Ghosts beneath the waves

Ghost gear's catastrophic impact on our oceans, and the urgent action needed from industry

WORLD ANIMAL PROTECTION

We were known as WSPA (World Society for the Protection of Animals)

Cover image: A loggerhead turtle is trapped in a ghost net in the Mediterranean sea.
Jordi Chias / naturepl.com

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Anonymous

Food and Agriculture Organisation, The United Nations

Foreword

Our oceans are nearing tipping point and plastic waste is one of the greatest threats to them. Large numbers of plastic bottles and bags float around the earth but there is another, lesser-known, man-made killer plastic lurking in our oceans. Fishing gear is designed to catch and kill marine life, and 'ghost gear' – abandoned, lost or discarded fishing gear - is the most harmful form of marine debris for animals.

Each year at least 640,000 tonnes of this 'ghost gear' is lost or left in our oceans. The enormous impacts of ghost gear spell out the need for urgent attention: if this deadly threat to our oceans, marine animals and ecosystems is not addressed, there is a great risk that that ghost gear will interact and combine with other current oceanic threats to create what the UN termed "a destructive cycle of degradation." Ultimately this could mean our oceans simply stop providing for humans in the many ways we now rely on them.

Worryingly, the level of ghost gear has increased in recent years and it is likely to grow further as fishing efforts intensify all over the world. Effective solutions are being found locally and nationally, yet I believe only a global approach can enable us to monitor and fight this threat.

The Global Ghost Gear Initiative, founded by World Animal Protection in 2015, is a global movement whose participants – NGOs, fishing industry, private sector, academia and governments – are working together to build evidence, define best practice and inform policy, and catalyse and replicate sustainable solutions to this problem worldwide.

Belgium is a proud partner of the Global Ghost Gear Initiative and believes that multi-stakeholder platforms are needed to deal with the issue of ghost fishing gear at a global level and a wide range of stakeholders are needed to tackle this problem. The GGGI is undoubtedly an initiative worth supporting.

I believe that together we can address this problem, and the solutions trialled and tested by the Global Ghost Gear Initiative prove this. Belgium is a proud sponsor of a project in Vanuatu focusing on reducing the impact of ghost gear for local communities and supporting a commercial fishing company improving its fishing gear management.

As guardians of the oceans, everyone has a role to play towards greater responsibility and stewardship. Urgent action is needed to stem the tide of ghost gear entering our oceans every day. Investment in ghost gear solutions and best practice will ultimately create a healthier, more plentiful marine environment that benefits the larger fishing industry, supports small fishing communities, and safeguard marine ecosystems, and protect marine animals. Together we can work towards safer, cleaner oceans for all.

The time for action is now.

The Government of Belgium,
Didier Reynders, Deputy Prime Minister and Minister of Foreign Affairs and European Affairs

Executive summary

Part One: The problem

Abandoned, lost or discarded fishing gear – otherwise known as 'ghost gear' – is a problem that spells catastrophe for marine life as we know it. At least 640,000 tonnes of ghost gear are added to our oceans every year, killing and mutilating millions of marine animals– including endangered whales, seals and turtles. The vast majority of entanglements cause serious harm or death. Swallowing plastic remnants from ghost gear leads to malnutrition, digestive blockages, poor health and death.

45% of all marine mammals on the Red List of Threatened Species have been impacted by lost or abandoned fishing gear.

Already threatened ecosystems, including shallow coral reef habitats, also suffer further degradation from ghost fishing gear.

Ghost gear undermines the viability of our fisheries too, as it catches and kills an enormous volume of seafood which would otherwise form part of the regular catch, in some cases worth millions of dollars depending on the fishery.

Ghost gear: largely a plastic problem

It's impossible to talk about ghost gear without talking about plastics. The volume of both macroplastics (plastic remnants visible to the human eye) and microplastics generated by ghost gear is staggering. Since some plastics can withstand up to 600 years within ocean conditions, the threat to our ocean environments is far reaching.

As much as 92% of marine animal/debris encounters involve plastic debris. 71% of entanglements involve plastic ghost gear.

Microplastics also pollute marine food webs. The European shellfish consumer is exposed to as much as 11,000 microplastic particles annually. Toxic impacts are not fully understood, but could include embryo development, altered genetic profiles and hormone disruption.

A problem of global proportions

The impacts of ghost gear are both staggering and truly global in proportion, for example:

- In just one deep water fishery in the north east Atlantic some 25,000 nets have been recorded lost or discarded annually.
- Almost 5000 derelict nets removed from Puget Sound through retrieval programs were entangling over 3.5 million marine animals annually, including 1300 marine mammals, 25,000 birds, and 100,000 fish.
- Derelict fish traps near Oman are estimated to cause marine mortalities between 57 kg per trap in a three-month period alone. One study estimates over 15,000 traps lost within this study area every year.
- At current fishing levels, over the next 60 years in the Florida Keys alone, a staggering 11 million traps could become lost.

Illegal, unreported and unregulated (IUU) fishing: doubly dangerous

It's estimated that 1 in 5 wild caught fish is IUU. Because IUU fishing is both illegal and highly profitable, companies involved do everything they can to avoid detection or capture, including abandoning gear. IUU fisheries are also less likely to report gear lost through adverse conditions or user error might be denied access to port and are unlikely to be using marked gear.

Cost of inaction

Ghost gear is also extremely damaging to the sustainability of fisheries and marine habitats. There is a great risk that our oceans could simply stop providing for humans in the many ways we now rely on them. Just as ominous are the potential long-term effects of microplastics on human and marine food chains.

Priority should be given to tackling the problem of ghost gear, given its link to other key issues affecting ocean health – macroplastics, microplastics, pollution, food security, and IUU ¬– and ultimately to prevent the accumulation of more ghost gear in our oceans and seas.

Part Two: The solutions

World Animal Protection's Sea Change Campaign, launched in 2014 with its Fishing's Phantom Menace report, works with stakeholders to tackle ghost gear with the 4 R's: Reducing the volume of fishing gear entering the oceans; Removing ghost gear already there; Recycling ghost gear in innovative ways; and Rescuing marine animals.

The Global Ghost Gear Initiative (GGGI) is a practical, industry-led effort to solve the ghost gear crisis. Its aims are to:

- Protect marine animals from harm.
- Improve the health of marine ecosystems.
- Safeguard the health and livelihoods of those who depend on our oceans.

In June of 2017 the GGGI launched a best practice framework (BPF) that offers guidance and aims to diminish the threat of ghost fishing.

Success stories

Globally there are many fantastic projects that are working to reduce ghost gear impacts and have a lasting positive effect on communities.

In Rehmangoth, Pakistan local divers have recovered and recycled gear and in so doing are raising over 92% of a typical month's fishing income. Funds are being used to refurbish a community centre.

Other scalable, replicable projects include those in the Gulf of Maine, USA; Alaska, USA; Indonesia; and Vanuatu.

Evidence has shown that in many cases the benefits generated by ghost gear solutions outweigh the costs of implementation. Investment in ghost gear solution projects will ultimately create a healthier marine environment that benefits the larger fishing industry, supports communities, and protect marine animals currently under threat. Our corporate ranking shows that companies choosing to be part of the solution both through participation in the Global Ghost Gear Initiative as well as through project work perform better in terms of addressing ghost gear in their supply chains.

Part Three: Evaluation

World Animal Protection conducted a review of 15 of the world's leading seafood suppliers in relation to their handling of ghost gear in their operations and supply chains.

Companies were scored separately and tiered in each of the following areas:

- Policy and Commitments.
- Management and Systems.
- Implementation and Reporting.

Overall the consolidated scores across the three categories were disappointing.

Assessment total

Tier 1 **Leader:** setting best practice	Tier 2 **Achiever:** integral to business strategy	Tier 3 **Improver:** established, but work to be done	Tier 4 **Engaged:** on the agenda, but limited evidence of implementation	Tier 5 **Not engaged:** no evidence that ALDFG is on the business agenda
None of the assessed	None of the assessed	• Thai Union • Tri Marine • Young's Seafood	• Bumble Bee Foods • Dongwon (StarKist)	• Beaver Street Fisheries • Clearwater Seafoods • Cooke Seafood • East Coast Seafood Group • High Liner Foods • Maruha Nichiro • Nissui • Pacific Seafood Group • Pescanova • Samherji

An analysis of the overall results shows that while some companies are demonstrating effort to address ghost gear, none are deeply invested in a solution set, and the majority have yet to step up to the plate to any degree.

The assessed companies, and the industry as a whole, must do more on ghost gear. Action can include incorporating the BPF into existing CSR strategies where they exist to address abandoned, lost or discarded fishing gear (ALDFG), as well as becoming a signatory to the GGGI, and include that information on their company website. This gives companies an edge over their competitors and helps customers make a clear and better seafood choice.

Looking to the future

Large seafood corporations have a responsibility to marine wildlife, the communities affected by ghost gear and to future generations of fishers, to ensure that they use the resources of the oceans sustainably. They must take urgent action to stem the tide of ghost gear entering our oceans every day.

Many of the projects undertaken by World Animal Protection and GGGI participants have recognised the need to include fishing communities in ghost gear solutions. Inclusive, incentivised business models have proven to be highly effective. Local communities are empowered to be authors of solutions to ghost fishing gear, rather than labelled as an uncaring part of the problem. Funds generated by projects benefit local people as a whole, encouraging further participation and a sense of investment in their coastlines.

Investment in ghost gear solution projects, such as those associated with the GGGI, will ultimately create a healthier, more plentiful marine environment that benefits the larger fishing industry, supports the small fishing communities, and protects the marine animals currently threatened by ghost gear.

Image: A Hawaiian monk seal is caught in fishing tackle in the Pacific Ocean.
Michael Pitts / naturepl.com

Part 1 – Ghost gear: a catastrophe in the making

Part 1 – Ghost gear: a catastrophe in the making

'Ghost gear' – abandoned, lost or discarded fishing gear (ALDFG) – is a problem that could spell catastrophe for marine ecosystems. Ghost gear accounts for 10% of all the debris accumulating in our oceans and is a major threat to marine wildlife [1,2]. A 2009 estimate by UNEP and FAO suggests that about 640,000 tonnes of ghost gear are added to our oceans every year. It is likely that this number is now even higher [1,2]. Even within small areas, the amount of ghost gear can be staggering. The Florida Keys National Marine Sanctuary, for example, is estimated to be littered with 85,000 active ghost lobster and crab pots [3]. In addition, there are over a million inactive traps or trap remnants in the same study area [3] which are no longer actively fishing as their design intended, but which contribute to marine debris and endanger wildlife through entanglement and ingestion.

Ghost gear mutilates and kills millions of marine animals every year, including endangered whales, seals, and turtles [4]. Gillnets, traps and pots, and fish aggregating devices (FADs) are the most likely to become ghost gear, and the deadliest when they do [5]. Compared to all other forms of human-caused marine debris, ghost gear poses the most danger to marine animals [6] and is four times more likely to impact marine life through entanglement than all other forms of marine debris combined [6].

Threat to marine life

Animals from hundreds of different species of marine wildlife become casualties of ghost gear annually, becoming entangled in unmonitored commercial and recreational nets, lines, traps and other gear. Of all marine mammals on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species, 45% have been impacted by lost or abandoned fishing gear [2]. In 2010, when 870 ghost nets recovered in Puget Sound, USA were studied, they contained more than 32,000 marine animals, including over 500 birds and marine mammals [7,8].

Whales, sharks, seals, turtles, and birds suffer due to entanglement, often drowning or sustaining horrific injuries in their attempts to escape. Debilitating wounds cause immense suffering, in some cases over years, before the animal finally succumbs to its injuries.

Threat to habitat

In addition to maiming and killing hundreds of thousands of marine animals, the health of entire ecosystems is also at risk from ghost fishing gear. Shallow coral reef habitats are at particular risk. Numerous studies confirm increasing levels of broken coral, decreased coral cover, and lower species diversity in areas where debris is proliferating [9,10]. 30% of corals in the wider Caribbean Sea are at risk from human causes including ghost fishing gear [11].

Threat to fisheries

In addition to animal suffering and fatalities, ghost fishing gear has a significant economic impact on fisheries. Ghost gear catches and kills fish stocks that would otherwise form part of the catch, and in some cases would be worth millions of dollars. Ghost gear has caused an estimated 5-30% decline in some fish stocks [8].

Gear replacement and repair costs also negatively affect fisheries in a variety of ways, including loss of fishing time, the financial impact of replacing lost gear, and reduced populations of target species due to mortalities from ghost fishing gear [8].

The storms around the British Isles in 2013/2014 wreaked havoc on the UK fleet. Fishermen were forced to leave pots in the water and, for those with over 100 pots per string, it was not uncommon for individuals to lose £25,000 of gear over the winter [12]. The UK Government provided assistance via a storm damage replacement scheme, using European Fisheries Fund money, to support fishermen who had lost gear [13].

While recognition of the impacts of ghost gear has grown, so has the scale of the problem, due to the continued growth of global fishing operations and changes in gear material. The use of non-biodegradable plastics within the fishing industry means the threat of ghost gear will not disappear without significant action. Cooperation between the seafood industry, governments, and both intergovernmental and non-governmental organisations is vital to ensure the safety of the billions of animals currently threatened by ghost fishing gear.

