EFFECTIVE GHOST GEAR SOLUTIONS

LEARNING FROM WHAT WORKS

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GLOBAL GHOST GEAR INITIATIVE®

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Cover photo credit: GGGI (Joel Baziuk)

Photo credit: Matt Gilbert

FOREWORD

This report was commissioned jointly by the Global Ghost Gear Initiative® (GGGI), Ocean Conservancy, and World Wildlife Fund (WWF) to showcase progress preventing harm from ghost gear globally.[1] It outlines a path forward that builds on existing successful projects and capitalizes on the energy and expertise of the many individuals, organizations, and governments determined to alleviate the problem of ghost gear. The report:

- Summarizes current global understanding of fishing gear loss, causes of loss, and negative impacts of ghost gear;
- Describes effective best practices implemented around the world to address the problem in successful projects; and
- Identifies policy and practical steps needed to continue progress on reducing harm from ghost gear worldwide.

The GGGI Best Practice Framework for the Management of Fishing Gear (BPF) and the United Nations Food and Agriculture Organization (FAO) Voluntary Guidelines on the Marking of Fishing Gear (VGMFG) are highlighted as guiding principles that "come to life" in the hands of creative and passionate people from diverse backgrounds, organizations, and governments. Case studies illustrate programs that work and showcase strategies proven to reduce harmful impacts of ghost gear. Each successful case study was uniquely developed for a specific location, fishery, or community with wide cross-sectoral stakeholder involvement and particular attention paid to fishers' roles.

There is much more work to be done, certainly. This report lays out a path for progress at different scales, highlighting what can be done by the many fisheries stakeholders. We hope this document inspires and galvanizes even more progress on this critical issue for our ocean.

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[1]The term ghost gear used in this document is synonymous with abandoned, lost, or discarded fishing gear, which is sometimes abbreviated to ALDFG in scientific and fisheries management circles.

EXECUTIVE SUMMARY

According to the Food and Agriculture Organization of the United Nations (FAO), the global fishing industry harvested 171 million metric tons of seafood valued at 362 billion USD in 2016 (FAO, 2018a). Fish consumption is at an all-time high and the ocean feeds more people than ever. FAO predicts that world fish production will continue to increase over the coming decade. As fishing and aquaculture continue to grow, so too will the problem of ghost gear.

In 2009, the United Nations Environment Program (UNEP) estimated that ghost gear accounts for 10 percent of all marine litter entering the ocean each year (Macfayden et al., 2009), however, this number could be much higher today. Fishing gear is lost for many reasons, but most commonly occurs when gear snags on reefs or rocks, gets tangled with other fishers' gear, or washes away during inclement weather. In some cases, it also gets abandoned intentionally by those fishing illegally to evade capture or to avoid being denied entry to port. Often these causes are influenced by other regionally specific drivers of fisher behaviors, such as market forces and fisheries management decisions.

Ghost gear washes up on beaches, damages marine and nearshore habitats, and can be found in the enormous trash gyres that circulate in the Pacific, Atlantic, and Indian oceans. Ghost gear can continue to entangle and trap fish and other marine animals long after it is lost or abandoned at sea. This phenomenon, known as ghost fishing, can significantly reduce valuable catches in some fisheries and can harm multiple non-target species, such as mammals, sea turtles and birds.

In fact, scientists have estimated that global efforts to remove abandoned, lost, and discarded fishing gear, also known as ghost gear, could generate hundreds of thousands of dollars in economic value to fisheries worldwide. In 2016, a study by researchers at William & Mary's Virginia Institute of Marine Science found that removing abandoned fishing gear could generate significant economic value for commercial fisheries (Scheld et al., 2016). Their research focused on a program to remove derelict crab pots from the Chesapeake Bay and estimated the effort gave area crab fishers a boost of 21 million USD in harvest value over a six-year period. The economic benefits of the program far outweighed the program's total cost. Generally speaking, addressing ghost gear improves fishery sustainability and creates a win-win for fishers and fish.

ESTABLISHING BEST PRACTICES THROUGH COLLABORATION

To address growing concerns about ghost gear, World Animal Protection founded the Global Ghost Gear Initiative® (GGGI) in 2015. Hosted under Ocean Conservancy's Trash Free Seas® program since 2019, the GGGI is a diverse alliance of participants from the fishing industry, academia, governments, and nongovernmental organizations. Working with its members, the GGGI developed and launched the Best Practice Framework for the Management of Fishing Gear (BPF) in 2017, elements of which were reflected in FAO's 2018 Voluntary Guidelines for the Marking of Fishing Gear (VGMFG). These two documents outline proven strategies to reduce ghost gear and provide clear options and recommendations for fisheries managers.

The GGGI BPF explains which options are available to different industry stakeholders along the seafood supply chain. It is divided into sections for each stakeholder group, such as gear manufacturers, fishers, retailers, and more; and recommends strategies to prevent, mitigate, and cure the problem

Photo credit: Thanda Ko Gyi

of ghost gear. Actions laid out in the GGGI BPF fall into categories of voluntary guidance, third-party certification schemes, regulatory measures, and awareness building.

The VGMFG focuses on fishing gear marking as an important best practice to prevent and mitigate ghost gear. Gear marking includes making it more visible through lighting, flagging, and buoys; marking gear by location through satellite buoys and other means; and marking gear to identify its owner. Collectively, these methods help fishers keep track of their gear, help prevent gear loss, assist with gear recovery, and help fisheries regulators identify illegal, unregulated, and unreported (IUU) related fishing gear.

IMPLEMENTING BEST PRACTICES AT ALL SCALES

Many passionate and dedicated partners are using the GGGI BPF and VGMFG to address ghost gear in small- and large-scale settings alike.

At the local level, the GGGI-supported Myanmar Ocean Project removes ghost gear from the Myeik Archipelago, one of the most untouched island groups with pristine ecosystems in the world. In the United States, the Puget Sound Derelict Fishing Gear Program, run by GGGI member Northwest Straits Foundation, has removed thousands of nets in the Salish Sea. World Wildlife Fund (WWF) Mexico is testing alternatives to high-risk gillnets in the shrimp fishery in the Gulf of California while WWF India engages with fishers to protect sea turtles from entanglement in India's fisheries.

At the regional and national level, Canada's Department of Fisheries, Oceans, and the Canadian Coast Guard (DFO) has launched a new program to remove ghost gear and encourage fishers to use new gear technologies to reduce gear loss. The MARELITT Baltic project involved stakeholders from multiple countries to reduce the impact of marine litter in the form of derelict fishing gear in the Baltic Sea. A similar project involving Nordic countries, Clean Nordic Seas, has been operating for over 35 years.

CHARTING THE COURSE FOR FUTURE ACTION

Best practices demonstrating how to successfully address the problem of ghost gear provide a strong foundation for future action. Moving forward, all stakeholders involved in the seafood supply chain need to continue to make progress around four pillars:

- Research and building evidence
- Policy and advocacy
- Fisheries management
- Market-based solutions

Research and Building Evidence

Better understanding of the ecological and economic costs of ghost gear is needed so we can better inform solutions. Research into the impacts on target, non-target, and protected species are informing species recovery plans and galvanizing action. More fisheries are gaining a better understanding of how ghost gear affects their livelihoods, and many are requiring fishers to report and recover lost gear and adopt innovative gear technologies to mark and track fishing gear.

Policy and Advocacy

Stakeholders need to continue to work with national governments, international bodies, and multinational seafood corporations to adopt best practices that address ghost gear at the local, regional, and national levels. The United Nations Sustainable Development Goals (SDGs) are driving countries to pledge actions that reduce marine pollution and aim for sustainable fisheries, and ghost gear management clearly aligns with these pledges. High-level commitments translate to on-the-ground solutions and pave the way for local actors to implement site-specific solutions.

Fisheries Management

Fisheries managers need to improve their abilities to reduce harm from ghost gear by promoting workable solutions informed by local stakeholder involvement. It is critical to understand the specific drivers for gear loss at the local and regional level to ensure that prevention and mitigation strategies are feasible and appropriate. Lost fishing gear prevention happens at the fishery and local level, and pilot projects demonstrating the feasibility of best practices can be scaled up and widely adopted. Continued outreach and promotion of the GGGI BPF and VGMFG at the local, regional, and national fishery management level is imperative.

Market-Based Solutions

Market-based solutions are needed to create real change along the seafood supply chain. These include ecolabel certifications that are powerful marketing tools for fisheries and drive better fishing practices at all scales while informing consumers; as well as innovative fishing gear recycling and upcycling programs that address the disposal challenges associated with end-of-life fishing gear. We also need more industry influencers to join efforts to fight ghost gear and inspire smaller actors to participate.

CONCLUSION

This report outlines effective ghost gear solutions that are as varied as the world's fisheries and can inspire action that protects fish and other marine life that rely on the ocean. These solutions showcase progress at each point along the supply chain, highlighting how everyone involved in the global fishing industry as well as NGOs and governments can contribute meaningfully to ghost gear solutions. Collective and collaborative action to solve this global problem has grown exponentially in recent years and is a good indicator that this is a problem we can solve. Multi-stakeholder efforts will remain essential to achieve success in confronting this problem globally, through direct project support, capacity building, research, outreach, and advocacy. In collaboration with myriad partners around the world, the GGGI, Ocean Conservancy, and WWF will continue their commitments to eliminate ghost gear from our global ocean.

Photo credit: World Animal Protection

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ABBREVIATIONS USED

AFAD	Anchored fish aggregating device
ALDFG	Abandoned, lost, or otherwise discarded fishing gear
ARAP	Autoridad de los Recursos Acuáticos de Panamá
ASEAN	Association of Southeast Asian Nations
BPF	Best Practice Framework for the Management of Fishing Gear
CAD	Canadian dollar
COFI	FAO Committee on Fisheries
DFO	Canada's Department of Fisheries, Oceans, and the Canadian Coast Guard
EIHA	OSPAR Environmental Impact from Human Activities Committee
EPR	Extended producer responsibility
FAD	Fish aggregating device
FAO	Food and Agriculture Organization of the United Nations
FIP	Fishery Improvement Project
GGGI	Global Ghost Gear Initiative
GPML	Global Partnership on Marine Litter
IGO	Intergovernmental organization
IMO	International Maritime Organization
ISSF	International Seafood Sustainability Foundation
IUU	Illegal, unregulated, and unreported fishing activity
MSC	Marine Stewardship Council
NOAA	National Oceanic and Atmospheric Association
NWSI	Northwest Straits Marine Conservation Initiative
ORP	Olive Ridley Project
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
RFMO	Regional fishery management organization
SDG	United Nations Sustainable Development Goals
UNEP	United Nations Environment Program
USD	United States dollar
VFD	Vanuatu Fisheries Department
VGMFG	Voluntary Guidelines for the Marking of Fishing Gear
VMS	Vessel Monitoring Solutions
WWF	World Wildlife Fund

GHOST GEAR: WHAT WE KNOW

The ocean feeds over 3.2 billion people globally. Capture fisheries and aquaculture industries harvested 188.5 million tons of seafood valued at USD 362 billion in 2016 (FAO, 2018a). With this immense production comes unfortunate side effects, including the global problem of ghost gear. Ghost gear is the most harmful form of marine debris for marine animals and their habitats. It impedes safe navigation, taints our beaches and reefs, and causes economic losses to fisheries and other marine-dependent industries across the globe.

