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ASIA PACIFIC CIVIL FORUM ON MARINE LITTER

MARINE LITTER NEWS

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Dear Readers,

As we present the May 2025 issue of Marine Litter News, we are reminded once again that the solutions to marine litter are neither simple nor one-size-fits-all—but they are emerging from every corner of the world, powered by people who care, observe, and act.

In this issue, we share stories that shed light on hidden pollutants like pyroplastics, expose the environmental costs of slack-filled packaging, and explore how data science is reshaping marine conservation efforts. From empowering women and communities in the Philippines, to advancing ocean literacy in India, and building regional partnerships across Southeast Asia, each article offers a unique perspective grounded in action.

We extend our heartfelt gratitude to the contributors from diverse regions—from West Africa's public awareness campaigns to Australia's systems-based approaches to ghost gear management—for generously sharing their experiences, insights, and research. These voices bring not only knowledge but also a sense of shared purpose that transcends borders.

As OSEAN hosted a side event at the 10th Our Ocean Conference this spring, we were proud to introduce our citizen-powered digital monitoring platform, Ocean Knights, as part of the movement toward "Digital Oceans." The global conversations unfolding—from treaty negotiations to grassroots cleanups—underscore a powerful truth: citizen engagement, backed by data and science, is driving meaningful change.

This newsletter is not just a reflection of what has been done—it is a snapshot of what is possible when science, policy, and people come together. We hope this issue leaves you informed, inspired, and ready to keep building a cleaner, wiser, and more connected ocean future.

Thank you, as always, for being part of this growing wave.

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CAMOUFLAGED CONTAMINANTS: INVESTIGATING THE THREAT OF BURNT PLASTICS IN COASTAL AREAS

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Burnt plastic pollution has been documented along coastlines around the world, highlighting the global scale of this environmental issue. Research on burnt plastics such as pyroplastics and plastiglomerates has been found in the US (Corcoran et al., 2014; De-la-Torre et a., 2022), Japan (Furukuma et al., 2022), UK (Turner et al., 2019), Germany (Ehlers & Ellrich, 2020), India (Gunasekaran et al., 2024), and numerous other countries. Considering its likeliness to blend in with natural surroundings and its resemblance to rocks (Figure 1), burnt plastics often go unnoticed, posing significant threats to the marine environment. This article hence introduces these rock-like anthropogenic materials, explores their distinctions, and emphasizes the urgent need for further research on their environmental impacts.

[Figure 1. Pyroplastics in various colors (a, b) and camouflaged among pebbles on a South Korean pebble beach (c).]

To gain a clearer understanding of the implications of burnt plastic pollution, it is essential to differentiate between plastiglomerates and pyroplastics. Research on plastiglomerates dates back to 2014 and plastiglomerates are typically classified as either 'in situ' or 'clastic' (Corcoran et al., 2014; Corcoran et al., 2020). These anthropogenic rocks are formed when melted plastic fuses with natural elements such as sand, rock, or coral, resulting in a solid, rock-like structure (Ehlers & Ellrich, 2021). The melting process usually occurs due to local heat sources such as campfires or elevated beach temperatures (Turner et al.,

2019). Pyroplastics, in contrast, are primarily composed of plastic that has been burned and re-solidified. Most often, pyroplastics incorporate non-plastic materials, giving them a brittle texture and rock-like appearance (Turner et al., 2019). Similar to plastiglomerates, the common source origin of pyroplastics is from open burning of waste on beaches, campfires, or in disposal sites (Turner et al., 2019). The color of plastiglomerates and pyroplastics vary based on their original plastic, but most appear gray, making them hard to distinguish from surrounding pebbles and rocks (Figure 1). Understanding the characteristics of plastiglomerates and pyroplastics provide valuable insight into how to identify them hence increasing its identification during routine cleanups and/or coastal monitoring.

When comparing their compositions, plastiglomerates typically contain large amounts of natural material bound by plastic, making them denser than pure plastic and more likely to sink or become buried (Turner et al., 2019). Pyroplastics, on the other hand, are primarily composed of altered plastic, with characteristics depending on the original material present around it and the intensity of heat exposure. Pyroplastics can range from slightly deformed plastic to significantly charred material (James et al., 2022). Unlike plastiglomerates, pyroplastics often have lower densities, enabling them to float and be transported across long distances (Turner et al., 2019). Fundamentally, the difference in their compositions can influence how each type of burnt plastic interacts with the marine environment, and its potential dispersion.

The study of burnt plastics is particularly significant for several reasons. First, their deceptive, pebble-like appearance makes them difficult to distinguish without a trained eye (Figure 1c). This camouflage likely leads to an underestimation of their prevalence in environmental surveys, hindering accurate assessments of the true extent of plastic pollution. Second, burnt plastics can fragment into microplastics at an accelerated rate which allows them to spread far and wide potentially releasing toxic chemicals into the environment and the food web (Turner et al., 2019). Third, the combination of burnt plastic undergoing different chemical transformation and its ability to bond with natural substrates, sink, or drift far from their source, is a particular threat to the environment because they may be able to release harmful pollutants such as dioxins, furans, particulate matter, volatile organic compounds (VOCs), and polycyclic aromatic hydrocarbons (PAHs) (Plastic Pollution Coalition, 2025). As research on burnt plastic grows, it is becoming increasingly clear that burnt plastics represent a distinct and pressing subset of marine plastic pollution.

Given the global increase in both forest and urban fires, research on burnt plastics deserves greater attention especially since plastics burned in urban fires can be transported through drainage systems and rivers, ultimately reaching coastal environments. We at OSEAN are actively documenting burnt plastics found along Korean coastlines. While still in its preliminary phase on analyzing plastic composition and calculating abundance, we plan to expand into identifying polymer types in the near future. We currently possess over 200 pyroplastic samples of various sizes and colors from across Korea, all of which will be analyzed using our FT-IR spectrometer. If you are interested in collaborating, please contact me via email.

