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Preface

Dear readers,

I dare say that the global will to address the issue of marine litter has never been more enthusiastic. Combating marine litter and its source continues to be at the top of the agenda for many important international organizations and every month we learn of new developments underway. It's an indication that we still have much more to do in effectively mitigating marine litter and that it requires dedicated global participation. The articles contained in this issue highlight noteworthy activities conducted by our members in the Asia-Pacific region. As marine advocates championing for a pollution-free ocean, I, on behalf of our Asia Pacific Civil Forum on Marine Litter (APML) members, am excited to showcase our latest efforts to remind the global community that the issue of marine litter is a grave threat to marine life and humanity requiring all of us to take immediate action.

This year, we have the pleasure of adding Indonesian Waste Platform (IWP) as one of our APML members. IWP was established in 2015 to collectively address pollution from land and sea-based sources and riverines in Indonesia. With the involvement of more than 6,000 engaged stakeholders, IWP supports its stakeholders to be the drivers of change in its national and international networks. By facilitating cross-sectoral collaborations, promoting education and awareness raising campaigns, and enhancing community-led waste management, IWP continues to lead waste mitigation efforts not only in Indonesia but also internationally.

Last May, Our Sea of East Asia Network (OSEAN) had the privilege to launch the East Asian Seas Initiative on Clean Oceans. This new initiative includes OSEAN and a few other APML members, namely Indonesian Waste Platform, GreenHub, International Coastal Cleanup Philippines, along with the Korean Ministry of Oceans and Fisheries and Partnerships in Environmental Management for the Seas of East Asia to achieve zero plastics in East Asian seas by 2030. In Taiwan, the latest reports on seafloor marine debris were examined to get a better understanding of Taiwan's underwater marine litter and similarly, a photographic documentation of marine litter impacts on wildlife in South Korea was recently published by OSEAN to raise awareness on the seriousness of underwater derelict fishing gear. In Shanghai, a children's program organized by Rendu Ocean called the "Little Blue Detective" has been providing valuable opportunities for kids to engage in beach cleanups and such beach cleanups and monitoring activities have also been carried out along the coastlines of the Great Barrier Reef in Australia by Tangaroa Blue and its partners. Lastly, to underscore the importance of monitoring efforts as the lynchpin for mitigating marine debris, we have also included a report on the monitoring and assessment of beach litter along the shorelines of Vietnam and an assessment of marine debris retention and accumulation rate at Keelung Islet in Taiwan.

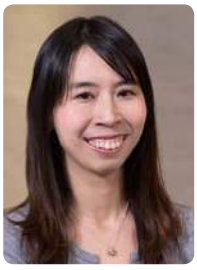
In parallel with the growing and diversified activities of our APML members, we have also welcomed two new co-editors, Ning Yen and Semee Rhee. As the CEO and co-founder of IndigoWaters Institute, Ning has been a dedicated advocate for protecting the world's oceans. She has worked for Greenpeace Taiwan as an oceans campaigner for more than seven years and has honed her skills in policy lobbying and public communications. She was a key member of two Pacific expeditions to expose the gravity of overfishing by conducting investigations on illegal, unreported and unregulated (IUU) fishing operations and surveying labor conditions. In 2017, she played a pivotal role that led Taiwanese NGOs and the Environmental Protection Administration to adopt the "Marine Debris Governance Platform" and she also helped draft the Action Plan of Marine Debris Governance in Taiwan. Semee Rhee is currently the Manager of International Cooperation for OSEAN. As a committed environmental steward championing for animal rights and environmental protection, Semee believes that environmental protection equates to protecting animal rights and human rights. She has legal experience in both corporate and non-profit organizations focusing on trademark violations, copyright infringements, and has supported various immigration cases ranging from asylum to business immigration. She holds a B.A. from the University of Michigan, and a J.D. from the University of Oregon School of Law.

I hope you enjoy our latest issue and I encourage all of you to join our efforts in making the waters of the Asia-Pacific region plastic free.

With much love and gratitude,

Sunny Hong

Editor in Chief, **Sunwook Hong**
(*Ph.D., President of OSEAN*)



Co-Editor, **Ning Yen**
(*CEO and Co-Founder, IndigoWaters Institute*)

Co-Editor, **Semee Rhee**
(Manager, International Cooperation Division of OSEAN)

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East Asian Seas Initiative on Clean Oceans Launched During the P4G Seoul Summit

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Deputy Minister Sang-Keun Song from MOF and Director Sunwook Hong from OSEAN at P4G Seoul Summit Special Session.Online (clock-wise): Ms. Aimee T. Gonzales, Executive Director of PEMSEA, Ms. Nguyen Thi Thu Trang, Co-Founder of GreenHub, Ms. Nina van Toulon, Director of IWP, and Mr. Geronimo P. Reyes, Director of ICC Philippines (Source: MOF, 2021)

On May 26, 2021, during a special session scheduled on the third day of the P4G Seoul Summit, a Memorandum of Understanding (MOU) signing ceremony was held to officially launch the partnership for East Asian Seas Initiative on Clean Oceans (EASICO). The overall objective of EASICO is to achieve zero plastics in East Asian seas by 2030 through collective partnership in raising public awareness on marine plastics, utilizing citizen science in identifying the issues and impacts of plastic pollution, and building capacity by providing training and assistance to community-led programs. The Initiative is expected to start in 2022 for three years. The Deputy Minister from the Korean Ministry of Oceans and Fisheries (MOF), Mr. Sang-Keun Song, and Director Sunwook Hong from Our Sea of East Asia Network (OSEAN) personally attended the signing ceremony while the other parties attended online.

Deputy Minister Sang-Keun Song (MOF) and Director Sunwook Hong (OSEAN) with signed MOUs (Source: MOF, 2021)

In addition to MOF and OSEAN, the parties to EASICO include Partnerships in Environmental Management for the Seas of East Asia (PEMSEA), Indonesian Waste Platform (IWP), GreenHub, and International Coastal Cleanup Philippines (ICC Philippines). These organizations have long dedicated their efforts in reducing marine waste and have been instrumental in tackling marine litter in their respective regions. IWP has been addressing issues of marine waste for more than 10 years through strategic cross-sectoral partnerships with governments and civil society organizations and have an impressive track record for enhancing community-based waste management. Moreover, IWP continues to educate and raise awareness on waste literacy while championing for harmonized citizen science monitoring protocols and data standardization. GreenHub is also an active civil society organization aiming to improve waste management, biodiversity conservation, and agricultural sustainability in Vietnam. Regarding waste management, GreenHub has worked with many international governmental and non-governmental organizations over the years to strengthen Vietnam's waste management efforts and has continuously engaged in marine debris monitoring and coastal cleanups. ICC Philippines also has a long history of conducting coastal cleanups. As the

national coordinator for ICC, a hallmark project of Ocean Conservancy, ICC-Philippines has brought on many passionate volunteers to collect litter along the coasts and waterways of the Philippines since 1994. Lastly, PEMSEA, in particular, has extensively worked on implementing sustainable development strategies for environmental challenges in East Asian seas through intergovernmental and multisectoral partnerships. In addition to being an important party providing financial support to EASICO, the ambitious work and expertise of PEMSEA in integrated coastal management and sustainable waste management will accordingly play a key role in providing guidance for EASICO.

Minister Seong-Hyeok Moon (MOF), Director Sunwook Hong (OSEAN), and Mr. Won Bae Kim (PEMSEA) turning the wheel
(Source: MOF, 2021)

Upon signing the MOU, Minister Seong-Hyeok Moon of MOF gave words of encouragement to further celebrate the launching of EASICO. Minister Moon stated his hopes for EASICO to serve as a global best practice for marine litter management led by civil societies and reminded that the international community must come together to address the problem of marine litter. Following Minister Moon's speech, the Executive Director of PEMSEA, Ms. Aimee Gonzales, also showed her support for the Initiative by underscoring the importance of governments cooperating and taking cross-sectoral approaches in mitigating marine litter. Ms. Gonzales further highlighted the importance of using citizen science in combating marine litter to fully understand the realities of marine plastics and expressed her excitement for working with EASICO.

The ceremony concluded with the turning of a steering wheel. Minister Seong-Hyeok Moon, Director Sunwook Hong, and Mr. Won Bae Kim of PEMSEA, turned a steering wheel placed on the stage while a virtual ship sailed off wishing the success of EASICO and the betterment of our oceans.

