a long time, and have few young, which makes their populations highly vulnerable to targeted fishing, let alone ghost fishing.

Adult female green turtle *(Chelonia mydas)* entangled in fishing line on North Beach, Henderson Island.Photographie: Jennifer Lavers

Traps & pots

Traps, such as those used for lobsters and crabs, get lost when they are detached from their ropes and/or buoys during a storm, or when cut off by boat propellers, and due to negligence in trap maintenance.[17,18] **About 9 % of all fishing traps globally are lost every year[19] but this varies significantly by type and area. For example, annual trap losses reported by fishers in Florida have been typically 10–20 % of their total traps fished, amounting to 50,000–100,000 lost traps in recent years.**[20]

The impact of ghost traps depends on where they are placed – soft sand, gravel, seagrass meadows, rock or coral reefs.[21] **Ghost traps continue to catch animals until they substantially degrade – trapped animals starve and die, and/or get eaten by other predators or scavengers. Traps move about in storms, like mini-bulldozers, and can significantly degrade seagrass meadows and damage corals and sponges.** Trailing ropes from lost buoys may also entangle seabed structures and snare other marine life. While some parts of traps degrade, plastic parts, such as buoys, remain a persistent source of marine litter. Thousands of ghost traps have a significant negative effect on the marine environment over an extended period of time.

Lines

Industrial pelagic longlines, such as those used to catch tuna, sharks and billfish, consist of a main line suspended from surface floats, with branch lines hanging below, each with a baited hook. These longlines can be over 100 kilometres long with 2,000–3,000 branch lines and hooks.[22] There are also bottom-set longlines, targeting species like cod and Antarctic toothfish, and a range of shorter lines such as those used in pole and line, trolling and handlines.

An estimated 29 % of all lines are lost each year: 23 % of handlines, 65 % of pole-lines, 20 % of longlines (including 17 % loss of hooks from longlines), and 22 % of trolling lines.[23] Again, the impact of these losses depends very much on the design of the lines. A simple pole with a line and a single, unbaited barbless hook, like those used to catch skipjack tuna, is considerably less likely to ghost fish than a longline with thousands of branch lines and baited hooks. There are also large numbers of longline vessels operating at sea. In the the largest tuna fishing grounds of the Western and Central Pacific, for example, 2,581 longline tuna vessels are registered to fish in 2019 (66 % of all vessels), with just 100 pole and line vessels (less than 3 % of tuna vessels).[24]

FADs

Purse seine vessels targeting tropical tuna use artificial drifting fish aggregating devices (dFADs) to attract fishes. FADs are rafts made from various natural and synthetic materials, with long pieces of old fishing nets, ropes, and plastic ribbons hanging 40–100 metres beneath them to slow their movement across the sea. Most dFADs are now tracked via GPS-equipped, satellite-linked buoys and use sonar. Fishing vessels encircle the dFADs with a large curtain of purse seine net, to catch all the fishes gathered there.

This method is mainly used to target skipjack tuna, but also catches juvenile yellowfin and bigeye tuna and other marine life – 2.8 to 6.7 times more non-target species, including threatened sharks, than fishing on free-swimming schools of tuna.[25] The old nets and ropes hanging below dFADs also entangle sea turtles and sharks, an often hidden impact. One study found that the number of silky sharks killed by entanglement under dFADs in the Indian Ocean was 5–10 times bigger than their known bycatch in purse seine nets in the region.[26]

There have been few controls put on dFAD use, and the numbers of dFADs released are largely unknown.[27,28] An estimate of the total number of dFADs put in the oceans in 2013 suggested it was in the range of 81,000 and 121,000.[29] More recent estimates for the largest tuna fishing grounds of the Western and Central Pacific alone, were 30,700–56,900 dFAD deployments in 2016 and 44,700–64,900 in 2017.[30] In the Eastern Tropical Pacific Ocean, total numbers of dFADs deployed per year have increased steadily, from about 4,000 in 2005 to almost 15,000 in 2015.[31] In the Atlantic Ocean dFAD numbers have increased in recent years, potentially reaching 18,000 or more dFADs in 2014, an estimated 3.7-fold increase since 2004.[32] A 2014 paper estimated that European Union-flagged vessels alone deployed 10,500 to 14,500 dFADs in Indian Ocean waters in 2013.[33]

A Northern Gannet *(Morus bassanus)* on the "Lummenfelsen" on Helgoland carrying a plastic rope to build up his nest. Chicken of various bird species often get strangled in plastic ropes used as nesting material.