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EASICO'S FINAL WAVE: CLOSING 3 YEARS OF MARINE PROTECTION WORK

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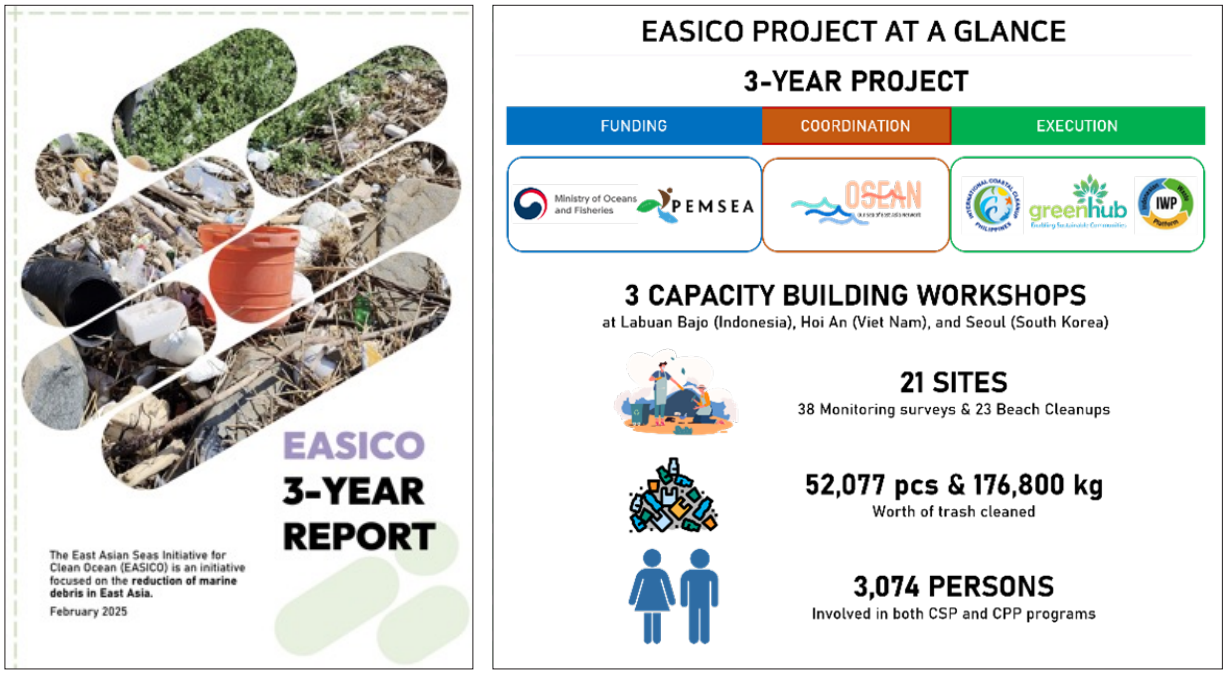
Overview

The East Asian Seas Initiative on Clean Oceans (EASICO) was established in 2021 to combat marine plastic pollution in East Asia, with an ambitious goal of achieving zero plastics in the region's seas by 2030. Funded by the Korean Ministry of Oceans and Fisheries and coordinated by Partnerships in Environmental Management for the Seas of East Asia (PEMSEA) and Our Sea of East Asia Network (OSEAN), the EASICO initiative has fostered regionally collaborative efforts from Centre for Green Development (GreenHub; Viet Nam), ICC Philippines, and the Indonesia Waste Platform (IWP). Over three years, EASICO has focused on implementing capacity-building workshops, citizen science programs (CSP), and community participation programs (CPP). The EASICO initiative finally concluded in February 2025 and a 3-Year Report was made to commemorate the success of the initiative. The report highlights how partnerships were built and expanded, communities were trained, data was generated, and local and regional solutions on marine plastic waste were promoted.



[Figure 1. (Left) Cover page of the EASICO 3-Year Report. (Right) EASICO Project at a Glance]

Capacity Building Workshops (CBWs)

The EASICO Initiative held three annual CBWs to foster cross-country collaboration, strengthen technical capacity, and build networks among NGOs, private institutes, researchers, and government officials. In its first year, the first capacity building workshop was carried out in Labuan Bajo, Indonesia (2022). It was focused on community-based waste management and citizen science. Participants from Indonesia, South Korea, the Philippines, and Viet Nam engaged in various discussions on marine debris and abandoned fishing gear. On top of those discussions, site visits were carried out to Komodo National Park and surrounding areas of Labuan Bajo where participants learned about the local collection and recycling centers and the refill/reuse systems.

The second CBW was carried out in Ha Noi, Viet Nam (2023). Themed around enhancing scientific capacity, this workshop centered on data collection and policy integration, as well as stakeholder ecosystem building. A monitoring survey was carried out in Cat Ba to expose participants to the monitoring methodology utilized in Viet Nam. The third CBW took place in Seoul, South Korea (2024) focusing on responding to the Global Plastics Treaty. Highlights of the workshop included training on AI-driven waste tracking tools (i.e., Ocean Knights), digital citizen science apps, and regional policy discussions. For the fieldwork, participants were taken to see one of the most equipped privately owned microplastic laboratories in Seoul.

Citizen Science Programs (CSP)

The CSP component empowered communities to gather reliable data and understand marine litter trends through hands-on involvement. For IWP, the team monitored 13 beaches in Komodo National Park, trained locals and international volunteers, and collected 12,108 items totaling 243 kg worth of trash. 88% of collected waste was plastic, with beverage containers being the most common across all beaches over the years. ICC Philippines conducted 23 cleanups in Cavite and involved 2,356 people, including local government units and coast guards. In total, ICC Philippines removed 30,765 pieces of waste, an equivalent of 9,946 kg. The top items identified were plastic bottles and fishing gear. For GreenHub, their team conducted 11 surveys in Da Nang and Hoi An bringing the total volunteers to 210 people. In total, they collected 9,204 items, weighing a surprising 166,612 kg. On top of the surveys, GreenHub also organized a 4-day workshop to share data with relevant stakeholders and promoted digital platforms like their 'Plastic and Health Digital Platform'. In short, citizen science programs are crucial to the collection of global beach monitoring data, which aids in the development of local policies and increases public awareness on plastic pollution.

[Figure 2. (Left) Monitoring survey in progress. (Center) Items collected post-survey. (Right) Subsequent sorting of the collected items by IWP Team]

[Figure 3. Coastal cleanup organized by ICC Philippines]

Community Participation Programs (CPP)

The CPP component focused on grassroot engagements, sustainable livelihoods, and social enterprise to reduce plastic pollution and raise awareness. Over the years, IWP has focused on various objectives, such as fishermen's use of single-use ice bags and their adopt-a-beach program. By engaging locals, the business sector, and the tourism industry in Komodo National Park, IWP hopes that locals can manage beach cleanliness on their island. For ICC Philippines, the team focused on practical programs such as trash trap installments in rivers, mangrove planting activities, and reef cleanup and assessment expeditions. Through educational campaigns and practical activities, they focused on long-term reef and coral rehabilitation activities and awareness-raising.

Spotlight should also be given to ICC Philippines' response to the Manila Bay oil spill. By using improvised oil booms, this not only prevented oil from getting into marine protected areas such as mangroves, turtle nesting areas, and coral reefs but also contained the oil until cleanups could take place. GreenHub, similar to IWP, changed their focus each year. In 2022, GreenHub launched Green Houses to support waste pickers and women unions. In 2023, they helped fund and raise capacity building for 'The Happiness Shop,' which focused on training disadvantaged women to make upcycled products. Finally, in 2024, GreenHub helped fund and improve the sustainability of the Green Garment Initiative, which blends plastic upcycling with everyday items such as bags and fans. In short, each organization focused on various objectives but educated and included locals in the fight to prevent plastic pollution and to protect their marine and coastal environments.

[Figure 4. (Left) Workshop at Yen Garden Hoi An making recycled crafts from leftover fabric. (Right) A Happiness Store member practicing lantern making. Photos by GreenHub]

Looking Ahead

The EASICO Initiative offers a blueprint for multi-stakeholder collaboration on marine plastic pollution. It shows that success requires a mix of data-driven decision-making, grassroots empowerment, financial innovation, technological integration, and regional policy alignment. While achieving zero plastic waste by 2030 is ambitious, the groundwork laid by EASICO makes it a reachable target should momentum be sustained.