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Two Reports Exposing Seafloor Debris in Taiwan

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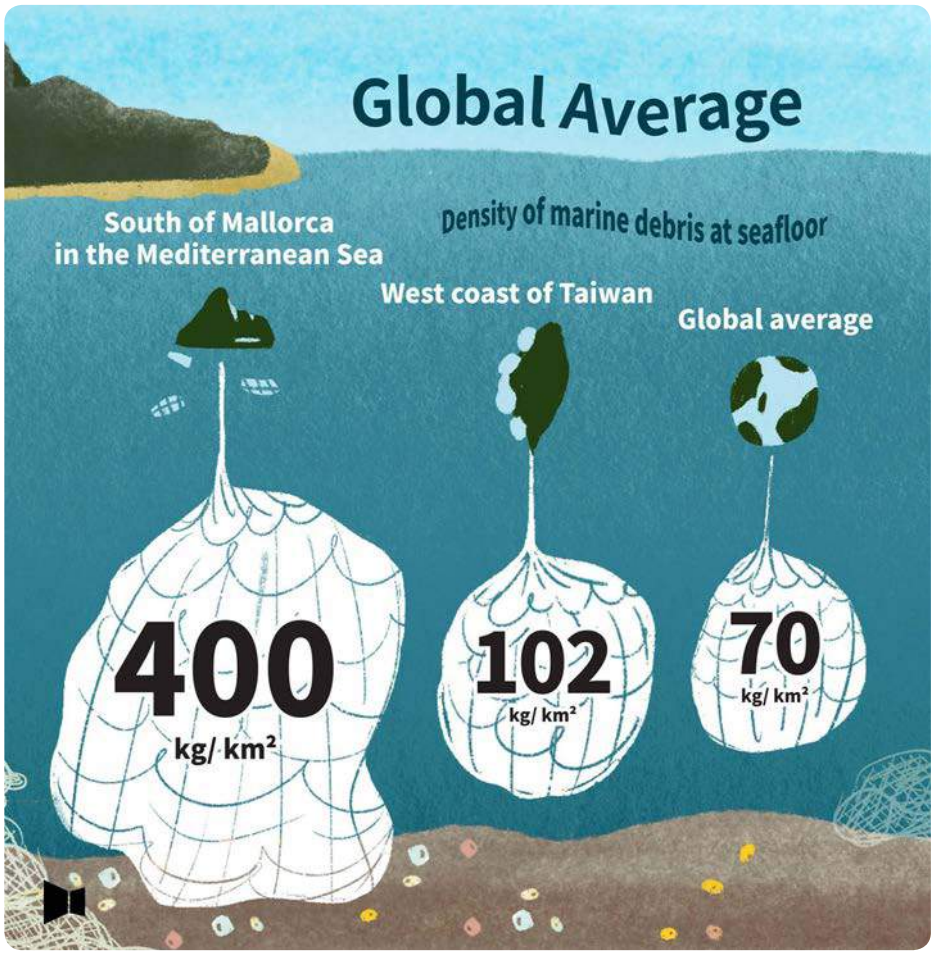
2020 was Taiwan's first time releasing two reports on seafloor debris. The past survey of marine debris in Taiwan mostly concentrated on coasts and sea surfaces. Therefore, these reports on seafloor debris provide the missing puzzle that we needed to better understand the realities of Taiwan's marine debris.

However, it is not easy to articulate the current situation on seafloor debris. There isn't a globally harmonized survey method for seafloor debris and most reports list number of items or density of debris as a major index. So far, the most shocking density of seafloor debris is as high as 400 kg per square kilometer located south of Mallorca in the Mediterranean Sea. The average seafloor debris density in the western coast of Taiwan is 102 kg per square kilo-meter, which is higher than those in Japan, Korea and China.



Nevertheless, Yen, CEO and co-founder of IndigoWaters Institute, said that since every country uses different survey methods, it would be more valuable to compare the number year by year in one single country. Accordingly, this is what Taiwan should continue to do.

By the end of 2020, there were two reports published on seafloor debris in Taiwan. One is from IndigoWaters Institute using dredges along the western coast of Taiwan, while the other used underwater photography from ITRI (Industrial Technology Research Institute) commissioned by the Taiwan Ocean Conservation Administration (OCA).

The following are a summary of the findings from the two reports:

1) Near the sea from Tamsui, the most polluted sampling station, the survey team found the total number of debris to be more than the number of animals. While there are about 70 small shells, there are more than 200 pieces of debris found in the same location.
2) The estuaries easily become hotspots of seafloor debris. As a result, the key for future management should address interception from the source.
3) Hualien and Changhua are both top polluted places. Located in the middle of Taiwan, Hualien, Taichung and Changhua happen to have the highest tidal range in Taiwan. In other words, these places possibly become hotspots after the flow of tides.
4) Large fishing nets and fishing gear are everywhere on the seafloor of Taiwan. Dr. Fang, the Principal Investigator of OCA's project, told us they found a large fishing net longer than 500 meters. Moreover, there are huge amounts of fishing lines near the National Museum of Marine Biology and Aquarium.

Why is it important to monitor seafloor debris?

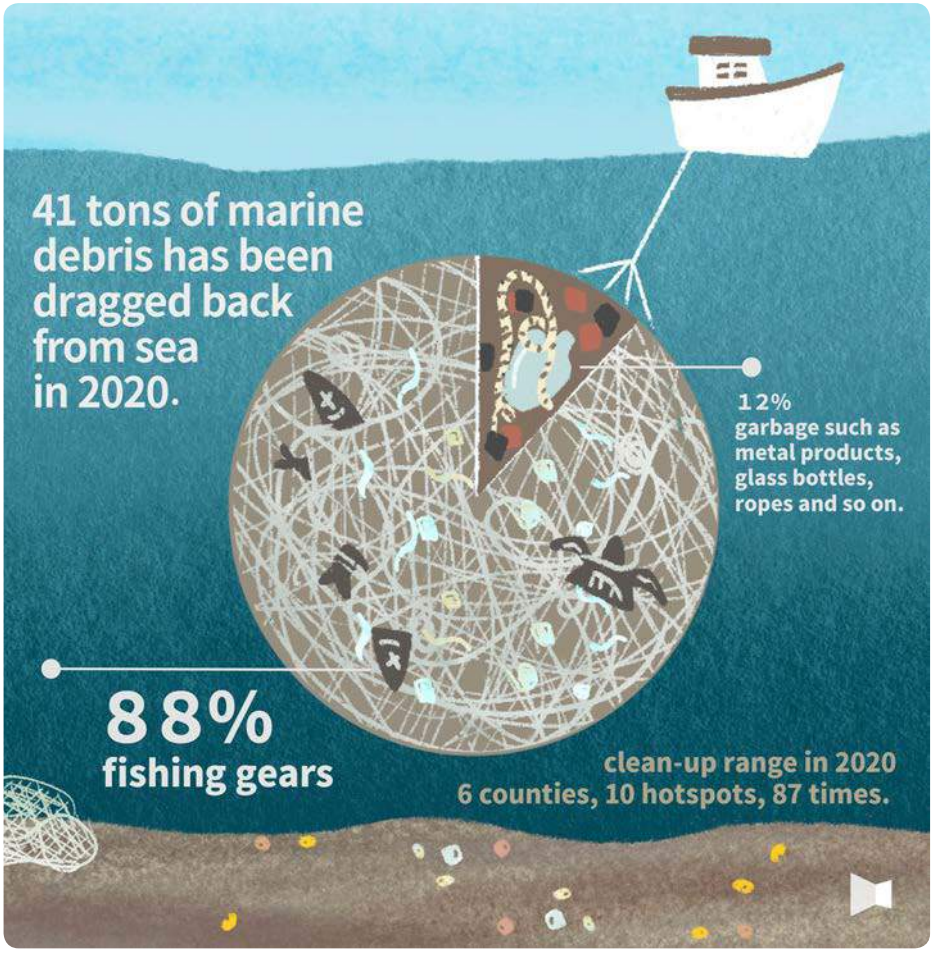
The importance of seafloor debris survey is to identify potential threats to marine life, to remove hazardous substances in channels, and to propose source control policy to intercept or reduce debris.

Yen, who delivered the first report on seafloor debris in Taiwan pointed out that the UK government has monitored the seafloor debris for 25 years. UK researchers have found out that after the UK implemented the bill charging for plastic bags, the number of plastic bags on the seafloor increased significantly. Furthermore, the South Korean government also found out that derelict fishing gear accumulated in a specific southern coast after long-term monitoring. As a result, the South Korean government initiated a policy of recycling fishing gears and created fishermen education programs to prevent lost gears from entering into the ocean. Hence, monitoring is the first step to environmental recovery.