Some trends are particularly worrying from the point of view of abandoned, lost and discarded gear. In the Eastern Tropical Pacific, the number of dFADs recovered has been reported to decline significantly, and the difference (deployed minus recovered) to have increased greatly. In general, it has been reported that while dFAD deployments continue to increase, operators are fishing on lower percentages of their dFADs, leading to a rise in the number intentionally left or abandoned at sea each year.[34]

Despite most dFADs having sophisticated tracking buoys attached, many are intentionally abandoned when they float outside of preferred fishing grounds. **One study conservatively estimated that 10 % of abandoned dFADs end up beached in the Atlantic and Indian Oceans each year.**[35]

Anchored FADs (aFADs) are also used by some nations to assist artisanal fishers by attracting pelagic species closer to shore; however, they are used in smaller numbers than dFADs. These aFADs can break free of their anchors, especially in bad weather, or be dragged into deeper water due to poor anchor design. Loss rates for aFADs used in in the Maldives[36] and Samoa[37] have been recorded as 82 % and 79 %, respectively.

Lost FADs contribute plastic, metal and electronic waste to the marine environment. Ropes and netting hanging below FADs can continue to entangle sharks and turtles. Although so-called non-entangling and more biodegradable dFAD designs are being introduced their use has not been made mandatory by any regional fisheries management organisation (RFMO). While many of the reports of FAD beaching or entangling on coral reefs are anecdotal, one study in the Seychelles has highlighted the problem.

The Island Conservation Society (ICS) has conservation centres on five islands in the Seychelles, and its staff have been removing lost or abandoned FADs from their islands for many years.[38] In a systematic survey of two remote atolls in 2015, ICS found 48 FADs entangled or beached on each – a total of 96 FADs.[39] In addition to those, ICS has found another 114 FADs across their area of operation since 2011, bringing the total number of beached or entangled FADs to 210. Over a third of those FADs were caught on coral by their netting and ropes. Five of them had sea turtles trapped in the netting, only one of which was alive. Like most of the Seychelles, these atolls are important nesting sites for seabirds and sea turtles and beached FADs are a threat to them. The ICS removes FADs whenever they can, but it can be difficult and dangerous, and the tides and weather must be just right. Most of the FADs they found were made from synthetic materials with few biodegradable parts. Rubbish must be transported to the main island of Mahé for disposal, so cleaning up FADs is a costly business.

GHOST GEAR IMPACTS

Ghost fishing gear is a threat to marine habitats and biodiversity, especially sensitive habitats and endangered species. Ghost gear is a significant source of litter in marine ecosystems, but has higher impacts than other litter due to its potential to continue to entangle and trap marine life.

Killing ocean creatures

It is difficult to quantify the impact of ghost fishing on fish species, as this depends on a variety of factors including the rate of gear loss, the catching efficiency of particular gear types, the materials used in construction and the rate at which the gear breaks down once it is abandoned, lost or discarded, and the susceptibility of the animals in the area. However, **ghost gear may continue to catch both commercial and non-target species for many months, years or even decades after it is lost or discarded. Snared fishes starve to death or are picked off by predators. Dead animals attract scavengers, some of which also get caught, providing a constant source of 'bait' for the ghost gear.[40] In addition, ghost gear structures can themselves act as aggregating devices, increasing local abundance and further contributing to their catches.[41]**

Sea turtles, marine mammals, and seabirds are also entangled in lost nets and other debris.[42] It can be difficult to pin this down to ghost gear as the initial cause, as often entanglement by marine mammals in live fishing gear becomes the cause of gear getting damaged and lost, which then leads to further entanglement for other animals. Entanglement can result in injury, exhaustion and eventual drowning, or impair mobility, feeding and reproduction. The affected animal may become snagged on underwater or land-based features such as rocks or trees, resulting in trauma or death.