Acknowledgements

This initiative could never have been successful without the dedication and hard work of the individuals behind the scenes. Our heartfelt gratitude goes to the team members from OSEAN, GreenHub, ICC Philippines, and IWP, whose unwavering commitment, expertise, and collaboration have been the backbone of this project. We would also like to acknowledge PEMSEA and the Ministry of Oceans and Fisheries of the Republic of Korea for their generous support and invaluable guidance, which have been instrumental in driving this initiative forward.

CITIZEN SCIENCE AND LOCAL DATA DRIVING MARINE LITTER SOLUTIONS AND SOCIAL CHANGE IN THE PHILIPPINES

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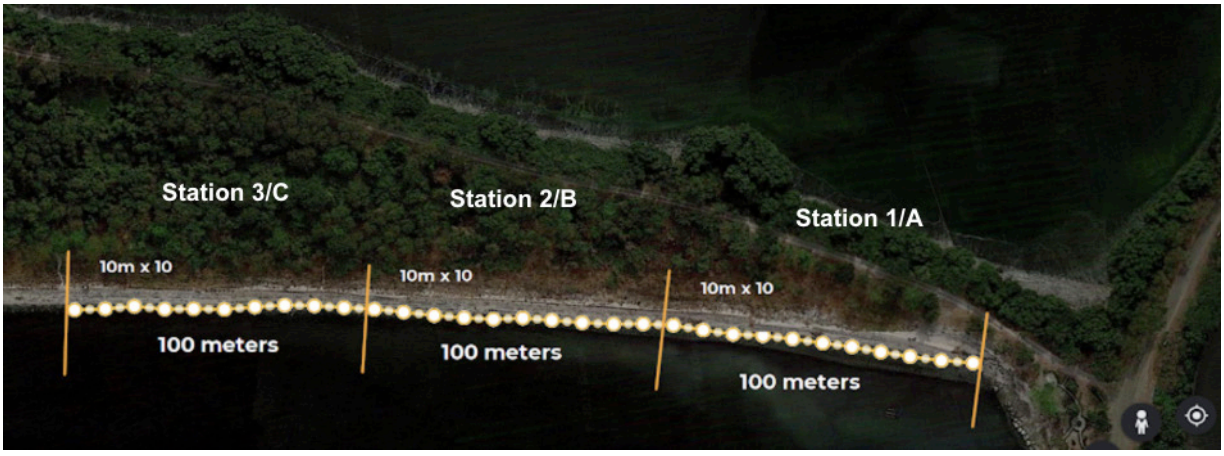
In the Philippines, marine litter is more than just an environmental issue—it's a deeply intertwined social and systemic challenge. Along the shores of Manila Bay, where urbanization, monsoon rains, and typhoons constantly reshape waste patterns, understanding the local environmental context and inspiring community members to be agents of change has proven crucial for effective marine litter management.

Through the My OSEAN Mission program, led by CORA Philippines under the KOICA-EMLM project together with Our Sea of East Asia Network (OSEAN), a new model is emerging: one that fuses high-frequency, systematic local monitoring of marine litter data with citizen science to create more informed solutions for stakeholders and lasting social change.

The Importance of Regionalized, Regular Monitoring

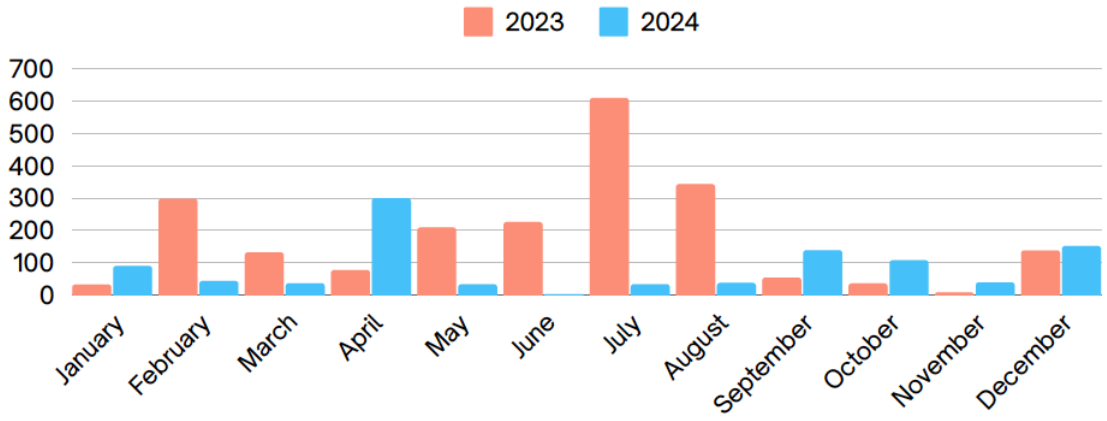
Central to the success of the program is its deployment of a sustainable process to collect, record, and analyze marine litter data using standardized tools like the Rapid Assessment of Standing Stock (RASS) and Clean Swell© across a 100-meter station divided into 10-meter substations, with an additional 10-meter sample for the next 200 meters along the coast of Manila Bay in Las Pinas-Paranaque Wetland Park.



[Figure 1. Cleanup site mapped and divided into substations at Las Piñas–Parañaque Wetland Park, Manila Bay, Philippines under the My OSEAN Mission program]

Recognizing the limitations of standard global data collection forms, the program also enhanced its reporting tools to better capture the true diversity of waste found along the Manila Bay coastline. New categories were added to the data collection forms for items like diapers, sanitary napkins, rubber slippers, construction materials, and electronic waste (e-waste). This adaptation ensured that the data not only reflected international marine litter classifications, but also captured region-specific debris critical to informing local waste management strategies.

Manila Bay's waste dynamics are significantly influenced by tides, rainfall patterns, and seasonal typhoons. In 2024, the Citizen Scientist program recorded visible spikes in marine litter accumulation after major weather events like Typhoon Ewiniar (Philippine (PAGASA) Local Name called "Bagyong Aghon") and Severe Tropical Storm Trami (Local Name "Kristine").



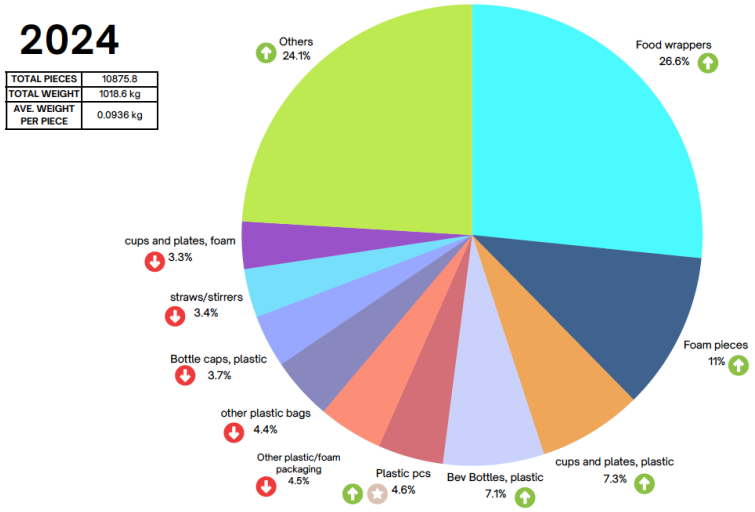
[Figure 2. Comparison of volume of marine litter collected (kg) per month Stations 1.1, 2.1, and 3.1 from 2023 to 2024]

Data collected through monthly cleanups at the Las Piñas–Parañaque Wetland Park showed that debris volume and type fluctuate depending on storm surges and monsoonal runoff. For example, September's cleanups revealed a notable increase in heavier, bulkier debris following typhoon activity, compared to the predominance of lightweight plastics during dry months.