From current statistics we can see that the distribution of marine debris is also quite different among coasts, sea surfaces and seafloors due to sea currents and the density of debris.

According to Hu, Research Director of IndigoWaters Institute, usually, debris with higher density such as fiber will sink to the seafloor. Also, when algae or certain bacteria attach to film plastic, buoyancy becomes compensated, and therefore will sink to the seafloor.

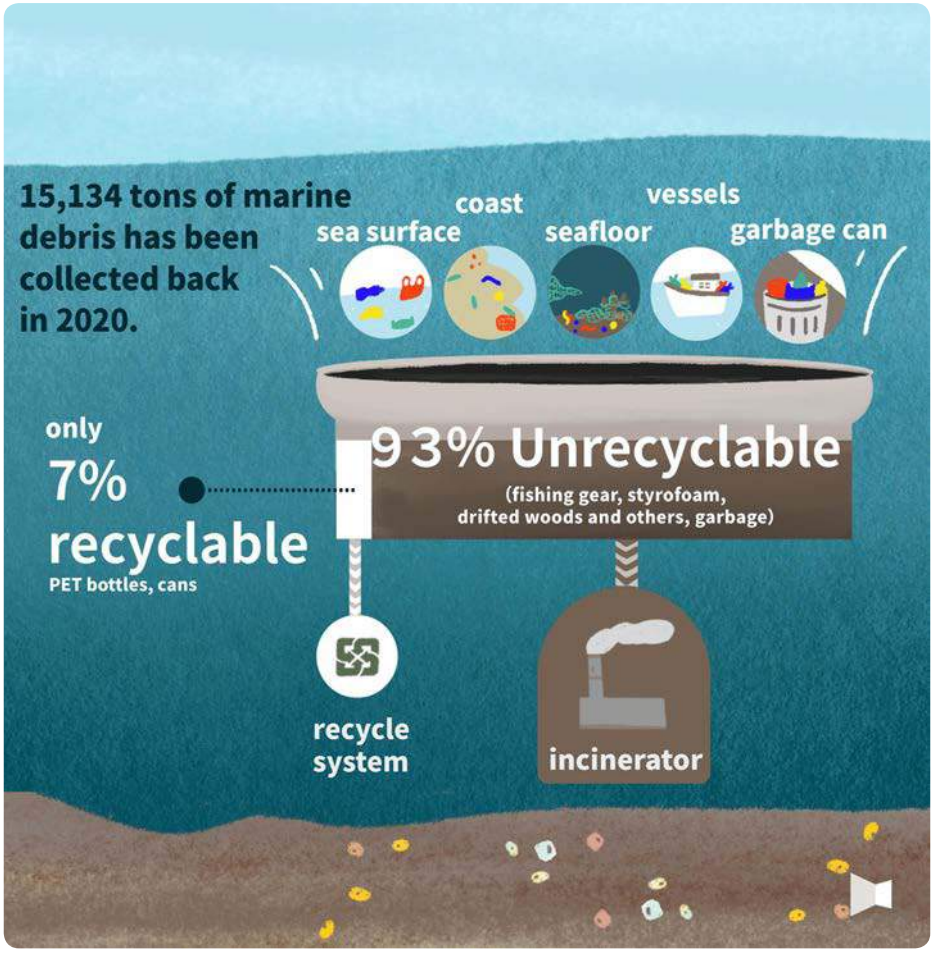
Another insight is that large fishing gear and fishing nets dominate the largest percentage of seafloor debris. According to the statistics from OCA, in 2020, 41 tons of marine debris have been collected back from the sea, and 88% were fishing gears and fishing nets.



This result also shows that measures such as fishing gear management should be taken in order to prevent disposals in seas.

Where did the marine debris go?

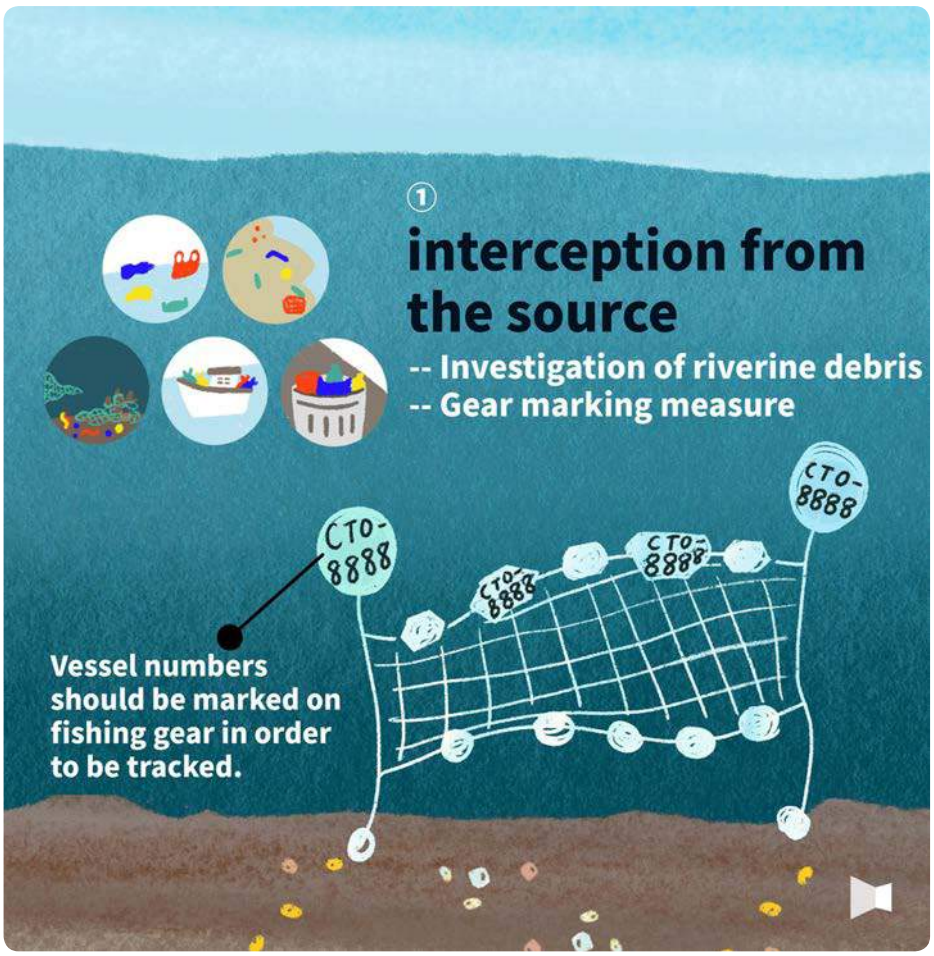
What happened next after collecting all the debris? According to the statistics from OCA, 93% of the collected marine debris (mainly fishing gears, Styrofoam, etc.) cannot be recycled, therefore they all end up going into the incinerator, which burdens the garbage system on land.



While it is extremely difficult to do marine debris cleanups, especially when they are on the seafloor, management at its source plays an important role in preventing the debris from going into the sea.