Ghost fishing gear – the background

How is ghost gear created?

Ghost gear's capacity to entangle, injure and kill hundreds of species of marine animals on a large scale makes it a serious concern requiring urgent action.

There are several causes of ghost fishing gear [1]:

- damage and/or loss of gear through adverse weather conditions
- snagging on marine environments
- gear conflict (incidents where fishing vessels or their gear interact with each other, either accidentally or intentionally, causing damage)
- gear abandoned at end of life due to lack of net disposal facilities or the high cost of disposal
- lack of ability to retrieve lost gear
- abandonment to avoid detection when fishing illegally
- human error

Image: An illegal vessel fishing off the coast of Thailand.
Jim Wickens for World Animal Protection

Deadly debris: the plastics problem

Globally, ghost gear hotspots differ in the types of gear they contain, the original target species to be fished, and the currents that carry them. Some ocean basins, such as the North Atlantic and South Pacific Ocean basins, contain significant amounts of accumulated ghost gear due to the currents and winds that can carry gear thousands of miles from their points of origin. Ocean gyres, where circulating currents concentrate marine debris, contain vast amounts of material hazardous to marine life, including ghost gear. One study of the Northeast Atlantic gyre system reports a concentration of small pieces of plastic of over 334,000 pieces per square kilometre [14]. Considering that ghost gear is estimated to represent 10% of all marine debris, its contribution to these floating plastic patches is enormous.

Research shows that as much as 92% of encounters between marine animals and debris, including ghost gear, features plastic debris, causing a wide range of potentially lethal problems. Up to 71% of entanglement incidents involve encounters between individual animals and plastic rope and netting – essentially ghost gear. Entanglement causes harm or death to the animals involved in 79% of cases. Plastic fragments, potentially originating from ghost fishing gear, accounted for 37% of ingestion incidents [15].

Entanglement in ghost fishing gear causes painful cuts in many species, and further suffering occurs if they survive. Ghost gear entanglement can prevent animals from foraging and escaping threats, due to drag and reduced mobility. Drownings and starvation due to ghost fishing gear encounters are well documented [16,17]. Juvenile seals and sea lions are especially at risk from ghost fishing gear, when their instinctive curiosity and playfulness leads them to interact with deadly debris [17].

When marine species eat or swallow ghost fishing gear, particularly plastics, they can experience digestive blockages, dietary dilution, malnutrition and in some species, increased buoyancy, which can cause a range of serious problems, including reduced growth rates, overall poor health, and ultimately, death. Direct consumption of marine plastics has been documented across all sea turtle species [16]. Marine animals also take in toxic material through their regular diet, i.e. where turtles consume shellfish or crustaceans already contaminated with plastics.

Impact on birds

Marine birds – particularly diving birds – suffer injury and death from ghost fishing gear. Diving birds may become entangled when chasing fish, becoming trapped underwater and drowning. In Puget Sound, piles of bones have been found underneath nets [18]. Over 90% of northern fulmars have ingested plastic fragments, and over 83% of Scopoli's Shearwater birds have ingested nylon threads. During feeding, plastics are regurgitated by parents and fed to their young chicks [10]. Some marine birds incorporate plastic material into their nests, and inadvertently become tangled in ghost fishing gear, particularly lines, which wrap around their feet and prevent movement [10,19].

Impact on cetaceans

Together with other institutions, the Institute for Terrestrial and Aquatic Wildlife Research of the University of Veterinary Medicine Hannover compiled research indicating how the ingestion of marine debris can cause suffering and potential mortalities within cetaceans. It found that whales that have ingested marine debris can experience gastric blockages, ruptures, and an inability to process food correctly, potentially leading to starvation. Necropsies on 22 sperm whales stranded on the North Sea coast found that 78% of the foreign items found within the bodies were fishing related, including net pieces over 13 metres in length. Analysis of the nets suggested they were likely to have originated from the North Sea shrimp fishery [20]. 98% of the whale entanglements in one study involved ghost gear [21], while 82% of North Atlantic right whales and 50% of humpbacks between Cape Cod (USA) and Nova Scotia (Canada) have become entangled at least once [22].

Since 2012, the number of species affected by marine debris has increased by over 23%, or up to 817 affected species (Table 1) [10].

Image: A fish caught in a drifting ghost net.
Alessio Viora / Marine Photobank

Table 1: Number of species with plastic entanglement and/or ingestion records [10].

		Number of species with entanglement records			Number of species with ingestion records		
Key features	Total number of known species	SCBD (2012) (%)	Gall & Thompson (2015) (%)	SCBD (2016) (%)	SCBD (2012) (%)	Gall & Thompson (2015) (%)	SCBD (2016) (%)
Marine mammals	115	52 (45%)	52 (45%)	53 (46%)	30 (26%)	30 (26%)	46 (40%)
Fish	16,754	66 (0.39%)	66 (0.39%)	129 (0.77%)	41 (0.24%)	50 (0.30%)	62 (0.37%)
Seabirds	312	67 (21%)	79 (25%)	80 (26%)	119 (38%)	122 (39%)	131 (44%)
Marine reptiles	70	7 (10%)	7 (10%)	8 (11.4%)	6 (8.6%)	6 (8.6%)	6 (8.6%)
Brackish turtles	6	n/a	n/a	1 (16.7%	n/a	n/a	0

Macro and microplastics – the link to ghost gear

Visible pieces of plastic debris, termed 'macroplastics', that wash up on our coastlines are just a fraction of the total in our oceans. As much as 70% of floating macroplastic debris on the open ocean is fishing-related, measured by weight [23]. The amount of macroplastics and marine debris, including ghost gear, washing up on British coastlines alone is huge: over 268,384 individual pieces of beach litter were collected by volunteers over a single weekend in 2016, while in 2015, four tonnes of ghost fishing nets were recovered from just one beach in Cornwall, UK [24].

The vast majority of ghost gear and marine debris is made of plastic. When plastic production increased dramatically after World War II, the manufacture of fishing gear transitioned from natural, biodegradable materials to plastic because it was valued for its durability, low cost, and flexibility.

Biodegradable parts of fishing gear have been proven to reduce the length of time that derelict gear can continue to trap fish after it is lost [25,26], but plastics still dominate in fishing gear manufacturing. Some plastics are capable of withstanding up to 600 years within ocean conditions [27]. It is these qualities of persistence and strength, however, which pose such a threat to our environment and the animals in it.

Lightweight and buoyant plastics get carried by currents and remain near the surface where they can easily, and lethally, entangle some of our most iconic marine animals. Monofilament line and gill nets are very tough and almost impossible to see under water – Spectra fibre fishing line, for example, is advertised as being four times stronger than nylon (spectra fibre slings were used to lift sections of the new San Francisco Oakland Bay Bridge weighing 2.6 million pounds [28]. Incredibly strong fishing lines and nets mean that divers can find themselves trapped within ghost fishing gear, making a dive knife an essential part of a diver's equipment. For animals, making escape from the deadly nets is extremely difficult, and can cause fatal injuries or drowning. In fact, in 79% of cases entanglement directly causes harm or death to the animals involved [15].

The invasion of macroplastics

Turtle hatchlings are one of many marine animals whose habitats and behaviours are severely impacted by macroplastics. Tanzanian researchers report that marine debris and macroplastics washing ashore affect the selection of turtle nesting sites there [29]. Turtles instinctively lay their eggs above the high tide line, because their eggs need oxygen, while the young hatchlings need proximity to water. Macroplastics and other marine debris litter the beaches, forcing turtles to lay their eggs below the high tide line, leaving them at risk of water inundations and of their nests being destroyed by the tides. Saltwater inundation has been proven to lower the rates of successful hatchings [30]. With all seven marine turtle species listed as vulnerable, endangered or critically endangered [31], the problem of macroplastics cannot be ignored.

Macroplastics also affect species physiology and behaviour, such as where plastic fish aggregating device (FADs) and ghost FADs have been found to affect tuna. According to the GGGI's Best Practice Framework, FADs have a high likelihood of loss [32]. The Pew Environmental Group collected data detailing how interactions between tuna and FADs in the Pacific have resulted in behavioural changes as well as other alterations in school movement patterns and composition. Migratory paths could be affected also, having an unpredictable effect on future tuna populations [33].

Macroplastics can also act as vectors and breeding grounds for disease, threatening both human health and marine life. [10,34] They may also provide transportation for rafting species, potentially leading to ecologically damaging bio-invasions from non-native species [35]. During a survey in the Antarctic, at least 10 species of organisms were found on plastic marine debris; some had grown to a size that suggests they had been afloat for over a year [36].

Plastics of all sizes have been found in all the world's ocean regions. Those under 5mm long are known as 'microplastics' [37]. One study estimates that more than 5 trillion plastic pieces are currently floating in our oceans and seas, weighing over 250,000 tonnes [38]. This staggering figure is likely a fraction of the true amount, as it doesn't account for the massive volume of plastic drifting beneath the surface – most fishing gear will eventually sink if floatation devices are removed [23].

Polluting our food web: microplastics

Exposure to UV light and general weathering can fragment plastic marine debris and ghost fishing gear into microplastic particles [35]. These are easily consumed by a range of organisms, polluting marine food webs [10].

One study found microplastics in the digestive tracts of 80% of seals tested off the coast of Ireland [39]. Another study [40] found that 56% of whale species interacted with marine debris including ghost fishing gear, and micro and macroplastics accounted for 69% of the debris they ingested.

Microplastics have been found in the digestive systems of a wide range of marine animals, from zooplankton to whales [41,42]. One recent study identified microplastics in 25% of marine fish sampled from markets in California, USA, and Indonesia [43]. Oysters and mussels have been found to contain microplastics, and the European shellfish consumer is exposed to as much as 11,000 microplastic particles annually [44].

The potential impact of human ingestion of microplastics via marine animal and shellfish consumption is a serious concern. Many plastics are toxic, containing dangerous chemical components and additives which leach into the organism upon ingestion [45]. Although more research is needed to understand the potential harm, documented effects on various marine organisms include toxic responses, impact on embryo development, altered genetic profiles and hormone disruption [46,49].

Image: An albatross has perished due to ingesting plastics
Steven Siegel / Marine Photobank

Ghost gear types

Gillnets: the most damaging ghost gear

Gillnets, designed to catch fish by entangling them around their gills, are the most damaging type of fishing gear, and, along with trammel nets, make up an estimated 19% of the gear used in the global marine fisheries catch [50]. The FAO recognises that gillnets have high ghost fishing potential, and research shows that gillnets and other entangling nets can maintain high ghost fishing catch rates for long periods, up to years in some cases. The design and manufacturing of gillnets dramatically impacts which marine animals are likely to become caught. Sea turtles, for example, are more likely to be caught in nets with larger mesh sizes, such as pelagic drift nets. However, even fine-mesh gillnets can catch as many as 4 turtles for every 100 metres of net [51]. Various studies report that over 80% of whale entanglements in the north-west Atlantic involve traps and gillnets [52]. Many gillnets are set in areas with strong currents, making them more susceptible to accidental loss. Compared to other fishing gear, gillnets are relatively inexpensive and so there is little incentive to retrieve lost and damaged gear.

In South Africa, several hundred African penguins were reported caught in gillnets around Dassen and Robben Islands. Since gillnet exclusion zones were put in place in 2001, any bycatch that now occurs in these areas would be from ghost – including illegal – gillnets [53]. A small number of Galapagos penguins have also been found entangled in ghost fishing gear in the Bolivar Channel of the Galapagos Marine Reserve [53].

In a bay close to the African penguin colony on Halifax Island of Namibia, small pieces of broken gillnet regularly wash up on the beaches [54].The close proximity of gillnet fishing activities and the projected path of ghost net fragments drifting with the prevailing current to Halifax Island overlap with penguin foraging paths, creating a significant entanglement threat. Gillnet entanglement has been directly observed for crowned cormorants, and fragments of gillnets have been recovered from crowned and cape cormorant nests [54].

Traps and pots: perpetual killers

The traps and pots that are used in a variety of crustacean fisheries, particularly crab and lobster, are especially prone to loss. Like with gillnets, losses are often the result of conflict with other gear, vessels and even large marine mammals. Theft, storms and other accidents can also lead to trap loss.

Pots and traps also tend to pass through a ghost fishing "lifecycle." They are typically baited when they are set. I the pot is lost, over time the bait or the lost catch attracts scavengers. These scavengers may then become entrapped and subsequently die, forming new bait for other scavengers. Animals captured in ghost traps die from starvation, cannibalism, infection, disease, or prolonged exposure to poor water quality (i.e. low dissolved oxygen). A key point is that ghost gear catching efficiency is dependent upon gear design, species behaviour and seasonality.

A second key risk of this gear is entanglement of large marine mammals with connecting ropes and lines, which can occur both when the gear is under control or is abandoned, lost or discarded. Within Cape Cod, USA, several studies have found a high rate of marine debris entanglement in grey seals, up to over 37% in one study [55,56].

Fish aggregating devices (FADs): deadly drifters

FADs are devices intentionally introduced into the ocean to aggregate fish at a specific location, significantly increasing the yield of certain catches. They are used by commercial as well as recreational fisheries and can be drifting (DFADs) or anchored (AFADs).

