



Ghost gear: The most dangerous marine litter endangering ocean

Suman Nama¹✉ and Suchismita Prusty²

¹Fisheries Resources Harvest & Post-Harvest management division, ICAR-Central Institute of Fisheries Education, Mumbai, India;

²Fisheries Economics, Extension, and Statistics Division, ICAR-Central Institute of Fisheries Education Mumbai, India.

Article History

Received:

22nd April 2021

Accepted:

8th May 2021

✉ Corresponding Author

For more details mail us @ editor.fsr@gmail.com

ABSTRACT

Lost, abandoned, or discarded fishing gear is commonly called ghost gear is having an inevitable environmental, social and economic impact, which we never see or consider. The lost gear keeps catching marine fauna, including mammals, fishes, crabs. This undermines the sustainability and economic returns of fishers as part of their harvest are lost. Ghost gear also damages suitable marine habitats such as coral reefs, seagrass beds, and benthic algae. As a result, we are losing the keystone species from marine habitat. While the problem is known for decades, in the last few years only we have begun to understand the extent of the issue, and many international instruments have been made to mitigate the problem. However, the existing instruments are not performing up to a great extent to address all the issues. We need to take strict enforcement and management strategies to reduce the harmful impacts of ghost gear. In this regard, much government needs to create mass awareness among the fisheries around the globe. We can also adopt mitigation options such as biodegradable materials for gear making and gear marking systems to minimize ghost fishing.

Keywords: ghost gear, sustainability, keystone species, biodegradable materials.

Every year, millions of tons of gear are lost due to accidentally fishing pressure and environmental causes. However, we hardly understand the harmful impacts of lost fishing gear; even fishers rarely grasp it. Nevertheless, the harmful impacts of ghost gear exist for decades; in the last few years, we understand its breadth and scale. Every year 6.4 million tonnes of fishing gear are left in oceans and seas (UNEP, 2005). In the Salish Sea, over 5,400 animals of 40 different species, including marine mammals, elasmobranchs, and reptiles, are being caught in ghost gear (Stelfox *et al.*, 2016). (Sheavly, 2005) found that material collected from UK and US beaches at least 14 % and 10 % respectively was rope, fishing nets, and line. A summary report suggested that 90 % of marine debris entering the coastal regions of northern Australia is related to fishing, especially prawn trawlers.

Ghost gear is dangerous for seals and sea lions. 1500 Australian sea lions die annually by entanglement with a gill net. When comparing fixed gear with mobile gears, mobile gear has much higher impacts on non-target species catch, discards, habitat, and biodiversity damage. Whereas actively fishing fixed-gears are very selective and have negligible habitat impacts. However, marine mammals and sea birds may get entangle as net fragments

are washed inshore. Lost fishing gear is most likely to prove a lethal form of marine plastic debris, and its impacts 50% of seabirds, 66% of marine mammals, and all species of sea turtles (Wilcox *et al.*, 2016). Richardson *et al.* (2019) estimated that 29% of all fishing lines, 8.6% of traps and pots and 5.7% of all fishing nets used globally are lost or discarded into the aquatic environment. Fisher-reported current fisheries management regimes and market forces are responsible for gear loss during lousy weather, influencing fisher behavior.



Fig 1: Harbor Seal entangled in fishing net

Source: <https://ndla.no/>



We need to create mass awareness to prevent fishing gear loss with regulations, education and voluntary measures. Prevention measures include marking fishing gear and restricting the use of gear in certain seasons or areas. Although some fishing gear will get lost, an adaptation of mitigation measures, including biodegradable materials for gear making, is one effective way to prevent harmful impact ghost fishing (Barnard, 2008; Bilkovic *et al.*, 2012). One document was created for the Catalyze and Replicate Solutions Working Group of the Global Ghost Gear Initiative (GGGI). The document aims to help prospective solutions project managers by providing a general overview of methods and techniques used globally to locate abandoned, lost, or otherwise discarded fishing gear (ALDFG) in marine habitats.

The document describes several methods used, provides general techniques, benefits and limitations of the methods, and provides contact information of individuals and entities experienced in the methods. It is necessary to identify the drivers and root causes of loss and abandonment of fishing gear if we want to implement effective long-term strategies to reduce the problem of ghost gear (Antonelis, 2013). We need to have an international treaty to tackle the issues of ghost gear and plastic pollution. Although we have some international institutes, they are fragmented and ineffective. More than 1.8 million people from 40 different countries already joined a global agreement to beat marine plastic pollution. We need more support from effective global governance; NGOs form a new UN treaty to beat marine plastic pollution, including ghost gear.