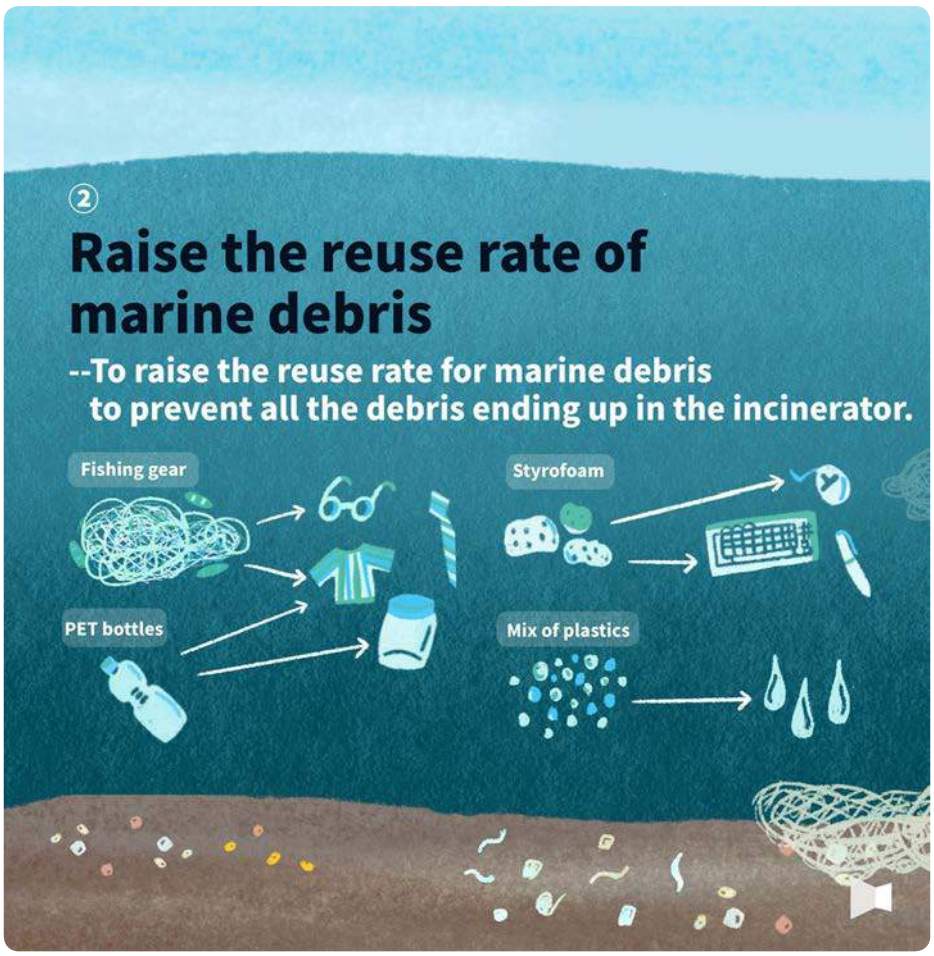
The Minister of Ocean Conservation Administration, Hsiang-wen Huang, said that besides continuous cleanups, interception from the source and the increase of marine debris reuse will be the future key measures taken by the government.

To control the source, the Taiwan Fisheries Agency and Council of Agriculture will launch a new “Gear Marking Measures of Gillnet Fishery” regulation in July 2021. This new regulation will require marking fishing vessel numbers on all the fishing gear in order to be tracked. Also, if fishing gear were to be abandoned or lost, fishermen would need to report back to the government and violators will be fined from 30,000 to 150,000 NT dollars (US$1,000-5,000). In addition, Yen also suggests investigating the status of river debris in order to develop future interception measures.



As for the collected marine debris, OCA has launched a Marine Debris Recycling Coalition, gathering 17 institutions (including a reuse institute, a retailer of recycled marine debris products, and a research institute) in order to raise the reuse rate of marine debris and to save them from entering into the incinerator.

The development of this reuse system is now in its testing phase. If all goes well, Styrofoam can be turned into keyboards and mouses, fishing gear can be remade into eyewear and clothes, and PET will turn into bottles and packaging material.



However, potential problems such as low motivation of collecting the right material, the difficulty of dividing debris into material-based groups, and time consuming efforts should be resolved in the near future.

Marine debris has asked humans to pay the price, including expensive and time consuming cleanups.

Marine debris have existed in seas for a very long time, but measures regarding marine debris are just getting started. Taiwan's systematic year-by-year investigations, the gear marking measure of fishing gear, the investigations from the source and the system for increasing the reuse rate of marine debris have just begun.

We often hear scholars at various marine seminars calling for a reformation on the conditions of fishing industries and for plastic economies to be thoroughly changed.

As individuals, to avoid an ecological catastrophe, we should start by reducing plastics in our everyday lives.

*This article is translated and slightly re-written from "The Report of Seafloor Debris that You Don't Know" published in Taiwan's media "The Reporter" on 2021/4/21.
The original link is here: https://www.twreporter.org/a/marine-litter

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OSEAN's Second Photographic Casebook: Marine Litter Impacts on Wildlife in South Korea

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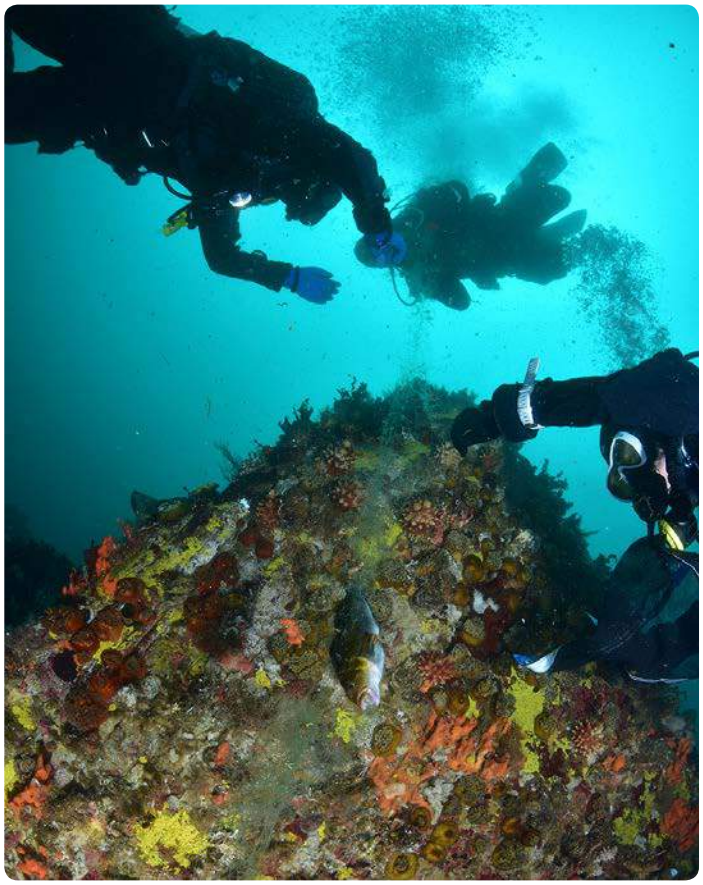
Most literatures address the issue of land-based marine litter, but for South Korea, sea-based marine plastic litter is the most harmful marine pollutant.[1] In response, the Korean Ministry of Oceans and Fisheries has set aside an enormous budget to continuously expand marine litter retrieval efforts for the past 20 years. Most of these efforts are aimed at collecting marine litter, particularly discarded fishing gear, detected underwater. Discarded fishing gear that threaten marine life are often found entangling coral reef colonies or being used as habitats by marine creatures.

Entangled fishing net on black coral , Hye-Eun Lee @diane.log[2]

1 Hong et al., 2014.
2 Kwak et al., 2021.



Rescuing a rock greenling, Hye-Jin Kim @moskino24 [3]

According to Macfadyen et al., discarded fishing gear are those that are involuntarily lost, inappropriately or illegally installed and neglected, or purposely abandoned.[4] Aside from discarded fishing gear, litter from recreational fishing, coastal leisure activities, and land-based litter also flow into the waters and impact marine life. Unfortunately, these incidents do not get easily detected. Even when underwater research is conducted for the very purpose of addressing marine litter impacts on marine life, locating specific sites and time pose tremendous difficulties. Moreover, the degree of harm endured by marine creatures are often understated due to their seemingly unimpaired mobility and this often leads to inaccurate assessments of marine litter impacts on marine life.[5]

This photographic casebook is a collection of records and photographs compiled by professional divers from Team Booster and recreational underwater swimmers to illustrate the harm caused by marine litter. Divers from Team Booster used state of the art equipment to research and record underwater areas 50 meters or deeper based on citizen science, and recreational underwater swimmers collected photographs of marine life suffering from marine litter. These records were not gathered for the purpose of marine litter research, but they provide valuable information regarding the dangers of marine litter and shed light on the most harmful effects of underwater litter. The casebook gathers 42 cases from 2013 to 2020 during the months of May to December as these months are best for scuba diving in waters surrounding South Korea. In addition to photographs, the casebook also provides meta data including the type of marine litter, the type of injured species and its common name, the type of fishing gears, and in the case of fishing nets, the condition of the nets (old, moderate, fairly new) are also recorded. Furthermore, the casebook also includes an explanation on different types of fishery methods and the related components of common fishing gear to allow readers to better understand the harmful effects that discarded fishing gear have on marine life.