FAO estimated in 2009 that 705,500 tons of fishing gear is lost or abandoned in the ocean each year (Macfadyen et al., 2009). The United Nations Environment Program estimates that ghost gear accounts for 10 percent of all marine litter entering the ocean each year (UNEP, 2017). These numbers play out at regional scales with an estimated 10,000 gillnets lost in the Baltic Sea and more than 12,000 crab pots lost in the United States' Salish Sea every year (Antonelis et al., 2011; Szulc et al., 2015). In the Western Central Pacific Ocean, nearly 5 percent of the 30,000 drifting fish aggregation devices (FADs) deployed each year are abandoned and wash up onto nearshore habitats (Escalle et al., 2019). This gear loss adds to the growing mass of plastics entering our ocean every year. Indeed, it is estimated that in some locations, ghost gear accounts for over half of all macroplastic pollution in the ocean if measured by weight (Moss, E., Eidson, A., Jambeck, J. 2017).

Because modern fishing nets and other fishing gear components are largely made of plastics, ghost gear potentially persists in the marine environment in some form (e.g., synthetic fibers) indefinitely. Ghost gear can continue to entangle and entrap marine animals after it is lost, including the species targeted by fishers. This phenomenon, commonly known as "ghost fishing," can significantly reduce catches in some fisheries. With an estimated 5 to 30 percent decline of some fish populations from ghost fishing and lost harvest values reaching millions of dollars, ghost gear can negatively impact the livelihood of fishers and jeopardize the accuracy of the fish population assessments used by fisheries managers to regulate catches (Antonelis et al., 2011; NOAA, 2015; Scheld et al., 2016). The economic harm caused to fishers also includes the loss of the gear itself, which can be very expensive. In the Area A crab fishery in British Columbia, Canada, annual replacement of lost gear costs the fishery over 650,000 CAD (over 490,000 USD) (Drinkwin et al., 2017). Other industries suffer as well, with shipping and transport and other vessels at risk of damaging propellers with drifting ghost gear.

Ghost gear is the deadliest form of debris to marine animals (Wilcox et al., 2016). While much fishing gear is designed specifically for the target species, once lost it can capture animals indiscriminately. In the Salish Sea, more than 260 unique species, including marine mammals, birds, protected fish, and commercially valuable invertebrates, get entangled and killed in lost salmon gillnets.[2] Mammals, birds, and reptiles drown regularly in ghost gear. Fish and invertebrates become trapped, injured, and prey for other animals, which may also become trapped. This deadly pattern of ghost fishing continues until the gear loses its integrity. This usually occurs within the first year of loss but there are observed cases of ghost gear continuing to capture and kill animals decades after being lost (Baeta, F., Jose Costa, M., & Cabral, 2009; Erzini et al., 1997; Gilardi et al., 2010; Tschernij and Larsson, 2003).

Lost fishing gear also damages important nearshore and marine habitats. Impacts of ghost gear vary widely from place to place but often affect the sensitive

[2] *Washington State Derelict Fishing Gear Database, accessed October 8, 2019.*

nearshore areas, seagrass beds, macroalgae, coral reefs, and mangroves that are so important as nursery areas for numerous species (NOAA, 2016). Ghost gear harms corals, scours bottom habitat of animals like urchins, anemones and sponges, damages vegetation, builds up sediment, and smothers and impedes access to niche habitats (Balderson and Martin, 2015; Good et al., 2010; Valderrama Ballesteros et al., 2018).

CAUSES OF FISHING GEAR LOSS

Gear loss is commonly caused by snagging on reefs, rocks, or bottom structures, where it can interfere with gear that is designed to touch the sea bottom. Demersal gillnets or trammel nets and long lines are particularly susceptible to this kind of loss. Almost 80 percent of longlines set in the Gökova Special Environmental Protection Area of the eastern Mediterranean Sea were lost during the 2007 fishing season, with most of the loss caused by snagging on the sea bottom (Ayaz et al., 2010). However, other gear that is not designed to touch bottom can be lost through unintended contact with the seafloor when the gear is moved by weather and currents or if fishers are not aware of subsurface obstructions. In some studies that identify "hotspot" areas of ALDFG accumulation, rocks, reefs, wrecks, and other bottom anomalies are sometimes referred to as "net habitat" and targeted for surveys and removal activities (Antonelis, 2013).

Entanglement with other fishers' gear and damage from non-fishing vessel traffic is another major cause of gear loss. Loss caused by encounters between vessels can be particularly troublesome in enclosed fisheries areas where vessel traffic is concentrated (Antonelis et al., 2011; Matsouka, 1997). Conflict between vessels and gear usually occurs when static and mobile gears are deployed in the same place and time. Sometimes lost static gear, such as shellfish pots, can drift into areas where mobile gear (trollers or trawlers) are operating, causing gear loss as well as navigation hazards. Fishing vessels are not the only vessels that cause ghost gear. Ferries, tugboats, cargo vessels, pleasure boats, and other vessels all contribute to the problem as well. In the Bay of Fundy in Canada, for example, aquaculture boat propellers are known to sever lobster pot lines during routine inspections of aquaculture beds (pers. com. Lillian Mitchell, February 6, 2019).
Ghost gear is often attributed to inclement weather, be it strong tides, wind, or currents. Static gear can be transported off its deployed location and/or driven into bottom obstructions. Fishers operating smaller boats off the Algarve in southern Portugal reported that gear loss was due mainly to rough weather while larger boats identified gear conflicts as the main cause of gear loss (Santos et al., 2003). Mobile gear is also susceptible to loss during inclement weather as fishers struggle to balance safety and fishing efficiency against economics.

Other causes of loss identified by Brown et al. (2005) for European fisheries included long soak times, fishing in deep habitats, and deploying more gear than can be hauled in regularly. Loss or abandonment of fishing gear by IUU fishing is also suspected of contributing considerable amounts of ghost gear, as illegal fishers often abandon or discard fishing gear to conceal their activities. In 2017, GGGI, World Animal Protection, and WWF Mexico collaborated on a project that removed 5,200 square meters of illegally set gillnets that were lost and abandoned in the Gulf of California. The project illustrated the nexus between IUU fishing and ghost gear. Other studies have documented the connection as well, though it is difficult to quantify at global scale (Edyvane and Penny, 2017).

Ultimately, many of the causes of ghost gear are exacerbated by other pressures facing fishers. In a unique study of underlying causes of gear loss, Richardson et al. (2018) determined that while fishers in Oceania's Arafura Sea identified gear conflict and snagging on obstructions as the major causes of gear loss, further investigation found fishers were operating in close proximity with each other, often near subsurface obstructions, due to key fisheries management decisions and significant IUU fishing. Over-allocation of fisheries resources as well as IUU fishing can drive fishers into riskier grounds or lead to overcrowding of fishing grounds, both of which can result in more fishing gear loss.

It is critical to understand and address the multiple and regionally specific drivers impacting gear loss in order to successfully reduce ghost gear.

BEST PRACTICES

To address growing concerns about harmful impacts of ghost gear, World Animal Protection formed the GGGI in 2015. In 2019, Ocean Conservancy assumed leadership of the GGGI. GGGI partners have developed a connected framework for solutions.

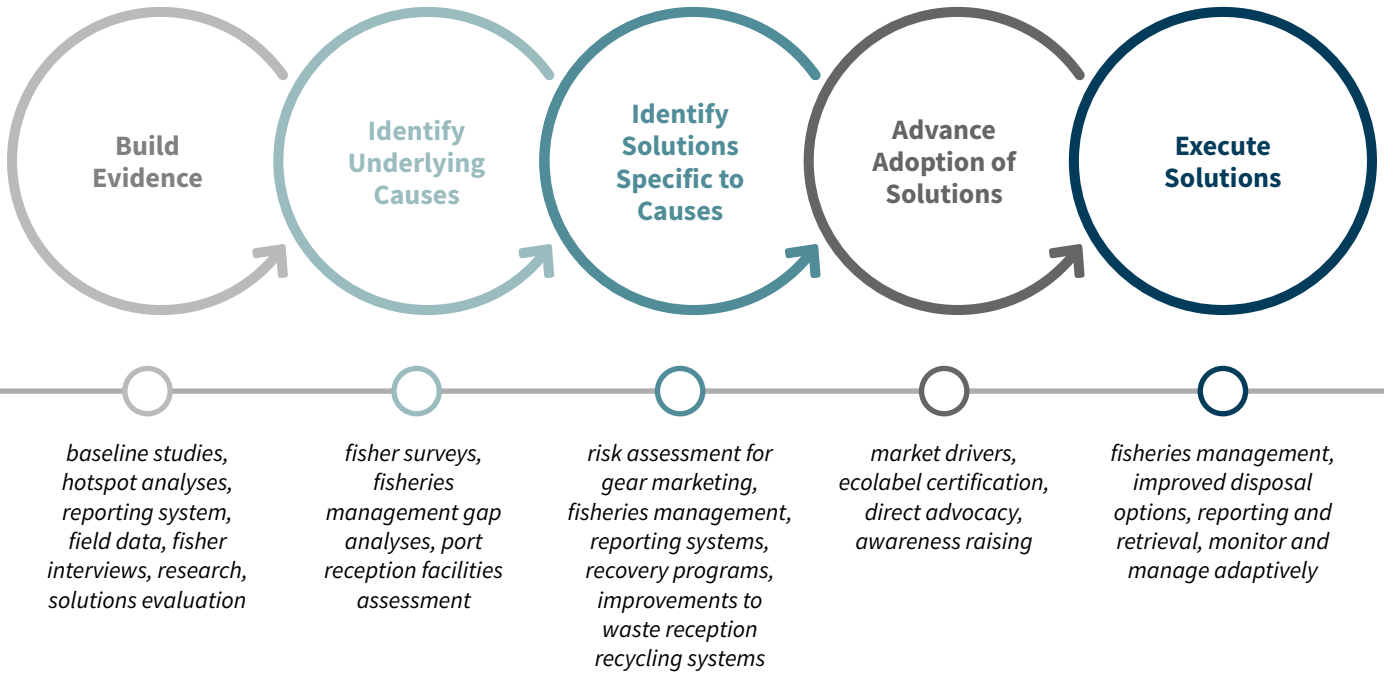
Successful solutions tend to follow a consistent path. The path includes:

- Building evidence;
- Identifying local/regional causes of gear loss (including causal drivers);
- Identifying solutions and best practices tailored to address specific causes and drivers;
- Advancing these solutions and best practices through policy, management, and market forces; and
- Implementing solutions and best practices (see Figure 1).