Potential threats of Ghost gear

Ghost gear may have an impact on the aquatic environment in several ways, including;

- Continued catching of target and non-target fish and shellfish species.
- Entanglement of marine mammals, sea birds, and sea turtles.
- Physical impact on the benthic environment.
- Ghost gear becomes a navigation hazard and threatening the life security of mariners.
- Ghost gear may spoil the natural beauty of aquatic habitat and affect the tourism industry.
- Ghost gear affects the sensitive habitat, including seagrass beds, coral reefs, macroalgae, and mangroves that play a vital role as a nursery ground for numerous commercially essential species .

- It can interfere with fishing operation, damage fishing boats, contaminate beaches and commercial harbors
- Disturb the benthic habitat of sessile animals, builds up sediment, damages vegetation (Consoli, 2019).
- 'Vaquita,' the world's smallest porpoise, is now in the merge of extinction due to entanglements with lost gill nets (Crosta & Sutherland, 2017).
- Causes Lead pollution from sink lines used in gillnets.

Causes of fishing gear loss

Direct causes

- Accidental loss of gear due to extreme environmental conditions such as low ground and extreme weather
- Deliberate disposal at sea due to spatial pressure (Misplaced gear, Gear conflict, and damage gear)
- Deliberate gear due to operational/ economic pressure (too much gear for space and time)
- Non -retrieval of gear due to enforcement pressure (IUU fishing)

Indirect causes

- Lack of gear/waste disposal facilities
- Inaccessible onshore gear/waste disposal facilities
- Expensive onshore gear/waste disposal facilities

How much fishing gear becomes ghost gear

It is estimated that fishing waste (ghost gear) contributes up to 10% of marine litter, which means every year, somewhere between 0.5 to 1 million tons of fishing gear entering the oceans (Jambeck *et al.*, 2015).

Table 1: Details of types and quantity of gear entering the world ocean

Area/Country	Types of gear	Amount/quantity	Duration	Author
South Korea	Traps	11436 tons	Every year	Kim <i>et al.</i> , 2014
South Korea	Gillnet	38535 tons	Every year	Kim <i>et al.</i> , 2014
Chesapeake Bay	Blue crab traps	16000 tons	2004-2008	Angstadt & Hershner, 2008
Canada	Gillnet (Halibut fisher)	70 km	Five year	Treble & Stewart, 2010
Baltic Sea	Gillnet	5500-10000 pieces	Every year	Szulc <i>et al.</i> , 2015
Western Central Pacific Ocean	Drifting FADs	5% (>1300 pieces)	2016-2017	Escalle <i>et al.</i> , 2019



Types of gear causing the most ghost fishing

Gillnet

Gillnet is a passive gear mostly made of monofilament and operated at different water depths. The lost net keeps on fishing even after the net falls apart in the ocean.

Pot and Traps

It is one of the most dangerous ghost gears. It operates by using bait to trap fishes. The use of biodegradable materials for making traps and gear marking can be the best way to reduce fishery impacts.

Fishing aggregating devices (FADs)

FADs are made from old purse seines and wrapped around the rafts to attract the fishes. The annual loss of FADs is estimated from 45000-100000 (Baske *et al.*, 2012).

Hooks and line

Hooks & line are widely used to catch the big sized targeted species, but if they are lost can have detrimental impacts on the ecosystem since they keep catching sea turtle, mammals.

Trawl nets

Trawl nets get lost when they are operated in the rocky substrate and coral reef areas. This gear cannot catch more fishes like other gear, but it can still entangle octopus crabs.

Purse seine

It is mostly lost accidentally while operating. This heavy gear sinks at the sea bottom. Since it does not have a large mesh size, it catches small animals and can affect others' biodiversity.

The economic cost of ghost gear

Lost gear continues to capture marine animals indiscriminately, but the targeted one is the most prominent ghost fishing victim. In Puget, 178874 harvestable crab values of US\$ 744296 were lost due to the loss of crab traps in one season. Harvest of blue crab increases up to 13504 tons valued at US\$ 21.3 million after removing 34408 lost crab traps over six years.