3 Ibid.
4 Macfadyen at al., 2009.
5 Hong et al., 2013.

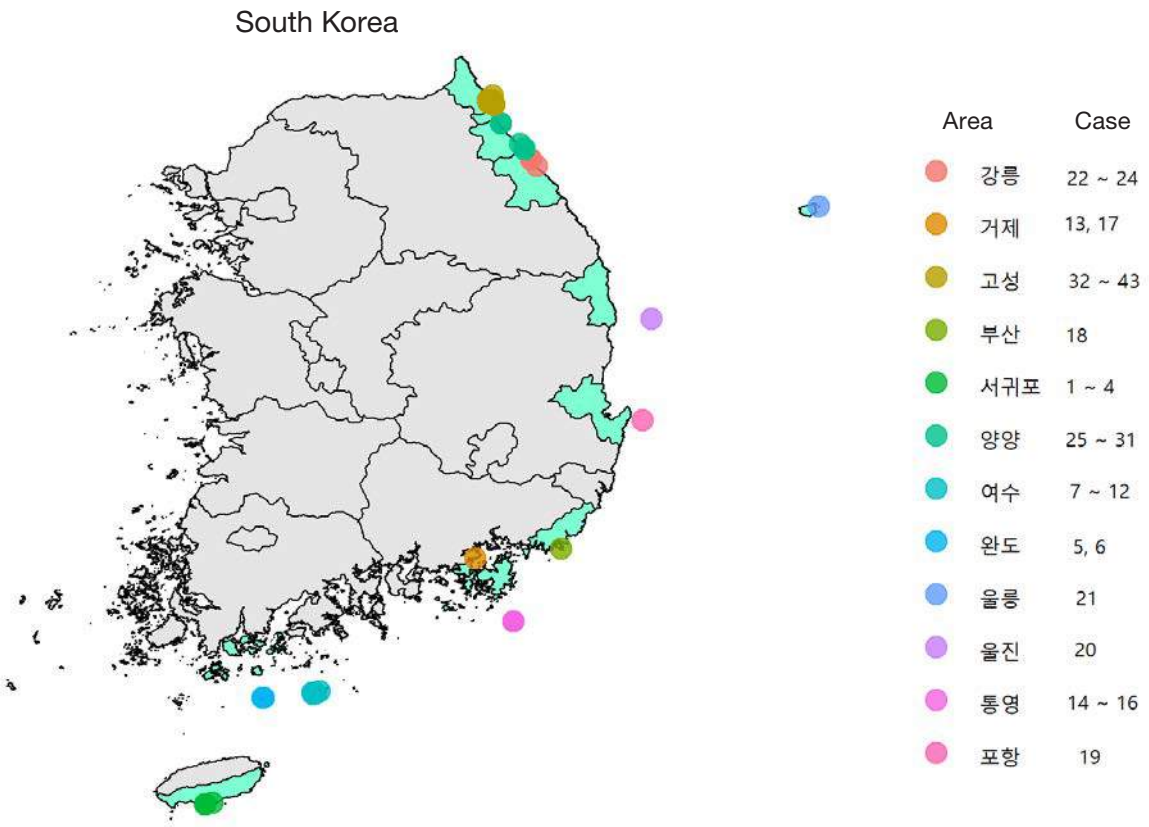


Figure 1: Map of locations where cases were collected [6]

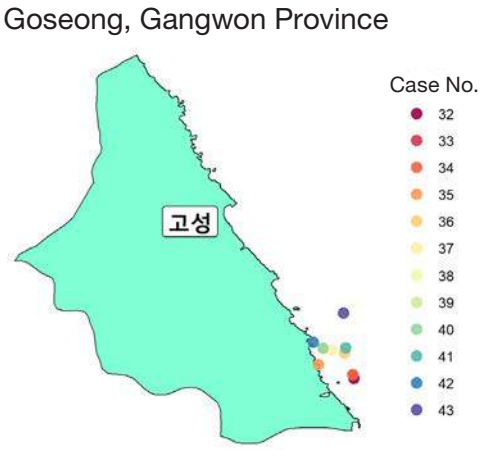


Figure 2: Map of locations where cases were collected [7]

Figure 3: Map of locations where cases were collected [8]

Although this casebook is limited to subjectively selected incidents detected along the territorial waters of South Korea, OSEAN hopes that this casebook will nonetheless raise public awareness on the seriousness of marine litter and be a resourceful guide to help effectively reduce marine litter and discarded fishing gear.

For a more detailed look at the casebook please visit www.osean.net.[9]

6 Kwak et al., 2021.
7 Ibid.
8 Ibid.
9 www.osean.net/data/edu.php?ptype=view&idx=7151&page=1&code=data_edu

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How Kids Can Be Involved in Protecting the Ocean

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"Little Blue Detective" is a beach cleanup program specially designed for families with children. Kids get to “detect” what kills marine animals and learn how to take steps to protect marine life and oceans. This program combines nature education and marine stewardship, from which kids can learn more about social responsibility.

1 Purpose of the Program

China has about 18,000 kilometers of continental coastlines and more than 40% of its population is gathered along the coast. Increasing pollution of marine litter has directly affected many cities, including Shanghai. However, some studies have noted that children in Shanghai do not know much about their local coastal waters.

Shanghai Oasis Ecological Protection Exchange Center conducted a survey under the theme “Intimacy between Children in the City and Nature” in 2013. This earlier study pointed out that among more than 1,300 children surveyed, 12.4% of them tend to have a nature-deficit disorder.

Echoing the survey, Rendu Ocean successively organized two large-scale questionnaires involving more than 200 students. The results showed that only 12% of them had been to Shanghai beaches, while only 2% knew that the seawater in Shanghai was yellow instead of dark blue.

This is only one side to the story, the other lies in parents’ expectations. Many parents hope that there will be more environmental protection activities for kids to keep them close to nature. That’s why the “Little Blue Detective” program started in 2017.

Last year, Rendu Ocean carried out 14 activities under the program throughout the year. A total of 78 families and 369 kid detectives learned the hazards of marine litter and cleaned up about 570 kilograms of marine waste.

Through this program, children learn to monitor marine debris, record related data and understand the hazards of marine debris. They are also taught to make the connection between the origin of ocean waste and their daily lives and to realize the need to form good habits to reduce pollution in their day-to-day lives.

2 Their Hopes

For parents, the program is a good opportunity to spend quality time with their kids. But for kids, it's much more than that.

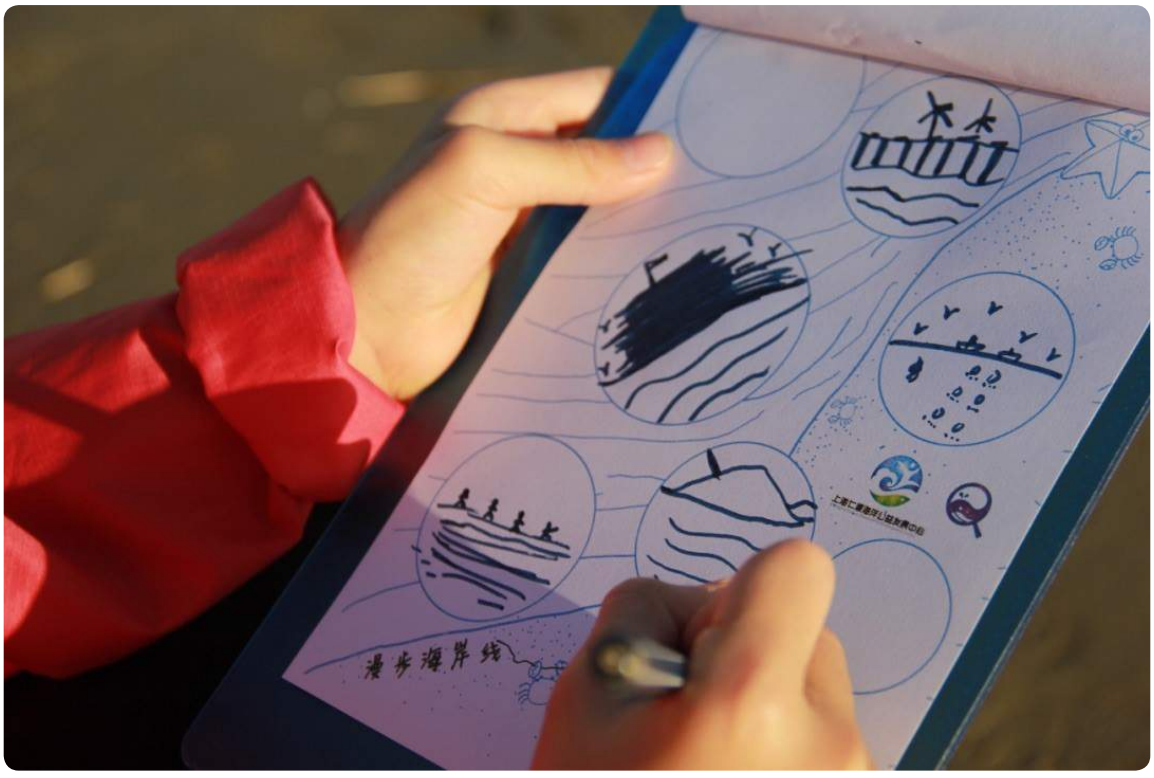
A junior high school student, who saw the ocean for the first time said, "that's not the sea I imagined," when responding to the question "how do you feel today?"

