Marine Litter from Fisheries in the Gulf of Mannar and Palk Strait

KNOWLEDGE BASIS AND RECOMMENDED AVENUES FOR CHANGE

Summary Report

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About the project partners:

SALT is a Norwegian private advisory and research enterprise based in Norway. SALT specializes in services related to enabling sustainable marine environments and coastal communities.

Lanka Environment Fund (LEF) is a not-for-profit organization established in 2019 in Sri Lanka. The aim of the Fund is to support existing conservation and environmental initiatives with their work and to foster a sense of stewardship of the island's exceptional beauty and natural value.

International Union for Conservation of Nature (IUCN) Sri Lanka is a membership union uniquely composed of both Government and Civil Society organizations serving in Sri Lanka for more than 30 years. IUCN is an organization dedicated towards safeguarding the environment by supporting sustainable natural resource management initiatives covering conservation and management of critical habitats, policy/legal and institutional support and environmental education and awareness.

Suganthi Devadason Marine Research Institute (SDMRI) is a research and higher education organization, based in Tamil Nadu, India. Research is focused on the needs of marine and coastal ecosystems in India; to promote higher education in marine science; and to enhance societal involvement in marine resource conservation and to assist the coastal folk in the improvement of socio-economic conditions.

Summary:
Marine Litter from Fisheries in the Gulf of Mannar and Palk Strait

Knowledge Basis and Recommended Avenues for Change

About this document

In this document, we summarize the results of a study on marine litter from fisheries in the Gulf of Mannar and the southern section of Palk Bay conducted between November 2021 and August 2022. These sensitive marine areas in India and Sri Lanka have a high ecological value, with several marine protected areas containing rich biodiversities, and form critical economic zones to sustain the livelihoods of local communities. We build on new data and knowledge and draw upon existing literature to describe the challenges and potential solutions to marine litter from fisheries, particularly the amount of abandoned, lost or otherwise discarded fishing gear (ALDFG). We highlight the importance of forming new partnerships to reduce the economic and ecological impacts of marine litter from fisheries on marine and coastal ecosystems while balancing development, livelihood and conservation approaches. The overarching objective of the report is to promote evidence-based decision-making to strengthen the governance and policy and the design of pilot approaches to reduce the amount of marine litter from fisheries in India and Sri Lanka.