These findings underscore a vital lesson: marine litter management strategies must be localized and dynamic, reflecting site-specific environmental factors rather than relying on static assumptions.

Citizen Science: A Model for Empowering Change

In 2024, over 30 trained Citizen Scientists and hundreds of general waste-picking volunteers gathered data across 12 months, providing a detailed, month-to-month picture of waste trends. Their work revealed not only what types of litter were most common (food wrappers, foam pieces, and plastic cups/plates), but also how waste characteristics changed with weather patterns.



[Figure 3. Composition of top marine litter types across Station 1.1, 2.1, and 3.1 collected during My OSEAN Mission cleanups, January–December 2024]

The Top 10 marine litter types made up over 77.6% of all debris collected in 2024 across Station 1.1 to 1.10, Station 2.1, and Station 3.1, underscoring the persistent dominance of single-use plastics along Manila Bay's coastlines and the urgent need to target the most common single-use plastics through localized waste reduction strategies and behavior change initiatives.

Beyond environmental monitoring, the Citizen Science approach is proving to be a powerful behavior change strategy. Behavioral research linked to the program found that participants showed significant improvements in environmental confidence, waste segregation practices, and personal recycling habits.

Driving Social Behavioral Change

Engagement doesn't end with cleanup events. Findings from CORA's Social Behavioral Change Research showed that when individuals actively participate in data collection, their sense of environmental responsibility deepens.

In the case of My OSEAN Mission:

- 97.7% of Citizen Scientists and volunteers reporting improved knowledge of environmental issues, and 77.3% proactively increasing waste segregation and recycling behaviors.
- Waste segregation behavior improved by 14.5% among participants including households and children.
- Mothers and women emerged as key agents of change within households, influencing daily waste practices and education towards waste impact and recycling.

Crucially, major communication channels like social media platforms (especially Facebook) and frequent announcements and reminders with local government leaders were identified as critical vehicles for spreading awareness and sustaining momentum.

Toward a Sustainable, Scalable Model

CORA's results of the Pilot Cleanup demonstrate that combining localized environmental data with citizen empowerment can yield measurable environmental and social outcomes. But scaling this success requires further investment.

Key recommendations moving forward include:

- Establishing an integrated environmental monitoring system to track tides, rainfall, and waste influxes when marine litter data is collected.
- Standardizing and automating data collection tools to improve long-term trend analysis.
- Continuing capacity building among Citizen Scientists to refine debris quantification and data interpretation.
- Maintain engagement and open dialogue with local government units, national stakeholders, and private sector allies to translate data insights into action and sustain systematic marine litter monitoring programs.

The program envisions a future where citizens are not just participants, but co-creators of solutions using data, science, and collective action to shape cleaner, healthier coasts for generations to come.

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DIGITAL TIDES IN BUSAN: OSEAN AT 10TH OUR OCEAN CONFERENCE

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[Figure 1. Group Photo with the Attendees]

On April 30th, 2025, OSEAN (Our Sea of East Asia Network), hosted an official side event of the 10th Our Ocean Conference in Busan. The Our Ocean Conference is a high-level international marine conference where government agencies, research institutions, and civil society from various countries present commitments, review their implementation, and discuss policy cooperation. The conference traditionally focuses on six key agenda areas: Marine Protected Areas (MPAs), Sustainable Fisheries, Marine Pollution, Climate Change, Maritime Security, and the Blue Economy. This year, Digital Oceans was introduced as a new thematic focus, expanding the agenda to seven areas. OSEAN was chosen to host a seminar specifically on this emerging topic at the conference.

The side event titled 'Empowering Citizens through Data Science for a Cleaner Ocean' focused on the importance of citizen science data in marine environmental conservation efforts and discussed strategies for effective citizen participation whilst maintaining reliable data collection.

The keynote speech was delivered by Chris Dorsett, Vice President of Ocean Conservancy, who presented strategies for marine conservation through data collection and utilization. Following Chris Dorsett was the presentation by Dr. Cheolyong Lee, Head of the Ocean Big Data and AI Center at the Korea Institute of Ocean Science and Technology, who introduced Busan's data-based smart marine environment management support platform model. He also outlined plans for integrating local data into the platform. Afterwards, Dr. Hong Sunwook, President of OSEAN, proposed a practical model for collecting marine debris data. She presented the OSEAN's 'Ocean Knights' smartphone application which combines citizen science and data science to empower citizens to take part in hands-on marine conservation efforts.

[Figure 2 and 3. Speakers and panelists answering questions from the audience]

Experts from the Korea Marine Debris Institute, Taiwan International Cooperation and Development Fund (TaiwanICDF), and UK's Plymouth Marine Laboratory participated in the panel discussion. The session was successfully concluded after in-depth discussion on topics such as reliable citizen science data collection methods, long-term monitoring funding strategies, and considerations for designing data platforms.

The 10th Our Ocean Conference, held from April 28th to 30th, featured dialogue on a global initiative aiming to expand Marine Protected Areas (MPAs) to 30% by 2030. During the conference, the Korean Ministry of Oceans and Fisheries affirmed its commitment to this objective. The issue of ghost fishing gear was also highlighted as a major agenda. Much of the concerns were raised about marine ecosystem damage and fisheries resource loss caused by abandoned fishing gear, instigating discussions on national response measures and policy approaches. The discussion also covered the link between the Global Plastic Treaty and marine pollution response, with the anticipation that the treaty's implementation will enhance global collaboration in preserving the marine environment. Additionally, there are increasing international conversations on the sustainable use and sharing of marine resources, indicating that the marine environment is likely to become a central focus for official development assistance and future international cooperation.

[Figure 4. Attendees at the seminar]

Acknowledgements

The OSEAN side event was a success thanks to the collective efforts of many. Our sincere gratitude goes to the OSEAN team for their dedicated organization. We thank the organizers of the 10th Our Ocean Conference for providing the platform for this crucial discussion. We deeply appreciate the valuable contributions from Ocean Conservancy and the Korea Institute of Ocean Science and Technology. We are also grateful to the expert panelists from the Korea Marine Debris Institute, the Taiwan International Cooperation and Development Fund (TaiwanICDF), and the Plymouth Marine Laboratory for their insightful participation. Finally, we acknowledge the support of the Ministry of Oceans and Fisheries of the Republic of Korea and other partners who contributed to this initiative.

OCEAN LITERACY: A KEY SOLUTION TO COMBAT OCEAN LITTER AND PROTECT MARINE ECOSYSTEMS

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Introduction

[Figure 1. Elsie Gabriel]

Ocean litter pollution is one of the most pressing environmental crises of our time. Every year, an estimated 11 million metric tons of plastic waste enter the ocean, harming marine life, disrupting ecosystems, and even entering the human food chain (Jambeck et al., 2015). From microplastics in seafood to ghost fishing gear entangling marine animals, the consequences of ocean pollution are far-reaching.

