Assessment And Mitigating of Ghost Fishing Mortality And Its Impacts

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Abstract:
Ghost fishing refers to the phenomenon where abandoned, lost, or discarded fishing gear continues to trap and kill marine organisms, leading to significant ecological and economic consequences. To mitigate the impact of ghost fishing on marine ecosystems, fishers can adopt various strategies and practices. It is an unintended consequence of modern fishing practices, is a significant threat to marine life and the health of our oceans. Lost or abandoned fishing gear, also known as ghost gear, continues to trap and kill marine creatures indiscriminately, resulting in a never-ending cycle of death and destruction underwater.

Keywords: fishing, marine, fishers, impact, practices, ecosystems

Introduction:
"Ghost fishing" is a part of the global marine debris issue that impacts marine organisms and the environment. Lost or discarded fishing gear that is no longer under a fisherman's control becomes known as derelict fishing gear (DFG), and it can continue to trap and kill fish, crustaceans, marine mammals, sea turtles, and seabirds. The most common types of DFG to ghost fish are gillnets and crab pots/traps, with longlines and trawls less likely to do so. Ghost fishing can impose a variety of harmful impacts, including: the ability to kill target and non-target organisms, including endangered and protected species; causing damage to underwater habitats such as coral reefs and benthic fauna; and contributing to marine pollution. Factors that cause gear to become DFG include poor weather conditions, gear conflicts with other vessels or bottom topography, gear overuse, and too much gear being used.

What is ghost fishing?
Ghost fishing refers to lost or abandoned fishing gear, also called derelict fishing gear (DFG), that continues to capture fish and other marine animals after the gear is no longer under the control of a fisherman[1]. The most common types of DFG to ghost fish are gillnets and crab pots/traps, but other types of fishing gear, like longlines and trawls, can also ghost fish if they become DFG. Although the original intent of each is to capture a particular "target" species, whether for commercial or recreational use, derelict fishing gear can continue to fish for target as well as non-target species (called ghost catch) after it is lost, broken, or discarded. For example, a crab trap may break loose from its buoy in bad weather and continue to trap crabs, which may then act as bait themselves and attract other fish or species not originally intended for capture. Ghost fishing specifically implies that the organisms caught in the DFG die as a result of starvation, predation, or cannibalism [1]. This means that just because an organism enters a piece of DFG, also known internationally as abandoned, lost or otherwise discarded fishing gear (ALDFG), the gear is not necessarily ghost fishing unless mortality occurs. The time over which DFG can continue to ghost fish can vary according to the specific gear type, but can range from days to years. Over the course of its lifespan, a piece of DFG may kill large numbers of commercially valuable or threatened species[2]. This ghost fishing phenomenon is a part of the global marine debris issue that impacts marine organisms and the environment. Ghost fishing can impose a variety of harmful impacts, including: the ability to kill target and non-target organisms, including endangered and protected species; causing damage to underwater habitats, like coral reefs and benthic fauna; economic losses from target species mortalities and replacement costs; and contributing to marine pollution.
There are many ways that fishing gear can become derelict, and more than one of the following can be contributing factors:
1. Environmental: storms, wave action or currents, sedimentation, ice cover, deep-water conditions
2. Gear conflict: entanglement with other vessels or bottom topography such as reefs or rocky bottoms
3. Gear condition: breaks loose/cut loose (intent can be accidental or deliberate) due to old age/overuse;
4. Inappropriate disposal at sea

The Threat of Ghost Fishing

Ghost fishing is an insidious threat that lurks beneath the surface of our oceans. It occurs when fishing gear, such as nets, lines, and traps, is either accidentally lost or intentionally left behind by fishermen. This abandoned gear continues to entangle marine animals, leading to prolonged suffering, starvation, and eventual death.