A 2016 study of marine plastic impacts on wildlife found that 45% of species listed on the IUCN red list of threatened species had been reported to have interactions with marine plastics, including ingestion or entanglement in ghost gear.[43] In a single incident last year, around 300 sea turtles were discovered dead in a ghost fishing net in Mexico.[44] Illegal and ghost gillnets in the Sea of Cortez are killing the last of the vaquita porpoises, threatened with imminent extinction – the population may have dropped to just 10 individuals in 2018.[45] Reports of stranded marine animals regularly include fishing gear among the plastics found in their stomachs, including a recent case of a pregnant sperm whale found in Italy with over 20 kilograms of plastic, including fishing nets and lines, in her stomach.[46]

In addition to the fishing gear itself, other debris from fisheries and aquaculture end up in the ocean and can impact marine life by being ingested or entangling creatures. Common items include plastic oyster spacers from aquaculture operations,[47] and packing tape and bands from bait and fish boxes.[48] **Once plastic fishing gear breaks down into smaller sizes it continues to pose the same problems as marine plastic pollution generally, including being ingested by animals and fed to their young. Modern plastics are thought to last up to 600 years in the marine environment,[49] so the impacts of plastic ingestion and toxicity may persist long after fishing gear loses its form.**

Damaging habitats

Ghost gear is a significant threat to marine habitats and biodiversity, especially sensitive habitats and endangered species.[50] Ghost gear, as for any accumulation of marine litter, can alter and degrade marine habitats through physical damage caused by abrasion, shearing, or smothering, and can change the physical and chemical composition of marine sediments. Physical damage reduces the quality of marine habitats and can impair critical feeding areas, breeding grounds (such as turtle and seabird nesting sites), nurseries and refuges used by a wide range of different organisms that occupy these habitats. Lost or degraded habitats reduce the resilience of marine creatures and their ability to survive, and can ultimately alter complex marine ecosystems and reduce local biodiversity. Even the removal of ghost gear can cause further damage or disruption to habitats.

Seamounts

Seamounts are undersea mountains rising from the seabed, and are hotspots for benthic, demersal and pelagic marine biodiversity. This is turn makes them hotspots for fishing activity, and at risk of abandoned, lost and discarded fishing gear. **Seamounts, banks, mounds, and ocean ridges were found to have the highest proportion of derelict fishing gear in the litter found on them,** in a study of undersea features in European waters. The litter found on Condor Seamount, Hatton Bank and Wyville-Thomson Ridge was over 85% fishing gear.[51] In New Zealand, fishers even named the first seamount trawled in the Chatham Rise area "Graveyard" after all the fishing gear caught and lost on it. The ghostly theme stuck, and subsequent names in the Graveyard Seamount Complex include Morgue, Headstone, Zombie, Diabolical and Ghoul.[52]

Studies of seamounts in the northeast Atlantic have found fishing debris particularly accumulates on their summits. On the Condor Seamount, 50 % of litter on the flank and 73 % on the summit was fishing line alone.[53] Meanwhile, on two seamounts in the Gorringe Bank, 56 % of observed litter was from fishing activities, including fishing line, nets and cables, again concentrated on the summits.[54] A study of deep sea litter in the Atlantic and Indian Oceans found that fishing gear made up an even higher proportion (84 %) of debris on Indian ocean seamounts and other features, with the Sapmer

Seamount having the greatest amount of litter observed. The authors estimated that over 32 million litter items are present on Atlantic seamounts, and 38 million on the seamounts of the south-west Indian Ocean.[55]