Similar pathways are identified by other researchers, but they are consistent in that the first step is assessing the scale of the problem and the final step is implementing tailored solutions (Bilkovic et al., 2016; Drinkwin, 2016). Building awareness and research are integral parts of each step along the path.

The GGGI BPF, completed in 2017, consolidates established ghost gear best management practices and has greatly advanced implementation of solutions, as have the FAO's Voluntary Guidelines for the Marking of Fishing Gear (VGMFG), which was endorsed by the FAO Committee on Fisheries (COFI) in 2018. These two documents describe tried and true strategies to reduce harm from ghost gear.

Figure 1. Pathway to ghost gear management solutions



GGGI'S BEST PRACTICE FRAMEWORK FOR THE MANAGEMENT OF FISHING GEAR

As the GGGI was established, members identified the need for a comprehensive document outlining actions to prevent and reduce harm from ghost gear along every step of the seafood supply chain. The GGGI BPF answered that need. Developed in 2017 and finalized through an extensive stakeholder engagement and consultation process, the GGGI BPF lays out management options to avoid ghost gear and mechanisms for responsible fishing gear use. The GGGI BPF explains which options are available to different stakeholders along the seafood supply chain and is divided into sections for each stakeholder group outlining strategies for prevention, mitigation, and cure.

Critical stakeholders identified in the GGGI BPF include:

- Fishing gear designers, manufacturers, and retailers;
- Fishers;
- Fisheries organizations;
- Port operators;
- Fisheries managers and regulators;
- Fisheries control agencies;
- Fisheries and marine environmental researchers;
- Seafood ecolabel standard and certification programs;
- Seafood businesses; and
- Non-governmental organizations.

Actions laid out in the GGGI BPF fall into four main categories: voluntary guidance, third-party certification schemes, regulatory measures, and awareness building.

Voluntary guidance can be a powerful tool, especially if it is backed by fisheries organizations or cooperatives. Many fisheries rely on voluntary compliance to manage everything from seasons, to fishing areas, to gear reporting and recovery. For example, to avoid gear conflicts in the Area A crab fishery in British Columbia, Canada, salmon trollers and crab fishermen have an informal agreement that trollers will fish outside a designated depth contour and crabbers will fish inside the contour.

Third-party seafood certification schemes are also powerful tools to drive better management of fishing gear. Consumers look to these schemes to inform their seafood purchases. Schemes can require measures to prevent and manage ALDFG for certification. Recently, the GGGI-member Friend of the Sea seafood certification program of the World Sustainability Organization adopted portions of the GGGI BPF into its tuna standards. GGGI is currently working closely with the Marine Stewardship Council (MSC) to incorporate ghost gear considerations more clearly into its revision of its benchmarks.

Regulatory measures are critical to a well-managed fishery and, when enforced adequately, ensure that fishers who follow the rules are rewarded while fishers who engage in illegal activities are penalized. Regulations can require gear loss avoidance measures and reporting and retrieval of lost gear. Consistent enforcement of fishing regulations is often an effective best practice to avoid ghost fishing. In the Salish Sea, frequent sweeps to recover lost shellfish pot gear, performed during days when no fishing is allowed, are helping prevent the loss of harvestable crab due to ghost fishing (Northwest Straits Foundation, 2015).

Building awareness about the harm ghost gear causes to animals, habitats, and the fishing industry, and providing information about how to avoid this harm can motivate compliance with voluntary and regulatory measures. It can also motivate regulatory agencies and third-party certification schemes to include gear loss prevention and management in their programs. In many instances, fishers are unaware of the damage caused by ghost gear or the scale of gear loss in their own fishery. Building awareness through pilot removal operations or fisher interviews/workshops is often the first step to developing fishery-specific solutions.

Global best practices must be applied in and responsive to local contexts, and the GGGI BPF can be

approached as a starting point to develop regionally and nationally specific solutions. For example, while the GGGI BPF in the context of ghost gear ranks gillnets, traps and pots, and FADs as the three highest-risk fishing gear types if lost because of their propensity to ghost fish and their relatively high loss rate, it is lost and abandoned trawl gear that is most frequently found in huge quantities along the coast of the Arafura Sea (Wilcox et al., 2014).

FAO VOLUNTARY GUIDELINES FOR THE MANAGEMENT OF FISHING GEAR

The VGMFG were endorsed by COFI in July 2018 after an expert consultation (April 2016) and a technical consultation (February 2018), as well as the execution of a pilot gear-marking study in Indonesia performed in conjunction with the GGGI. The VGMFG include all types of fishing gear and a separate discrete section on FADs.

The VGMFG make the case for fishing gear marking as an important best practice to prevent and mitigate ghost gear. Marking gear to make it more visible, through lighting, flagging, and buoys, helps fishers keep track of their gear and helps prevent gear loss caused by gear and vessel conflicts. Marking fishing gear for its position, through satellite buoys and other means, can help fishers locate gear that has been lost. Marking gear to identify its owner assists with identifying lost gear that is found or retrieved by a third party and also helps fisheries regulators identify IUU fishing gear. The guidelines also recommend that gear marking systems should be developed in a transparent and collaborative manner with fishing communities and other stakeholders.

A key recommendation in the VGMFG is that a risk assessment should be the first step to developing a gear marking system. A risk assessment should be based on the specific fishery characteristics and should address the following: ecological risks, economic risks, technological risks, safety and navigational risks, social and cultural risks, the availability and quality of data, and the value across the fishery of harmonizing gear marking. FAO is planning to develop specific guidance on how to conduct a gear marking risk assessment based on the criteria in the VGMFG.

As part of the risk assessment, the VGMFG include recommendations to identify hotspot areas and to prioritize recovery of ghost gear relative to its potential to create a hazard to navigation, its harm to sensitive habitats, and its likelihood of ghost fishing.

In addition to gear marking, the VGMFG also include sections on reporting and recovery of ghost gear and recommends requirements on reporting lost fishing gear to appropriate authorities. This reporting system should be linked to a record or register of reported gear maintained by relevant authorities and shared with cooperating relevant organizations and stakeholders as appropriate. Reports should be shared with transiting vessels if the lost gear might pose a safety hazard.

Photo credit: GGGI (Joel Bazuk)

FISHERIES MANAGEMENT BEST PRACTICES

Because of the importance of fishers' actions in reducing the occurrence of gear loss, the GGGI BPF and the VGMFG include clear options and recommendations for fisheries managers to prevent and minimize harm from ghost gear. Many of these best practices may be implemented by fisheries managers for reasons other than preventing gear loss. Gilman (2015) summarized 16 fisheries management strategies available to fisheries managers to prevent and reduce harmful impacts of ghost gear. Only six of the methods call out ghost gear explicitly. Others, such as spatiotemporal restrictions, are generally implemented for other reasons, but have the added benefit of reducing gear loss. The GGGI BPF consolidates important fisheries management strategies into the following seven broad categories.

Spatial and Temporal Separation of Fishing Types

Separating fishing fleets avoids gear conflicts and can protect sensitive habitats. One example of this is the Alaska Fish and Game Department, which utilizes spatial separation of trawl vessels from special Crab Management Areas devoted to pot fisheries only. This measure is generally designed to protect nursery areas for crab but also effectively prevents gear conflicts. Many spatiotemporal measures are not specifically designed to address gear conflicts or prevent gear loss, but they often serve that purpose. In traditional villages in Vanuatu, chiefs historically have restricted access to certain reef areas by designating them "tabu." This effectively creates small marine protected areas and greatly reduces the risk of net loss on reefs (Hickey, 2007). Off the coast of Washington State in the United States, designated vessel traffic lanes are followed voluntarily by crab fishers and vessel captains specifically to avoid gear conflict and improve navigational safety.

Fishing Gear Marking and Identification

Marking gear helps avoid gear conflicts, helps locate lost gear, and distinguishes legal fishing gear from illegal gear. As laid out in the VGMFG, gear marking should, among other things, provide a feasible and verifiable means of identifying the ownership and position of fishing gear, and its link with vessels and operators of the fishing gear (FAO, 2018b). Traditional gear marking techniques include flags, reflectors, buoys, inscriptions, writing, and tags. Newer kinds of marking, such as electronic buoys, electronic devices, tags with QR coding, and coded wire tags, are being assessed in multiple fisheries to determine their usefulness (He and Suuronen, 2018). Satellite buoys are now commonly attached to drifting FADs so fishing companies can track their location remotely. Where reporting of lost gear is mandatory, locating the owner of recovered lost gear that has not been reported can trigger penalties. This is the case in Washington's State's Salish Sea, where reporting of gear loss is mandatory – fishers have been fined for failing to report the loss of gear that was subsequently recovered by removal teams and traced back to its owner.

Best Fishing Practices

Common best fisheries management strategies, including registration, seasonal restrictions, and gear marking, help prevent and mitigate gear loss. Having retrieval equipment on board harvesting vessels and training crews in gear retrieval techniques are also best fishing practices specific to minimizing harm from lost gear. Ensuring adequate space to stow damaged gear is another best practice to avoid the need to discard gear into the sea for lack of space. Like other solutions to ghost gear, best fishing practices can be tailored to each fishery, addressing identified causes of gear loss that are sometimes unique. For example, staying with your gear, reducing soak times, and reducing the amount of gear deployed were identified as necessary best practices to avoid loss of gear in the northeast Atlantic deep water net fishery but were not identified as necessary in the coastal fishery (Brown et al., 2005).