Researchers for the Island Conservation Society in the Seychelles studied the impacts of ghost DFADs [57]. DFAD use has increased massively in recent years, with numbers in the Atlantic and Indian Oceans quadrupling over a 6 year period [58] – and increasing the creation of derelict fishing gear. The Pew Charitable Trust estimates that up to 121,000 FADs are deployed annually. Most remain in the ocean until they are removed or destroyed.

DFADs play a key role in tuna fishing, with the majority of tuna worldwide being caught using this practice [59]. Unfortunately, however, the mesh size of DFAD nets is deadly for many marine mammal species, as well as sea turtles [60]. Sharks are also needlessly killed, with annual entanglement deaths for silky sharks estimated to be similar to the actual fisheries catch for the same species [61]. The European Parliament's Committee on Fisheries noted that many of the shark species routinely bycaught in FAD operations, are worryingly declining in abundance [62]. Monitored DFADs can prove deadly enough to marine megafauna and other animals – lost, abandoned or discarded DFADs are an even greater threat to marine life.

AFADs are used by small-scale fishers around the world to maximize fishing effort in nearshore areas (up to 10km offshore). These AFADs can break away from their anchors at various weak points, drifting away and sometimes washing onto reefs, seagrasses, mangroves, and beaches, causing harm to these habitats. Depending on their design, AFADs may entangle non-target species, during their lifespan or after they are lost and drifting. Lost AFADs contribute to the growing amount of marine debris accumulating in our oceans. Because AFADs often involve a considerable investment to construct, deploy, and maintain, when they break away it represents an economic loss to their owner as well as to the fishers who rely on them for higher fishing efficiency.

Unlike drifting FADs used in industrial fishing, most AFADs deployed for nearshore and coastal artisanal fishing are not installed with devices to track their locations. When they break away and drift, there is no method to track their position to retrieve them and they have no identifying markers. Traditional tracking devices used on Drifting DFADs are relatively expensive. Developing a low-cost tracking method for AFADs would have multiple benefits: AFADs could be retrieved for reuse; retrieval would minimise negative impacts to species and habitats; and retrieval would reduce marine debris accumulation.

Hooks and lines: a treacherous tangle

Longlines – long backing lines with a series of baited hook lines attached to them – are used extensively in fishing. Due to their length, design and ability to be easily tangled, as well as their relatively low cost, there is little incentive for lost gear removal. The overall quantity of ghost longlines is likely to be high [32]. Monofilament ghost lines can continue to fish until all the hooks are free of bait. Marine mammals also run the risk of ingesting the hooks themselves. The lines can also cause serious injuries and mortalities to animals that become entangled in them.

Images top to bottom:

Gillnets. Tom Campbell / Marine Photobank
FADs. iStock by Getty Images
Hooks and lines. Terry Goss / Marine Photobank

Ghost Gear: a crisis of global proportions

While researchers continue to assess the problem of ghost fishing gear, there is no doubt that the problem is severe. The UN reports that only 47% of target fish populations in the Atlantic Ocean are healthy [63]. Global and regional agreements have recognised the serious threat posed by marine debris and ghost fishing gear, including the EU Marine Strategy Framework Directive (MSFD) and 11th Conference of the Parties to the Convention on Biological Diversity (CBD COP 11 Decision XI/18) [64,65].

Although ghost gear can be found in all oceans and seas globally, there are hotspots. World Animal Protection's 2014 report, 'Fishing's Phantom Menace', presents further regional examples of the scale of ghost gear [66].

1. North-east Atlantic

In just one deep water fishery in the north-east Atlantic, some 25,000 nets – totalling around 1,250km in length – have been recorded lost or discarded annually [8]. Around the coast of Cornwall, UK, over 2014 and 2015, volunteers recorded almost 51 tonnes of new ghost fishing gear items [67]. The report, commissioned by World Animal Protection, also detailed the recovery of marked ghost gear which had travelled up to 4,700 km, from Maine, USA, to Cornwall, UK. Marking gear provides valuable data, and reinforces the need to push for the uptake of gear marking systems, as recommended in the GGGI's Best Practice Framework [5].

2. North-east Pacific

It's estimated that the derelict nets - almost 5000 in number – removed from Puget Sound, USA through gear retrieval programmes (mentioned earlier in this paper) were entangling over 3.5 million marine animals annually. This included 1,300 marine mammals, 25,000 birds, and 100,000 fish [68].

3. North-west Atlantic

Within the USA, 20-25% of lobster pots are lost annually. In real terms, within Maine alone, 3 million pots are set every year, potentially adding at least 600,000 new ghost traps to Maine waters yearly [69]. Within Chesapeake Bay there are an estimated 145,000 derelict crab pots, which translates to an estimated 12-20% of the total annual summer deployment of crab pots. Derelict pots catch an estimated 6 million crabs annually, killing approximately 4.5% of the total harvested in the Bay. In addition, 3.5 million white perch and almost 3.6 million Atlantic croaker are killed by derelict crab pots annually [4].

4. Gulf of Oman & Arabian Sea

Derelict fish traps in fishing grounds near the Sultanate of Oman are estimated to cause marine mortalities weighing between 67.27 and 78.46 kg per trap, over three month and six month periods respectively [70]. Additional research in 2009 [71] found that over 15,000 traps – 18 traps per fisher – are lost within the relatively small study area every year. Economic losses from ghost fishing traps was estimated to be over $2.6

million. In the larger coastal area of the United Arab Emirates, estimates suggest that approximately 260,000 traps are lost every year [1].

5. South-east Asia and North-west Pacific

A year-long study of ghost fishing of crab traps around Thailand found that over 96% of entrapped individuals were non-target animals [72]. On Australia's northern shore, over 13,000 deadly ghost nets were removed between 2005 and 2014, generated by legal as well as illegal, unreported and unregulated (IUU) fishing [51]. Monsoons and trade winds transport ghost gear from the Arafura and Timor Seas into Australia's Gulf of Carpentaria. Climatic conditions in the Gulf cause ghost gear accumulation in this hotspot – and it remains there until physically removed. Estimates suggest that between 5,000 and 15,000 turtles have been killed by ghost fishing nets in this region [73]. Around South Korea, the inflow of marine debris from ocean sources is estimated at 58,000 tonnes annually. At the end of 2012, an estimated 152,241 tonnes of marine debris had accumulated on the coast of South Korea and within its waters [74].

6. Caribbean and Gulf of Mexico

About 250,000 traps are lost annually in the Gulf of Mexico [75]. Within the Florida Keys, around 18% of lobster traps are lost annually, or between 90,000-100,000 traps [3,76]. Over the course of 2 years, ghost trap clean-up operations in offshore Louisiana removed over 3,600 crab traps, where the rates of actively fishing ghost crab traps range between 33%-88% [77]. Hurricanes, cyclones and tropical storms common in the Caribbean region can cause massive increases in lost fishing gear rates. On the Gulf Coast, estimates suggest that over 50% of all traps were lost as a result of hurricanes Katrina, Rita and Wilma [1]. A study of lobster traps lost in tropical cyclones forecasts immense increases in ghost trap numbers in the Florida Keys. At current fishing levels, over the next 60 years, a staggering 11 million traps could become lost in this region alone [78].

Illegal, unreported and unregulated fishing: doubly dangerous

The tipping point?

According to the FAO, 50% of global fish stocks are fished sustainably, while 31% are being overfished. Illegal, unreported and unregulated fishing (IUU) is a clear threat to the future of the legal fishing industry and to marine ecosystems. The most obvious impact is economic: IUU fishing diverts revenue from legal fishing activities, and likely reduces revenue from seafood exports [63]. In some areas, IUU fishing catches an estimated up to 50% more than legal methods, threatening the sustainability of fisheries and livelihoods [79,80]. In northern Australia, it's estimated that foreign IUU reduced total revenues by approximately $1 million between 2004-2005, and reduced profitability by around 10% [81].

Flags of convenience: camouflaging the kill

In exclusive economic zones (EEZs), the coastal state is responsible for monitoring activities within 200 nautical miles of its coastline. Marine areas outside their waters and past the boundaries of the EEZs are classed as the high seas. Responsibility for the activities of the vessels in these waters passes to the vessel's "flag state" – the state in which the vessel is registered. IUU fishers are able to avoid detection by using 'flags of convenience' (FoCs), registering vessels under foreign flag states to circumvent international law. This practice limits the ability of flag states to accurately monitor vessels registered to them: it is extremely difficult to enforce legislation on vessels profiting from IUU [82]. Transhipment – a practice where fishing vessels maximize their time at sea by using alternative refrigerated vessels, 'reefers', to move their catch to port – enables IUU fishing by allowing the unmonitored transfer of illegally caught fish [83]. Several of the ports which 'reefers' most frequently visit have yet to ratify the FAO's Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing, obstructing efforts to control seafood traceability [83].

IUU: the untraceable problem

Complex supply chains can mask IUU activities: some studies link much of the seafood on our tables to illegal fishing. Between 20 and 32% of seafood imported to the USA originates from IUU fishing. Recent research puts the quantity of IUU fish imported into Japan on par with that of the United States [80]. The traceability of seafood is extremely difficult, particularly within large corporations with various branches and subsidiaries. Even seafood shipments from countries considered to be responsibly managing ocean stocks have poor traceability documentation [80].

IUU fishing is a high profit activity. In the vast oceans and seas, identifying IUU vessels is extremely difficult. There is limited capacity for states to monitor fisheries, there is no global requirement for tracking and identifying vessels, and

Image: Fishermen casting their nets on an IUU vessel. Jim Wickens for World Animal Protection

weak or non-existent IUU laws pose little threat [84]. An estimated 1 in 5 wild caught fish is thought to be caught illegally. In 2009, worldwide fishing losses due to IUU were estimated between $10 - $23.5 billion [85], and it is likely to have increased since.

IUU vessels and ghost gear: covering their tracks

The UN confirms there is a strong link between IUU fishing and ghost gear [86]. To avoid detection or capture by authorities, or to ensure entry into port, IUU vessels may abandon gear. Similarly, fishing at night to avoid detection may increase the likelihood of lost gear, or damaged gear breaking free. Gear lost through adverse weather conditions or user error is also highly unlikely to be marked or reported by IUU vessels [86]. It is particularly distressing that IUU fishing often takes place in some of the most sensitive fishing grounds [87]. Illegal fishing in the Gulf of California, for example, is pushing the critically endangered vaquita porpoise closer to extinction, as they become entangled in illegal nets [88,89]. In the waters between northern Australia and southern Indonesia, there are a large number of IUU fishing vessels [90]. Some vessels use dangerous drift nets, stripping the water of all but the smallest of fish, causing senseless suffering and death to entangled whales, seals, turtles and sea birds [91]. Research has found IUU fishing to be directly linked to decreasing shark populations [81], as well as implicated in the decline of albatross numbers [92].

As alternatives to drift nets, some IUU vessels use destructive methods like blast fishing – using explosives such as dynamite – and cyanide poisoning. In the process they destroy delicate coral reefs. Off the Tanzanian coast, blast fishing with dynamite is both widely practiced and ecologically disastrous, wiping out both the wildlife within the blast radius and their entire habitat [93]. Over 36 days, researchers in Tanzanian waters identified 318 separate blast fishing detonations, with some IUU hotspots hammered by up to 9.9 blasts per hour [94]. In addition to habitat destruction, the blast sounds are likely to cause suffering to a range of whales and other marine mammals, whose preference for shallow, near shore waters – the ideal habitat for blast fishing – and sensitivity to unnatural sounds, makes them particularly vulnerable to the impacts of IUU [94,95].

The GGGI's Best Practice Framework [5] outlines several actions that can be taken to combat IUU fishing. Gear marking is a very important tool to help regulate both legal and illegal fisheries. If gear is well marked and has sufficient identification, it can be linked to vessel or gear registers – and enforcement agencies can then check on gear settings within areas. Finding unidentified fishing gear in a location where all gear must be marked and linked to a vessel / gear registry means it is likely being illegally operated and appropriate action can then be taken.

Image: Fishermen tend to their equipment on an IUU vessel. Jim Wickens for World Animal Protection

The heavy cost of inaction

Decline in fish stocks and catches

As the sheer volume of ghost gear increases every year, so does its effects on fish stock populations. Although the effects on different fish species may vary according to the amount and types of ghost gear invading their habitat, the impacts include an estimated 5-30% decline in some fish stocks [8] and damage to important marine habitats. Research by the National Oceanic and Atmospheric Administration (NOAA) found ghost gear to be directly responsible for a 5% reduction in total cod catch in the Baltic Sea, and a 20-30% reduction of Greenland halibut catch off the coast of Norway [8].

Clean up costs

Ghost gear costs governments and marine industries hundreds of thousands of dollars every year in clean-up expenses and lost fishing time [96]. Within the Scottish fishing fleet, the catch of 86% of surveyed vessels was restricted by marine debris, and 95% had snagged their nets on debris on the seabed – potentially damaging gear and creating additional ghost gear [96] in the process. An even greater financial cost is the loss of target species catch, in some cases worth millions of dollars. One study estimated that nearly 175,000 harvestable Dungeness crab are killed every year by ghost traps in Puget Sound, or about 4.5% of the annual harvest. The loss of the crabs alone is valued over $744,000 [97]. Some studies suggest that over 90% of species caught within ghost gear have commercial value, translating into substantial loss of revenue. With the decline of stocks in target fisheries, the cost to the fisher to maintain catch levels increases. [8].