Trawl nets, lines and heavy trawl doors were all found on seamounts in the North West Hawaiian Islands, as well as extensive habitat damage from fishing by these destructive fishing gears. However, the findings were not all doom and gloom – the study also found that even for the slow-growing benthic communities on seamounts, long-term protection resulted in signs of recovery on a timescale of 30–40 years.[56]

Economic and other impacts

In addition to environmental impacts, lost and discarded fishing gear also has significant socioeconomic impacts on both fishers and the broader community.[57, 58, 59, 60]

Ghost gear can cause further damage to and loss of fishing gear and catches, through entangling other fishing gear. Replacing lost gear can also be costly, although sometimes gear is dumped when it is snagged because it avoids the direct costs associated with potential vessel damage or loss of other parts of the gear, or when retrieving gear would reduce fishing time and incur greater fuel costs, as it is the case with dFADs.

Lost gear is a hazard to ship navigation and safety at sea, and there are significant costs for removing entangled gear from propellers or engines, repairs, fuel, loss of earnings, and for rescue services required when it causes breakdown.

There are socioeconomic costs when 'ghost fishing' effectively competes against fishers for their catch. For example, in the US Atlantic blue crab fishery in Chesapeake Bay around 20 % of pots are abandoned each year but may go on fishing for several years. After the failure of the fishery in 2008, a programme was established that removed about 10% of derelict pots, which resulted in a 27% increase in catch.[61] Similarly, octopuses caught by ghost-fishing in a southern Japanese coastal trap fishery was estimated to be at least equal to, and as much as double, the annual octopus landings in the fishery.[62] Ghost gear also impacts fishers by reducing biodiversity and damaging the marine habitats that support important commercial species.

There have been significant resources invested in researching ghost gear problems and solutions, and in cleanup programmes. Ghost gear can be costly, difficult and dangerous to remove,[63] especially for isolated coastal communities that may not have facilities to deal with synthetic materials and need to have them transported elsewhere.[64]

Finally, as for any kinds of littering, there are the local financial impacts of reduced visitor numbers for recreational, tourism and diving activities due to unsightly lost gear on beaches and at sea.[65]

CURRENT REGULATIONS

There are a wide variety of policies, regulations and recommendations addressing abandoned, lost and discarded fishing gear at national, regional and international levels. These are often scattered throughout different geographies, conventions and measures, and in some cases are only voluntary. In combination, these existing regulations are either insufficient or there are major gaps in their implementation and enforcement,[66] and are failing to deal with the scale and impacts of ghost fishing and marine debris from fisheries.

Due to the many different characteristics of fisheries, fishing gears and the ecosystems they operate within, specific regulation at both local and regional level is part of the solution to abandoned, lost and discarded fishing gear and its impacts. This requires ecosystem-based, precautionary fisheries management with stringent requirements for banning, restricting or zoning problematic gear types, in conjunction with the protection of vulnerable ecosystems and important areas for wildlife and fish populations.

International agreements and recommendations

UN General Assembly and Sustainable Development Goals

Target 14.1 of the UN's Sustainable Development Goals requires that countries "by 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution."[67] The UN General Assembly (UNGA) has also adopted several more specific resolutions on abandoned, lost and discarded fishing gear, in particular UN Resolution 60/31 (2005). The 2018 UNGA Sustainable Fisheries Resolution calls on States and RFMOs, once again, to adopt effective management measures to address the issue of lost or abandoned fishing gear and related marine debris.[68, 69]

Plastic Waste in Verde Island, Philippines: A crab was trapped inside a discarded cup in Verde Island Passage, the epicenter of global marine biodiversity, in Batangas City, the Philippines.

UN Fish Stocks Agreement and Regional Fisheries Management Organisations

Existing fisheries regulations at national and regional level take a range of approaches to address the problem of ghost gear, including requirements for gear labelling and lost gear reporting, prohibition on the disposal of materials at sea, management of gear (for example regulating gear types, lengths and mesh sizes, soak times, etc) and area-based management tools (including zoning to separate gear types and protection of vulnerable areas such as seamounts). At a regional level, these are agreed through RFMOs.