Yet, despite the alarming scale of the problem, public awareness and action remain limited. The root cause? A lack of ocean literacy.

Ocean literacy—the understanding of how the ocean influences us and how we influence the ocean—is critical to solving the marine litter crisis. By integrating ocean education into national policies and curricula, governments can empower future generations to adopt sustainable behaviors, drive policy changes, and build careers in ocean conservation and waste management.

A powerful example of this is the Young Environmentalists Programme's (YEP) Ocean Literacy project, which has been recognized by the UNESCO Green Citizen Project for its transformative impact. Through hands-on activities, educational workshops, and citizen science programs, YEP educates students in schools and communities on marine ecosystems, plastic pollution, and sustainable solutions. The program trains young ambassadors who lead coastal cleanups, conduct research on local marine litter, and advocate for policy changes to reduce waste. By engaging youth in conservation from an early age, the initiative fosters a generation that sees the ocean not just as a resource but as a responsibility.

[Figure 2. Young Environmentalists Programme College students of Kadmat Lakshadweep islands building a garden wall with recycled plastic bottles]

[Figure 3. Capacity enhancement of women in ocean conservation as part of Young Environmentalists Ocean Literacy Program]

If we are to tackle the global plastic crisis and safeguard marine biodiversity, ocean literacy must be prioritized at all levels—schools, businesses, and communities.

The Link Between Ocean Literacy and Marine Litter Pollution

Understanding the Impact of Ocean Litter

Most people associate ocean pollution with images of plastic bags floating in the sea or turtles entangled in fishing nets. However, the full scale of ocean litter pollution is far more complex and dangerous:

- **Microplastic Contamination**
  Tiny plastic particles are found in seafood, drinking water, and even the air we breathe.
- **Ghost Fishing Gear**
  Lost or abandoned fishing nets continue to trap and kill marine life for years.
- **Chemical Pollution**
  Plastics release toxic chemicals that affect marine ecosystems and human health.
- **Economic Losses**
  Coastal tourism and fisheries suffer billions in losses due to polluted waters and declining marine biodiversity.

Without proper education, individuals and industries unknowingly contribute to the problem. Ocean literacy helps people recognize their role in preventing marine litter by promoting responsible consumption, waste reduction, and sustainable practices.

How Ocean Literacy Can Help Combat Marine Litter

1. Transforming Consumer Behavior

Many people are unaware that over 80% of marine litter originates from land-based sources (UNEP, 2021). Poor waste management, single-use plastic consumption, and lack of recycling infrastructure are major contributors.

Through ocean literacy, governments and educators can:

- **Teach students about plastic pollution**
  Schools should include lessons on plastic life cycles, ocean currents, and how waste ends up in the sea.
- **Promote responsible consumption**
  Encourage reusable alternatives, proper waste disposal, and plastic-free habits.
- **Increase awareness of hidden plastics**
  Many everyday items, like synthetic clothing and personal care products, release microplastics into waterways.

When consumers understand how their choices impact marine health, they make more sustainable decisions.

2. Engaging Coastal and Urban Communities

Coastal communities are the first to experience the devastating effects of marine litter, yet urban populations are often the biggest contributors. Bridging this gap through community-driven ocean literacy programs can:

- **Empower locals to implement waste management solutions**
  Organize cleanup drives, recycling stations, and sustainable business initiatives.
- **Educate fishermen and coastal workers**
  Train them in responsible fishing practices and waste disposal to prevent ghost gear pollution.
- **Encourage urban populations to rethink waste habits**
  Connect city dwellers with the reality of their impact on co astal ecosystems through campaigns and workshops.

Marine litter is not just a coastal problem—it is everyone's responsibility.

3. Encouraging Policy Advocacy and Industry Accountability

Laws and regulations play a crucial role in reducing ocean litter, but many policies lack enforcement or public support. An ocean-literate society is more likely to demand strong environmental policies and corporate responsibility.

- **Encouraging plastic bans and EPR (Extended Producer Responsibility) programs**
  Educated citizens push for policies that hold companies accountable for waste.
- **Promoting circular economy solutions**
  Ocean literacy fosters innovation in sustainable packaging, biodegradable materials, and recycling technologies.
- **Strengthening international cooperation**
  Governments that prioritize ocean literacy support global treaties such as the UN's Global Plastic Treaty.

By integrating ocean literacy into education, we can create a generation of eco-conscious policymakers, entrepreneurs, and activists who will drive systemic change.

The Role of Ocean Literacy in Career Development and Blue Economy Solutions

Beyond raising awareness, ocean literacy can create career opportunities in waste management, marine conservation, and sustainable industries. The growing Blue Economy—valued at $3 trillion (OECD, 2020)—offers numerous job prospects in:

1. Sustainable Waste Management & Circular Economy

- **Sustainable Waste Management & Circular Economy**
  Businesses converting ocean waste into reusable products.
- **Biodegradable Material Researchers**
  Scientists developing alternatives to plastic packaging.
- **Coastal Cleanup & Waste Diversion Initiatives**
  Job opportunities in NGOs, research institutions, and environmental agencies.

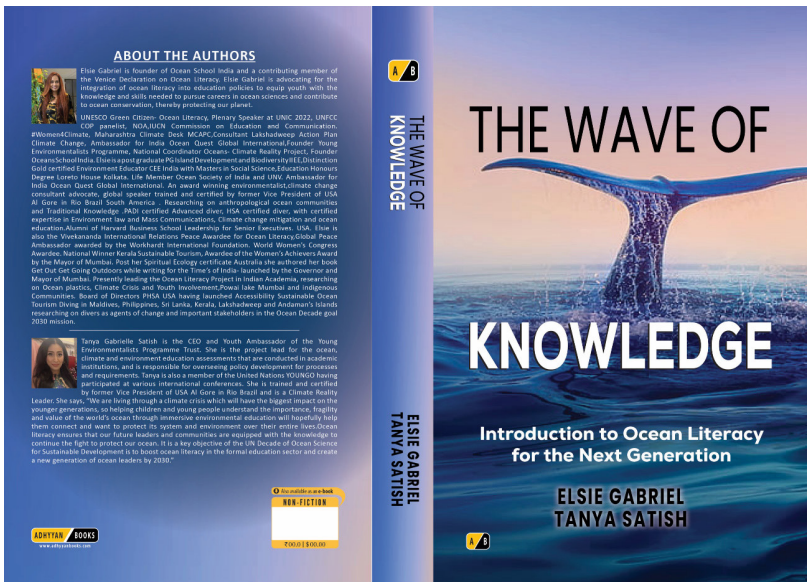
2. Ocean Conservation & Citizen Science Programs

- **Marine Biologists & Conservationists**
  Working on pollution impact studies and habitat restoration.
- **Diving Tourism & Eco-Guides**
  Training divers to collect marine debris data and support reef cleanups.
- **Ocean Ambassadors & Educators**
  Teaching communities about pollution prevention and conservation.

3. Policy & Advocacy in Marine Pollution Reduction

- **Environmental Law & Policy Careers**
  Creating regulations to hold polluters accountable.
- **Corporate Sustainability Officers**
  Helping businesses adopt plastic-free operations.
- **Journalists & Documentary Filmmakers**
  Raising awareness on marine litter through storytelling.