Innovative Gear Design to Reduce Gear Loss and to Minimize Ghost Fishing

Even in the best managed fisheries, some level of gear loss may occur. Methods to limit ghost fishing, such as requiring biodegradable cord on shellfish pots' escape hatches, are necessary to minimize ghost fishing by lost gear. Developing biodegradable FAD designs and promoting FAD designs that do

not entangle animals is an important focus when addressing species and habitat impacts of FADs. Likewise, developing effective and affordable means to locate gear that has been lost, such as GPS enabled smart buoys, is a promising field of research.

Lost Fishing Gear Reporting and Retrieval

Immediate retrieval of lost fishing gear is the best way to avoid the problem of ghost fishing and other harm. This requires having equipment on board to retrieve lost gear. End of season retrieval programs can also be effective. In the Chesapeake Bay, extensive removal of derelict blue crab traps between 2008 and 2014 increased the blue crab harvest by 38 million pounds (23.8 percent) (Bilkovic et al., 2016). In the Gulf of Mexico, the Texas Parks and Wildlife Department has implemented a "roundup" of lost crab traps with volunteer boaters for 15 years. This annual project has removed more than 30,000 lost crab pots and engaged more than 1,000 privately owned vessels ("Sixth International Marine Debris Conference: Achieving regular, systematic removal of lost fishing gear through collaborative fisheries management," n.d.). The FAD Watch program, where drifting FADs are recovered when they approach sensitive nearshore habitats and before they beach in the Seychelles, is considered a model way to avoid harm from beached FADs. Regular removal of lost crab pots in the California Dungeness crab fishery, managed by the fishers' associations in the area, both limits ghost fishing and removes a potential source of whale entanglements.

Reporting systems are an effective way to facilitate retrieval of ghost gear and to document the extent and scale of fishing gear loss. The Newly Lost Net Reporting, Response, and Retrieval Program of the Northwest Straits Foundation in the Puget Sound includes a real-time telephone and online reporting system for lost fishing nets. Fishers are required to report lost nets within 24 hours. Reports to the system are responded to within hours and response teams are mobilized to find and retrieve verified newly lost fishing nets. The program has removed over 70 newly lost gillnets since the program's inception in 2012. Canada's recently developed gear loss reporting requirement has identified clear concentrations of lost snow crab gear in eastern Canada, allowing the government to focus subsequent retrieval activities (Petrovic, 2019).

Disposal of End-of-Life Gear

Having efficient, accessible, and reasonably priced disposal options and port reception facilities can prevent dumping gear at sea, particularly in areas of the developing world where alternate disposal options (such as landfill) may not be available. While it is difficult to quantify the amount of fishing gear being dumped in the ocean, Richardson et al. (2017) analyzed pollution incidents reported by fisheries observers employed by the Secretariat of the Pacific Community/Pacific Islands Forum Fisheries Agency (SPC/FFA) between 2003 and 2015. They identified 10,613 pollution incidents recorded as discharges of fishing gear in the purse seine, longline, and pole and line fisheries (Richardson et al., 2017).

Education and Awareness

Awareness of the harm caused by ghost gear is not yet widespread in the seafood sector. Improving this understanding may motivate more careful fishing gear management. Education is also needed to train fishing crew members about how to prevent lost gear, including gear stowage, and retrieval methods. The Northwest Straits Foundation sends an annual letter to all licensed fishers operating in the Salish Sea reminding them about the requirement to report lost nets and the availability of on-call response and retrieval teams should fishers be unable to recover their own lost gear. The letters include magnets and cards with the reporting system information, all designed to make reporting easy.

It should be noted that changing fisher behavior is influenced by multiple drivers including, but not exclusive to, fisheries management; economic drivers in the form of selective procurement by seafood companies and seafood certification schemes; and internal and community drivers, such as fishing associations' Codes of Conduct. As noted by WWF India, fishers from closely knit fishing communities can be motivated by community benefits as well. As younger fishers enter the profession, they bring with them new ideas and, in many cases, a more conservation-minded outlook.

Prevention: Solutions Informing Government Policy

Supporting a stewardship approach to addressing ghost gear

Mandatory reporting requirements for lost gear in Canada (Canada ALDFG Program, GGGI Member)

Canada signed onto the GGGI in 2018 and is acting on its commitment to address ghost gear through regulatory and operational measures, as well as by providing funding opportunities for innovative solutions both within Canada and internationally. An early action in 2018 was awarding funding through its Innovative Solutions Canada program to five small businesses for development of gear technologies to reduce ghost fishing and develop/improve ghost gear removal technologies.

As a first step to the regulatory program, Canada has expanded mandatory reporting requirements for lost gear to additional commercial fisheries in 2019. Additionally, a new requirement to report any retrieved gear previously reported lost has been introduced in commercial fisheries, which will allow for targeted retrieval efforts and a robust analysis of the ghost gear issue in Canada.

In July, 2019, Canada's Department of Fisheries, Oceans, and the Canadian Coast Guard (DFO) also carried out a three-day ghost gear removal project in the Gulf of St. Lawrence in 2019, removing over 100 crab pots, more than 9 kilometers of rope, and releasing over 10,000 pounds of live crab back to the water for the benefit of the fishery and endangered North Atlantic right whales in the area.

Going forward, the Government of Canada will work with stakeholders through a new Sustainable Fisheries Solutions and Retrieval Support Contribution Program. The 8.3 million CAD program will assist indigenous groups, fish harvesters, the aquaculture industry, nonprofits, and communities to take

Photo credit: Canada Department of Fisheries and Oceans

concrete actions to support ghost gear prevention, retrieval, and responsible disposal. It will also support fish harvesters to acquire new gear technologies to reduce gear loss. A critical component of this program is supporting harvester-led gear retrieval efforts.

Canada also hosted the first-ever Gear Innovation Summit in Halifax in February 2020 with the focus being on bringing fishers, technology companies, gear manufacturers, and government representatives together to discuss technological solutions to mitigate ghost gear.

Successful Strategies

- Taking a comprehensive and strategic approach to addressing ghost gear at the national fisheries management level
- Showing leadership by dedicating funding to gear prevention and removal efforts both domestically and internationally
- Learning from other areas and adopting successful strategies to the local and regional context
- Building capacity in the fisheries sector to address ghost gear
- Tying actions together with the Canada-wide strategy on zero-plastic waste

For more information: ***www.dfo-mpo.gc.ca/species-especes/mammals-mammiferes/ghostgear-equipementfantome/index-eng.html***

Ghost gear best practices advocacy on the world stage

Promoting guidelines for the marking of fishing gear (World Animal Protection, GGGI Member)

World Animal Protection founded the GGGI in 2015 to drive solutions to the problem of lost and abandoned fishing gear worldwide. World Animal Protection's work did not stop there, of course. Among its many other actions, World Animal Protection staff led the charge to garner political attention to the issue, framing ghost gear in the context of sustainable development goals, the General Assembly Sustainable Fisheries Resolution and driving global policy action.

In 2014, as a first step on the policy action track, World Animal Protection, working with FAO, sought to develop and adopt guidelines for fishing gear marking at the international level as an important best practice to mitigate ghost gear and address IUU fishing. Marking gear to make it more visible through lighting, flagging, and buoys helps fishers keep track of their gear and helps prevent gear loss from gear and vessel conflicts. Marking fishing gear for its position, through satellite buoys and other means, helps to locate gear that has been lost. Marking gear to identify its owner assists with identifying lost gear that is found or retrieved by a third party and helps fisheries regulators identify illegally set fishing gear. Marking gear improves our understanding of where and why gear is lost, which informs prevention and remedial management actions.

To advance formal adoption of gear marking guidelines, World Animal Protection helped organize and stimulate the dialogue at the Expert Consultation on the Marking of Fishing Gear in 2016. The guidelines were drafted to include sections promoting the reporting of and removal of lost fishing gear as companion pieces to gear marking. Following this meeting, World Animal Protection and the GGGI supported two gear marking pilot projects: one working with anchored FADs in Vanuatu and one partnering with FAO to test gillnet marking in Indonesia. Results of these projects were compiled and shared at the subsequent FAO Technical Consultation on the Marking for Fishing Gear held in 2018. At this meeting, the text of the VGMFG was finalized and adopted for consideration by the Thirty-third Session of COFI.

World Animal Protection also encouraged the UN Member States participating in the Technical Consultation to provide a broader policy framework that would encourage the application and use of the gear marking guidelines as well as other ghost gear reducing policy actions. The development

Photo credit: Mario Dominguez

of a global strategy to prevent and reduce ghost gear and an encouragement for Member States to develop national action plans on ghost gear were subsequently included in the recommendations for consideration and endorsement by COFI.

After careful engagement with Member States by World Animal Protection that included building support for the urgency and relevance of global policy action on ghost gear, COFI endorsed the VGMFG in July 2018, called on Member States to develop national ghost gear action plans, and called on FAO to lead the effort to develop a global strategy to prevent and reduce ghost gear. This success has set the stage for subsequent regional workshops in 2019 in Africa, the South Pacific, Southeast Asia, and Caribbean/Latin America jointly hosted by GGGI and FAO. These workshops drew upon both the GGGI BPF and FAO VGMFG to build awareness and capacity among fisheries managers and other stakeholders about best practice in preventing gear loss, guidelines for gear marking, and the importance of lost fishing gear reporting and recovery. These workshops are the beginning of an FAO Umbrella Program on Responsible Fishing Operations including ALDFG, bycatch, marine litter and discards that will be developed further ahead of the 34th UN FAO COFI Meeting and implemented in partnership with GGGI and others.

Successful Strategies

- Engaging UN Member States and intergovernmental organizations (IGOs) on the international stage
- Advocating for science-based and field-tested policy solutions
- Adopting a multi-stakeholder approach to build trust and achieve broad-based and sustainable change
- Forming alliances with FAO and UN Member States and the GGGI
- Framing ghost gear in the context of Sustainable Development Goals and broader UN policy

For more information: *www.ghostgear.org*

Photo credit: Autoridad de los Recursos Acuáticos de Panamá

Tackling ghost gear in Panamá

Diving for ghost gear in Panamá (Autoridad de los Recursos Acuáticos de Panamá, GGGI Member)

The Republic of Panamá signed on to the GGGI in 2017 and was the first Latin American nation to do so. The country is addressing the problem of ghost gear comprehensively through dedicated ghost net removals by trained divers from the Autoridad de los Recursos Acuáticos de Panamá (ARAP). The program has five main components: location of lost fishing gear, diver training on safe and environmentally sound removal methods, fishing sector outreach, ghost gear removal, and disposal of recovered gear.