The UN Fish Stocks agreement, which is legally binding, requires States and RFMOs to minimize pollution and catches by lost or abandoned gear specifically.[70] Unfortunately, measures taken to date are rather limited. According to a recent review of 19 global and regional bodies, out of 18 categories of measures identified as being potentially useful in addressing abandoned, lost and discarded fishing gear and ghost fishing, nine are not being used by any of them and another five categories are used by only 1 or 2. The Northwest Atlantic Fisheries Organization (NAFO), the North-East Atlantic Fisheries Commission (NEAFC) and the South East Atlantic Fisheries Organisation (SEAFO) have measures which include reporting lost fishing gear and requiring that every reasonable attempt to retrieve lost gear is made. In the case of SEAFO, the fact that only four incidences of lost gear have been reported to the Executive Secretary since the beginning of 2015,[71] given the frequency of lost gear, casts doubts about its implementation. The unabated proliferation of FADs over the last 20 years, most of which end up abandoned or lost, is quite telling of the failure of tuna RFMOs to address the impacts of lost gear.

The UN International Maritime Organization (IMO)

The major legislation governing pollution from ships is the IMO's International Convention for the Prevention of Pollution from Ships (MARPOL), under which Annex V prohibits the discharge of garbage, including fishing gear, from ships.[72] Exception is made in the case of accidental loss, as long as "all reasonable precautions have been taken to prevent such loss," or discharge of fishing gear for the protection of the marine environment or the safety of the ship or its crew. Any such loss or discharge must be recorded and reported to the flag state of the vessel and coastal state where the incident occurred.

The Marine Environment Protection Committee (MEPC) of the IMO is currently developing an action plan to address marine litter from ships, including through abandonment and loss of fishing gear. This should consider extending IMO's mandatory reporting requirements under MARPOL Annex V to include reporting of discharge or accidental loss of fishing gear from flag States to IMO.[73] Further, the London Convention and Protocol on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter is also considering what actions could be taken, including through enhanced cooperation among UN Agencies and existing agreements to address this serious problem.

The UN Food and Agriculture Organization (FAO)

The FAO has acknowledged the extent of the problem since the 1980s. The 1995 FAO Code of Conduct for Responsible Fisheries[74] requires States to minimise catch by lost or abandoned fishing gear in a number of ways, including:

- Environmentally safe fishing gear and techniques
- Technical measures for gear, methods, zoning, area and seasonal closures
- Technologies, materials and methods to minimise loss or impacts from lost gear.

The FAO has produced several reports and consultations and concluded the FAO Voluntary Guidelines for the Marking of Fishing Gear, adopted in 2018, aimed at combating, minimising and eliminating abandoned, lost or otherwise discarded fishing gear, facilitating the identification and recovery of such gear and assisting with identifying IUU fishing activities.[75]

At its most recent session, the FAO Committee on Fisheries again encouraged the FAO "to conduct further work on quantifying the impacts of [abandoned, lost, and discarded fishing gear] (ALDFG) and developing and documenting best practices for addressing ALDFG, including the recovery and recycling of gear, the use of biodegradable gear to minimize its contribution to marine plastic pollution, as well as the reduction of ghost fishing," as well as "the development of a comprehensive global strategy to tackle issues relating to ALDFG." [76]

The UN Environment Programme (UNEP)

UNEP convenes the Global Partnership on Marine Litter, as well as International Marine Debris Conference under which the Honolulu Strategy, a global framework for prevention and management of marine debris, was developed.[77] UNEP also works with governments on issues, including marine litter, through its Regional Seas Programme.