He answered with a serious face. "What I protect is not only the ocean, to be more accurate, I'm protecting my future," he added.

3 Why Kids are Important

369 kid detectives joined the program last year, which reflects their passion and the progress of this program. Cleanup activities are relatively passive among other methods in dealing with ocean pollution. More importantly, higher awareness and green habits are more effective to achieve goals on ocean pollution reduction. Through these practices, kids will be able to connect with the environment to learn more about their surroundings and ways that they can make a difference through minor changes in their daily lives. THIS IS WHAT REALLY MATTERS.

Although there are many concerns about ocean pollution, hopes for a better blue planet will be rekindled as many more young voices participate in environmental conservation.



All photos above are provided by Rendu Ocean

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ReefClean: Australia's Approach to Large-Scale Marine Debris Removal, and the Prevention of Marine Debris in the Great Barrier Reef

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Background

The greatest threats to Australia's World Heritage-listed Great Barrier Reef are climate change, coastal development, runoff and human activities such as illegal fishing and pollution.

ReefClean is a five-year project funded by the Australian Government's Reef Trust program and delivered by Tangaroa Blue Foundation in collaboration with partner organizations, community groups, traditional custodians and individuals along the 2,300km coastline of the Great Barrier Reef. The goals of the project are not only to remove marine debris, but also to prevent further pollution through source identification and reduction interventions, education and awareness campaigns.

The partnership includes Reef Check Australia, Capricornia Catchments, Eco Barge Clean Seas, Oceanwatch Australia, South Cape York Catchments, and AUSMAP, along with community groups and volunteers.

Image 1 - Gidarjil Development Corporation Land and Sea Rangers, Barney Point Gladstone.

ReefClean Activities and Data

ReefClean has evolved a unique shoreline monitoring methodology for a total of 33 coastal and estuarine sites spanning the 6 Natural Resource Management (NRM) regions of the Great Barrier Reef coastline. Sites are monitored on a quarterly basis (during March, June, September and December) using four x 25m transects. This provides a high quality baseline dataset, inclusive of geospatial data and detailed information on each item of marine debris recorded. All data is entered into the Australian Marine Debris Initiative (AMDI) and analysed by the team at Tangaroa Blue Foundation.

Baseline monitoring data is complemented by wider scale marine debris clean-ups, large community strategic events like the annual Great Barrier Reef Clean-up (held in October), island based clean-ups, remote clean-ups in Cape York and the Torres Strait and underwater clean-ups. The program also includes detailed microplastic studies with AUSMAP during March and September at each coastal site.

With 1627 clean-up events recorded as of December 2020, the ReefClean program has engaged 5212 participants in the removal of nearly 45 tonnes and over 946,332 items.

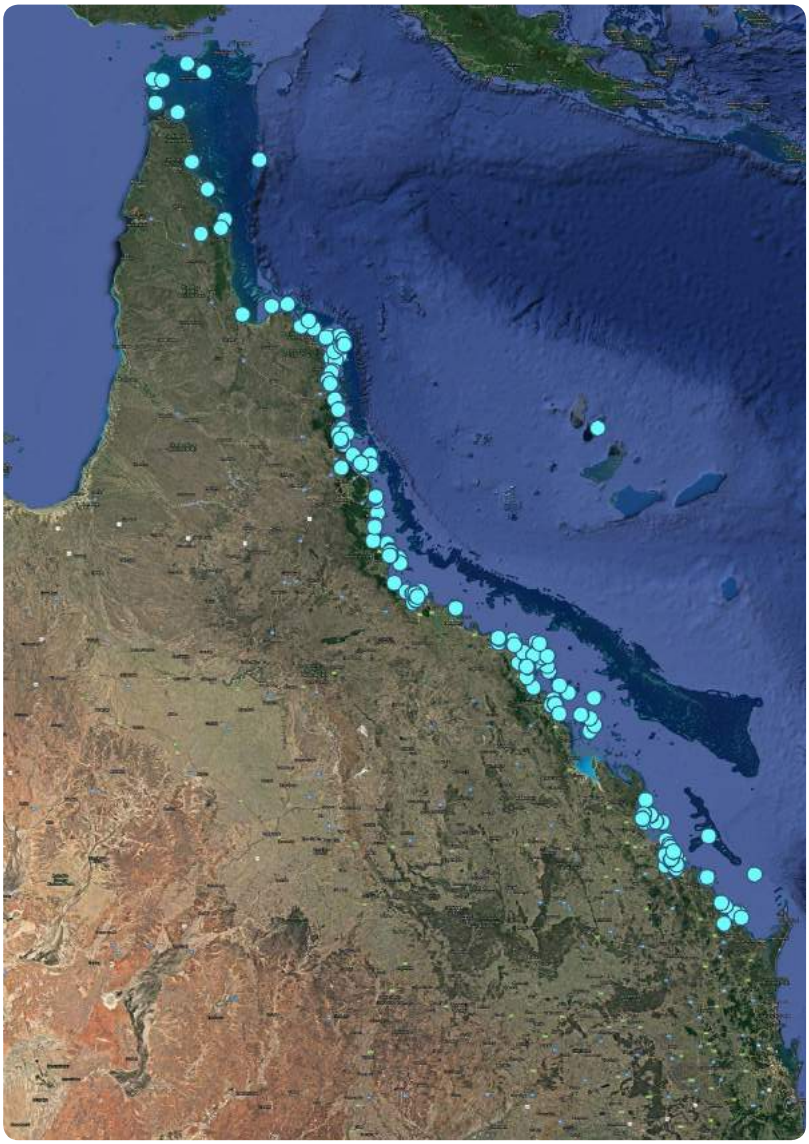

Image 2- ReefClean Clean-Up event sites

Analysis of the site data shows that remote areas and islands are more significantly polluted, with 44% of the total items recovered under the project being from remote and sparsely populated locations such as populated islands (30%) and remote islands (12%) (Chart 1).

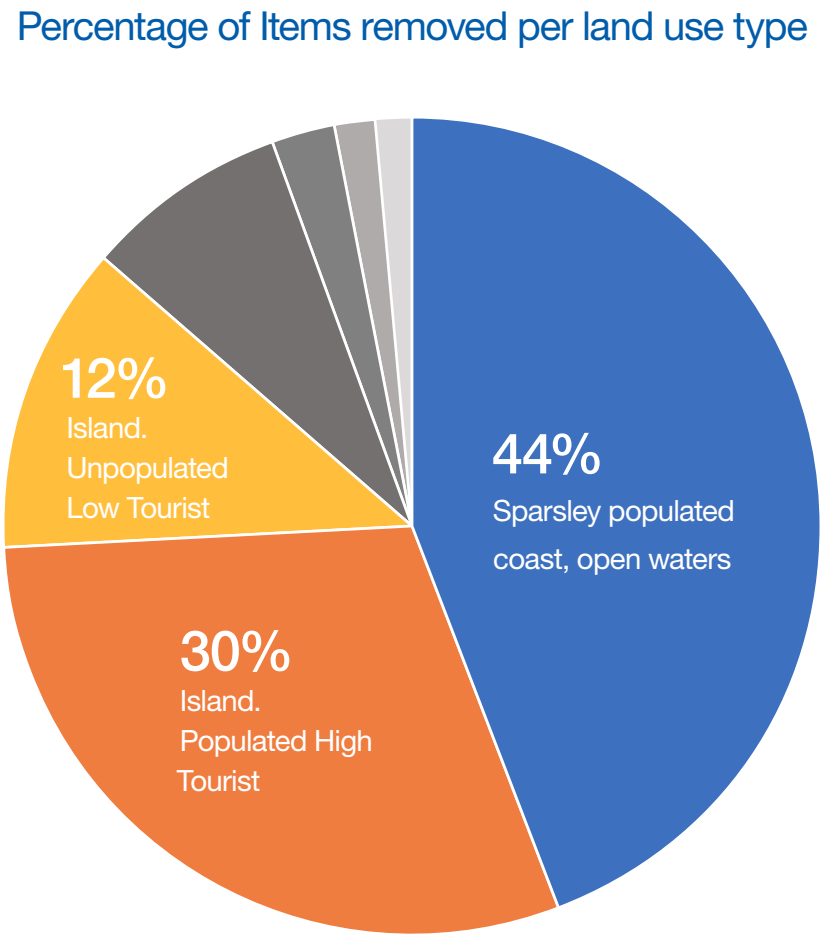

Chart 1 - Percentage of Items removed per land use type.