Background
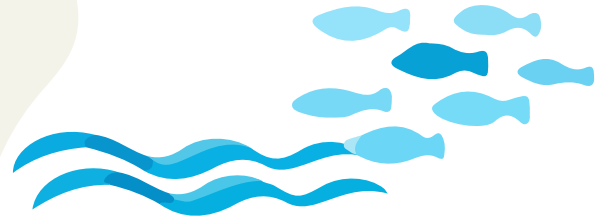
The Gulf of Mannar and Palk Bay are areas of high biodiversity and sensitive marine ecosystems, located between the northwestern and northern coasts of Sri Lanka and the Southeastern coast of India, where more than 4,000 species have been reported, including corals, seagrasses, mangroves and reef fish[1]. These marine areas also support the survival of several endangered animals, such as marine mammals, including whales, dolphins, dugongs and sea turtles[2]. These habitats are under increasing pressure due to high resource exploitation, destructive fishing methods and pollution – not least plastic pollution from fisheries. Recognizing the threats to the living resources, the governments of India and Sri Lanka have declared more than 12,000 km[2] as Marine Protected Areas in the Gulf of Mannar and Palk Bay (Figure 1).
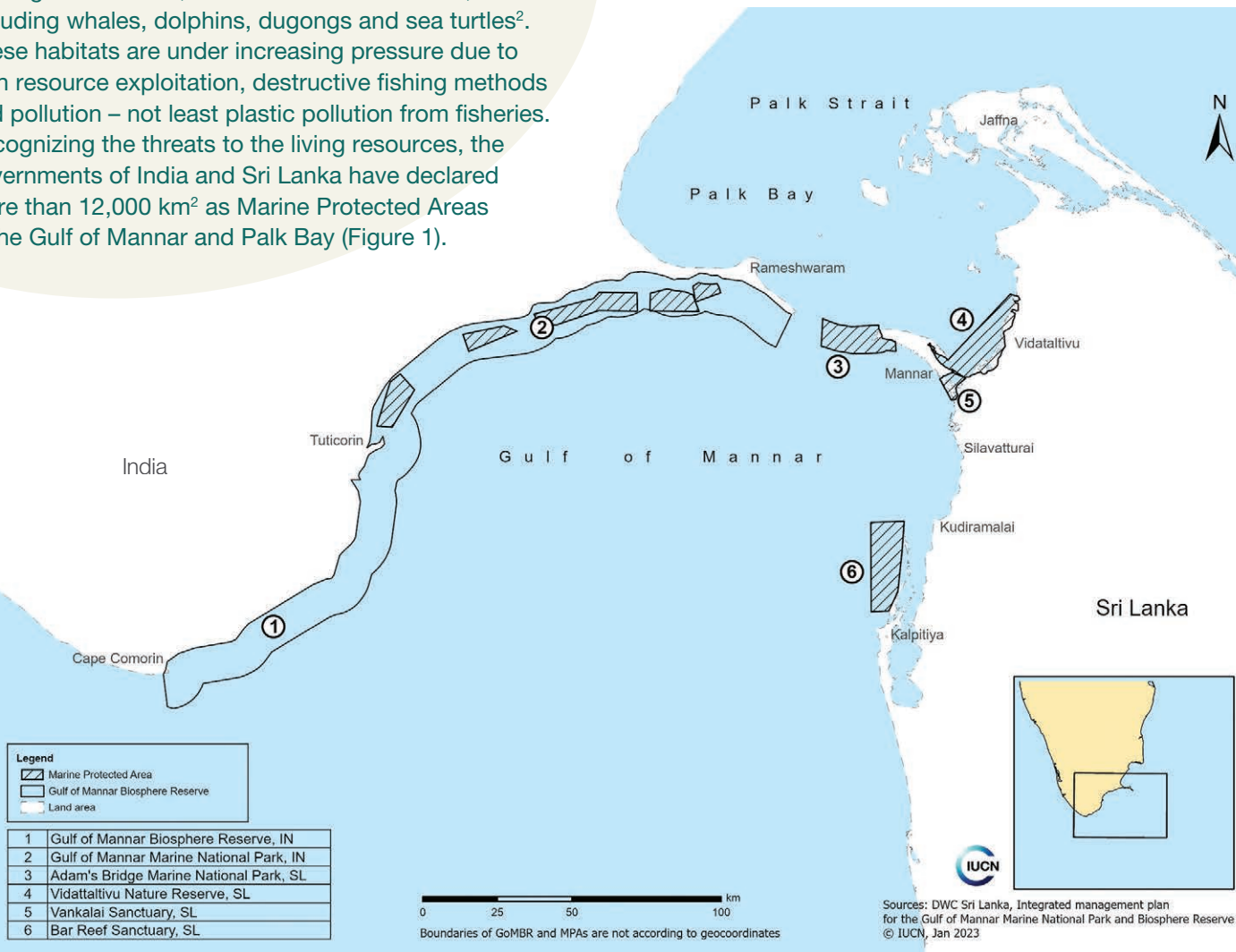
Figure 1. Marine protected areas (MPAs) in the Gulf of Mannar and Palk Strait and the Gulf of Mannar Biosphere Reserve (GoMBR). Source: IUCN, Jan 2023.

[1] Balaji, S., Edward, J. K. P., & Samuel, V. D. (2012). Coastal and Marine Biodiversity of Gulf of Mannar, Southeastern India - A comprehensive updated species list. G. o. M. B. R. Trust. https://www.forests.tn.gov.in/app/ webroot/img/document/publications/gotn/Publication%20No_22.pdf

[2] ENVIS. (2015). Database on Gulf of Mannar Biosphere Reserve. http://tnenvis.nic.in/writereaddata/DATABASE%20ON%20GULF%20OF%20MANNAR%20FINAL%20.pdf

[3] Sulochanan, B., Veena, S., Ratheesh, L., Padua, S., Rohit, P., Kaladharan, P., & Kripa, V. (2019). Temporal and spatial variability of beach litter in Mangaluru, India. Marine Pollution Bulletin, 149, 110541. https://doi.org/ https://doi.org/10.1016/j.marpolbul.2019.110541

[4] Perumal, K., Muthuramalingam, S., & Chellaiyan, S. (2023). Marine litter on the beaches of the Kanyakumari, Southern India: An assessment of their abundance and pollution indices. Marine Pollution Bulletin, 186, 114443. https://doi.org/https://doi.org/10.1016/j.marpolbul.2022.114443

[5] BOBLME. (2013). Country report on pollutionSri Lanka. https://www.boblme.org/documentRepository/ BOBLME-2011-Ecology-14.pdf