In Louisiana, over 65% of recovered ghost traps analysed by citizen scientists were found to be actively ghost fishing, reducing the available stock for legitimate traps [77]. Research suggests that the removal of derelict crab pots in Chesapeake Bay has increased crab harvests by 23.8%, or $33.5 million over a period of six years. Removing derelict posts increased the efficiency of active pots [4]. Similar research [98] suggests that removing less than 10% of the derelict pots from global crab fisheries could increase the annual value of the catch by $831 million: clearly, increased harvest and other revenue benefits of ghost gear removal programs makes them an effective and valuable solution.

System failure?

Ghost fishing gear is extremely damaging to marine animal welfare, to the economy, and to the sustainability of fisheries and marine habitats. The enormous impacts of ghost gear spell out the need for urgent attention:

> If this deadly threat to our marine animals and ecosystems is not addressed, there is a great risk that that ghost gear will interact and combine with other current oceanic threats to create what the UN termed "a destructive cycle of degradation." Ultimately this could mean our oceans simply stop providing for humans in the many ways we now rely on them [63].

The ever-growing areas of ghost fishing gear and macroplastics accumulation are the "assembly line" for future microplastics, as these larger plastic pieces are steadily being broken down into particles which are far more difficult to retrieve. The short- and long-term effects of microplastics within the marine and human food chains are unknown. Priority should be given to tackling the twin problems of current ghost fishing gear and macroplastic debris at the same time, before they deteriorate further, to prevent the accumulation of more ghost gear in our oceans and seas.

Image: World Animal Protection join a beach clean after a storm in Hawaii.

Part 2 – Solutions

World Animal Protection's Sea Change campaign

In response to the dire threat ghost fishing gear poses to marine animals and their habitats, World Animal Protection launched the Sea Change campaign in June 2014, with the release of the report Fishing's Phantom Menace. The ongoing campaign goal is to protect marine animals from tragic suffering and death by ghost fishing gear.

World Animal Protection achieves this by working with stakeholders to deliver a practical platform that tackles ghost fishing gear through the 4 Rs, namely by:

Reducing the volume of fishing gear entering the oceans.

Removing ghost fishing gear.

Recycling ghost fishing gear in innovative ways, and creating sustainable business models.

Rescuing animals – providing training and support, and enabling rescuers to free marine animals entangled in ghost fishing gear.

GLOBAL GHOST GEAR INITIATIVE

Central to this campaign is the creation of the Global Ghost Gear Initiative (GGGI), a multi-stakeholder alliance committed to driving and developing solutions to the global problem of ghost fishing gear. The ultimate aims of the GGGI are to:

- Protect marine animals from harm.
- Improve the health of our marine ecosystems.
- Safeguard the health and livelihoods of those who depend on them.

GGGI's Best Practice Framework for the Management of Fishing Gear

In June 2017, the GGGI's Define Best Practice and Inform Policy Working Group launched its Best Practice Framework (BPF) – a tool that offers recommendations and practical guidance on fisheries management, aiming to mitigate the threat of ghost fishing. Launched at a side event at the SeaWeb Seafood Summit, the creation of the BPF involved intensive assessments of current industry practices and the gear currently in use, legally and illegally, around the world. Gear characteristics were assessed for their potential to contribute to ghost gear levels, both in terms of the likelihood of being lost, discarded or abandoned in the first place, and its impact once unmonitored.

The BPF looked closely at current management options, such as the use of tags and other identification methods used to mark gear, and focused on the most common gear types in both small and large-scale fisheries. The BPF also examined how these solutions are given force, for example, through legislation, codes of conduct or inclusion in certification schemes. A public consultation of more than 50 stakeholders, the majority of which were industry representatives, was then held to gather feedback on the BPF.

Image: An example of BPF is gear marking in Indonesia which links the equipment to manufacturers and owners to help find solutions.

Reducing ghost gear with best practice solutions

Marking gear

The GGGI has identified a range of solutions to help reduce the threat of ghost gear, including improved marking of fishing gear. As reported by the FAO [50], properly marked fishing gear can reduce the amount of gear discarded by legal and illegal fishing vessels, in turn reducing their negative impacts. As regional fishing authorities may not be able to effectively implement gear marking schemes, this task should ideally be implemented at the manufacturing stage, where traceability can be built right into products.

Recycling gear

Similarly, manufacturers can provide both incentives and facilities for fishers to return end of life fishing gear, which could in turn be refurbished or recycled. Recycling needs to play a prominent role in ghost gear solutions: there is great potential for end of life fishing gear to be collected and recycled in a number of innovative ways.

Manufacturing biodegradable gear

Several practical steps can be taken to minimize the dangers of ghost fishing pots. For crab pots, design changes such as biodegradable escape panels would reduce mortalities, as would mobilising groups to speed up the removal of derelict pots. Biodegradable gear features have been shown to reduce the number of animals accidentally caught [25,26], and do not adversely affect the catch when compared to standard pots. Researchers from the Virginia Institute of Marine Science found that their fully biodegradable solution was more effective than standard rot cords, and far more effective than previous biodegradable plastics [69]. In the Chesapeake Bay area, biodegradable escape panels could reduce mortalities from derelict pots by as much as 2.8 million crabs or more each year – from 4.5% of the harvest to just 0.6% [4]. Untreated cotton twine, or 'rot cord' is already being used to create biodegradable escape hatches for crabs fished in British Columbia, Canada [100].

A new life for deadly ghost gear

GGGI participant Plastix Global has recycled ghost gear collected from GGGI projects in the UK and Alaska. Transforming ghost gear back into plastic pellets, local crafts or other goods creates a 'circular economy'; in other words, these initiatives contribute to local fishing communities that would otherwise have their livelihoods endangered by ghost gear.

GGGI participant Bureo is one company leading the way in the use of recycled ghost gear material. With assistance from the Chilean Government, Northeastern University, the World Wide Fund for Nature (WWF) and the Marine Conservation Action Fund (MCAF), Bureo launched the 'Net Positiva' project. As Chile's first ever net collection and recycling programme, Net Positiva provides fishers with disposal points for end of life gear, which is then recycled into innovative products including sunglasses, frisbees, chairs, and skateboard decks. Each board keeps more than 30 square feet of discarded fishing net out of the sea.

Launched in 2013, the Healthy Seas initiative coordinates the collection of ghost nets across the Mediterranean, Adriatic and North Seas, before recycling them in a stylish and innovative way. A collaboration between the ECNC Group, Aquafil Group, Star Sock and Ghost Fishing, the Healthy Seas initiative is a GGGI participant. The 'journey from waste to wear' produces ECONYL ® nylon yarn from ghost nets, used to make sustainable textiles, which are then turned into clothing. So far, ECONYL yarn has been used to create sportswear, swimwear, underwear and carpets. Since the start of the initiative in 2013, Healthy Seas has removed over 311 tonnes of abandoned nets.

GGGI participant Axiom Cycling Gear is committed to sourcing environmentally friendly materials, creating a new type of fabric, Oceanwave, made from recycled fishing nets. Their Seymour series of bags are the world's only cycling bags made out of reclaimed, ghost fishing nets.

Planet Love Life, another recent signatory to the GGGI, is supporting the retrieval and removal of ghost fishing nets through their ghost gear collection and reward program. In return for donations of salvaged marine debris and fishing nets, Planet Love Life will produce handcrafted rope bracelets created from the collected debris.

Fourth Element, a longstanding member of the GGGI, makes adventure swimwear including drysuits, wetsuits and rash guards from recycled ghost fishing nets using ECONYL yarn. Their swimwear range is made from 78% recycled materials, and each piece of swimwear comes packaged in non-plastic bags made from cassava starch and other renewable resources. In 2017, a range of their OceanPositive collection was sold in FatFace stores in the UK.

Image: Fishing nets are collected, sorted, cleaned and then prepared for recycling at the Plastix recycling facility, Denmark.
Plastix Global

Image on page 30: OceanPositive suits designed by diving specialists Fourth Element are made from ECONYL®, a fabric made from recycled plastic fishing gear. They are sold by international clothing brand FatFace.
Daan Verhoeven

GGGI success stories

GGGI success stories

By the end of 2017, 8 holistic GGGI projects, in addition to GGGI participant-led projects, were underway, offering effective solutions to the threat of ghost gear. Projects around the world successfully combat the threat of ghost gear in various ways:

- Ghost gear retrieval projects have reduced the levels of ghost gear in our oceans and seas, preventing suffering and saving the lives of countless animals likely to become entangled.
- Projects trialling best practise recommendations such as gear marking projects and research are making great progress in the identification of lost gear; satellite technology has been used to track the movement of drifting FADs, ensuring that they are monitored.
- Retrieved ghost gear is being recycled and manufactured into innovative new products.

Examples of GGGI projects helping to mitigate the problem of ghost gear follow.

Image: World Animal Protection and SAS pull up discarded fishing nets during a beach clean in the UK.

Image: A volunteer carries a bundle of lost fishing net ashore to be recycled as part of the Olive Ridley Project.
Olive Ridley Project

Pakistan

With support from World Animal Protection and Ocean Conservancy, through the GGGI initiative, the Olive Ridley Project in Pakistan is reducing the impact of ghost fishing nets. Based in Rehmangoth, the project supports net removal, education and awareness raising within the local fishing community. Named after one of the species of sea turtle most affected by ghost fishing nets, the Olive Ridley Project provides disposal facilities for unwanted fishing gear located near ports and turtle nesting sites that would otherwise continue to be gear dumping grounds.

Local divers have been trained by turtle expert Martin Stelfox on how to safely recover ghost gear. So far, 1,100kg of gear has been recovered, and 350kg of this has already been recycled, raising over 92% of a typical month's fishing income. The money has been invested back into a community fund, where it has been used to refurbish a community centre. Local fishers have been taught the impacts of ghost gear, and are passing on the message to other community members, encouraging active removal of ghost fishing gear and marine debris. Collected ghost nets are being integrated into crafts by local artists, with products sold to raise money for community needs.

USA

1. The seas around South-east Alaska are frequented by several species of whales and seals, some of which have previously become entangled in crab pot lines and buoys. A project funded by World Animal Protection here removed derelict crab pots and other ghost fishing gear from the Gastineau Channel. Led by the Douglas Indian Association (DIA) and associates at Natural Resources Consultants (NRC), the project involved sonar surveying of selected coastal areas to collect data and ultimately locate and remove ghost fishing gear. Working with the Alaska Department of Fish and Game (ADF&G), with an onboard biologist and gear removal expert, the team located 209 lost crab pot targets in the surveyed areas. The density of ghost crab pots in the Gastineau Channel study area was found to be 45 pots/km2, over 4 times the density of 11 other previously studied Alaskan sites. While numerous constraints limited the amount of crab pots that could be removed – including the presence of boat wrecks, fibre-optic cables under the sea bed, and the location of human remains – the project was able to remove 35 of the target pots. The project also confirmed that the presence of rot-cord – biodegradable material used to create escape hatches in case of trap loss – helps reduce unwanted crab mortalities; no crabs were found in the pots which showed evidence of biotwine use.

2. A separate project together with seafood companies Trident, Alyeska, Unisea and Westward and with support from NOAA's National Fish and Wildlife Foundation in Dutch Harbor in Unalaska, Alaska focuses on the collection and recycling of end of life nets and gear. As the leading seafood port of the US for 20 years, Dutch Harbor is a valuable asset to the US fishing industry, landing seafood valued at almost $200 million in 2014. Despite its importance, however, the port has no established disposal facilities for end-of-life fishing gear, leading to an unwanted backlog of derelict fishing nets littering the area.

   The project in Dutch Harbor sees the nets bundled by Swan Nets, then collected and transported end of life fishing gear to Denmark, where GGGI participant Plastix Global recycles them, circulating the material back into the economy as basic plastic. In the first phase of the project, 80 nets totalling over 420,000 lbs in weight were removed from Dutch Harbor and are currently being recycled, with more waiting to be picked up. The second phase, planned for 2018, will expand this project into four new Alaskan locations.

Images top to bottom:
End of life fishing nets stacked in Dutch Harbour, Alaska. Plastix Global
Ghost fishing gear and pots removed with the help of local fishermen in Maine, USA.

3. In collaboration with GGGI participants the Gulf of Maine Lobstermen Foundation and NOAA, World Animal Protection is leading a lobster pot recovery and recycling project. Launched in April 2015, the project locates and removes at-sea gear in the Gulf of Maine – a lobster fishing area prone to high levels of gear loss due to gear conflict. By dragging grapple hooks in areas known to have high gear loss rates, local fishers can retrieve ghost lobster pots before transporting them for sorting and processing. Reusable gear is then claimed by the owner, when possible,

and end-of-life gear is removed and recycled, thanks to the National Fish & Wildlife Foundation's Fishing for Energy program. Non-metal gear is collected by a waste-to-energy facility which powers the local community, while unusable metal traps are crushed and sold for recycling.