With the right education, young people can transform their passion for the ocean into impactful careers.



[Figure 4. Author's book]

[Figure 5. Promoting #Dontbeatosser campaign in Sydney, Australia]

How Governments Can Integrate Ocean Literacy to Fight Marine Pollution

To effectively combat marine litter, governments and educational institutions must take action by:

- **Incorporating ocean literacy into school curricula**
  Teaching plastic pollution, marine ecosystems, and climate impact from an early age.
- **Funding youth-led innovation in waste management**
  Supporting startups and research focused on sustainable alternatives.
- **Partnering with businesses for responsible production**
  Incentivizing industries to develop zero-waste packaging and ethical supply chains.
- **Implementing nationwide cleanup and recycling programs**
  Engaging communities in sustainable waste management solutions.

- **Launching large-scale awareness campaigns**
  Using media, public service announcements, and social platforms to educate the masses.

Fighting marine litter requires collective effort—and education is the key driver of change.

Conclusion

Marine litter pollution is not just an environmental crisis; it is a human crisis affecting our food, health, and livelihoods. Ocean literacy is the most powerful tool we have to prevent and reverse this damage.

- An educated society will demand policy changes and adopt sustainable habits.
- A knowledgeable workforce will innovate solutions for plastic reduction and waste management.
- A responsible industry will shift toward circular economy principles.

Governments, educators, and businesses must collaborate to make ocean literacy a global priority. By doing so, we can turn the tide on marine litter pollution and build a future where both the ocean and humanity thrive.

The ocean sustains us—now, it's time we return the favor.

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PUBLIC AWARENESS AND EDUCATION ON MARINE LITTER: A PATH TO HEALTHIER OCEANS IN WEST AFRICA COUNTRIES

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Introduction

Marine Litter has proven to be a detrimental environmental issue which has caused threats to marine ecosystems, human health and local economies in various regions, including the West African Subregion (Langeard, 2022). Marine litter poses significant health risks to communities in West Africa, impacting both human health and the environment (Ferreira et al., 2021). Plastic waste and other debris can leach harmful chemicals into coastal waters, affecting drinking water sources and marine life (Dyck et al., 2016). Also, accumulated litter can create breeding grounds for disease-carrying vectors like mosquitoes, leading to increased cases of diseases such as malaria and dengue fever, which are prevalent in West African countries such as Nigeria and Senegal (Omang et al., 2021). As coastal communities bear the consequences of the impact of pollution, it becomes essential to raise public knowledge about marine litter. The present situation of marine litter in West Africa is discussed in this article, as well as the need for awareness to be raised on sustainable ways to mitigate this problem and practical ideas for improving the quality of the marine environment.

[Figure 1. The West African Subregion. The colored areas represent West African Countries.]

The State of Marine Litter in West Africa

Marine litter encompasses a wide range of materials, including plastics, metals, and organic waste. In West Africa, the situation is dire:

- **Plastic Pollution**: Approximately 80% of marine litter is plastic, with significant contributions from urban runoff and inadequate waste management systems (Dyck et al., 2016).from urban runoff and inadequate waste management systems (Dyck et al., 2016).
- **Economic Impact**: The fishing and tourism industries, vital to many West African economies, suffer losses due to polluted waters and declining marine biodiversity (Tibbetts, 2015).

- **Ecological Harm**: Entanglement and ingestion by marine organisms, such as sea turtles and seabirds, lead to injuries and fatalities (Arunima, 2020).

The sources of marine litter in West Africa are multifaceted.

[Figure 2. A visual representation of marine litter accumulation in Senegal. (Source: Down to earth)]

The Role of Public Awareness and Education

Education is an effective tool in combating marine litter (Nukpezah et al., 2022). Increasing public awareness can help provide communities with the knowledge and capacity required to adopt sustainable practices and advocate policies that protect marine environments (Lucrezi, 2022). Key benefits include:

- **Behavior Change**
  Educating the public about the sources and impacts of marine litter encourages individuals to reduce waste and participate in cleanup efforts.
- **Community Engagement**
  Awareness campaigns can mobilize local communities to take action, fostering a sense of ownership over local marine resources.
- **Policy Advocacy**
  Informed citizens are more likely to support and demand effective policies aimed at reducing marine litter.

Strategies for Effective Education

To effectively raise awareness about marine litter in West Africa, several strategies can be employed:

- **School Programs**
  Educating the public about the sources and impacts of marine litter encourages individuals to reduce waste and participate in cleanup efforts.
- **Community Engagement**
  Awareness campaigns can mobilize local communities to take action, fostering a sense of ownership over local marine resources.
- **Policy Advocacy**
  Informed citizens are more likely to support and demand effective policies aimed at reducing marine litter.

Case Studies of Successful Initiatives

1. The 'Clean Seas' Campaign

The United Nations Environment Programme (UNEP) launched the Clean Seas campaign, which aims to engage governments, the public, and the private sector in reducing marine litter (Clemente, 2023). In West Africa, countries like Senegal and Ghana have adopted this initiative, leading to:

- Increased public participation in beach cleanups.
- Enhanced regulations on plastic production and waste management.

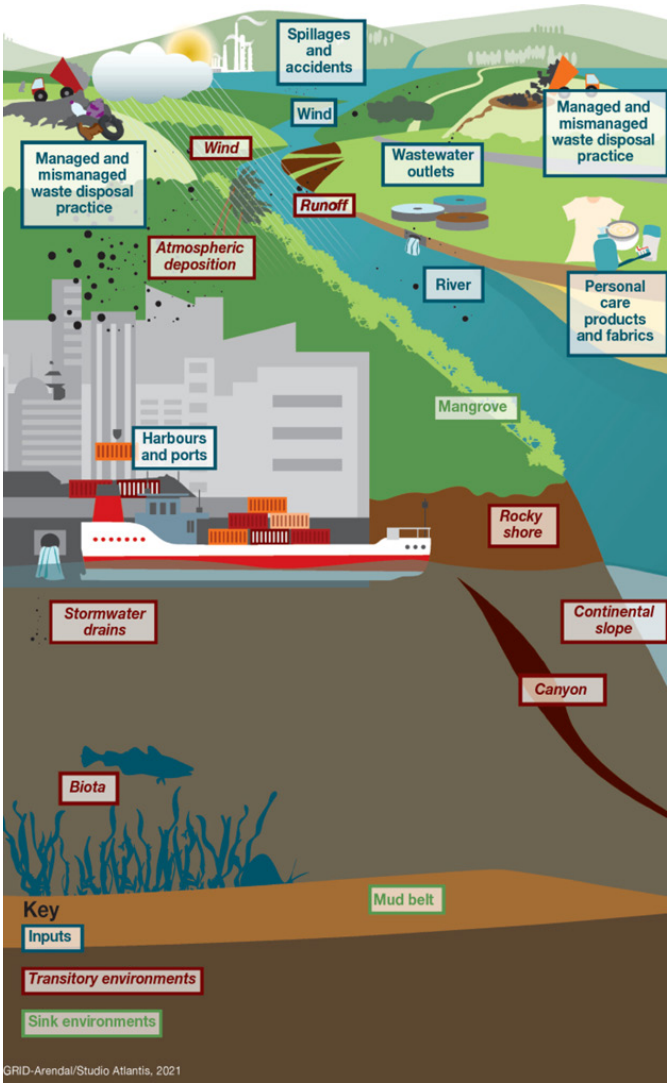
2. Local NGO Efforts

Organizations such as Ocean Conservancy and Green Africa have implemented community-based programs that educate fishermen and coastal residents about the impacts of marine litter (Sackey et al., 2021). These initiatives have resulted in:

- Improved waste management practices.
- Greater community involvement in marine conservation efforts.