[6] (Gallagher et al., 2023; Thomas et al., 2019)

India and Sri Lanka face challenges with managing plastic waste on land, beaches and in the ocean. Previous research has shown that fishing activities significantly contribute to the total litter on Indian coasts[3]. In India, plastics have also been found to be the most prevalent material in marine litter[4]. In Sri Lanka, few studies on marine litter have been conducted. Still, different types of litter have been found[5], and studies have shown high concentrations of microplastics in coastal sediments and waters[6]. Also, in the Gulf of Mannar, fisheries and ocean-based industries are responsible for significant plastic pollution. Yet, little is known about the economic impacts of marine litter, especially ALDFG, and its effects on the biodiversity in this region. In this report, we provide a holistic picture of the issues with marine litter, primarily focusing on ALDFG, from fisheries in the region, including

- the natural values of the geographical region;
- an overview of the fisheries industry and fishing gear production;
- the concentration and composition of marine litter in the region stemming from fisheries;
- governance and policy on marine litter from fisheries;

"India and Sri Lanka were ranked 12th and 5th, respectively, among 20 countries **assessed for mismanaging plastic** waste globally (Jambeck et al., 2015), with **85%** and **82% mismanaged in each country**"

Photo: © Chanaka Sooriyabandara

- case examples of good practices from around the world to prevent and manage marine litter from fisheries;
- recommendations to prevent and mitigate marine litter from fisheries.

In this project, we aim to reduce the amount of marine litter deriving from the fishing industry within the Gulf of Mannar and the southern section of Palk Bay. The outcomes of this report contribute to our scientific knowledge base and form the base for the dialogue meetings and pilot approaches in the next part of the project. In the final step of this project, we will advocate systemic solutions to policymakers and key stakeholders (Figure 2).

Project outline and timeline

Scientific knowledge base → Policy orientation & dialogue → Pilot projects → Foundation for systemic solutions

2021-2024

Photo: © Fergus Kennedy

Figure 2. The project's outline and timeline

How we collected our results

- We collected marine litter at 17 locations along the Gulf of Mannar coastline (12 in India and 5 in Sri Lanka) and analyzed it to improve the understanding of concentrations and composition of marine litter (Figure 3)

- We interviewed 343 Indian and 125 Sri Lankan fishermen along the coast of the Gulf of Mannar to gain insights about their perceptions about marine litter
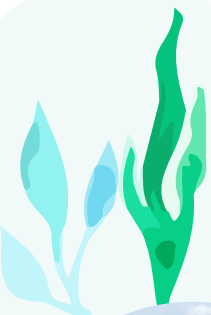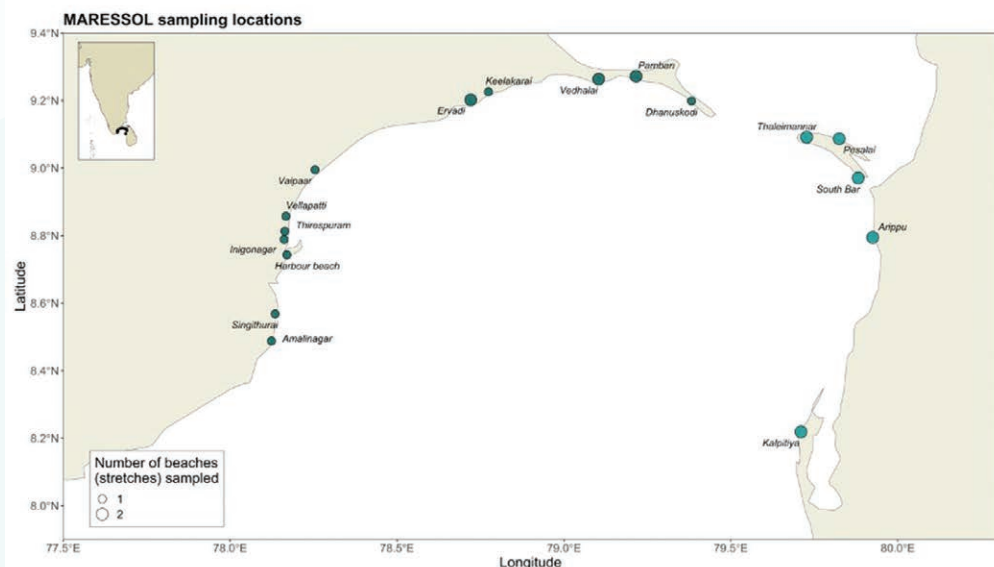
Figure 3. *Map showing sampling locations. Within each location 1-2 beaches were sampled. On each beach, 3-4 transects were sampled for macrodebris, 3-9 quadrats sampled for microplastics in sediment, and 1-3 water samples to test microplastic concentrations. Sampling was repeated during different seasons. See text for details.*