- **Extent of the problem:** Ghost fishing affects all marine ecosystems worldwide. According to the United Nations Environment Programme, ghost gear accounts for 10% of all marine litter, with an estimated 640,000 tons present in our oceans.
- **Impacted species:** All marine species are susceptible to ghost fishing, including fish, marine mammals, turtles, and crustaceans. Whales, dolphins, and seals are particularly vulnerable due to their curious and inquisitive nature.
- **Environmental impact:** Ghost fishing not only harms marine life, but it also disrupts entire ecosystems. Marine litter, including ghost gear, damages habitats such as coral reefs and seagrass beds, affecting the biodiversity and health of these fragile ecosystems.

Key Takeaways

Ghost fishing poses a severe threat to marine life and ecosystems worldwide. By uniting divers against this harmful practice, we can make a significant impact on the preservation of our oceans:

- Ghost fishing occurs when fishing gear is lost or abandoned in the ocean, trapping and killing marine species indiscriminately.
- Globally, ghost gear accounts for 10% of marine litter, with approximately 640,000 tons present in our oceans.
- Marine life, including whales, dolphins, and seals, suffer extensively due to ghost fishing.
- Ghost fishing disrupts ecosystems, damaging habitats like coral reefs and seagrass beds.
- The global initiative unites divers to raise awareness, remove ghost gear, and promote responsible fishing practices.
- The ""Diving Against Debris"" program empowers divers to physically remove debris, collect data, and educate others.
- By joining forces, divers have a direct impact, a global reach, and serve as ocean ambassadors, inspiring action and change.

As responsible individuals, it is crucial that we support and participate in this global initiative. Together, we can put an end to ghost fishing, protect our marine ecosystems, and ensure a sustainable future for generations to come.

Occurrence:

Anywhere fishing gear is deployed, there is the potential risk for ghost fishing, and thus DFG can enter marine systems at a variety of locations worldwide. On this global scale, drifter experiments have shown five main areas where marine debris tends to accumulate which are known as convergence zones[3]. The ocean currents and prevailing winds concentrate water masses into these specific regions, and marine debris, including DFG, can likewise be concentrated there. One such “hot spot” of DFG accumulation with documented ghost fishing in the U.S. is the Northwestern Hawaiian Islands (NWHI). This hot spot is due to a concentration of ocean currents in an area known as the North Pacific subtropical convergence zone. DFG accumulated in this zone leads to the coasts and coral reefs of the islands, which has resulted in ghost fishing[4-7]. The DFG that are mostly responsible for ghost fishing in this area may originate from various current drift net fisheries from North Pacific Ocean fisheries, or may be decades-old remnants of Japanese, Korean, and Taiwanese fleets lost prior to high-seas drift net bans in the early 1990s [8-9]. Since 1996, NOAA’s National Marine Fisheries Service, NOAA’s National Ocean Service, and other state and federal organizations have removed hundreds of tons of derelict nets from the NWHI’s coral reefs in an effort to restore fragile habitats and reduce the impact on the local marine fauna.

The Role of Ghost Net Recovery and Salvage Efforts:

Recognizing the immense threat of ghost nets, several organizations and initiatives have emerged around the world to recover and salvage these hazardous fishing gears. These efforts are not only important for animal welfare but also contribute to significant ecological restorations. Let's explore some key features and advantages of ghost net recovery initiatives:

- **Preventing Animal Entanglement:** The primary goal of ghost net recovery initiatives is to remove these abandoned nets from the ocean, reducing the risk of marine animal entanglement and alleviating their suffering.
- **Restoring Marine Habitats:** By removing ghost nets, these initiatives help in conserving critical marine habitats and coral reefs, enabling the recovery of damaged ecosystems and promoting biodiversity.
- **Recycling and Waste Management:** Salvaged ghost nets can be recycled into various products such as clothing, accessories, and even new fishing equipment. This not only reduces plastic waste but also supports sustainable practices.
- **Community Engagement:** Many ghost net recovery projects involve collaboration with local communities, raising awareness about the importance of marine conservation and promoting responsible fishing practices.

Impacts of Ghost Fishing:

There are a wide variety of impacts that ghost fishing can have, including the DFG responsible for ghost fishing being a type of marine pollution, but three in particular stand out. Although the most obvious is the mortality of organisms in

DFG, damage can also be done to the habitat in which DFG becomes lost, and economic losses are also a consequence of ghost fishing.