Mapping Marine Litter Sources

To develop effective education and awareness campaigns, it is essential to identify the key sources of marine litter in West Africa (Jorgensen et al., 2020). Understanding the sources of marine litter is essential for developing targeted interventions.



[Figure 3. Marine Litter Sources and Distribution Pathways (Source: The African Marine Litter Outlook)]

Challenges to Overcome

Despite the progress made, several challenges remain:

- **Limited Resources**
  Many communities lack the financial and technical resources needed for effective waste management and educational programs.
- **Cultural Attitudes**
  Deep-rooted cultural practices regarding waste disposal can hinder progress.
- **Regulatory Gaps**
  Inconsistent enforcement of environmental regulations can undermine efforts to reduce marine litter.

The Path Forward

To pave the way for healthier oceans in West Africa, a multi-faceted approach is essential:

- **Strengthening Partnerships**
  Collaboration between governments, NGOs, and the private sector can enhance resource sharing and amplify educational efforts.
- **Innovative Solutions**
  Investing in technology for waste management and recyclingcan significantly reduce marine litter.
- **Continuous Monitoring**
  Implementing systems to monitor marine litter levels will help track progress and inform future strategies.
- **Public Awareness Campaigns**
  Educating communities about the dangers of marine litter and promoting responsible waste disposal practices.
- **Improved Waste Management Systems**
  Investing in better waste collection and recycling facilities to prevent litter from entering marine environments.
- **Legislation and Policy Enforcement**
  Implementing stricter regulations on plastic production and usage, along with penalties for littering.

Conclusion

Public awareness and education are critical components in the fight against marine litter in West Africa. By empowering communities through education and fostering collaborative efforts, we can work towards healthier oceans for future generations. The journey may be challenging, but with collective action, a cleaner marine environment is within reach.

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LESS IS MORE:

TANGAROA BLUE FOUNDATION AND THE INTERNATIONAL WASTE PLATFORM WORK WITH CITIZEN SCIENTISTS TO QUANTIFYING NON-FUNCTIONAL SLACK FILLING IN GLOBAL PACKAGING

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Background

Plastic pollution is a worsening environmental crisis, with frequent and concerning predictions regarding the quantity of plastic being produced and inappropriately managed, and the associated consequences for species and ecosystems (Persson et al., 2022). For example, the United Nations Environment Programme predicts plastic waste in aquatic ecosystems could triple by 2040 (UNEP, 2021) while the estimated global cost of municipal solid waste management is predicted to increase by 60.5% by 2040, costing global economies US$61 billion under a business-as-usual scenario (Kaza et al., 2018).

Plastics' largest market is packaging (accounting for ~36% of global production; Geyer, 2020) with ~ 85% of single-use packaging ending up in landfills, as unregulated waste, or are incinerated (Pellengahr et al., 2023). While approaches to reducing plastic demand and/or consumption through the actions of individual consumers can play a role (e.g., beach clean-ups; Rabiu and Jaeger-Erben, 2024), large-scale actions implemented at the state, national, or international level typically result in the greatest impact (Nikiema and Asiedu, 2022).

Implementing changes to plastic packaging can sometimes be difficult as the packaging chosen for certain products is influenced by marketing choices, including brand identity (Ghorbani and Westermann, 2024) and maintaining product integrity (i.e., functional slack filling). However, growing awareness of the waste crisis, combined with outcry over deceptive packaging practices; for example, package downsizing or 'shrinkflation' has brought the need for sustainable packaging principles to the forefront (Conklin and Marzen, 2023). Non-functional slack filling (or underfilling; see Box 1) is one of the most common forms of deception because the packaging is designed to suggest a certain amount of content when in fact much of the package is filled with air rather than the product (Wilkins et al., 2016). Consumers are up to five times more sensitive to price as they are to package size, which is why many manufacturers choose package downsizing over price increases (Çakır and Balagtas, 2014). Thus, slack filling exacerbates the plastic crisis, contributing to unnecessary plastic production and waste while potentially misleading consumers about product quantity.

Aims and Methods

Given the potential benefits of reducing plastic packaging, from both an environmental and consumer/economic perspective (Conklin and Marzen, 2023), Tangaroa Blue Foundation teamed up with the International Waste Platform and around 50 citizen scientists from around the globe to generate much-needed data on the prevalence and severity of non-functional slack filling in different consumer products sold in 24 countries.

During 2024 and 2025, citizen scientists were asked to document instances of non-functional slack filling in the items they purchased during a normal trip to the grocery store. Following a detailed methodology, participants provided a range of measurements for each project, including the dimensions of the empty space (Figure 1).

Items were grouped according to four broad categories: cleaning products (e.g., dishwashing liquid, laundry detergent), confectionary (e.g., candy, chocolate), human food (e.g., dried nuts, yoghurt), and domestic animal food.

Preliminary results

Data for a total of 111 products were provided by citizen scientists from 24 countries, of which 103 (92.7%) were classed as non-functional slack fill. Most products (79%) were packaged in soft plastics or mixed materials (e.g., soft plastic with a foil liner; 12.6%). In products identified as having non-functional slack fill, around 89 mm of plastic material was deemed to be surplus per product. Thus, items contained substantially less product than what was possible given the dimensions of the packaging (i.e., if the packaging had been completely filled). Overall, confectionary items had the highest amount of slack filling (around 65%).

Discussion

Addressing the slack fill problem presents an important opportunity to reduce excessive and largely avoidable amounts of unnecessary plastic production and waste without compromising product integrity or consumer experience. In fact, addressing slack fill may actually improve consumer experience with 78% of Australians expressing frustration and concern about the use of plastic and its impact on the environment (YouGov, 2024).

The reduction in packaging waste through limiting slack fill would also benefit local communities and governments by reducing the burden on waste collection services. Fewer materials to collect, transport, and process means reduced operational costs for local governments and waste management companies (Hossain et al., 2022). Less slack fill, and therefore less packaging overall, could potentially translate into reduced costs for waste disposal and recycling, which are often borne by municipalities and passed on to taxpayers (Huang et al., 2022). Additionally, reducing the volume of plastic waste can help extend the lifespan of landfills, delaying the need for costly expansions or the creation of new waste disposal

sites (Anderson and Gbor, 2024) and reduce the risk of litigation for plastics manufacturers (Conklin and Marzen, 2023).