Photo: © Vincent Kneefel –
The Ocean Story

Photo: © Arjan Rajasuriya

What we discovered

About the litter we found in the Gulf of Mannar

- Average litter concentrations in the Gulf of Mannar span roughly around less than one to just a few items per square meter

- Abandoned or otherwise discarded fishing gear (ALDFG) made up a significant share of stranded macro debris in the Gulf of Mannar: 50% of litter items and 74% of total litter weight on Indian shores, and 41% of items and 40% of the weight on Sri Lankan shores.

- Rope was the most abundant ALDFG-related item in Sri Lanka and India. Other common items were parts of nets, styrofoam, boat pieces, traps, floats and buoys, etc. (Figure 4)

- On the Indian side of the Gulf, 3.54 to 85.94 microplastic items per kilogram of sand were recorded in the surface sediment at 12 selected beach locations during the Northeast Monsoon. During the Inter-monsoonal period, the range was 5.00 to 89.67 items/kg. In water samples, abundance ranged from 8.22 to 106.85 items per liter.

- On the Sri Lankan side of the Gulf, 32 to 57 microplastic items per kilogram sand were recorded in the surface sediment at five selected beach locations during the Southwest Monsoon period, and 380 to 800 items per m-3 in surface waters.

- ALDFG items can play a dominant role in the presence of microplastic found on beaches (Figure 5)

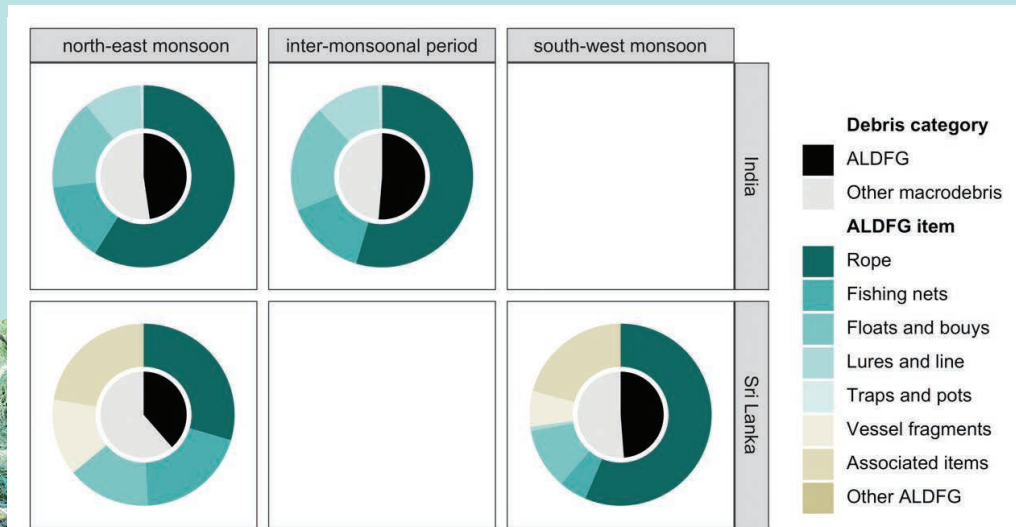- No regulations are in place to manage ALDFG in India and Sri Lanka