Removing the ghost lobster pots littering the seabed not only prevents gear conflict, it saves local fishers money in gear recovery and replacement, and prevents the unwanted ghost trapping of local lobster stocks. As with all GGGI projects, a key aim is to raise awareness of the negative impacts of ghost gear among local communities, the fishing industry, and other stakeholders, and to create a long-term sustainable model to prevent further ghost gear entering the environment.

UK

Across the UK, beach litter is at its highest ever level, with the Marine Conservation Society (MCS) reporting that plastic litter on beaches increased by 140% between 1994 and 2013. Fishing gear such as lines, nets and crab pots are regular finds on beaches in the UK, posing both a public health risk and a threat to marine wildlife. A number of GGGI participants including MCS and Surfers Against Sewage, coordinate national clean-up efforts led by volunteers who monitor and remove litter from beaches, contributing valuable data and insights into the main waste culprits.

1. GGGI Participants KIMO and Plastix Global collaborated with ports and fishers in parts of Scotland in a pilot project funded by World Animal Protection. The project collected more than 50 tons of ghost fishing nets from the waters around Peterhead, Ullapool, Scrabster and Macduff harbours. The majority of collected nets have already been recycled in Denmark by project partner, Plastix.

2. Within Scapa Flow, Orkney, the group Ghost Fishing UK have completed their third annual dive, supported

Image: Recovering lost gear.
Peter Verhoog / Ghost Fishing

Image: Biodegradable hooks being trialled with lobster pots.

by GGGI. Each year, the number of divers trained has expanded, leading to the latest dive's recovery over 30 pots and creels, and 100kg of net and other ghost fishing gear. Funded by World Animal Protection and the FatFace Foundation – the charitable branch of the clothing brand FatFace – the dives of Ghost Fishing UK were guided by the Big Scapa Cleanup project, a citizen-science data collection model which provides information on ghost gear locations and conditions, leading to more efficient gear locating and collection. Advanced dive training was also provided by Rich Walker, head of the diving group Global Underwater Explorers, who educated volunteer divers about the legalities and practicalities of recovering ghost fishing gear while diving. Divers were also trained in species recognition so they could collect data on the species interacting with ghost gear in the area.

3. Fathoms Free is a volunteer marine conservation organisation based in Cornwall, which focuses on beach clean-up operations, underwater ghost gear removal, data collection, recycling and raising awareness of marine conservation efforts. In a collaborative project with GGGI participants, including Plastix and the Cornwall Seal Group, Fathoms Free have been undertaking the removal of ghost fishing gear from beaches and coastal waters, using a dive boat funded by GGGI. In July 2017, Fathoms Free became the first organisation in the UK to receive the Marine Management Organisation (MMO) licenses necessary for legal underwater retrieval of lost fishing gear. In 2017 alone, Fathoms Free collected almost 700kg of ghost gear - a single dive in April 2017 located and retrieved 5000 pieces of lightweight fishing line, 3000 metal fishing hooks, sinkers and links, and other pieces of marine debris [101,102]. The project is driving innovative and sustainable recycling solutions in order to create a long term model that prevents ghost gear from entering the marine environment, and aids in its removal.

4. Following severe storms during the winter of 2013/14, the fishing industry in Wales suffered incredibly high losses of fishing gear, most of which was never recovered. These losses highlighted the issue of ghost fishing amongst the industry and spurred the creation of a new group, Pembrokeshire Sustainable Shellfish Initiative (PSSI), to tackle the problem. In 2016 PSSI introduced a series of voluntary measures such as gear tagging, biodegradable hooks, escape hatches and v-notching of lobsters with a group of fishermen in Pembrokeshire. GGGI participant World Animal Protection supported the project by producing information posters and leaflets as well as a peer-to-peer educational film to encourage wider uptake of the initiative. Neptune's Army of Rubbish Cleaners also joined the collaboration by working with fishermen to locate and retrieve lost pots.

The South-west Pacific

In 2017, World Animal Protection, on behalf of the Global Ghost Gear Initiative (GGGI), received funding from the Kingdom of Belgium to tackle the ghost gear issue in the Pacific, and to assist local communities. The project is divided into two complimentary parts:

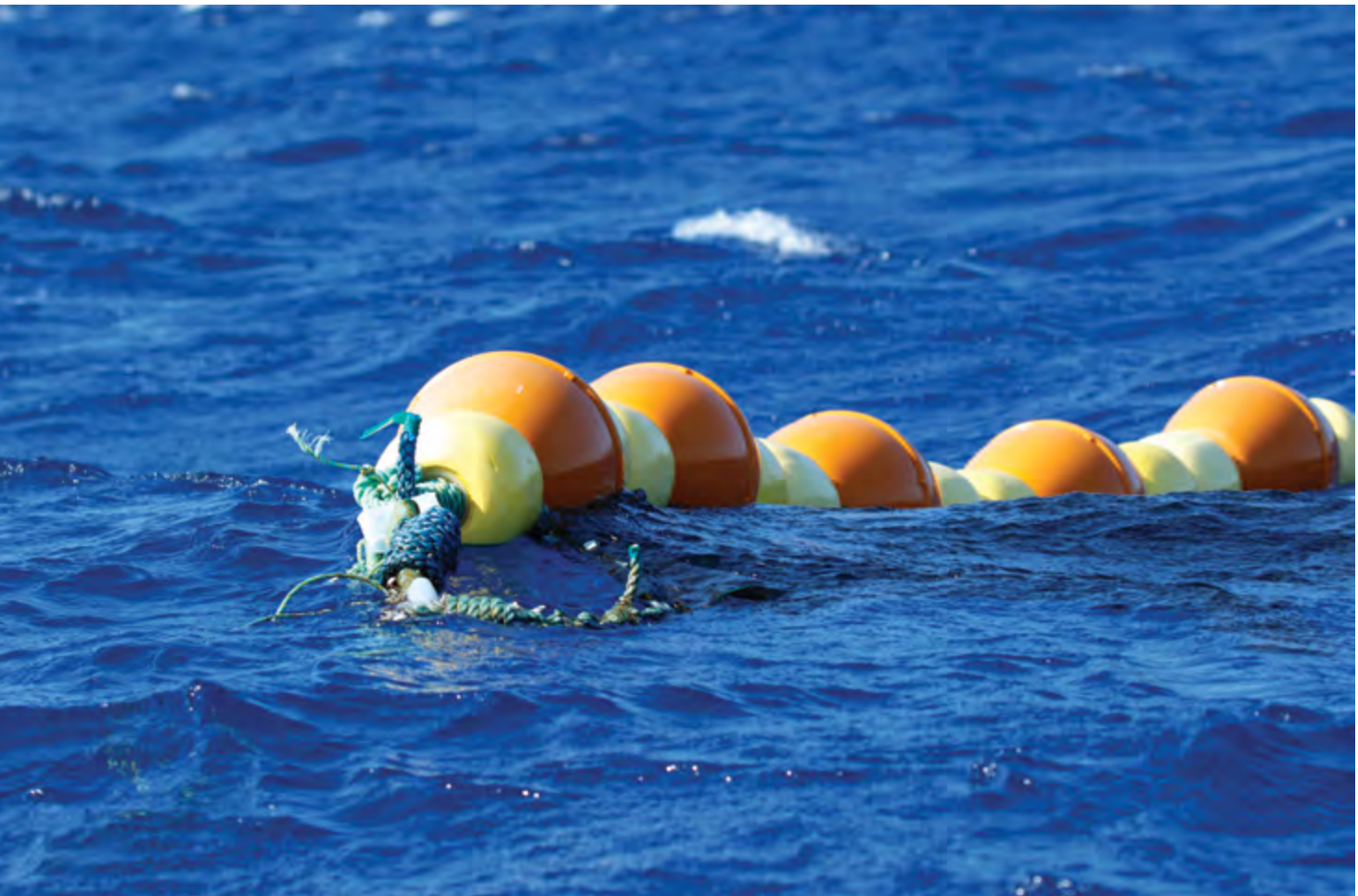
- to review Tri Marine's Fish Aggregating Device (FAD) policies and operations in the South Pacific, and make recommendations for adoption of the GGGI's Best Practice Framework for the Management of Fishing Gear; and

- to provide a case study of best practices for FAD marking and tracking for the Food and Agricultural Organization of the United Nations (FAO) Technical Consultation on the Marking of Fishing Gear in February 2018.

Tri Marine became a participant in the GGGI last year and has been a supporter of the Best Practice Framework for the Management of Fishing Gear – a tool developed by the GGGI to assess the risks of different types of fishing gear when lost or abandoned and to support the development of policies and strategies to prevent and remedy the problem throughout the supply chain.

The second part of this ongoing project involves the trial of artisanal Anchored Fish Aggregation Devices (AFADs) position tracking technology in the Pacific Islands. The trial evaluates its effectiveness and recommends protocols for monitoring the positions of artisanal AFADs to aid in their retrieval. It also recommends potential responsible disposal, retrieval and recycling/re-use options for end of life AFADs.

Image: Best practice FAD in the South West Pacific.



Indonesia

In a collaborative project funded by the Food and Agricultural Organization of the United Nations (FAO), World Animal Protection and the GGGI worked with the Centre for Fisheries Research – Ministry of Maritime Affairs and Fisheries (MMAF - Indonesia) and other groups to investigate and test the marking and tracking fishing gear in two gillnet fisheries. Indonesia was proposed as a region for the project due to the severity of the marine debris problem in its waters, including ALDFG, known to originate there, coupled with increased threat of IUU and the stated recognition and willingness of the Indonesian government to take steps towards addressing it.

Gillnets are widely acknowledged to pose the greatest risk to marine wildlife and habitats when lost or abandoned, due to both their durability and their design. The marking of gillnets could be an important tool to track ownership and encourage responsible behaviour. Due to the low value of gillnets and a government subsidy programme providing nets to fishers there is limited incentive to retrieve lost nets in either of the two project sites, although repair and reuse of damaged nets is commonly reported.

Baseline research so far has including consulting fishers about their current gear-marking methods, reasons for gillnet loss, behaviours around reporting or retrieving lost gear, and scope for a system of gear marking. Initial research has provided valuable insight into current marking practices, loss rates, and marking incentives, and will help to better understand which gear marking alternatives could be most efficient.

The Government of the Netherlands is currently partnering with World Animal Protection and GGGI to expand this project, including embedding and improving current management practices for gillnets, such as gear marking, lost gear reporting and other best practices outlined in the GGGI Best Practice Framework. Scoping for the implementation of a pilot circular economy net recycling initiative to incentivise fishing communities to responsibly manage end-of-life fishing gear is also being undertaken.

Images top to bottom:
Gear marking in Indonesia which links the equipment to manufacturers and owners to help find solutions.
Tagged fishing gear as part of a gear marking trial.

Image: Using side scan sonar technology to find discarded nets.

Mexico

With around 23 remaining individuals, the vaquita is the most endangered marine mammal in the world. All of these small porpoises live in the upper Gulf of California, where illegal fishing and ghost nets pose a grave danger to them. Vaquitas become tangled in gillnets originally intended to catch totoaba fish, another critically endangered species valued for its use in traditional Chinese medicine [88,89]. GGGI was approached by the International Committee for the Recovery of the Vaquita (CIRVA) to help locate ghost nets in the Gulf of California, and to create a sustainable way to remove and recycle them. Working collaboratively with Monterey Bay Diving and local fishermen, the team used specialist sonar scanning technology to locate discarded nets likely to entangle vaquitas.

The 'Saving the Vaquita' project – jointly funded by World Animal Protection, the Association of Zoos and Aquariums (AZA), and WWF Mexico – has removed more than 7,700 square meters of net from the vaquitas' habitat since its launch. This has helped to take the immediate pressure of ghost gear off of these critically endangered marine mammals, but vigilant protection of the vaquitas' habitat and continued removal of new ghost nets are needed if they are to be saved from extinction.

Canada

1. In April of 2016, GGGI participants, World Animal Protection, Emerald Sea Protection Society (ESPS), Northwest Straits Foundation (NWSF) and Natural Resource Consultants (NRC), launched a project to remove a huge section of purse seine ghost netting that had been disrupting the environment and killing or injuring animals off Pender Island, British Columbia since before 1990.

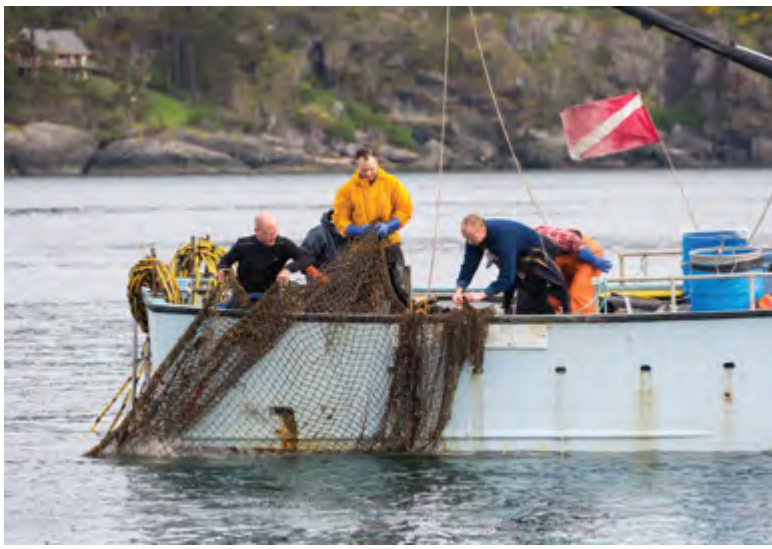
   The two-day long project involved a team of divers removing the net from the reef by hand, freeing any entrapped animals and pulling the net onboard. Over 2,500 pounds of netting was removed from the ocean and sent for analysis to determine the recycling potential of a years-old derelict net.