The fishing sector in Panamá includes industrial, artisanal, and recreational fishers, all of whom lose gear, and all of whom can be part of the solution. ARAP works closely with local fishers who report to ARAP personnel where gear has been lost or located. ARAP then geo-references the reports prior to mobilizing removal operations. Removal operations are carried out by divers, by grappling, or through beach cleanup activities. Since starting the program in 2009, ARAP has engaged with thirty fishing communities and removed 4,383 kilograms of nylon nets and 500 kilograms of non-nylon lost fishing gear and other debris from the ocean.

In 2018, ARAP hosted a ghost gear dive removal workshop in partnership with the GGGI that brought participants from eight countries together to learn about solutions to the problem of ghost gear. Panamá continues to lead in Latin America, illustrating that by working together with fishers and many partners, real progress can be made to reduce harm from lost fishing gear.

Successful Strategies

- Engaging fishing communities collaboratively to help locating ghost gear
- Specialized training for divers to remove ghost gear
- Partnering with multiple Panamanian agencies, including the Navy

For more information: *arap.gob.pa*

Photo credit: Olive Ridley Project

Prevention: Market-based solutions

Donkey harnesses, dog leashes, and bracelets: making useful end products from waste fishing nets

Net upcycling in Pakistan (Olive Ridley Project, GGGI Member)

The Olive Ridley Project (ORP) – a GGGI member since 2015 – focuses on protecting olive ridley sea turtles and their habitats in the Indian Ocean. Its founder, Martin Stelfox, was working as a marine biologist in the Maldives in 2012 when he noted a lot of sea turtles entangled in ghost gear. Confirming that other biologists in the area were seeing the same problem, Stelfox did what any good scientist would do and started recording his observations and taking data on the types of nets he was seeing. This work turned into the ORP, which today focuses on protecting sea turtles and their habitats in the Indian Ocean through rehabilitation, research, education, and outreach.

In Pakistan, ORP engages fishers in the community of Rehmangoth in Karachi where there was a large concentration of ghost nets documented on beaches and reefs close to sensitive sea turtle habitats. After holding workshops and listening sessions with fishers and hearing about their concerns, ORP developed the project to collect waste fishing gear and engage local designers and community women to create marketable products from the material. The project has also involved area divers to retrieve lost fishing gear after fisher reports of gear loss. The resulting products are sold, the women earn money, and some proceeds are invested back into a community fund. The products sold include donkey harnesses, dog leashes, and bracelets. Monetizing the waste fishing nets and paying the community for collecting the nets was key to getting

participation. “The people of this community are suffering from poverty,” says Stelfox. “There is no school, and medical facilities are far away.” Listening to the concerns of local fishers was also important to building trust and understanding how to design the project for the community’s benefit. ORP also engaged a local fisher as field coordinator. For fishing to continue for future generations, “We need a cleaner ocean,” noted Asif Baloch, the ORP field coordinator. “ORP gives me that opportunity and it provides me and other villagers with an added income which is very helpful in these difficult times.”

The project has engaged 2,000 fishers in the collection of four metric tons of net and has engaged 11 community women in product manufacturing. The project has raised 360,000 rupees (about 2,294 USD) by manufacturing and selling dog leashes, donkey harness, and jewelry. With average monthly income being 10,000 rupees, women in the community can make an additional 2,500 rupees per month on average by making these products.

The net storage hut that ORP and the community built from waste plastic bottles is now empty of nets because all the net material has been upcycled. Collections will continue and ORP has a goal to help double the community women’s average monthly wages. ORP also plans to expand into other fishing communities in Pakistan.

Successful Strategies

- Building trust within the community, including fishers and women who are skilled at craft making
- Identifying and working with a local champion to drive the project in the community
- Engaging professional designers to ensure products were of high quality
- Providing alternative income to community members by monetizing and upcycling waste fishing gear into new marketable products

For more information: *oliveridleyproject.org*

A circular economy model in one of the world’s biggest fisheries

Collecting nets for recycling in Peru (Bureo and WWF Peru, GGGI Members)

If your goal is to engage the fishing industry in a circular economy model where fishing gear manufacturing, use, and materials recovery for reuse is the norm, why not work with one of the largest fisheries in the world? GGGI member Bureo and WWF Peru are doing just that on a new project in Peru working with the anchoveta fishery. This fishery, which produced 2,855,040 metric tons of anchoveta in 2016 (second worldwide only to Alaskan pollock production), is controlled by just five major fishing companies (FAO, 2018a). In 2018, with the help of net manufacturers in Peru, as well as the marine conservation work carried out by WWF with the anchoveta industry, Bureo and WWF Peru engaged three of these companies to provide their end of life fishing nets for recycling. Since February 2019, Bureo has collected over 100 metric tons of nets donated by fishing companies. A portion of the proceeds from the sale of these nets to recycling companies is invested towards projects in local artisanal fishing communities.

The project also includes engaging artisanal fishing communities in net collection and paying them for nets collected for recycling. WWF Peru is responsible for working with local artisanal communities and has successfully engaged two communities, which are committed to collecting nets for recycling. Nets are deposited in local collection centers and then transported with the nets collected from the commercial fleet to a processing center. There, they are prepared for recycling and shipped to Asia, where Bureo’s recycling partners recycle the material for use in a variety of products, including the famous Bureo Skateboard, parts of office chairs, bicycle equipment, and other products from corporate partners committed to sustainable sourcing of plastics.

The funds generated by the artisanal communities for collecting and selling their nets for recycling is used for community needs. When WWF first approached fishers and proposed paying them individually for their nets, they weren’t very interested. But when WWF suggested the revenue from the nets could be

Photo credit: WWF Peru

used for community projects, fishers were much more receptive. "In Peru, artisanal fishing is a family affair," says Evelyn Luna Victoria, WWF Peru project lead. "Fishers are motivated to help their community."

Successful Strategies

- Engaging net manufacturers as an entry point to engaging major fishing companies
- Monetizing end-of-life fishing gear
- Investing income from recycled nets into community projects to appeal to fisher and the wider community
- Investing income from recycled commercial nets to support work in artisanal fisheries
- Upcycling waste fishing gear into marketable plastic for manufacturing and marketing new products

For more information: *www.ghostgear.org/projects/2018/11/21/qf8ta90ssp85rbkpd6cqhls0w2mnfi*

From waste to wear

Upcycling fishing nets into consumer products (Healthy Seas, GGGI Member)

Healthy Seas, a GGGI member since 2015, is an environmental initiative melding circular economy with marine conservation through the upcycling and regeneration of fishing nets into beautiful products like carpets, swimwear, and socks. Upcycled materials include end-of-life fishing nets from fishing communities or ghost gear that was removed from the ocean by volunteer divers or fishers. The makers of the end products market the materials themselves and donate a portion of the proceeds back to Healthy Seas. Since 2013, Healthy Seas has collected 500,000 kilograms of fishing nets for regeneration and upcycling.

Working primarily in the North Sea, the Adriatic Sea, and the Mediterranean Sea, Healthy Seas works closely with Ghost Diving, an international nonprofit organization of volunteer technical divers specialized in the removal of ghost gear and other marine debris, and with fishing communities to provide them with

a method to dispose of their end-of-life fishing gear. “The divers are very important in terms of outreach to the public and to provide strong visuals,” says Veronika Mikos, Project Coordinator. “The fishermen might be less ‘sexy’, but prevention is better and more effective. Given the scale of the problem it’s important to engage the fishermen.”

Started in 2013, the initiative was born when volunteer divers from Ghost Diving began removing ghost nets from shipwrecks in the North Sea. They connected with Aquafil, an Italian company which developed a system to regenerate old nylon fishing nets into yarn. The project then came together “like pieces in a puzzle,” says Mikos. Healthy Seas sends its materials to Nofir, a Norwegian company, which collects and recycles discarded equipment from fishing and fish farming around Europe and Turkey. Nofir separates out the components, sending the nylon to Aquafil and the non-nylon to other recycling or reuse partners, like Bracenet (also a GGGI member). The nets also go to school programs and art groups who make installations, such as the Plastic

Garbage Project “Out to Sea” – a travelling exhibition organized by the Museum für Gestaltung Zürich. Healthy Seas is included in the updated exhibition which opened in 2018 and will tour in more than 15 countries worldwide until the end of 2020.

Healthy Seas also works with fisheries schools in the Netherlands and in Greece. In Greece, Healthy Seas partners with ENALEIA, the first professional fisheries school in Greece started in 2016. ENALEIA students learn about sustainable fishing, including responsible handling of waste fishing nets, recycling, and circular economy in their curriculum.

Successful Strategies

- Monetizing end-of-life fishing gear by creating partnerships to regenerate this material into new marketable products
- Including circular economy concepts in fishing school curriculum
- Engaging fishing communities and raising awareness about ghost gear
- Working with dive partners to remove ghost gear

For more information: ***www.healthyseas.org*** **and** ***www.ghostdiving.org***

Photo credit: Healthy Seas

Combatting ocean plastics with the Global Ghost Gear Initiative

Leading by example in the fishing industry (Thai Union Group, GGGI Member)

Thai Union, one of the world's largest producers of shelf-stable tuna products, joined the GGGI in 2018 in a drive to help reduce the growing problem of ghost gear worldwide.

Healthy living and healthy oceans are integral to Thai Union's business. The company's global sustainability strategy, SeaChange®, includes a responsible sourcing program under which Thai Union has made a commitment to ensure safer, cleaner oceans by driving economically viable and sustainable solutions to the problem of ghost fishing gear and marine litter globally. This commitment drives Thai Union's work with the GGGI, which in 2019 saw the company be the first to publish a dedicated work plan to achieve its goals with the GGGI. Thai Union has been recognized for setting best practices in terms of policy and commitment to address the problem of ghost gear, and was highly commended for making this issue integral to the company's overall business strategy in World Animal Protection's 2019 Ghost Beneath the Waves report.

As a seafood leader, Thai Union has both the responsibility and the ability to influence the wider industry on action against marine plastics and the company carries out a wide-reaching advocacy program, participating in panels and conferences, often alongside industry bodies and partners. As raising awareness is critical to help illustrate the issue and its challenges, in June 2019 Thai Union collaborated with the GGGI to launch the #GhostGearReborn campaign in Thailand. The first activity of #GhostGearReborn was a dive in Thailand where members of GGGI and Thai Union, including the company's president and CEO, came together to remove fishing gear from the ocean off Koh Larn island.

In addition to this awareness campaign, Thai Union plans to take action through its participation in Fishery Improvement Projects (FIPs). FIPs are multi-stakeholder initiatives which work toward meeting the fisheries sustainability standard set by the MSC.