Habitat

Fisheries operate in many different types of habitats in order to capture their target species, whether it is along the coast in shallow waters, or further offshore in open ocean (pelagic) areas. Coral reefs, like those in Hawai‘i, are one type of habitat that can be impacted by ghost fishing, not only by the loss of organisms dying in DFG, but the physical damage done by the gear itself. This can occur when DFG such as lobster pots or bottom trawls sink or get dragged along the reefs by currents and storm action, which can destroy fragile corals and their associated inhabitants. Another habitat type that can be susceptible to impacts from DFG and ghost fishing is the benthos[10]. These ocean bottom regions, although generally remote in location, can still be damaged significantly when DFG, especially trap gear, sinks to the bottom where it can smother organisms that live on top of and just below the sediments, like seagrasses, crabs, and worms.

Species Mortality

One of the most significant ghost fishing impacts of DFG is the unintended deaths of target and non-target species, which contribute to the overall depletion of populations. DFG that begins ghost fishing poses a threat to a variety of non-target fish, turtles, seabirds, whales and seals[11-14]. This is especially problematic when endangered or protected species including marine mammals and sea turtles die as a result of ghost fishing.

Economic

It is difficult to gauge accurate total costs associated with ghost fishing, as this varies across specific fisheries, and can depend on the gear type, weather, and ghost catch rates, among other factors. Questions that make calculating economic impacts difficult include:

- At what rate is trap gear lost annually?
- How long exactly can trap gear continue to ghost fish?
- How effective is the trap gear at ghost fishing?
- How is a value placed on the loss of both commercial AND non-commercial species?
- What are the costs of DFG on the environment?

Environmental Consequences: The Hidden Danger of Ghost Fishing

Ghost fishing occurs when abandoned or lost fishing gear continues to trap and kill marine animals. This gear can include nets, lines, traps, and other equipment that has been discarded or accidentally left behind by fishermen. These unattended fishing gears may remain active in the ocean for years, trapping and killing large numbers of marine life including fish, turtles, birds, and even marine mammals.

The Scale and Impact of Ghost Fishing

The scale of ghost fishing is astounding. The World Animal Protection estimates that ghost nets alone account for 10% of all marine litter, weighing approximately 640 thousand tons. This staggering amount continues to accumulate, posing a significant threat to marine ecosystems and the biodiversity they support.

The impact of ghost fishing extends beyond the loss of individual marine animals. It disrupts entire food chains, leading to imbalances in ecosystems. When large numbers of fish and other marine organisms are needlessly killed, it affects predator-prey relationships and can lead to the collapse of fish stocks. This not only affects marine life but also has severe economic consequences for fishing communities that depend on these resources for their livelihoods.

The Causes and Solution

Ghost fishing can be attributed to various factors:

- Accidental gear loss: Rough seas, storms, or conflicts with other vessels can result in fishermen losing or abandoning their gear.
- Illegal, unreported, and unregulated (IUU) fishing: Unscrupulous fishermen intentionally abandon gear to avoid detection and prosecution.
- Inadequate waste management: Poor waste management practices in the fishing industry can contribute to gear ending up in the ocean.

Addressing ghost fishing requires a multi-faceted approach:

- Raising awareness: Governments, NGOs, and fishing communities must educate fishermen about the impact of ghost fishing and the importance of responsible fishing practices.
- Improved gear technology: The development of biodegradable fishing gear and gear with escape mechanisms can help mitigate ghost fishing incidents.
- International collaboration: Cooperation between countries is crucial to combat ghost fishing. Collaboration can involve sharing best practices, monitoring fishing activities, and enforcing regulations.

The Role of Technology

Technology has a pivotal role to play in mitigating ghost fishing:

- Satellite tracking: Satellite technology can be used to monitor fishing vessels and track their activities, alerting authorities to potential ghost fishing hotspots.
- Underwater drones: Drones equipped with cameras and sensors can be deployed to detect and locate abandoned fishing gear, allowing for targeted removal efforts.
- Data analytics: By analyzing fishing patterns and identifying high-risk areas, data analytics can help predict and prevent ghost fishing incidents.