2. In northern British Columbia, many derelict crab pots occupy the waters of McIntyre Bay and Hecate Strait. Data from the commercial crab fishery in that region over the past 10 years indicates between 6% and 10% of traps are lost each year due to severe weather.

   Despite having a well-managed fishery and undertaking stray pot removals each year, fishers in the area report that there are many stray pots underwater that have not been retrieved due to logistical and financial limitations. Lost crab traps can continue to "ghost fish", cause navigational and safety hazards to other vessels in the area, detrimentally impact marine habitat or entangle the marine mammal species that occupy or transit through the area.

   GGGI participants World Animal Protection Canada and Natural Resource Consultants (NRC) supported a project with local fishing industry stakeholders to undertake a derelict crab trap recovery project in the northern British Columbia Dungeness crab fishery. This fisher-led approach to removing several lost pots in the area trialled a more systematic approach to data collection to document potential negative impacts of lost traps to harvest revenue. Data about ghost gear bycatch, rot cord functionality, and trap condition was recorded for each trap and will contribute to the GGGI's global data portal.

   Learnings from this project will inform a second derelict crab pot survey and removal project taking place in another area of British Columbia in 2018 that is known to have an accumulation of lost posts. The project will assist the Department of Fisheries and Oceans (DFO) Canada to set the stage for a longer-term approach to addressing economic and ecological impacts of lost crab pots there.



Images top to bottom:
Divers remove ghost gear off the coast of Pender Island, British Columbia.
World Animal Protection helping to prepare end-of-life nets for recycling.

Image: A Thai vessel prepares to raise its net at sunrise after a four-hour trawl.

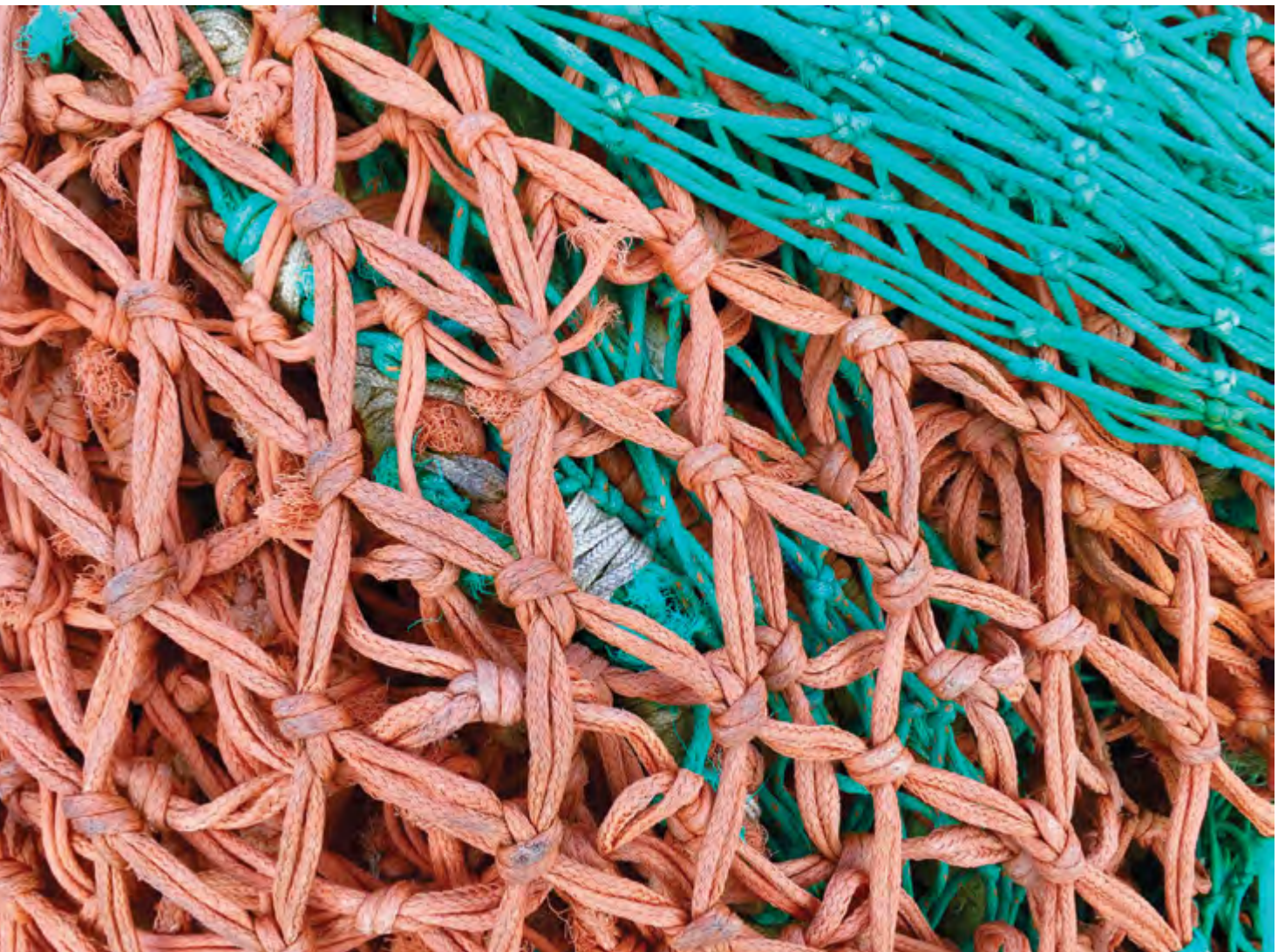
Part 3 – Company assessment findings

Part 3 – Company assessment findings

The Global Ghost Gear Initiative is a practical, industry-led effort to solve the ghost gear crisis. In order to measure our effectiveness over time, World Animal Protection reviewed 15 of the world's leading seafood suppliers, in relation to their management and reporting of ghost gear in their own operations and supply chains. This research sets a baseline against which to measure industry-wide progress in the coming years.

This chapter analyzes the results of this research, and provides insights into leading companies' perception of the importance of ALDFG in comparison to other marine sustainability issues and creates a platform for dialogue with those companies and others on this issue.

Image: A collection of nets.
Joel Baziuk



Methodology

Companies were selected on the basis of seafood market relevance, using sales figures obtained either from company websites or from reputable third-party sources where necessary. The selection includes some companies which are already signatories to GGGI. Companies predominantly involved in fishmeal production rather than supplying seafood for human consumption have not been considered in this assessment. Nevertheless, we recognise fishmeal fisheries may also contribute to and be affected by ALDFG. They may be included in a future assessment.

Criteria

The assessment protocol is based on World Animal Protection's extensive experience of similar exercises in other parts of the food industry, notably the Business Benchmark on Farm Animal Welfare (BBFAW). It addresses company approaches to ALDFG, based on their published information in three core areas:

- Policy and Commitment, including engagement with GGGI and adoption of the BPF;
- Management and Systems, including traceability as well as ALDFG objectives and targets;
- Implementation and Reporting, including participation in high impact fisheries and mitigation measures.

Each section is marked out of 50, giving equal weight to performance in the three core areas.

Data sources

The review draws on publicly available information from company websites, CSR strategies, annual reports, shareholder information, the latest news articles and press releases, as well as information known via companies' involvement with GGGI itself and material published by certain third parties, such as certification schemes as of December 2017. Other than that which has been communicated directly through GGGI engagement, only information in the public domain has been used to rate each company.

We recognise from our experience with other similar studies, such as BBFAW, that there's often a lot more good work going on than companies communicate widely. Each company has therefore been offered the opportunity to feedback on its own assessment and to provide evidence of any additional information which may have been difficult for our researchers to ascertain. Where such information is shown to be in the public domain, this may merit an adjustment of the company's score. Information provided by the company which has not previously been publicly disclosed, may be noted, but does not affect the company's score. Each company has been offered the opportunity of a more in-depth discussion of its approach to ALDFG with GGGI.

Scoring

The question by question performance of each company is not reported here, nor are their raw scores. Companies' total scores by section are ranked into one of the following five tiers:

% score		
82 - 100	leader	setting best practice
62 - 81	achiever	integral to business strategy
42 - 61	improver	established, but work to be done
22 - 41	engaged	on the agenda, but limited evidence of implementation
1 - 21	not engaged	no evidence that ALDFG is on the business agenda

The review found significant variation in how the selected companies communicate about their approach to ALDFG management as well as their environmental performance, traceability and sustainability initiatives.

Overall results

The baseline data set by this study leaves much room for improvement by all fifteen companies assessed.

An analysis of the overall results shows that while some companies are demonstrating effort to address ghost gear, none are deeply invested in a solution set, and the majority have yet to step up to the plate to any degree.

In short, there's a lot of work to be done by the industry as a whole.

Overall ranking is as follows:

Assessment total

Tier 1 **Leader:** setting best practice	Tier 2 **Achiever:** integral to business strategy	Tier 3 **Improver:** established, but work to be done	Tier 4 **Engaged:** on the agenda, but limited evidence of implementation	Tier 5 **Not engaged:** no evidence that ALDFG is on the business agenda
None of the assessed	None of the assessed	• Thai Union • Tri Marine • Young's Seafood	• Bumble Bee Foods • Dongwon (StarKist)	• Beaver Street Fisheries • Clearwater Seafoods • Cooke Seafood • East Coast Seafood Group • High Liner Foods • Maruha Nichiro • Nissui • Pacific Seafood Group • Pescanova • Samherji

What follows is an analysis of the results by category.

Image: Nets are cut in Steveston Harbour Authority as part of a recycling program to turn old gear into carpet tiles and other products, Canada.

Section 1 - Policy & commitment

Position on and commitment to issue of ALDFG
Overall in this category, each company scored maximum points on at least one question, but overall, scores were disappointing, with the average score at 22% of available marks (the highest score was 88% and the lowest was 4%).

12 out of 15 (80%) of the companies we assessed do not have any clear position on ALDFG, or even publicly acknowledge the issue. Only Young's, a GGGI signatory, specifically acknowledges the issue.

Only three companies, Thai Union, Dongwon (StarKist) and Young's have action plans in place. Young's has communicated to the GGGI directly that it has included some of the recommendations from the GGGI's Best Practice Framework in its wild capture fisheries policy, but it has yet to develop a public-facing and clear action plan on how to tackle ALDFG. Thai Union, another high scoring company, has a detailed policy on mitigation measures for FADs, but does not extend this policy to other types of fishing gear. Dongwon (StarKist) also has a policy on non-entangling FADs and on disposal of garbage, including nets.

Just 2 out of 15 assessed companies (13%) are signatories of GGGI – Young's and Tri Marine. Austral Fisheries, a subsidiary of Maruha Nichiro Corporation, is also a signatory, but the parent company and its other subsidiaries are not.

Young's and Thai Union are the only companies to have made commitments to implement the BPF or elements it into their operations. Young's has included the BPF in its wild capture policy, and Thai Union has expressed their intention to reduce the use of FADs and to only deploy non-entangling, biodegradable FADs from large purse-seiners by 31/03/2018. Though it has not fully expressed support for the BPF implementation, GGGI signatory Tri Marine has engaged with GGGI on the BPF, through participating in the consultation and by undertaking to implement it and is looking at making their FADs 100% biodegradable in the near future.

Sustainability programmes
Most companies have committed to some form of corporate sustainability policy and/or sustainability programme. Seven companies (47%) have marine litter programs, while five (33%) have marine pollution programmes. Bycatch/entanglement programmes exist at 40%, or six, of the companies evaluated. Ten, or 67% have a sustainable sourcing programme. One sole company has prioritized the Sustainable Development Goal 14.1 (Prevention and Reduction of Marine Pollution), and another has prioritized the Food and Agriculture Organization's Fisheries Code of Conduct. Finally, from among the 15 companies assessed, 9 have CSR programmes focused on the environment or other areas that don't fit into the above categories.

Within each tier, companies are organised in alphabetical order.

Section 1 – Policy & commitment

Tier 1 **Leader:** setting best practice	Tier 2 **Achiever:** integral to business strategy	Tier 3 **Improver:** established, but work to be done	Tier 4 **Engaged:** on the agenda, but limited evidence of implementation	Tier 5 **Not engaged:** no evidence that ALDFG is on the business agenda
• Young's Seafood	None of the assessed	• Tri Marine	• Dongwon (StarKist) • Thai Union	• Bumble Bee Foods • Beaver Street Fisheries • Clearwater Seafoods • Cooke Seafood • East Coast Seafood Group • High Liner Foods • Maruha Nichiro • Nissui • Pacific Seafood Group • Pescanova • Samherji

Section 2 – Management and systems

In relation to how action on ghost gear is incorporated into companies' management practices and systems, just four companies scored maximum points on at least one question in this section. Again, overall scores were disappointing; the average was 22% of the available marks (with the highest score at 44% and the lowest at 6%).