There are many factors including currents, recreational and industrial activities (eg. shipping) that influence the types of items found across this diverse landscape and there can be significant variations in the top 10 items found at each location.

The top 10 items for the ReefClean project overall as of December 2020 are a familiar blend of discarded plastics and single-use items, including bottle top lids, water bottles and plastic wraps. A stand-out mention also goes to rubber thongs which accounted for 7,874 out of the 15,717 items (50%) recovered from northern Queensland remote and isolated locations (Chart 2).

Top 10 items for ReefClean 2019-2020

Discarded plastics and single-use items, including bottle top lids, water bottles and plastic wraps are nearly 90%

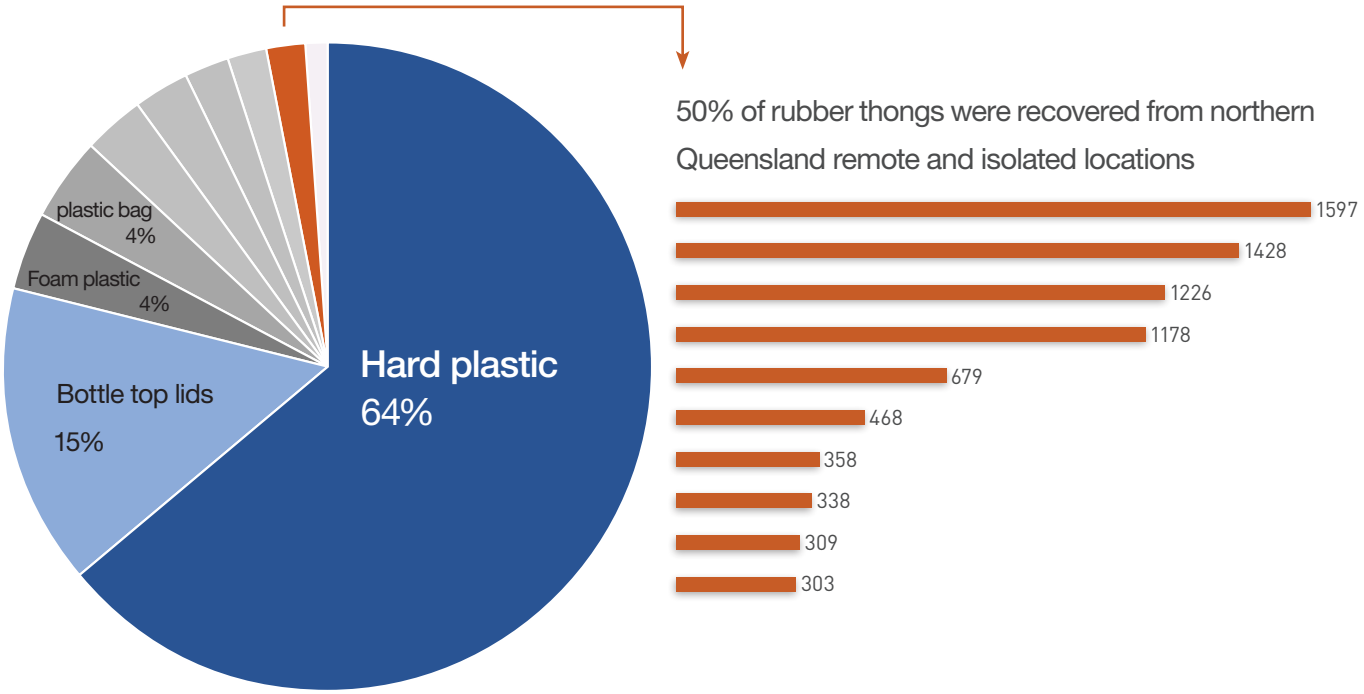

Chart 2 - Top 10 Items ReefClean and thongs found at various beach

Conclusion

The unique dataset that ReefClean has created is a valuable tool for policymakers to identify specific types of pollutants that have a long-term, damaging impact on the world heritage listed Great Barrier Reef ecosystems, local environments, and economy.

If we are to solve the complex problem of ocean pollution for future generations, data from programs like Australia's ReefClean project are essential.

Full reports are available from the Tangaroa Blue Foundation website *www.tangaroablue.org.*


ReefClean
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RESEARCH

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Monitoring and Assessment Program on Plastic Litter on Vietnam's Shoreline During the Period of 2018-2020

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Introduction

The rapid rise of plastic imports, production, and use in Vietnam has led to a country-wide crisis of plastics pollution especially in urban and coastal areas. 55% of consumers consider it a serious problem (Quach & Milne, 2019). Annually, there are about 2.8 to 3.1 million tons of plastic waste discharged on land. Vietnam is listed as a major international plastics polluter: one of the top five polluters of the world's oceans discharging 0.28 – 0.73 million tons annually (Jambeck et al., 2015). Vietnam is also mentioned as one of the countries with the highest mismanaged plastic waste generated by the coastal population (Law et a.l, 2020). In 2016, 0.57 million tons of mismanaged plastic waste were leaked into Vietnamese coastal areas (Law et al., 2020). Related health threats include microplastic fibers found in 12 of 24 commercial fish species in the Gulf of Tonkin (Koongolia et al., 2020). Besides, Vietnam's coral reefs and coastal mangroves were severely polluted by plastic waste. Lamb et al. (2018) estimated 41 million plastic items in Vietnam's coral reefs in 2010, rising to 177 million plastic items in 2025. These threats cause coral disease and a decrease in mangrove cover which in turn causes increased flooding in coastal communities and water-borne diseases, especially for family's dependent on fisheries and tourism (Menéndez et al., 2020).

However, there was no actual quantitative study or statistics compilation conducted on plastic waste in coastal areas, including Marine Protected Areas (MPA), which are the most severely impacted by marine waste pollution. To develop a standard method for monitoring plastic pollution and assessing the state of waste pollution and of plastic waste on beaches, IUCN Vietnam, GreenHub (in 2019), and WWF Vietnam coordinated with the Management Boards of 11 MPAs and National Parks[1] to conduct monitoring surveys and assess the beach debris items in 2020. This is one of the first quantitative studies on plastic waste in coastal areas of Vietnam.

1 Bai Tu Long NP, Bach Long Vy MPA, Cat Ba NP, Con Co MPA, Cu Lao Cham MPA, Ly Son MPA, Nha Trang Bay MPA, Nui Chua NP, Hon Cau MPA, Con Dao NP, Phu Quoc NP;

Following the United States Oceanic Atmospheric Administration (NOAA) and United Nations Environment Programme (UNEP's) document "Methods for surveying and monitoring coastal plastic waste," we adjusted the data collection according to the actual conditions in Vietnam. The criteria for beach selection for the survey are as follows: sandy beach, gravel beach or beach with a coral reef; easy to access, low seasonal fluctuations; at least 100m long; no regular cleanup activities (or if there are, last cleaning activity must occur at least 3 months prior to survey time); located in an MPA and/or there are rare, migratory species such as seabirds and sea turtles dispersed there. Survey and monitoring principles include: ensuring a consistent and cohesive survey process, analyzing samples and processing data differences between localities participating in the program; ensuring no harm and disturbance to the environment, biodiversity, and species during the survey and monitoring process; ensuring the availability and accessibility of data, survey results, and assessments to facilitate source analysis and assessment of changes in plastic waste across the region over time; ensuring the security of people and property for individuals and communities participating in the survey and monitoring process.

Data analysis

Data were collected by Management Boards of the MPAs (Bach Long Vi, Con Co, Cu Lao Cham, Nha Trang, Hon Cau), National Parks (Bai Tu Long, Cat Ba, Nui Chua, Con Dao, Phu Quoc), and volunteers.

After compiling data and correcting errors using Microsoft Excel, data analysis was done through the Minitab 19 software. Mann Whitney U was used to verify the differences in the numbers and mass of beach waste of the two seasons and regions, while Kruskal–Wallis one-way analysis of variance was used for the differences between survey locations. The data were then exhaustively examined using Tukey's Honestly Significant Difference (HSD) test. The average index is calculated per 1 m of beach length, which is a relatively common method used by studies on oceanic plastic waste quantification in many regions in the world.