The Sustainable Indian Ocean Tuna Initiative FIP aims to be in line with the GGGI BPF and the VGMFG and the FIP action plan includes marking, tracking, and monitoring FADs used in this fishery. Vessels must also comply with the International Seafood Sustainability Foundation (ISSF) guidelines on deploying only non-entangling FADs. FIP participants are also seeking to increase vessel participation in the 'FADWatch' project, which involves the interception and recovery of drifting FADs to prevent them from beaching on sensitive nearshore areas in the Seychelles. For more information, please refer to the published work plan.

"Thai Union is committed to healthy living and healthy oceans and we are always looking to lead by example and make a real difference in combating issues that affect this," said Tracy Cambridge, Responsible Sourcing Director (Europe). "It is important to us to work collaboratively with our suppliers, customers, and NGOs, as well as other industry players, to demonstrate that the global seafood industry is committed to taking action to address the issue of ghost gear."

More information on Thai Union's work with the GGGI and the #GhostGearReborn dive can be viewed in this video.

Successful Strategies

- Building awareness of ghost gear among seafood companies, suppliers, and retailers
- Engaging fishing companies and local communities to develop collaborative solutions to ghost gear
- Influencing the work plans of FIPs
- Sourcing from vessels using only non-entangling FADs

For more information:
www.seachangesustainability.org

Photo credit: Vanuatu Fisheries Department

George Amos and Nare Wolu, Vanuatu Fisheries Department, deploy a marked satellite buoy attached to an anchored FAD

Mitigation: Innovative gear technology solutions

Testing best practices at the local level to inform global processes

Marking and tracking AFADs in Vanuatu (Vanuatu Fisheries Department, GGGI Member)

The Republic of Vanuatu, a GGGI member since 2017, is an island nation in the south Pacific with a population of about 290,000. As in other Pacific Island nations, Vanuatu is seeking to increase its artisanal fishers' access to high protein pelagic fish through the use of anchored FADs. This both reduces pressure on fragile reef systems and provides higher protein fish for local consumption. The Vanuatu Fisheries Department (VFD) uses a non-entangling FAD design, the "Vatuika" FAD, for the anchored FADs they deploy. These FADs can cost up to 2,000 USD. The most pressing concern when they are lost, besides the economic costs to the VFD, is the potential to damage sensitive nearshore habitats.

In 2016, the GGGI supported a project to test position tracking and marking methods on anchored FADs in Vanuatu, collaborating closely with the VFD. The project objectives were to enable the VFD to recover lost FADs and provide a practical case study on anchored FAD management from an artisanal fishery to contribute to the FAO Technical Consultation on the Marking of Fishing Gears, held in February 2017.

Two tracking methods were tested: satellite buoys from Satlink and a position tracking unit from Pelagic Data Systems. The project partners were World Animal Protection, Natural Resources Consultants, and VFD with technical support from GGGI partners Pelagic Data Systems and Satlink. Field support was provided by Ocean Blue Fishing charter fishing company.

Both devices succeeded in providing real-time position data for the anchored FADs during the project period. In one instance, VFD personnel were able to track the position and successfully retrieve two

devices that had become separated from their FAD. An important takeaway from the project was that units designed to track drifting FADs at the water surface, like satellite buoys, are not able to withstand extended periods of submersion at depth that occur with anchored FADs.

Successful Strategies

- Testing marking and tracking methods for anchored FADs to prevent gear loss and facilitate gear retrieval
- Identifying and working with local leaders and champions from within the community
- Developing regionally specific ghost gear retrieval processes
- Conducting pilot projects to inform global policy processes

For more information: ***www.ghostgear.org/projects/2018/10/10/fish-aggregating-device-tracking-and-management***

Identifying alternatives to gillnets in artisanal shrimp fisheries

Alternative fishing gear trials in Baja California (WWF Mexico, GGGI Member)

Since 2016, WWF Mexico has focused its ghost gear activities in the northern Sea of Cortez, where the critically endangered vaquita (the world's smallest porpoise) is known to get entangled in lost and illegally set gillnets set to catch the totoaba – another endangered fish of approximately the same size as the vaquita, whose swim bladder is prized on the black market. The removal work involves a staggering number of partners, all bent on saving this struggling species. There are international conservation bodies, researchers, NGOs, the Mexican government (including the military), and local conservation-minded fishers all playing an important part in this work. Between 2016 and 2019 this group retrieved 62 tons of nets saving 3,400 animals alive and finding 3,100 death organisms. GGGI has supported the work in the past, with GGGI members Monterey Diving and World Animal Protection helping to locate ghost nets using side scan sonar in the first year of implementation.

"The first couple years of the project, we were removing ghost nets that had been left derelict in the sea," said

Photo credit: WWF Mexico

Emilia Marin, WWF Mexico project lead. “But now, it is mostly illegal gillnets. We effectively cleaned up the legacy ghost nets.”

The issue in this zone is not only to remove abandoned and illegal gear, but also to find alternatives to the use of gillnets. In this sense, WWF Mexico has been working with local fishers and academics from Mexico, Denmark, Sweden, the United States, Canada, Scotland, and Finland to test alternative gears that retain the needed catch efficiency but are less damaging than gillnets. “We’d love to see a gillnet free Sea of Cortez,” said Marin. The outcome has been development of several alternatives including pods for fish and suripera nets for shrimp. WWF Mexico is now expanding its work with local communities to other areas.

WWF Mexico plans to expand its work with local fishing communities in the Sea of Cortez to promote the switch from gillnets to trawls in shrimp fisheries.

Successful Strategies

- Engaging local fishers to test alternative fishing gears
- Engaging international fishing gear experts to design alternative fishing gears
- Integrating harvest economics into ghost gear solutions
- Exploring less risky gear types

For more information: *www.worldwildlife.org/species/vaquita*

Mitigation: Building evidence to inform solutions

Reducing the impact of marine litter in the form of derelict fishing gear in the Baltic Sea

Systemic solutions to ghost nets in the Baltic Sea (WWF Germany & WWF Poland, GGGI Members)

The MARELITT Baltic project was launched in 2016 to develop systemic solutions to the problems of ghost nets in the Baltic Sea. The project was coordinated by the Swedish Municipality of Simrishamn. Project partners from four countries included governments, universities, the fishing industry, diver groups, and non-governmental organizations.

The work spanned three years and included work packages focused on search and retrieval operations (led by WWF Poland), prevention (led by Municipality of Simrishamn), and processing and recycling of derelict fishing gear (led by WWF Germany and Keep the Estonian Sea Tidy). Each of these work packages was approached systematically and collaboratively with many assessments, reports, and field work.

WWF Poland started its work on derelict fishing gear in 2011, as a pilot project, during which the methodology of retrieval actions was developed in cooperation with polish fishers. In the next stage, in 2012, WWF Poland expanded the project also to Lithuania and engaged more fishing vessels as well as divers from both countries. In 2015, WWF Poland had partnered with no less than 100 fishers to remove 268 metric tons of ghost gear through searches based on interviews with fishers. When MARELITT Baltic was launched, the search was on to develop more systemic and efficient ways to locate derelict fishing gear host areas and to remove it from the sea.

Search and retrieval were carried out in close collaboration with the fisheries in each country, and hotspots were evaluated using the knowledge of fishers and divers to generate a hotspot map for efficient searches for ghost gear. The environmental impact of ghost gear retrieval operations was evaluated in an impact assessment by an external consultancy, which can be found on the MARELITT Baltic webpage.

The project also investigated, among other things, the feasibility of waste management and recycling end-of-life fishing gear and ghost gear, and conducted a survey of port reception facilities. Conferences held as part of the project shared project learnings widely throughout the region and beyond the Baltic Sea.

The final product of the project is the Baltic Sea Blueprint which compiles key takeaways and guides organizations and governments towards concrete actions to prevent and reduce harm from derelict


Photo credit: WWF Germany

fishing gear. Individual reports with recommendations for retrieval teams and policy makers are available on the MARELITT Baltic webpage.

The project demonstrated that the complex mitigation solution for derelict fishing gear is grounded in a process consisting of four key elements: mapping of sea areas where it has accumulated (with a crucial role of practical knowledge of fishers and divers), retrieval from these areas, identification of optimal recycling or waste management options for landed gear, and prevention through the improved gear marking (with the use of modern technologies, e.g. RFID marking system) and reduction of gear loss rate during fishing. It also showed that side scan sonar surveys allow more efficient locating and planning for gear removal. Finally, it highlighted how knowledge from fishers and divers is crucial to identifying search areas.

Successful Strategies

- Taking a systematic, fishery-scale approach to addressing ghost gear
- Engaging local fishers to locate and remove ghost gear
- Engaging technology experts and researchers
- Engaging professional divers for reporting and removing gear from wrecks

For more information: *www.marelittbaltic.eu*

A Nordic network of successful ghost gear solutions

Collaborating to fight ghost fishing in the Nordic (Clean Nordic Oceans)

Clean Nordic Oceans is a collaboration between partners in Norway, Denmark, Sweden, Iceland, the Faroe Islands, Finland, Åland, and Greenland (www.norden.org) to exchange knowledge and experience about strategies to reduce the effects of ghost fishing and to increase recycling of commercial and recreational fishing gear. This project builds on progress made by individual Nordic countries to reduce harm from ghost gear. A key part of the project is to exchange information about successful strategies, one of which is systematic removal of lost commercial fishing gear and better reporting systems.

The project lead, the Norwegian Directorate of Fisheries, has been implementing a lost gear location and recovery program for over 35 years and has so far retrieved over 22,000 gillnets and approximately 1,000 metric tons of other fishing gear. The focus is on locating and retrieving gillnets due to the severe impact of lost gillnets on commercial catch rates, particularly of Greenland halibut. They plan the locations of their removal work using a combination of vessel monitoring systems (VMS) data and reported losses from fishermen during the year. For the removal operations, the government hires fishing vessels and undertakes a sweep/drag retrieval operation.

Photo credit: WWF Germany (Florian Huber)

Approximately 80 percent of reported losses are removed. In 2018, 70 percent of the recovered pots and gillnets were delivered back to their owners. Remaining removed gear is recycled to the greatest extent possible through a partnership with Nofir. In 2019, removals were executed farther north than ever before, in the Svalbard zone, almost 77 degrees north. These operations removed 1,200 snow crab traps, 800 gillnets, 57,000 meters of rope, 24,000 meters of longlines, and other gear. Fishers pay a special fee that covers 70 percent of the cost of these removal operations.