Figure 4. *The proportions of ALDFG to other macrodebris (inner pies) and of different types of ALDFG items harmonized across datasets (outer donuts) by abundance (i.e., item counts). All debris sampled has been aggregated across the country and season.*
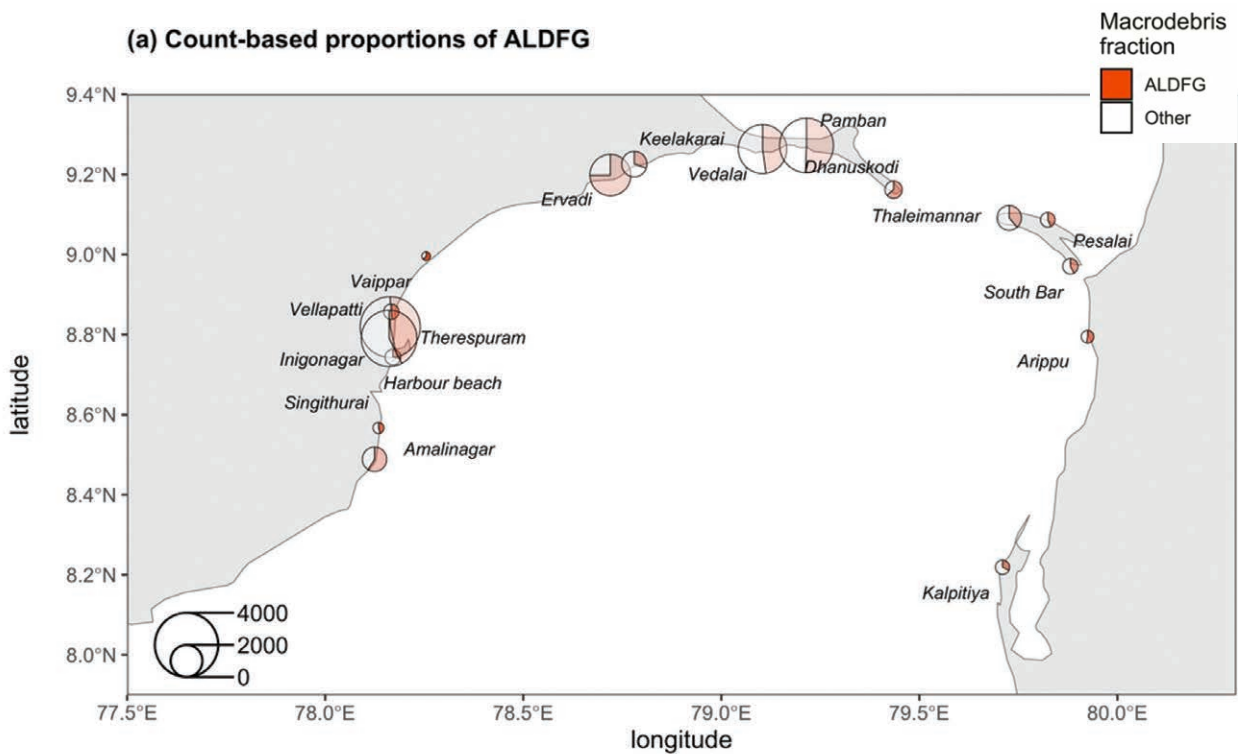
(a) Count-based proportions of ALDFG

Figure 5. *The relative abundance of ALDFG. Based on item counts, the proportion of beach-cast macrodebris consisting of ALDFG versus other litter types. The size of the pie is proportional to the total amount of litter used to calculate the proportions.*

What fisherfolk had to say about the litter from fisheries

Photo: © SDMRI

- Gillnets and bottom-set gillnets were the most used gear in both countries (Figure 6) and were regarded as having the most negative impacts on the marine environment by fishermen in both countries

- Gillnets were also regarded as most commonly lost on an annual basis by fishers in both India (70%) and Sri Lanka (38%) (Figure 7)

- Designated locations to dispose of used gear are lacking, according to Indian and Sri Lankan fisherfolk. At the same time, fishers in both countries are largely positive about supporting a system that would collect old fishing gear

- Lost gear is, to some extent, attempted to be both prevented and retrieved when lost by fishers, but to an unknown success rate

- In Sri Lanka, fishers blame "Bad weather" as the leading cause for gear loss, whereas "Bottom snagging" is regarded as the main cause by Indian fishers

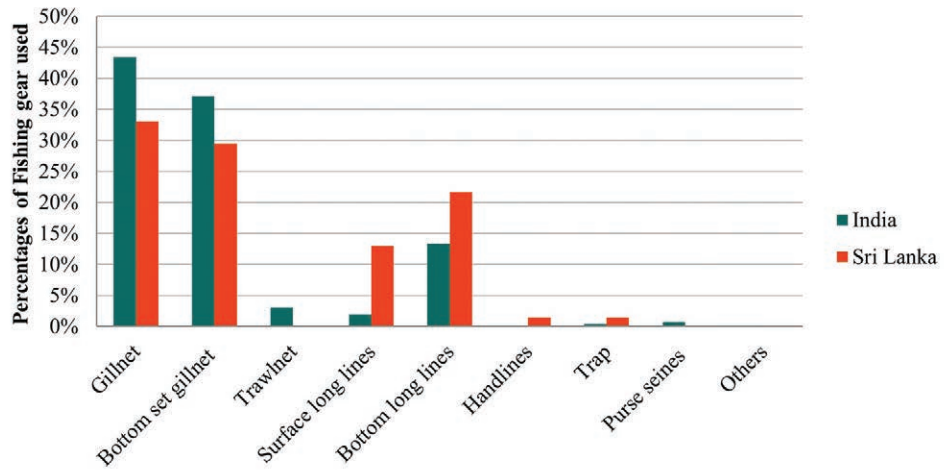- ALDFG is not commonly discussed among fisherfolk or between fisherfolk and the authorities