Methods to locate ghost gear

Scientists and fisheries authorities worldwide use the following methods to detect and remove ghost gear from the world ocean, including Sonar survey, Underwater visual survey, Dragging or grappling survey,

Surface visual survey, Fisheries data, and local knowledge.

Management and mitigation of Ghost gear

Retrieval gear from the fishing ground after it is lost is the only guaranteed method to eliminate ghost fishing. We need to adopt practical actions to reduce ghost gear impacts through collaborations between governments, fishers, NGOs, researchers, ports, and intergovernmental organizations. More than 100 organizations alliance and formed the Global Ghost Gear Initiative (GGGI) in 2015 to eliminate ghost fishing at an international level. There are several strict guidelines we have to follow to mitigate ghost fishing, including;

- Adopt Best Practice Framework (BPF) for Fishing Gear management and the Management of Fishing Gear (FAO), serve as comprehensive and progressive guides to assess and manage fishery-specific ghost gear problems.
- Joining the Global Ghost Gear Initiative (GGGI): It is the only global organization to provide critical technical support to the national fisheries to address ghost gear problems.
- Establish a new treaty/organization to address marine plastic pollution since this problem cannot be solved on a national or regional level.
- Design and manufacture of traceable and recyclable fishing gear.
- Design and manufacture of gear with biodegradable materials that are not harmful if lost.
- Report of lost fishing gear to the respective fisheries department/ authorities and GGGI App2.
- Retrieval of lost fishing gear; Fishers should carry well-trained crew members and retrieval equipment on board for safe retrieval.
- Share expertise to prevent fishing gear loss; the authority can provide training to new fishers to avoid fishing gear loss and create awareness about ghost gear's environmental impacts.
- Engage with government representatives to acquire more information about the ghost gear and learn the methodologies to mitigate it.
- Interact with fishing gear manufacturing industries and users to demonstrate the problem related to ghost gear.

International Framework and their role in prevention and mitigation of ghost gear

Several international organizations took the lead role to solve the problems arising from ghost fishing, including;



The United Nations Convention on the Law of the Sea (UNCLOS)

UNCLOS sets out the legal framework to protect and conserve the marine environment. Article 194 of UNCLOS share key management policies for State regulation of fishing gear by providing license of fishing equipment.

Convention for Prevention of Marine Pollution (MARPOL)

MARPOL is a crucial global organization worked against pollution at sea from ships. MARPOL Annex V120 obliges governments to prevents garbage pollution from ships, e.g., prohibited dumping of gear into the ocean.

Code of Conduct for Responsible Fisheries (CCRF)

123 is a voluntary international instrument that provides the legal framework for responsible fishing activities, including retrieval and management of abandoned or lost fishing gear for fisheries' sustainable development.

United Nations General Assembly (UNGA) Sustainable Development Goals (SDGs)

UNGA adopted 17 integrated SDGs with the aim of economic, social, and environmental sustainability and SDG 14 aims to conserve and sustainable use of marine resources.

United Nations Fish Stocks Agreement (UNFSA)

UNFSA was formed to Conserve and Manage Highly Migratory Fish Stocks and straddle Fish Stocks. Article 5(f) includes regulations for States to minimize catch by lost or abandoned gear. Article 18(3)(d) includes fishing gear marking systems for identification and detection when lost.

Significant gaps and challenges to manage ghost fishing

- Lack of harmonized and uniform binding standards at the international level to mitigate plastic pollution, including lost gear.
- Lack of global standards communication for monitoring, reporting, and research of ghost gear.
- Lack of international alliance efforts to address and assess ghost gear's extent in the marine environment and strict enforcement mechanisms.
- Lack of awareness about the environmental and socio-economic impact of ghost gear.

- Lack of interest of the governmental, inter-governmental, and NGOs to address the impact of ghost gear.

Conclusion

Ghost gear harms the marine environment and threatening marine biodiversity. We need to find the root causes of gear loss through a personal interview to develop effective strategies to prevent gear loss. Regional fisheries management organizations (RFMO) and global policies can play a crucial role in preventing and mitigating ghost gear through binding policies and voluntary measures to combat ghost fishing. Need to adopt preventive and mitigation measures, including binding measures, use of biodegradable materials, creating awareness at local, regional, and international levels. Apart from that, we need to create an International treaty with clear responsibilities and ambitions to prevent and reduce ghost gear. However, perhaps the most crucial measure to prevent ghost gear's impact would be implementing a strict code of conduct to reduce gear loss from gear interaction and theft.