The Norwegian Directorate of Fisheries also requires all fishers to recover lost fishing gear or to report any lost gear that cannot be removed. Regulations also require the fishers to report positions of fixed gear to avoid gear loss through vessel conflicts or conflicts with other fishing gear. The map of set fishing gear is online at www.barentswatch.no/fiskinfo. Successful strategies such as these have been informed by years of working with fishers to understand causes of gear loss and to develop locally relevant and feasible solutions.

Successful Strategies

- Engaging with fishers to ensure feasibility and uptake of solutions
- Sharing solutions throughout the Nordic region and building capacity for all partners in the network
- Requiring fisher reporting and retrieval of lost gear
- Implementation of dedicated fisheries management regulations to address ghost gear
- Mapping and sharing locations of set fishing gear to avoid gear conflicts as much as possible

For more information: *cnogear.org*

Curative measures: Working with fishers to remove gear and protect marine ecosystems

A comprehensive approach to preventing harm from ghost gear

Removing derelict fishing gear in Puget Sound (Northwest Straits Marine Conservation Initiative, GGGI Member)

Commercial and recreational fishing is a way of life in Washington State's Salish Sea, also known as Puget Sound. Lost fishing gear such as gillnets and crab pots are an inevitable by-product of this vibrant fishing heritage. The Northwest Straits Marine Conservation Initiative (NWSI) took on this problem in 1999. Since then, NWSI has removed, by hand, over 5,700 lost nets and over 4,500 lost crab pots. This removal effort has protected millions of animals from death by entanglement and has restored over 800 acres of marine habitat. With current gillnet loss rates estimated at less than 30 nets per year, the program is now focusing on preventing re-accumulation of lost fishing nets by managing a rapid response program aimed at removing newly lost nets quickly.

Collaborating with the NWSI in 2002, the Washington State legislature passed legislation to develop safe, effective methods to remove ghost gear and eliminate regulatory barriers to gear removal. The diver removal guidelines developed under this legislation are still used today to execute dive removal operations. Responding to the need to ensure that newly lost fishing nets do not reaccumulate in marine habitats, the State legislature mandated fisher reporting of lost nets within 24 hours. The Northwest Straits Foundation, the nonprofit partner of NWSI, developed a Newly Lost Net Reporting, Response, and Retrieval Program to respond to all reports of lost nets and mobilize removal teams when necessary. GGGI member Natural Resources Consultants is on contract to respond to all reports. Of 94 reports of lost fishing nets reported since 2012, 76 (79 percent) were located and removed.

The problem of lost crab pots is addressed differently because this gear loss is still very high (estimated at more than 12,000 pots lost each year) and the fishery has both commercial and recreational sectors.

The NWSI's work on crab pots educates recreational crabbers on how to avoid losing their pots. Several highly viewed educational videos were developed and disseminated widely, and local citizen committees work to educate crabbers at boat launches and through shared information at points of sale of crab gear. In 2015, the NWSI brought industry, fishers, resource managers, and citizens together to develop a comprehensive Puget Sound Lost Crab Pot Prevention Plan, which is currently being implemented by many partners.

"Each time we remove a piece of derelict fishing gear whether it's a crab pot or net the positive results are immediate," observes Jason Morgan, Northwest Straits Foundation Marine Projects Manager. "The restoration of over 800 acres of marine habitat and protection of millions of marine animals is one of the most important success stories for Puget Sound recovery."

The program also documented environmental and economic impacts of ghost gear, tested crab pot gear designs, and documented habitat recovery after net removal. This comprehensive approach to crab pot loss prevention and minimizing harm from lost nets through rapid response and removal is a model program that has inspired other projects globally.

Successful Strategies

- Scientific data collection on gear loss and species caught in lost gear
- Engaging fisheries managers and policymakers to create a systemic recovery program for recovering lost gear
- Engaging fishers to participate actively in gear reporting and removal
- Rapid response and retrieval to lost net reports and real time reporting
- Performing ghost gear removals
- Engaging marketers to design outreach campaign
- Engaging all fishery stakeholders in planning prevention strategies

For more information: *www.derelictgear.org*

Protecting our ocean health and biodiversity from marine debris

Disentangling sea turtles in India (WWF India, GGGI Member)

From the Eastern shores of India along the coast of Andhra Pradesh to Kerala and Goa on the West Coast, WWF India has embarked on a program to engage fishers around the causes and extent of fishing gear loss. Over the last year, WWF India has conducted more than 400 interviews with fishers and other stakeholders to better understand the ghost gear problem in India before framing solutions.

"Talk to the community, they are the ears and eyes out at sea," says project lead Ema Fatima. "We have received lots of reports of animals entangled in fishing gear, but we don't know how large the problem is or what is driving gear loss." The WWF India team is working to better characterize the problem and understand where, how, and to what extent ghost gear is causing harm to biodiversity. Surveys based on a model provided by the Olive Ridley Project (a GGGI member) were modified for the Indian context and applied with fishers, trawl owners, and the Coast Guard.

So far, the findings have been a revelation. Fishers in some areas reported losing up to ten pieces of netting every year. There are several reports of first-hand experiences of fishers encountering entangled animals from ghost gear, especially sea turtles, along the east coast of India. This area boasts the world's largest mass nesting rookery of olive ridley turtles.

"These nets and other gear help us earn our living," observed fisher Barri Nukaiyya, from Bhandharvanipeta in Srikakulam. "They are very valuable to us." Nukaiyya noted that he and other fishers sell their old nets to recyclers for a modest return. He also shared that fishers see nets entangling turtles from December to May, so they are careful to bring back their nets. Early actions for WWF are focused on encouraging reporting and removal of lost fishing gear found at sea by fishers and establishing improved disposal and collection systems within the local community for recycling, upcycling, and reuse.

WWF India is also currently carrying out a hotspot mapping project to identify geographic locations, habitat features, such as reefs and rocky beds, or ocean currents, and seasonal variations that might coincide with high reports of fishers losing gear. Future plans include ground-truthing at these identified hotspots.

This work is setting a solid stage for developing locally relevant prevention strategies and building support among fishers for tackling this issue in India.

Successful Strategies

- Engaging local fishers to identify causes/drivers for gear loss and hotspot accumulations of ghost gear
- Identifying and working with local leaders and champions from within the community
- Building on surveys developed by Olive Ridley Project
- Identifying locally specific causes of gear loss before developing solutions

Fishermen identify the kind of gear they use for fishing activities during a survey at Lawsons Bay Beach in Andhra Pradesh.

Photo credit: Myanmar Ocean Project (Thanda Ko Gyi)

Working towards a clean and healthy ocean in Myanmar

Removing ghost nets in Myanmar (Myanmar Ocean Project, GGGI Member)

Focusing on Myanmar's beautiful islands and marine parks in the Myeik Archipelago, the Myanmar Ocean Project is identifying ghost gear hotspots, gathering data, and cleaning up ghost gear from coral reefs and other sensitive habitats for the benefit of the mantas, sharks, and other marine fauna that inhabit this magical place. Project Director Thanda Ko Gyi was a research assistant for the Marine Megafauna Foundation, diving in unexplored areas of Myanmar, when she came face to face with ghost gear. "Anywhere new we dived, there were nets," said Ko Gyi. "There was no place where I didn't see them." Galvanized by concern for entangled animals, Ko Gyi began removing ghost gear with a small team. An article she wrote for the Asian online publication Coconuts.co was noticed by an alert GGGI member and Ko Gyi was connected to GGGI and Myanmar Ocean Project became a GGGI member in 2019.

With funding secured for more removal work from GGGI, World Animal Protection, and the National Geographic Foundation, the Myanmar Ocean Project ramped up its removal operations. In 2019, their team of highly skilled divers cleaned 26 sites in the Mergui archipelago, removing over 1,000 kilograms of ghost nets. Their process includes engagement with local communities by holding community meetings, presentations, and training workshops to showcase the work and discuss the ghost gear problem. "A lot of the villages we worked around were Moken villages," said Ko Gyi. "They are traditional people with a long history of free-diving for pearls and clams." The project team engaged these villagers to help identify where nets were and to mark them for later removal.

Information from their removal operations has been shared with Myanmar's Department of Fisheries and Environmental Conservation Department to inform Myanmar's adoption of the ASEAN framework on combating marine debris.

Successful Strategies

- Engaging local villagers/harvest divers to identify ghost gear hotspots
- Engaging community free divers
- Identifying and working with local champions
- Identifying local causes/drivers of ghost gear
- Ghost gear removals
- Disseminating data to inform national and regional policy

For more information: ***www.myanmarocean.org*** **and** ***www.ghostgear.org/projects/2018/11/21/gggi-project-myanmar-ocean-project-ghost-gear-removal-in-the-myeik-archipelago***

Photo credit: WWF India (Sumer Rao)

SOLUTIONS AT EVERY SCALE

Solutions to ghost gear are happening all over the world. What were once isolated efforts to solve the problem have moved into the global spotlight. Best practices are no longer theoretical but are being applied and refined throughout the seafood supply chain. A global network of organizations operating under the unifying umbrella that the Global Ghost Gear Initiative and its well-developed tools offer is actively promoting and supporting solutions. Capitalizing on this momentum, and using the GGGI BPF and the FAO VGMFG as foundations, solutions to ghost gear are being realized at every scale.

Moving forward, we must support and build upon the successful actions happening now. Continued work is needed around four pillars:

- Research and building evidence
- Policy and advocacy
- Fisheries management
- Market-based solutions

Each of these pillars is being addressed at different scales. Local projects serve as models for projects in other areas of the world and inform larger-scale approaches. Regional, national, and international commitments pave the way for local actors to implement site-specific solutions. All stakeholders along the seafood supply chain play a part in solving this problem. Seafood companies bring awareness of the issue to fish harvesters, retailers and consumers. Researchers quantify ghost gear impacts and test new types of fishing gear. And fishers apply their on-the-water expertise to prevent gear loss at the source and perfect retrieval techniques. Outreach, education, and communications weave through each of these pillars.

RESEARCH AND BUILDING EVIDENCE

More and more progress is being made to understand the ecological and economic costs of ghost gear. Estimates of harvest lost to ghost gear have been conducted in some European and American fisheries, compelling action where gear loss can be prevented and galvanizing removal operations. Research into the impacts to target, non-target, and protected species are informing species recovery plans and driving action, such as the net removal work to save the vaquita in the Gulf of California.