Figure 6. Percentages of gear used by fisherfolk interviewed in the survey, in India and Sri Lanka respectively.
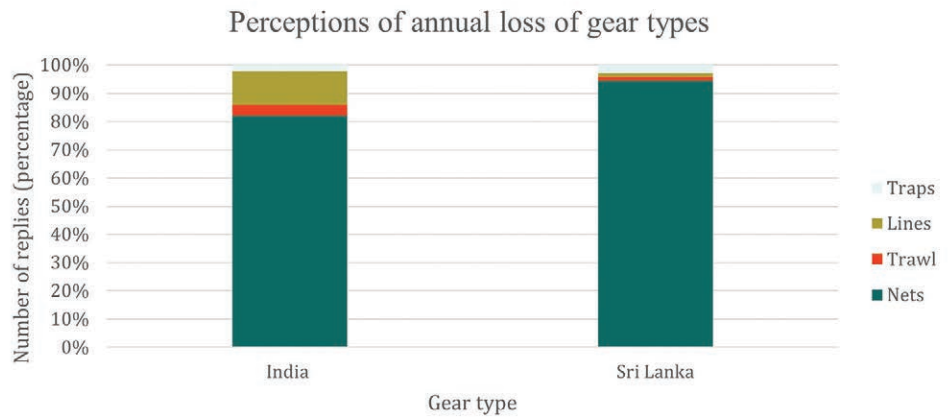

Figure 7. Percentage share of respondents stating that they lose different types of fishing gear annually.

"When asked if the fishers had designated locations to dispose used gear at, **all Indian respondents and 92% of the Sri Lankan answered that they did not have such**"

What we learned from other initiatives focusing on marine litter prevention and mitigation

Aquafil's factory in Thailand. Photo: © Aquafil.com

- We scanned available literature to find information from relevant regional and international stakeholders about tested practices that have been proven successful in preventing, mitigating or remediating marine litter from fisheries.

- We have highlighted 15 solutions in the report, which often imply close involvement of several sectors, including government agencies, private organizations and NGOs/civil society. They have been categorized as: gear design, reporting & retrieval programs, disposal systems, upcycling & recycling systems, and education & awareness. Examples include:

  ≈ A successful Korean buy-back program that removes seabed litter by utilizing the efforts of fishermen at sea, as well as providing an extra source of income for fishermen whilst making them more aware of the problems with marine litter

  ≈ An Italian private company, Aquafil, and a Californian company, Bureo, that recycle fishing gear into products for various industries including automobiles, electronics, clothing, oils, building materials, and consumer goods, such as watersport equipment, household wares, face masks and carpets

  ≈ A European state-financed recycling program, Fishing for Litter, active in 10 European countries that enables and encourages fishermen to remove litter from the ocean and send it for recycling, while also raising awareness

  ≈ The systematic cleanup of lost fishing gear in Norway by trained divers and the use of underwater technology for mapping litter and removing it

  ≈ The Indian CES program that develops ways to implement extended producer responsibility (EPR) schemes with the involvement of private-sector actors, such as recycling agents, the packaging industry and informal workers in the waste sector

  ≈ Several private initiatives in Sri Lanka: 1) Lanka Upcycles and Rice & Carry that collect and upcycle plastic products, including fishing gear, in different areas in Sri Lanka. 2) a fishing net collecting and recycling pilot in Galle is investigating a sustainable business case for marine litter

Photo: © Carl Höjman

Photo: Lanka Upcycles

Approaches to reduce litter: local and global examples

Case 1: Development of a Best Practice Framework in APEC to Address ALDFG
Case 2: Buyback of Litter Caught by Fishermen in South Korea
Case 3: Aquafil – Industrial Scale Nylon Recycling for Fishing Gear
Case 4: Net Free Seas in Thailand
Case 5: Ocean Plastics Scheme for Artisanal Fishers in Thailand
Case 6: Circular Economy Solutions Preventing Marine Litter in Ecosystems in India