Other programmes and resolutions

Other programmes of work and resolutions (mostly on marine debris generally, rather than ghost fishing and debris from fisheries specifically) from international bodies include a resolution under the Convention on the Conservation of Migratory Species of Wild Animal (CMS),[78] an entanglement response network established by the International Whaling Commission (IWC)[79] and the Working Group on Fishing Technology and Fish Behaviour co-sponsored by the International Council for the Exploration of the Sea (ICES) and the FAO that discusses issues related to abandoned, lost and discarded fishing gear, especially modifications to fishing gears and their operations that prevent, reduce and mitigate its impact. Regional measures exist in some ocean areas, including the Barcelona

Convention (Mediterranean) OSPAR Commission (Northeast Atlantic) and Helsinki Commission (Baltic).

A cross-sector approach

The Global Ghost Gear Initiative (GGGI), launched by World Animal Protection in 2015, is a key alliance committed specifically to the issue of abandoned, lost and discarded fishing gear. It is a cross-sectoral and solution-focused alliance including the fishing industry and other private sector players, academics, non-government organisations, governments and intergovernmental agencies. The GGGI has produced a comprehensive Best Practice Framework for the Management of Fishing Gear, which provides a valuable resource to guide fishery-level management, as well as higher level solutions to ghost gear.[80]

The need for a Global Ocean Treaty

Our global oceans are under threat. Greenpeace ships are exposing the threats currently facing the world's oceans and undertaking scientific research to document and build the case for comprehensive protection of ecosystems in international waters. Pollution and ghost fishing from abandoned, lost and discarded fishing gear is yet another of these global problems and an example of the inability of the existing, fragmented governance system to provide an adequate response.

64% of our oceans lie beyond the national jurisdiction of any one nation. This vast area is known as the high seas or international waters.[81] **There is currently no overarching or comprehensive framework to protect marine life on the high seas. The UN has recognised this gaping hole in ocean governance and are currently negotiating a treaty under the UN Convention on the Law of the Sea (UNCLOS).**[82]

Defending Our Oceans Tour – Hawaii Trash (Hawaii: 2006) Plastic is displayed on a beach and the word 'Trash' is spelt out from golf balls. It highlights the diverse range of sources from which the plastics in our oceans originate.

This new legally binding treaty is meant to overcome existing fragmentation and ensure comprehensive protection of marine biological diversity on the high seas. In particular, the Treaty should pave the way for the creation of a network of fully protected areas covering at least 30% of the oceans, including areas on the high seas, by 2030, following scientific recommendations.[83]

Although the new Treaty will not regulate fishing on the high seas per se, it could help address the impacts of abandoned, lost and discarded fishing gear in a number of ways, including by:

- Creating fully protected areas for critical habitats, including nursery, breeding and feeding grounds, and adopting measures to protect them, including, for instance, from the impact of lost fishing gear, in close coordination with relevant management bodies, including RFMOs.
- Ensuring that human activities are strictly assessed and effectively managed so that aspects like the impacts of lost fishing gear and ghost fishing are taken into account before activities are allowed to proceed in international waters.
- Strengthening cooperation and coordination across ocean management bodies, including between RFMOs, IMO, the FAO and other relevant bodies and agreements, as part of the implementation of the new Global Oceans Treaty.
- Providing a platform for regularly addressing issues related to high seas biodiversity conservation in a holistic manner, thus triggering action, for instance through the collection of more and better data and data sharing, clearly a fundamental issue when dealing with the problem of lost fishing gear.
- Providing common objectives, principles and standards as well as expertise and data to help ocean governance bodies to better perform their conservation obligations under existing frameworks (e.g. RFMO's obligations in relation to lost fishing gear).
- Requesting action is taken by relevant global and regional organisations to address marine pollution, including from fishing activities.

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Plastic Clean Up on Kaho'olawe (Hawaii 2006).
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Plastic Clean Up on Kaho'olawe (Hawaii 2006). Greenpeace partnered with the Protect Kaho'olawe 'Ohana (PKO) and Kaho'olawe Island Reserve Commission (KIRC) to do a beach cleanup.