Product traceability

Only two companies (13% of those assessed) publicly disclose that they have 100% verifiable traceability of their products and over-sight of supply chains: these are Bumble Bee and Clearwater Seafoods. Tri Marine states that it has 100% traceability, but it does not provide evidence as to how this is independently verified. Thai Union has publicly committed to achieving full digital traceability by 2020. Several companies provide some evidence of traceability for part of their product range, but do not publish detail (or evidence) of the exact proportion of their supply is traceable.

ALDFG management responsibility / targets

Dongwon (StarKist), Thai Union and Young's Seafood are the only companies to clearly assign management responsibility for ALDFG to specific individuals. Dongwan (StarKist) and Thai Union have both set out clear objectives and targets for the management of FAD. Indirectly, information is available about how some companies are involved in multi-stakeholder FIPs which in turn manage relevant aspects of their ALDFG policies and implementation, but this is incomplete.

Certification scheme participation

Every assessed company participates in at least one certification scheme that include mention of ghost gear. All but Nissui participate in the Marine Stewardship Council scheme. Only four (27%) are part of the Monterey Bay Seafood Watch scheme: they are High Liner, Maruha Nichiro, Pacific Seafood Group and Tri Marine. Cooke Seafood, Maruha Nichiro, Nissui, and Thai Union participate in the Friend of the Sea scheme. Meanwhile, the Sustainable Fisheries Partnership sees only 2 of the 15 participate (13%): they are Beaver Street and High Liner. Beaver Street also participates in the Aquaculture Certification Council scheme. Alaska Responsible Fisheries Management scheme has Cooke Seafood as a participant. Cooke Seafood and Pescanova participate in the Best Aquaculture Practice scheme; Ocean Wise has High Liner and Pacific Seafood Group on board.

Nissui promotes the acquisition of ISO14001 certification, which is the international standard for environmental management. As of the end of July 2014, a total of 63 locations (offices, domestic consolidated subsidiaries, and Group companies combined) had acquired ISO14001 certification. Thai Union is a member of the Global Aquaculture Alliance. Young's Seafood participates in the Seafish Responsible Fishing Scheme and is represented on its Oversight Board.

Image: Fishermen practicing sustainable methods; passive fishing.
Cecile Levieil / Marine Photobank

Section 2 – Management & systems

Tier 1 **Leader:** setting best practice	Tier 2 **Achiever:** integral to business strategy	Tier 3 **Improver:** established, but work to be done	Tier 4 **Engaged:** on the agenda, but limited evidence of implementation	Tier 5 **Not engaged:** no evidence that ALDFG is on the business agenda
None of the assessed	None of the assessed	• Dongwon (StarKist) • Thai Union • Tri Marine	• Bumble Bee Foods • Clearwater Seafoods • High Liner Foods • Young's Seafood	• Beaver Street Fisheries • Cooke Seafood • East Coast Seafood Group • Maruha Nichiro • Nissui • Pacific Seafood Group • Pescanova, Samherji

Section 3 – Implementation and reporting

Five companies scored maximum points on at least one question in this section. Overall scores were a little higher than in the previous sections: the average was 25% of the available marks (max. 64%, min 6%), with fewer companies failing to score on some of the questions.

Reporting on performance against ALDFG objectives

Having said that, not one company reports publicly on their performance against their ALDFG objectives, if they have any. Six companies (40%) – Bumble Bee, Clearwater Seafoods, High Liner Foods, East Coast Seafood Group, Nissui and Thai Union – report generally on marine sustainability issues. 10 out of 15 (60%) do not report formally on their marine sustainability performance.

Engagements with fishery improvement projects (FIPs) or schemes

Fishery Improvement Projects bring together multiple stakeholders with the aim of improving fishery management and practices. Thai Union is involved in two FIPs which include elements specifically about ALDFG:

- The Indian Ocean Purse Seine Tuna FIP, which it is undertaking in conjunction with Princes, WWF and others includes trialling of non-entangling FADs and management measures to address FAD loss.

- The Eastern Atlantic Ocean Purse Seine Tuna FIP includes a review of FAD design, deployment, and tracking with the aim of recommending a 'Code of Practice' for FAD design (a 'FAD CoP'), deployment and tracking. The FIP will also develop a FAD registration, monitoring and reporting system. In the fourth year of this FIP there will be a review of FAD use and FAD-related Abandoned, Lost and Discarded Fishing Gear (ALDFG) outcomes (especially on Vulnerable Marine Ecosystems), with recommendations for improving the FAD CoP's effectiveness.

Meanwhile, Tri Marine is also engaged in a FAD mitigation programme as part of the GGGI Pacific Island FAD tracking and marking project and has committed to transitioning to less entangling drifting FADs by April 2018.

Maruha Nichiro Corporation is involved in projects/FIPs on related issues that could include ALDFG.

12 companies (80%) – Beaver Street, Bumble Bee, Clearwater Seafoods, Cooke Seafood, Dongwon Industries (StarKist), East Coast Seafood Group, High Liner Foods, Nissui, Pescanova and Samherji – are involved in projects/FIPs generally but which are not related to ALDFG.

Lastly, Pacific Seafood Group stands alone as not being involved in any solution projects or FIPs.

Tackling ALDFG through gear and technology

Leading the pack, Thai Union and Tri Marine are both working on the development of non-entangling, biodegradable FADs as part of their involvement in FIPs in the Indian Ocean, Atlantic and Pacific. The involvement of these two large industry players could significantly mitigate the impact of FADs.

Through their project 'TrawlLight', Young's shows evidence of being an innovator of fishing gear that could perhaps also be applied to the problem of ALDFG.

Similarly, there is cursory evidence that Clearwater Seafoods is an innovator or manufacturer of fishing gear or other technology that could be applied in tackling ALDFG.

Clearwater Seafoods publically states: "Our fleet: habitat mapping, fishing gear innovation, and geographic positioning ensure that we target only where we can fish most efficiently and leave sensitive habitats undisturbed. Vessel monitoring systems provide 24-hour tracking and full transparency of fishing activity to our shore-side mangers, the government regulators even the general public."

Impact of company fishing methods

Unfortunately, all 15 companies are involved in high impact fisheries, for example, gillnets, traps & pots, FADs. There is evidence, however, that Dongwon (StarKist), Thai Union, Tri Marine and Young's have put in place mitigation procedures, such as the use of non-entangling FADs, transitioning from longlining to pole and line fishing, and publishing 'no dumping' policies.

We could find no published evidence of mitigation procedures by the other companies.

Customer engagement on ALDFG or GGGI

Only two of the companies, Young's and Tri Marine, show evidence of formal communication about ALDFG or the GGGI to their customers through education or awareness-raising activities. Tri Marine has contributed to online content on the GGGI website. Young's directors have spoken publicly about GGGI, for example, at the 2016 International SeaWeb Seafood Summit in Malta.

None of the other companies show evidence of formal communication about ALDFG or the GGGI to their customers through education or awareness-raising activities.

Marine sustainability roundtables

In terms of broader marine sustainability roundtables, four companies (27%) – Bumble Bee, Dongwon Industries (StarKist), Thai Union and Tri Marine – are engaged with the International Sustainable Seafood Foundation. Four companies (27%) – Bumble Bee, Nissui, Pacific Seafood Group and Thai Union – are engaged with the Global Sustainable Seafood Initiative.

Only Young's is a member of the Sustainable Seafood Coalition.

Additionally, six companies (40%) – Bumble Bee, Dongwon Industries (StarKist), Maruha Nichiro Corporation, Nissui, Pacific Seafood Group and Thai Union – are involved in other relevant initiatives. In some cases, these include membership of the Seafood Business for Ocean Stewardship (SBOS) initiative, and North Pacific Council.

Lastly, seven companies (47%) are not engaged with any broader marine sustainability roundtables or initiatives. They

are: Beaver Street, Clearwater Seafoods, Cooke Seafood, East Coast Seafood Group, High Liner Seafoods, Pescanova and Samherji.

NGO / Academic institution partnerships

A third of the assessed companies (5 out of the full 15) do not have partnerships on other ocean related issues with relevant NGOs or academic institutions. These companies are Clearwater Seafoods, Dongwon Industries (StarKist), East Coast Seafood Group, Maruha Nichiro Corporation, and Pescanova. The remaining two thirds of the assessed companies (10 out of the full 15) have partnerships with relevant NGOs or academic institutions, such as WWF, Greenpeace, Natural Sciences and Engineering Research Council (NSERC), National Fisheries Institute, NOAA Fisheries, Sustainable Fisheries Partnership, Seaweb and Ocean Trust.

Section 3 – Implementation & reporting

Tier 1 **Leader:** setting best practice	Tier 2 **Achiever:** integral to business strategy	Tier 3 **Improver:** established, but work to be done	Tier 4 **Engaged:** on the agenda, but limited evidence of implementation	Tier 5 **Not engaged:** no evidence that ALDFG is on the business agenda
None of the assessed	• Thai Union	• Tri Marine • Young's Seafood	• Bumble Bee Foods • Dongwon (StarKist) • High Liner Foods • Nissui	• Beaver Street Fisheries • Clearwater Seafoods • Cooke Seafood • East Coast Seafood Group • Maruha Nichiro • Pacific Seafood Group • Pescanova, Samherji

Regional and financial correlation findings

Over half of the assessed companies (8 out of 15, or 53%) are based in North America. 27% of companies (4 out of 15) are based in the Asian region and 20% (3 out of 15) European-based.

European companies were the most polarized in their scores, with Young's scoring the highest of all companies, but Samherji and Pescanova ranked as 'not engaged'. It is not the case that companies from specific regions scored higher or lower than those in other regions.

In terms of sales figures, Young's placed in the third tier in the assessment rankings, despite having a turnover of just 10% of the most profitable company, Maruha Nichiro, which scored as 'Not engaged'. Despite being more profitable than 10 of the other companies -with increased opportunities to reinvest in sustainability and best practice fishing methods - Pescanova also placed in the bottom tier.

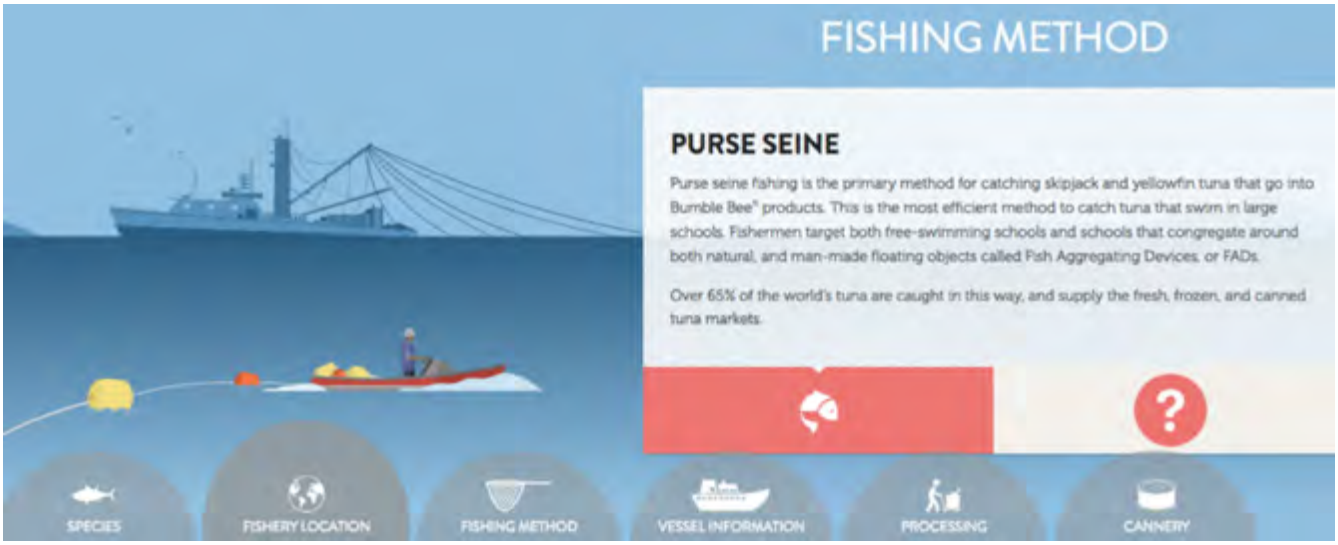
Image: A wild turtle swims in the sea.