Case 8: Gear Marking in Indonesian Small-Scale Fisheries
Case 9: Fishing for Litter in Europe
Case 10: Net+Positiva in Chile and Peru
Case 11: Fishing Gear Collection and Recycling in Sri Lanka
Case 12: Upcycling of Waste at Rice & Carry in Sri Lanka
Case 13: Fishing Net Collection and Recycling Pilot in Sri Lanka
Case 14: Net Collection Pilot in Ghana
Case 15: Diver-Based Cleanup of Raet National Park in Norway

Photo: BRS Secretariat

Photo: © Dinithi Samarathunga

What we recommend

The main routes to reduce marine litter can be categorized as: Regulation & Policy, Waste Management, Litter Removal, Further Research, Awareness & Education. The table below gathers recommendations for each of these themes based on findings in this report .

Immediate action (<1 yr)	
Medium-term action (1-3 yrs)	
Long-term action (3+ yrs)	

Table 1: A summary of identified issues related to ALDFG in the Gulf of Mannar and Palk Strait. Corresponding measures for each issue are proposed and potential stakeholder groups for realization of measures are suggested.

Identified issues	Related theme	Potential measures	Intended stakeholders
Lack of awareness and knowledge amongst fishers about losses of fishing gear, its impacts, and possible mitigation measures	Awareness & Education	Information posters at fish landing sites, adapted to local conditions.	Fishers, authorities
		Strengthening citizen science approaches by engaging fishers in surveys and cleanup programmes.	
		Improved waste management onboard and improved routines for gear maintenance according to the international standard on "Waste reduction and treatment on fishing vessels" (ISO 5020:2022).	
		Efforts to educate fishers through established programmes or digital channels.	
Lack of alternative livelihood options to supplement the income of fishers	Building Resilience	Establishing Public-Private-People Partnerships (PPPPs) to setup Environmental, Social and Governance (ESG) programmes such as alternative livelihood training courses and insurance schemes.	Intended stakeholders
Lack of incentives to reuse, recycle or recover fishing gear and fishers' waste	Regulation & Policy: Waste Management	Legislate extended producer responsibility for fishing gear. Follow the implementation examples in the EU.	Authorities, producers, importers
		Test take-back solutions for used fishing gear and waste, involving economic incentives along the value chain and technical solutions downstream for material recycling.	Authorities, producers, retailers, waste collectors, waste recycling agents, fishers
		Developing recyclable fishing gear with a focus on material composition.	Authorities, producers

Identified issues	Related theme	Potential measures	Intended stakeholders
Gear conflict and lack of easily available statistics on losses of fishing gear	Regulation & Policy: Awareness & Education	Develop and test new reporting systems for gear placement, marking, and loss: e.g., GPS trackers and digital platforms. This could be initiated with multi-day vessels that already have Vessel Monitoring Systems (VMS).	Authorities
		Implement new legislation to make loss and retrieval reporting mandatory for all fishers.	
		Information campaigns and training programmes to roll out reporting systems.	
		Strengthening regional governments' capacities to maintain records on the regional level inflow of gear and use of gear.	
		Creating a database to regulate the import and export of gear by including more information such as clear categorization of HS codes, materials used, etc.	
Cleanup of lost fishing gear and waste	Regulation & Policy: Litter Removal Waste Management Awareness & Education	Local adoption of the Fishing for Litter concept that has been in operation in several countries for years by incentivizing fishers to bring back ALDFG caught in their gear during normal fishing operations. There is a strong willingness to participate in such a programme amongst fishermen in the Gulf of Mannar, according to MARESSOL's survey study. Possible financing through the sale of fishing licenses.	Authorities, fishers
		Reef cleanups by divers funded by public authorities, possibly based on gear collection funding or the sale of fishing licenses.	
		Introducing stewardship approach as a new legislation by promoting locally managed areas to provide ownership for fishers to protect marine ecosystems due to ALDFGs.	
Bottom snagging leading to gear loss and ghost fishing	Regulation & Policy	Enforcement of the ban on using nets on reef habitats.	Authorities
Fishing in marine protected areas	Regulation & Policy	Increasing the enforcement of existing fishing bans in MPAs to prevent gear loss and ghost fishing in sensitive habitats. Challenging conflicts of economic interests between the livelihoods of fishers, the seafood industry, and marine environmental protection.	Authorities
		Introducing spatial management systems and additional regulations to strengthen the protection of MPAs.	
		Addressing the challenging conflicts of economic interests between the livelihoods of fishers, the seafood industry, and marine environmental protection.	