More and more fisheries are requiring fishers to report when gear is lost. This informs both retrieval programs and assessments of habitat and harvest impacts. Reporting is a key component of the new program in Canada and is currently required throughout the EU. The GGGI has created its global data portal – the largest database of ghost gear anywhere in the world, with hundreds of thousands of records from dozens of data partners, a map of ghost gear records, an ideal data card, a resource library with links to academic articles on ghost gear and more. The GGGI has also created their Ghost Gear Reporter app which feeds into the global data portal and have made this available in English, French, Portuguese, Spanish and Mandarin Chinese. Other global reporting of ghost gear, such as through marine debris cleanup efforts like Project Aware's Dive Against Debris App and the Ocean Conservancy International Coastal Cleanup Clean Swell App – both of which feed relevant ghost gear data to the GGGI data portal are painting a clearer picture of the global problem.

A full accounting, or mass balance, of fishing gear can help build a picture of how much gear is lost in the ocean. This occurs in Greenland, where fishers are required to account for all their gear at the end of the season. Panama and the European Union are also moving toward a full accounting of fishing gear imported and disposed of at end-of-life. Programs like this will help improve estimates of fishing gear lost, abandoned, or discarded at sea.

As important as global efforts to quantify ghost gear impacts are, local fishers and fisheries managers require site-specific data to truly embrace change, as reasons for gear loss and the subsequent impacts are often quite geographically unique. FAO is currently working to provide guidance on conducting local risk assessments as suggested in the VGMFG as well as a Global Fishing Gear Loss Study. And local stakeholders are conducting their own assessments of causes of fishing gear loss by working directly with fishers, such as WWF India's efforts, fisher surveys supported by the GGGI in Thailand (in collaboration with Thai Union), Jamaica and Grenada (in collaboration with national fisheries authorities), and fisher workshops conducted in British Columbia by GGGI members T. Buck Suzuki Foundation and Archipelago Marine Research.

Research on innovative gear technologies to mark and track fishing gear are also important. Blue Ocean Gear, Resqunit, and Pelagic Data Systems are GGGI members developing technological solutions to problems around tracking and finding lost gear and preventing ghost fishing. Research into innovative or alternative gears, such as that conducted by WWF Mexico, can help to replace high risk gears such as gillnets with lower risk options. More research on biodegradable materials, including natural fibers as in the work of the Tunacons FIP, will inform gear designs that cause less harm when they are lost. Further testing of biodegradable materials for gillnets and other gear holds promise for reducing ghost-fishing from lost nets in many other fisheries (Grimaldo, et al 2019; Kim, et al 2014).

POLICY AND ADVOCACY

The United Nations Sustainable Development Goals (SDGs) are, among other things, driving countries to pledge actions to reduce marine pollution, end hunger, ensure sustainable consumption and production and develop a circular economy. Ghost gear management clearly aligns with these efforts. International bodies, nations, and multinational seafood corporations continue to commit to solving the ghost gear problem. High-level commitments translate to on-the-ground solutions as goals and objectives are clarified. For example, in 2020, Canada created the Sustainable Fisheries Solutions and Retrieval Support Contribution Program to provide funding for ghost gear solutions both domestically and internationally. Increased funding for programs like this one and the already established NOAA Marine Debris Program and European Maritime and Fisheries Fund build local capacity to pilot and execute regionally-appropriate solutions.

Each new high-level commitment paves the way for local actors to implement site-specific solutions. Champions are finding sympathetic ears in local and national governments. GGGI members have already participated in multiple marine litter plans, including state level Marine Debris Action Plans in the United States and national marine litter actions plans in the South Pacific (Vanuatu, Solomon Islands). These efforts will continue as more countries develop Marine Debris Action Plans and the results of the capacity building workshops rolled out in 2019 become clearer.

Gilman identified 19 global and regional bodies, such as regional fishery management organizations (RFMO), that can establish binding measures for management of marine fisheries (Gilman, 2015). Other IGOs have mandates around waste management and marine litter. Ghost gear best practices are being promoted at the RFMO level and in regional bodies such as the European Union. RFMOs are driving changes in FAD management, recommending the use of non-entangling designs and biodegradable materials, the sharing of location information with fisheries managers, and end-of-life FAD recovery. Continued engagement by stakeholders advocating for the adoption of best practices to manage ghost gear at the regional, national, and local fisheries management level is critical.

Other multi-stakeholder partnerships – such as the Global Partnership on Marine Litter (GPML) driven by UNEP, the OSPAR Environmental Impact from

Photo credit: World Animal Protection

Human Activities Committee (EIHA), or the work by various stakeholders on extended producer responsibility (EPR) for fishing gear brought together by the European Commission – are also supporting and implementing best practice recommendations in their respective workstreams.

FISHERIES MANAGEMENT

At the fishery and local scale, we can promote workable solutions informed by local stakeholder involvement. This is where ghost gear prevention happens. Pilot projects demonstrating the feasibility of best practices can be scaled up and can also lead to wider adoption. The gear marking trials in Indonesia and Vanuatu conducted by the GGGI with local partners informed the eventual adoption of the VGFMG. The success of the FAD-Watch program in the Seychelles has motivated other tuna fishing companies to investigate how best to intercept FADs before they beach and harm sensitive coastal habitats. The adoption of fishing boat licensing and limits on numbers of gillnets in Panama will reduce risk of fishing net loss and serve as models for other countries in the region.

Continued outreach and promotion of the GGGI BPF and the VGMFG at the regional, national, and local fishery management level is imperative. The GGGI and FAO have held multiple regional workshops to build awareness and promote the GGGI BPF and VGMFG. Regional workshops held in Vanuatu, Senegal, Indonesia, and Panama engaged fishers, fisheries managers, and other stakeholders in total, over 200 participants from 101 countries participated in these workshops across the larger regions. Continued engagement will build more capacity to adopt best practices across regions.

Ghost fishing and ghost gear are not new problems. Their harmful impacts have been acknowledged in fisheries for decades. Common fisheries regulations requiring biodegradable cord securing escape hatches are commonplace in many shellfish trap

fisheries. These rules are designed to ensure animals can escape if the traps are lost. Other common fisheries management measures, such as marking gear for visibility and spatiotemporal separation of fishing fleets, are effective at preventing gear loss from gear and vessel conflicts. Less common fisheries regulations, such as the mandatory mapping of static gear in Norway, are designed specifically to prevent gear loss. Implementing best fisheries management measures in the GGGI BPF and the VGMFG will continue to improve managers' ability to reduce harm from ghost gear.

MARKET-BASED SOLUTIONS

Many of the largest seafood companies and retailers are joining the collective effort to reduce impacts of ghost gear under the unique GGGI umbrella. Industry influencers, like Seafood Business for Ocean Stewardship (SeaBOS) and Thai Union, are among the growing numbers of corporate and seafood company GGGI members. With this level of engagement comes real positive change along the seafood supply chain.

Eco-Certification and Sustainable Fisheries

Effectively addressing ghost gear is a component of any sustainable fishery. Ecolabel certifications are powerful marketing tools for fisheries and drive better fishing practices at all scales. The GGGI is working collaboratively with MSC – the largest certification body globally – to embed ghost gear best practices into its benchmarks. Already, Friend of the Sea, another leading certifier and GGGI member, incorporates ghost gear best practices into its program. The Aquaculture Stewardship Council, also a GGGI member, is addressing plastics, marine litter and ghost gear from the aquaculture sector in its revision process, while the GGGI is developing a BPF for the management of fishing gear in aquaculture operations to accompany its wild capture BPF.

To achieve ecolabel certification, many fisheries embark on Fisheries Improvement Projects (FIPs) that allow the fishery to work up to certification through systematic management improvements. GGGI member Tri Marine, a large tuna fishing and processing company, is participating in the Tunacons FIP testing FADs with biodegradable materials in the Eastern Pacific Ocean. Increasing inclusion of ghost gear best practices in FIPs will help harness market forces in support of global solutions.

A Word About End-of-Life Fishing Gear

In many areas of the world, end-of-life fishing gear presents a disposal problem for fishers. Where disposal is challenging, expensive or unavailable, gear is either piled up in storage or discarded illegally, either on land or in the sea. The former result is easy to identify (nets in Dutch Harbor, Alaska, for example) but the latter result is less obvious, and few fishers will admit to dumping end-of-life fishing gear in the ocean as a last resort.

Solutions to this problem include improving access to and affordability of appropriate disposal and recycling facilities by improving port waste reception and by developing recycling options. FAO is actively working with the International Maritime Organization (IMO) to improve guidance on port waste facilities to ensure that adequate facilities are available to fishers around the world. The European Commission is embarking on a progressive directive to harmonize port reception facilities, expand fishing gear recycling, and establish EPR for fishing gear. The Circular Ocean Project, led by the Environmental Research Institute (Scotland), is creating incentives and developing design solutions for upcycling end-of-life fishing gear. Such progressive actions move beyond just ghost gear solutions and encompass the larger problem of ocean plastics from the fishing industry.

Improvements in recycling are growing as private industry recognizes the value of fishing gear. Innovative fishing gear recycling and upcycling programs, such as Healthy Seas, Bureo, Olive Ridley Project, and Plastix are building successful models on which others can build. Solutions for artisanal fishers in less developed regions, such as the Bureo and WWF Peru project, where recycling and disposal services provided to artisanal fishers are subsidized by income generated through recycling of commercial fishing gear in addition to community programs being set up, are an inspiring example of what is possible when all stakeholders work together.

THE PATH FORWARD

The world's fisheries are varied and complex, reflecting the unique environment and culture of each region. While the main global causes of fishing gear loss and its harmful impacts are known, the global impact is yet to be quantified, and the drivers behind gear loss are often unique to each geography or management regime. Accordingly, ghost gear solutions must also be site-specific while drawing from global best practices. The solutions outlined in this report illustrate solutions at multiple scales, from international approaches to regional policies and local fishing practices, showing progress at each point along the seafood supply chain.

Collective action to solve this global problem has grown exponentially in the last few years. Seafood stakeholders at all levels, including fish harvesters, global fishing companies/retailers, IGOs, NGOs, researchers and small fishing communities, continue to step up and take action to reduce and eliminate ghost gear. The GGGI and Ocean Conservancy will continue their commitments to solve this problem globally, by continuing to bring key stakeholders together and function as the global leader, one-stop-shop and clearinghouse of tools, information, science and best practices on ghost gear solutions, while WWF remains committed to continue innovative projects and support capacity-building, research, outreach, and advocacy efforts. When aligned with a specific goal, humanity is capable of great things. Together, we can help solve this challenge and make the ocean cleaner and safer for all.

Photo credit: World Animal Protection

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