Best practices in action

Several companies stood out with respect to their sustainability/environmental objectives and communication. It would be a relatively short step for these companies to incorporate ALDFG into existing strategies.

a. Bumble Bee Seafood
(Overall assessment finding: Engaged)

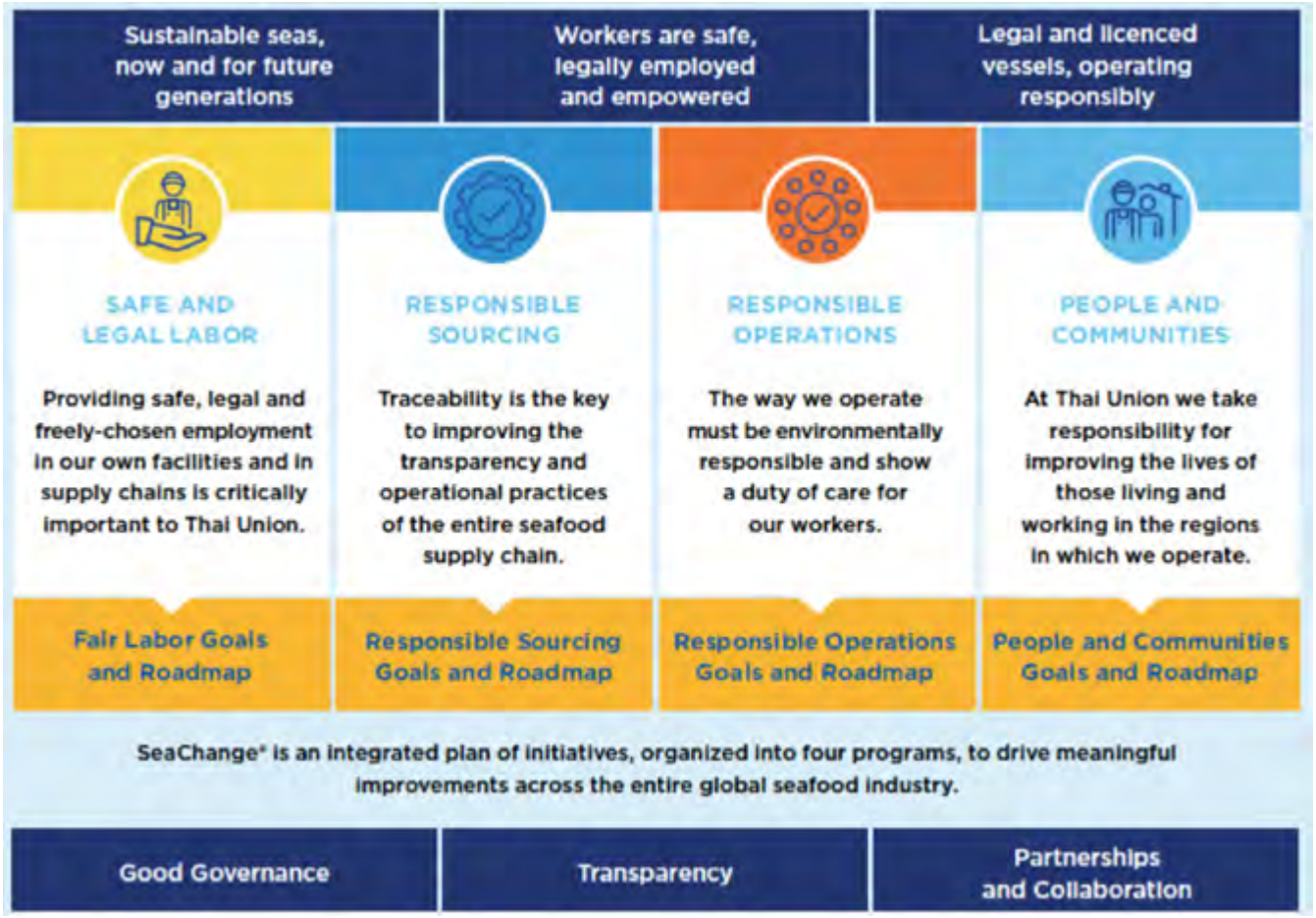
As part of Bumble Bee's 'Trace My Catch' seafood sourcing initiative, customers can track their can of seafood right through to the vessel it was caught on, along with a whole suite of information including fishing methods used. Where nets are used, ALDFG could be introduced along with the company's action plan to deal with it.



Source: http://www.bumblebee.com/tracemycatch/results

b. Thai Union
(Overall assessment finding: Improver)

Thai Union has a comprehensive CSR strategy 'SeaChange' that is accompanied by objectives and targets (Responsible Operations Goals and Roadmap), and an extensive communication strategy.



Caption: Thai Union's environmental policies incorporate marine litter and waste management; this lays the groundwork for the implementation of the BPF for ALDFG to be embedded into existing company strategy.

c. Maruha Nichiro
(Overall assessment finding: Not engaged)

Austral Fisheries, the 2017 Banksia Foundation Small to Medium Business Sustainability Leadership Award winner, is an exemplar for environmental policies and communication in the industry. It has made a commitment to become carbon neutral and is a signatory to the GGGI. Despite this no information could be found on action plans to address ghost gear. This may well be happening behind the scenes. A first step of creating a news story to promote the partnership with GGGI would be a priority.

As a winner of the Banksia Award, the company will have extensive monitoring and evaluation processes in place and therefore it can be assumed it has the framework in place to add the BPF for ALDFG.

It should be noted that Austral is a subsidiary of Maruha Nichiro, and while Austral is committed to clear environmental policies, Maruha Nichiro ranked in the bottom tier of assessed companies.

Caption: Austral Fisheries, the 2017 Banksia Foundation Small to Medium Business Sustainability Leadership Award winner has made a commitment to become carbon neutral and is a signatory to the GGGI. This image from the company's advertising campaign shows one of the steps it takes to protect sea birds as part of its sustainability programme.

d. Tri Marine
(Overall assessment finding: Improver)

Please see for more detail on the FAD mitigation programme as part of the GGGI Pacific Island FAD tracking and marking project on page 36.

Recommendations

This initial scoping process has provided an excellent benchmark to measure improvement in tackling the issue of ALDFG by a significant portion of the commercial fishing industry.

The following recommendations are made directly to the surveyed companies, and to any corporate actor wishing to make improvements to their policies and processes to become part of the solution. The assessment results have been shared with each company.

Key recommendations are to:

1. Incorporate the BPF to ensure action to address ALDFG is embedded into existing CSR strategies where they exist. This should include:

- Setting up an annual audit of the number of nets within the fleet, with data collection templates to include in company annual/CSR reports.
- Developing standard operating procedures for net management (storage, repair, upcycling/on selling) and include in staff briefings/inductions.
- Providing incentives for salvaging ALDFG, either own or others' via buyback schemes as part of initiatives such as Net Works (http://net-works.com/).
- Identifying social enterprise opportunities for upcycling discarded nets and support for procurement policies that utilise these products i.e. carpets in company HQs, other items such as glasses frames (Dresden Optics https://dresden.com.au/), skateboards and shirts (Bureo https://bureo.co/), art/sculpture for community engagement opportunities (Ghostnets Art https://www.ghostnets.com.au/ghostnet-art/) and positive media stories.

2. Become a signatory to the Global Ghost Gear Initiative and include that information on their company website to provide an edge over competition and help customers make a clear and better seafood choice. Becoming a signatory to, or engaging with the GGGI, significantly improved the scores of a number of companies assessed in this study. Companies are strongly encouraged to engage with the GGGI.

Image: iStock. by Getty Images

Shifting the tide

There is no doubt that the threat and impact of ghost gear needs our urgent attention. Organizations and agencies such as the FAO, UNEP and NOAA all agree that ghost fishing gear causes disastrous levels of environmental harm. Millions of individual marine animals die annually due to interactions with ghost fishing gear, including valuable protected, iconic and much loved species such as whales, turtles, seals and sharks. Marine environments also suffer due to ghost fishing gear, with biologically diverse marine habitats being threatened, and coral reefs sustaining potentially irreparable damage.

The cost of ghost gear is not only ecological – evidence proves that ghost gear has a dramatic economic impact on fisheries, in many ways. Stock which would otherwise form part of an intentional catch is instead caught by ghost gear, costing millions of dollars in losses. Ghost gear is also a navigational hazard for vessels, with additional economic impact from propeller and rudder entanglements requiring costly repairs or replacements. Additional economic losses are sustained indirectly, through the cost of lost fishing time and staff downtime [104].

Solutions to the problem of ghost fishing gear, such as those implemented by World Animal Protection and the GGGI, have proven to be effective and economically viable.

It is clear that some fisheries and marine stakeholders are truly committed to tackling ghost gear by participating in solutions-based projects. From gear removal and recycling to gear marking research, many organizations and companies have proactively shown their dedication to improving the world's oceans and seas. By working collaboratively in capacity building projects, and by sharing expertise and information with other stakeholders, groups have been able to make a real difference to ghost gear levels.

Although some fishery companies and marine organizations have made a positive impact on ghost gear levels and prevention, some of those who benefit the most from ocean resources are clearly not making the contribution they should to protecting marine life and habitats. Our findings show that highly profitable billion dollar companies do not use the recommended best practices designed to lessen the problem of ghost gear.

While global companies may claim to protect the best interests of the waters they utilize, there is little evidence that these pledges are being put into action. Many use fishing practices that are devastating to marine animals. In many cases, the traceability of their fish and seafood cannot be confirmed. Multi-billion dollar companies usually have subsidiaries whose actions are unmonitored [105]. Some suggest that IUU fishing operations hide behind corporate structures in the fishing industry, where corporations knowingly or unknowingly purchase stock caught by IUU fishing and benefit from this damaging practice [106].

Legality aside, the fishing industry is responsible for the creation of ghost fishing gear. Large seafood corporations have a responsibility to the marine wildlife and environments affected by ghost gear, to the communities affected by ghost gear who rely on marine resources to survive, and to future generations of fishers, to ensure that they use the resources of the oceans in a sustainable manner. The problem cannot be tackled solely by writing policies and pledging to make improvements. Efficient, practical projects need implementing at ground level, to ensure sustainability pledges are met in practice.

In many cases, when large corporations fall short of their responsibilities, local fishers step up to tackle the problem of ghost fishing gear. Their communities are the most at risk from the adverse effects of ghost gear, and their livelihoods and survival the most dependent on the health of marine environments and the abundance of seafood within it. As the primary suppliers of our oceans' seafood, they are on the front lines of the battle with ghost gear. Many of the projects undertaken by World Animal Protection and GGGI participants have recognised the need to include fishers and their communities in ghost gear solutions. Inclusive business models, where fishers are incentivised to participate in ghost gear collection and recycling, have proven to be highly effective. Local communities are empowered to be authors of solutions to ghost fishing gear, rather than labelled as

Image: A wild pod of spinner dolphins.

an uncaring part of the problem. Funds generated by the sale of collected end-of-life fishing gear are returned to the community, to be invested in facilities and projects that benefit local people as a whole, encouraging further participation and a sense of investment in their coastlines.

Evidence has shown that the proven environmental and economic benefits created by ghost gear solutions far outweigh the costs of implementation. Investment in ghost gear solution projects, such as those associated with the GGGI, will ultimately create a healthier, more plentiful marine environment that benefits the larger fishing industry, supports the communities whose livelihoods rely on their ability to fish, and protects the marine animals currently under threat of entanglement.

Despite the efforts we are seeing by some in the industry, some stark facts remain. Year after year hundreds of thousands of tonnes of ghost fishing gear are lost or abandoned into our oceans. Every year they kill millions of marine animals. Every year, this fishing gear, much of it made of plastic, breaks down and creates toxic pollution in our foodweb. And as a result, every year our ocean ecosystems become more fragile. Some would argue that we are hovering on the edge of system collapse.

Urgent action is needed to reverse this trajectory, and ensure that our oceans can continue to both sustain life and provide for humans in the many ways we have come to rely on them.

If there is any good news here, it is that the solutions, the best practices and the benefits of action are clear, and they are in our hands.

World Animal Protection, together with the Global Ghost Gear Initiative, provides leadership, support and action for our oceans because we believe that reversing the impacts of ghost gear is not only essential, it is achievable. Co-operation between industry, governments and non-governmental organizations can be a powerful force for change¬. It's critical that we truly harness it, before it's too late.

Our oceans, and the animals in them, deserve no less.

Glossary

ALDFG – Abandoned, lost or discarded fishing gear

AFAD – Anchored fish aggregation device

CSIRO - The Commonwealth Scientific and Industrial Research Organisation

DFAD - Drifting fish aggregating device (see FAD).

EEZ - Exclusive economic zone

EFF – European Fisheries Fund

FAD - Fish aggregating device. A man-made device, often consisting of buoys or floats used to attract pelagic ocean fish, such as tuna, which aggregate around them. FADS can be anchored to the seabed, or set adrift.

FAO - Food and Agriculture Organization (United Nations)

FoC – Flag of convenience

GGGI – Global Ghost Gear Initiative

GI Tracts – Gastrointestinal tracts

IUU Fishing – Illegal, unreported and unregulated fishing

NOAA - National Oceanic and Atmospheric Administration

PNA – The Parties to the Nauru Agreement

SPC - Secretariat of the Pacific Community

UNEP – United Nations Environment Programme

Images

Image A: Actively fishing trap. Note the lines extending up to surface buoys or to other traps.

Image B: Derelict fish trap.

NOAA/NCCOS/CCMA Biogeography Branch.

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World Animal Protection International
5th Floor
222 Grays Inn Road
London WC1X 8HB
UK
T: +44 (0)20 7239 0500
F: +44 (0)20 7239 0653
E: info@worldanimalprotection.org
W: worldanimalprotection.org

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