Photo: © Chanaka Sooriyabandara

Photo: © Dinithi Samarathunga

Identified issues	Related theme	Potential measures	Intended stakeholders
Ghost fishing and gear design	Regulation & Policy	Legislate gear design requirements covering biodegradable components to enable release mechanisms to stop the fishing ability of, e.g., traps and pots when lost.	Authorities, academia and research organisations
		Follow international research developments and assess whether biodegradable plastics should be used with a special focus on environmental impacts.	Authorities, academia and research organisations
		Introducing a fishing gear certification mechanism to ensure the quality of fishing gear.	Authorities
		Introducing and promoting regulations for the usage of alternative materials for fishing gear (for e.g., instead of using styrofoam pieces/PET as floaters).	Authorities
Knowledge gaps	Further Research	Further research on: - Density and distribution of ALDFG on sea-floor habitats. - Impacts of ghost fishing on the marine environment of the Gulf of Mannar. - Material flow analysis of sold discarded fishing gear: uncover the formal and informal waste collectors and waste facilities. Map the financial structure of the value chain for different gear types and materials. - Technical capacity for material recycling of used fishing gear in Tamil Nadu: Identify capacity, gaps, and weaknesses with installed waste treatment facilities and assess technology demands. - Improved gear quality considering a multi-criteria analysis of economic, social, and environmental factors from a lifecycle perspective. - Warning systems in areas with a high risk of gear conflict to reduce the losses due to bottom tangling. - Tools such as Natural Capital Accounting and Assessment and System of Environmental-Economic Accounting to assess the environmental impact of ALDFGs, e.g., social costs due to ghost fishing through lost incomes. - The carrying capacity of fisheries in each area to prevent overfishing that leads to habitat damage. - Identifying gaps in fisheries management, regulations, and policies and mapping out stakeholders and their mandates. - How spatial mapping and machine learning technologies can help in identifying lost gear.	Academia and research organisations
Lack of a unified monitoring body and system to address, enforce and strengthen decision-making on environmental impacts	Regulation and Policy	Introducing a centralized monitoring and operationalizing body for the GoM for UNCLOS, MARPOL, Oil spills, and harvesting densities (UNFSA) as an extension of IMO.	Authorities
		Promoting a dashboard system with continuous monitoring covering ALDFG, harvesting, and other issues and engaging citizen (fisherman) participation for monitoring.	Authorities
		Strengthening guidelines for regional fisheries, harbours, and ports at different scales to reduce environment impact due to ALDFGs.	Authorities

What we should still look into

Material flow analysis of sold discarded fishing gear – uncover the formal and informal waste collectors and facilities. Map the financial structure of the value chain for different gear types and materials

Technical capacity for material recycling of used fishing gear in Tamil Nadu and Sri Lanka, respectively: Identify capacity, gaps, and weaknesses with installed waste treatment facilities and assess technology demands

Photos: © Anja Stokkan

Photo: © Dinithi Samarathunga

Photo: © Arjan Rajasuriya

Photo: © Christine Fagerbakke / Norwegian Institute of Marine Research

Photo: © Dinithi Samarathunga

Our conclusion

- Marine litter from fisheries is a major threat to marine environments in the Gulf of Mannar and the southern part of Palk Bay. The situation is already concerning and is expected to grow in severity.

- Marine litter is one of several human-induced stressors which put pressure on the sensitive marine habitats of the Gulf of Mannar. The region is an important breeding and fishing ground for commercial transboundary species including marine turtles and the Dugong for both India and Sri Lanka – making the issue precarious and critical for both livelihoods along the coasts as well as the marine environment itself.

- Active involvement, collaboration, and regulatory intervention by public authorities in India and Sri Lanka are deemed critical to tackling marine litter from fisheries in the region successfully.

- Solutions development requires cross-sectoral approaches and partnerships involving close dialogue with the fishing industry (gear suppliers and the fishing community), the waste management sector and relevant representatives from civil society interest groups. The data from this report can be used as a starting point to set up these approaches and form new partnerships for potential solutions.

- The new policy needs to be developed covering comprehensive rules, guidelines, and action plans to improve waste management from fisheries, prevent marine litter and clean up items already lost. Policy areas recommended to focus on are: gear marking, mandatory gear loss reporting, extended producer responsibility for fishing gear, gear design, and litter removal incentive schemes.

- Marine National Parks, Biosphere Reserves, and Sanctuaries with eco-sensitive habitats (coral reefs, seagrass beds, mangroves, etc.) shall be a high priority in controlling and managing marine litter with relevant government departments.