Reducing the Impact of Ghost Fishing on Marine Ecosystems

Ghost fishing refers to the phenomenon where abandoned, lost, or discarded fishing gear continues to trap and kill marine organisms, leading to significant ecological and economic consequences. To mitigate the impact of ghost fishing on marine ecosystems, fishers can adopt various strategies and practices:

1. Gear Modification and Innovation

Fishers can modify their fishing gear to reduce the likelihood of it becoming lost or abandoned. This can include using biodegradable materials for fishing nets and ropes, which break down over time and minimize the persistence of ghost gear in the environment. Additionally, incorporating escape panels or weak links in fishing gear can allow trapped marine organisms to escape, reducing unintended catch and ghost fishing.

2. Responsible Fishing Practices

Adopting responsible fishing practices can help minimize the occurrence of ghost fishing. This includes properly disposing of old or damaged fishing gear, ensuring it is not left behind in the marine environment. Fishers can also implement regular gear maintenance and inspection routines to identify and repair any damaged gear, reducing the chances of gear becoming lost or abandoned.

3. Education and Awareness

Increasing awareness among fishers about the impacts of ghost fishing is crucial. Providing education and training on the proper handling and disposal of fishing gear can help prevent unintentional ghost fishing. Fishers can also be encouraged to report lost gear to relevant authorities, enabling timely retrieval and reducing its potential impact on marine ecosystems.

4. Collaboration and Technology

Collaboration between fishers, researchers, and policymakers is essential for developing effective strategies to reduce ghost fishing. By sharing knowledge and experiences, stakeholders can work together to develop innovative technologies and practices that minimize the impact of ghost fishing. This can include the use of GPS tracking systems to locate and retrieve lost gear, as well as the development of gear recycling programs to ensure responsible disposal.

5. Monitoring and Enforcement

Regular monitoring and enforcement of fishing regulations are crucial to combat ghost fishing. Implementing strict penalties for illegal or irresponsible fishing practices can serve as a deterrent and encourage compliance. Additionally, establishing surveillance programs and conducting regular assessments of fishing gear in marine environments can help identify areas prone to ghost fishing and inform targeted mitigation efforts. By implementing these strategies, fishers can play a vital role in reducing the impact of ghost fishing on marine ecosystems, contributing to the long-term sustainability of our oceans and the preservation of marine biodiversity.

The Gear

There are a variety of fisheries, usually categorized by what target species they are trying to catch specifically and by their scale of operation. Industrial and commercial fisheries operate on a broad scale requiring large boats and lots of gear (e.g., the Gulf of Mexico shrimp trawl fishery). Small-scale fisheries use smaller boats and less gear, like artisanal or recreational/sport fisheries. No matter what type of fishery it is, all run the risk of gear potentially becoming DFG. The types of DFG most often cited for ghost fishing are, in the order of prevalence and amount of available information [15].

Gillnets and pots have been the most documented gear types to date regarding ghost fishing, and this paper therefore concentrates on their loss rates, species mortalities, and mitigation efforts.

Figure : Several examples of different types of derelict fishing gear, from (a)gill nets, (b)to pots /traps.

Final Thoughts:

The main conclusions for this summary paper are the following:

• Ghost fishing contributes to increased mortalities in a wide variety of marine organisms and is especially damaging to endangered and protected marine species, such as marine mammal and sea turtle populations. It remains difficult to determine accurate ghost fishing catch rates, and future efforts should focus on standardizing field methods and metrics. Combating lost fishing gear in the deep sea is a complex challenge that requires innovative solutions and collective action. The magnitude of the problem demands immediate attention and the implementation of strategies that address prevention, retrieval, and responsible disposal. By developing and adopting these innovative solutions, we can contribute to the preservation of marine life, the protection of ecosystems, and a more sustainable future.

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