References

- Angstadt, K., Hershner, C. (2008). The Effects of Derelict Blue Crab Traps on Marine Organisms in the Lower York River, Virginia. *North Am. J. Fish. Manag.* 28, 1194–1200. <https://doi.org/10.1577/M07-014..>
- Antonelis, K.L. (2013). Derelict Gillnets in the Salish Sea: Causes of Gillnet Loss, Extent of Accumulation and Development of a Predictive Transboundary Model. Unpublished master's thesis. University of Washington.
- Barnard, D.R. (2008). Fishery Data Series No. 08-05 Biodegradable Twine Report to the Alaska Board of Fisheries.
- Baske, A., Gibbon, J., Benn, J., Nickson, A. (2012). Estimating the use of drifting Fish Aggregation Devices (FADs) around the globe, Pew Discussion Paper.
- Bilkovic, D.M., Havens, K.J., Stanhope, D.M., Angstadt, K.T. (2012). Use of Fully Biodegradable Panels to Reduce Derelict Pot Threats to Marine Fauna. *Conserv. Biol.* <https://doi.org/10.1111/j.1523-1739.2012.01939.x>
- Consoli, P., Romeo, T., Angiolillo, M., Canese, S., Esposito, V., Salvati, E., Scotti, G., Andaloro, F., Tunesi, L. (2019). Marine litter from fishery activities in the Western Mediterranean Sea: The



- impact of entanglement on marine animal forests. *Environ. Pollut.* 249, 472–481.
- Crosta, A. y K. Sutherland (2017). Investigating the Southeast China Totoaba Maw Trade as this Traditional Product is Causing the Extinction of Both the Vaquita and the Totoaba. Elephant ActionLeague (EAL).
- Escalle, L., Phillips, J.S., Brownjohn, M., Brouwer, S., Gupta, A. Sen, Sebille, E. Van, Hampton, J., Pilling, G. (2019). Environmental versus operational drivers of drifting FAD beaching in the Western and Central Pacific Ocean. *Sci. Rep.* 1–12.
- Jambeck, J. R., Geyer, R., Wilcox, C., Siegler, T. R., Perryman, M., Andrady, A., ... & Law, K. L. (2015). Plastic waste inputs from land into the ocean. *Science*, 347(6223), 768-771.
- Kim, S.G., Lee, W.I.L., Yuseok, M. (2014). The estimation of derelict fishing gear in the coastal waters of South Korea: Trap and gill-net fisheries. *Mar. Policy* 46, 119–122.
- Richardson, K., Hardesty, B. D., & Wilcox, C. (2019). Estimates of fishing gear loss rates at a global scale: A literature review and meta-analysis. *Fish and Fisheries*, 20(6), 1218-12310.
- Sheavly, S.B., 2005. Marine debris—an overview of a critical issue for our oceans. *Presentation at Sixth*.
- Stelfox, M., et al. (2016) A review of ghost gear entanglement amongst marine mammals, reptiles and elasmobranchs, *Marine Pollution Bulletin*.
- Szulc, M., Kasperek, S., Gruszka, P., Pieckiel, P., Grabia, M., Markowski, T. (2015). Removal of Derelict Fishing Gear, Lost or Discarded by Fishermen in the Baltic Sea: Final Project Report. WWF Poland.
- Treble, M.A., Stewart, R.E.A. (2010). Impacts and risks associated with a Greenland halibut (*Reinhardtius hippoglossoides*) gillnet fishery in inshore areas of NAFO Subarea 0. *Can. Sci. Advis. Secr. Res. Doc.* 032, i–v, 1–18.
- UNEP Regional Seas Programme, UNEP. Mediterranean Action Plan, Secretariat of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes, Their Disposal, UNEP/GPA Coordination Office and Intergovernmental Oceanographic Commission, 2005. *Marine Litter: An Analytical Overview*.
- Wilcox, C., Mallos, N. J., Leonard, G. H., Rodriguez, A. & Hardesty, B. D. (2016). Using expert elicitation to estimate the impacts of plastic pollution on marine wildlife. *Mar. Policy* 65, 107–114.