Finally, the identification of simple yet promising opportunities to reduce unnecessary plastic packaging will be essential to the High Ambition Coalition's participation in the Global Plastics Treaty, of which Australia is a member. Under the 'Product design' section and Annex X of the revised draft of the treaty (UNEP, 2023), there are clear expectations around the need for all signatories to commit to 'comply with minimum design and performance criteria' and 'reduce the use of plastics across the value chain, including in product packaging'. Once in force, parties to the treaty will also be required to 'adopt and enhance sustainable product design and performance criteria, by production improvement such as volume reduction, simplification of packaging, and use of mono materials [that make] it easier to break apart, sort out, and transport for ease of recycling' (UNEP, 2023). In Germany, new policies aimed at cutting deceptive (oversized) packaging are predicted to reduce waste plastic material by up to 27%, corresponding to three million 240-liter garbage cans being diverted from landfill annually (Anonymous, 2021). The robust data we present here, on the global prevalence and scale of non-functional slack filling, provide a critical first step in addressing this poorly understood issue and the key role it may play in achieving the aspirations of the Global Plastics Treaty.

Box 1. Definition of functional and non-functional slack fill

Following the guidelines of the United States of America Code of Federal States, functional slack fill is defined as "the difference between the actual capacity of a container and the volume of product contained therein." Non-functional slack fill is the empty space in a package that is filled to less than its capacity for reasons other than:

- Protection of the contents of the package.
- The requirements of the machines used for enclosing the contents in such package.
- Unavoidable product settling during shipping and handling.
- The need for the package to perform a specific function (e.g., where packaging plays a role in the preparation or consumption of a food), where such function is inherent to the nature of the food and is clearly communicated to consumers.
- The fact that the product consists of a food packaged in a reusable container where the container is part of the presentation of the food and has value which is both significant in proportion to the value of the product and independent of its function to hold the food, e.g., a gift product consisting of a food or foods combined with a container that is intended for further use after the food is consumed; or durable commemorative or promotional packages.

- Inability to increase level of fill or to further reduce the size of the package (e.g., where some minimum package size is necessary to accommodate required food labelling (excluding any vignettes or other nonmandatory designs or label information), discourage pilfering, facilitate handling, or accommodate tamper-resistant devices).

[Figure 1. Example image showing slack filling, and the measurements being recorded for one of the products included in the study.]

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YouGov, 2024. 78% of Australians are concerned about the use of plastic in the nation.

LAYING FOUNDATIONS BEYOND THE SHORELINE: WHY MARINE LITTER NEEDS SYSTEMS THINKING AND TRANSFORMATIONAL CHANGE

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The science of marine litter is no longer emerging; it is well-established. Decades of research have provided detailed insights into the composition, density, sources, and impacts of litter across marine environments. We understand the prevalence of microplastics in sediments and seafood. We have identified key source manufacturers, mapped origin locations, and refined clean-up methods with increasing precision. Across the sector, practitioners, scientists, and volunteers have worked tirelessly to remove litter from coastlines and quantify its ecological costs.

[Figure 1. Turtle found barely alive during patrol by Dhimurru Rangers. Photo by Jane Dermer]

Yet, despite this growing body of knowledge and action, marine litter continues to accumulate—and in some areas, it is worsening. This is not a failure of science or commitment but a signal that we must expand the scope of our work to encompass the full systems context in which litter occurs. Current efforts remain essential, but they often focus on the downstream symptoms of broader systemic failures. Clean-ups remove visible debris, research captures snapshots of impact, and interventions trial ways to reduce leakage. However, too few initiatives engage with the deeper social, economic, and governance systems that enable marine litter in the first place.

[Figure 2. Shark caught in a ghost net]

[Figure 3. Removal of discarded fishing nets]

This is the gap we must now close. Meaningful and lasting reductions in marine litter require shifting from isolated interventions to systemic action. This means integrating systems thinking into the design of marine litter research, responses, and prevention efforts. It requires asking not just "What is the litter, and where is it?" but "Why is it here? Where is it coming from? And how can we intervene at the level of systems, not just symptoms?"

The GhostNets Australia program exemplifies this shift. Originally focused on removing deadly lost, abandoned, or discarded fishing nets from northern Australia's remote coastlines, the program has evolved to become a leader in systems-based marine litter work. A key insight has been recognizing that poverty among remote coastal communities is a significant underlying driver of ghost nets across the Arafura Sea.

In these regions, fishers often lack access to functioning waste management systems. Discarding or abandoning damaged gear is not merely convenient—it is often the only available option. In response, the GhostNets Australia program is developing local solutions such as gear buy-back schemes and waste-to-energy initiatives. These interventions disrupt the poverty-environment trap by creating alternative economic value for waste that would otherwise end up in the ocean.

By integrating waste-to-energy initiatives, these programs not only reduce gear loss but also provide power, education, and livelihood benefits that strengthen community well-being. Crucially, they shift perceptions: fishers become stakeholders in the program's success, increase their engagement, support environmental stewardship, and become more receptive to fisheries education and sustainable practices.

This is systems thinking in action. It moves beyond individual nets to address the socioeconomic conditions that produce them. It creates feedback loops, realigns incentives, and opens new pathways for

transformation. It is not fast work, nor is it easily captured within a typical two-year project cycle. But it is the kind of work that lays the groundwork for lasting change.

However, even the most well-designed systems programs cannot succeed without an enabling environment. Here lies a critical challenge: the environmental timescale does not align with political or funding timescales. Transformational change takes time. Yet much of our sector remains trapped in short-term cycles driven by election terms, funding windows, and a culture of immediate deliverables. Program managers are often forced to think in 18-month increments, while the systems they seek to influence unfold over decades.

Even as more funders shift toward "impact-oriented" investment, funding structures remain poorly aligned with the demands of systemic change. Systems change is complex, resource-intensive, and requires sustained engagement—often five years or more. Yet most grant rounds prioritize short timelines, restrict budgets to tangible deliverables, and exclude critical activities such as staff time, policy engagement, and advocacy. These constraints make it difficult for systems-based work to succeed within standard funding models.

The result is a growing disconnect between ambition and architecture. Programs are expected to deliver lasting impact but must do so with tools designed for short-term outputs. Visual milestones and countable activities continue to dominate reporting—not because they represent real change, but because they fit neatly into existing funding frameworks. Without reforming how we fund and evaluate marine litter interventions, we risk perpetuating cycles of surface-level action while leaving root causes unaddressed.

At OceanEarth Foundation, we often reflect on the metaphor of European cathedrals. Many took centuries to complete. The first stones were laid by people who knew they would never see the finished building. Yet without their vision and effort, these cathedrals would not exist. Environmental program design must embrace the same spirit. We may not see the full results of the change we initiate, but without our work, there will be no result to see.

For program managers, this means resisting the temptation to design for the next report. It means designing for systems, not just symptoms. For funders and decision-makers, it means acknowledging the invisible work of laying foundations—of holding complexity, of building momentum where success cannot yet be easily measured. It means trusting in the value of cathedral-building.
Marine litter is not a peripheral issue; it is one of the most urgent environmental challenges of our time, threatening biodiversity, ecosystem function, and the systems that sustain human life. Every contribution—whether data collection, community action, or policy design—can be a stone in the foundation of something much greater. To those delivering this work: remember the cathedral you are helping to build, and reflect on what systemic changes would lay the strongest foundation possible.

To funders and decision-makers: does your current framework facilitate or restrict the kind of long-term, transformational change our ocean systems now demand?

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