The Coastal Clean Index (CCI) calculation method is based on the research of (Alkalay, Pasternak, & Zask, 2007). According to the research, CCI is calculated using the following formula:

$$CCI = \frac{\textit{The average quantity of plastic debris per a 5m cross section}}{\textit{The average area of the surveyed cross section}} \times K$$

In which, K is the correlation coefficient with value = 20.

The pollution ratings based on CCI are as follow:

0-2: very clean; 2-5: clean; 5-10: moderate; 10-20: polluted with plastic; >20: extremely polluted with plastic

RESULTS AND DISCUSSIONS

Overview of situation of plastic waste at the beaches

After monitoring 33 beaches in 4 phases (2 in 2019 and 2 in 2020), a total of 165,706 debris items of varying sizes had been collected, and the average is 63.25 items/m (SD ± 78.78). This is equivalent to a total mass of 2718.07 kg with an average of 1.04 kg/m (SD ± 1.74kg). The number (58.15±76.03 items/m) and mass (0.60±1.03 kg/m) of plastic debris (consisting of 20 types) were overwhelmingly higher than other types of waste, and accounted for 92% of the total number and 58% of the total mass. The remaining types of debris items include metal, glass, rubber, wood-paper, fabric, and other waste. These debris types made up a small number but were a high percentage in terms of mass, especially other waste items, which accounted for only 1.3% in number but up to approximately 10% in mass (Table 1).

The number and mass of debris in Vietnam's beaches are higher than that of South Korea (Hong, Lee, Kang, Choi, & Ko, 2014; Lee et al., 2017), making Vietnam one of the regions with the highest amount of plastic waste in the world (an average of 18.36 items/m) (Serra-Goncalves, Lavers, & Bond, 2019).

Table 1. Number and mass of waste collected at the beaches

Type of debris	Number				Mass			
	Total (33 beaches x 4 phases)	Proportion	Average (items/m)	SD	Total (33 beaches x 4 phases)	Proportion	Average (kg/m)	SD
Plastic	152.350	91.9%	58.15	76.03	1,573.4	57.9%	0.60	1.03
Metal	2.092	w.3%	0.80	1.72	83.26	3.1%	0.03	0.16
Glass	2.556	1.5%	0.98	1.53	215.33	7.9%	0.08	0.23
Rubber	3.145	1.9%	1.20	2.15	227.83	8.4%	0.09	0.46
Wood, paper	2.031	1.2%	0.78	2.13	234.64	8.6%	0.09	0.52
Fabric	1.404	0.8%	0.54	1.11	109.13	4.0%	0.04	0.11
Other waste	2.128	1.3%	0.81	2.37	274.44	10.1%	0.10	0.56
Total	165.706		63.25		2.718		1.04	

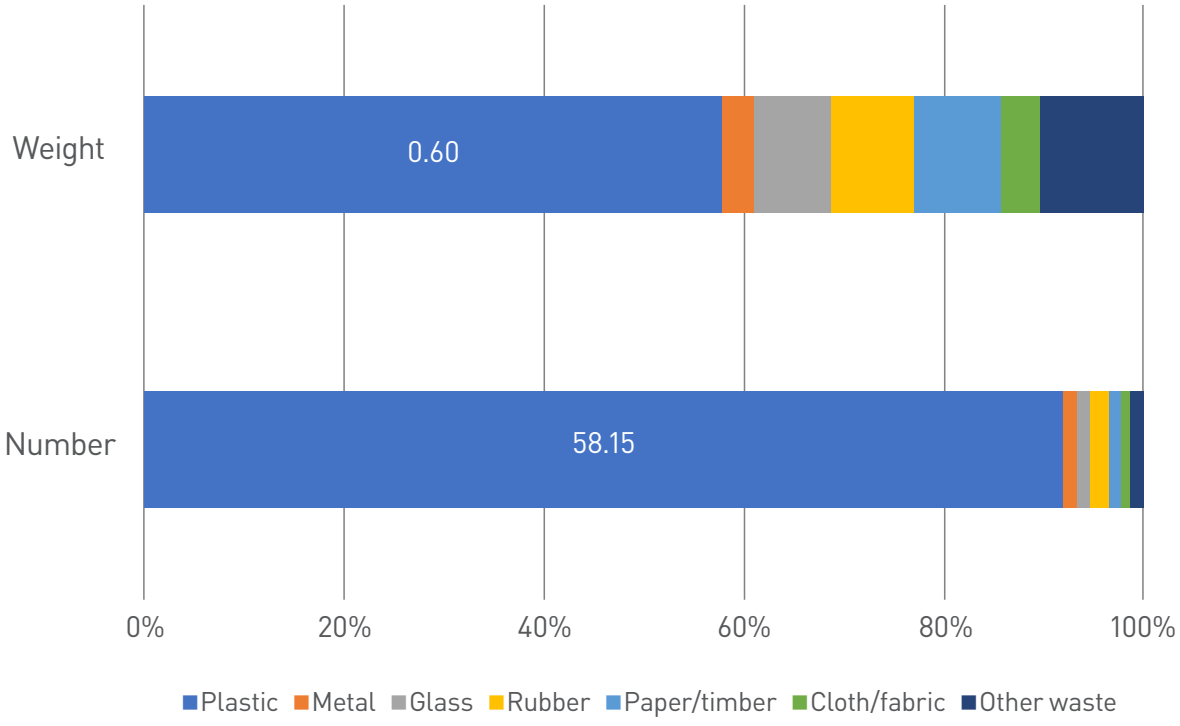

Figure 1. Proportions of waste type over each meter of beach length by number (items) and mass (kg)

Composition of plastic waste on the beaches

Among plastic debris types, foam buoys, ropes and small nets account for the largest proportion in terms of density, while in terms of mass, it's ropes, small nets, and foam buoys (Table 2). More specifically, fishery or fishery-related products (foam buoys, ropes-small nets, plastic buoys, fishing lines) account for 44.8% of the total waste item number and 47.6% of total waste mass. Plastic waste from domestic sources takes second place in both number (26%) and mass (26%). In third place is single-use plastic, which accounts for 21% in number but only 12% in mass. These results show that activities associated with fishing, aquaculture, and aquatic trade are the biggest source of waste on Vietnamese coasts, both in terms of number and mass. However, current policies focus mainly on domestic waste (such as nylon bags, plastic bottles, etc.) Therefore, it is necessary to have more in-depth research done on a larger spatial scale (on water surface, rocky reefs, coral reefs, mangroves, etc.) to more accurately identify the threats presented by this sector to the environment, especially regarding plastic pollution.

Table 2. The number and mass of plastic debris on the survey beaches

Type of plastic debris	Number			Mass		
	Average (items/m)	SD	Proportion	Average (kg/m)	SD	Proportion
1. Fishery						
Foam buoy	14.88	36.14	25.6%	0.09932	0.1989	15.0%
Rope/small net	9.73	23.62	16.7%	0.1809	0.7818	27.4%
Plastic buoy	0.9813	2.2477	1.7%	0.03224	0.0877	4.9%
Fishing line	0.4527	2.0346	0.8%	0.002081	0.00992	0.3%
2. Domestic						
Bottle cap/HDPE	3,493	7,059	6.0%	0.01124	0.02676	1.7%
Hard plastic	3,444	8,566	5.9%	0.0349	0.07385	5.3%
Beverage bottle	2,586	5,102	4.4%	0.06552	0.14486	9.9%
Food packaging	2.54	4.59	4.4%	0.02491	0.07073	3.8%
Cigarette filter	1.6	10,522	2.8%	0.001021	0.005176	0.2%
Other types of bottle	0.5664	1.1722	1.0%	0.0218	0.05199	3.3%
Personal hygiene products	0.5073	0.8751	0.9%	0.007101	0.016674	1.1%
Lighter	0.3802	0.5919	0.7%	0.004493	0.012215	0.7%
3. Single-use						
Styrofoam food container	6.86	31.56	11.8%	0.00893	0.03677	1.4%
Nylon bag	2,609	11,388	2.9%	0.05341	0.16841	2.1%
Single-use plastic	1,705	3.06	1.8%	0.01358	0.03705	0.2%
Straw	1.0302	1.7884	4.5%	0.001073	0.002616	8.1%
4. Other sources (multiple sources or unidentifiable sources)						
Other plastics	3,323	16,115	5.7%	0.08803	0.21393	13.3%
Soft plastic	1,162	3,101	2.0%	0.004985	0.016261	0.8%
Thin plastic	0.3038	1.3903	0.5%	0.003999	0.020008	0.6%
Balloon	0.01031	0.07704	0.02%	0.001123	0.012036	0.2%

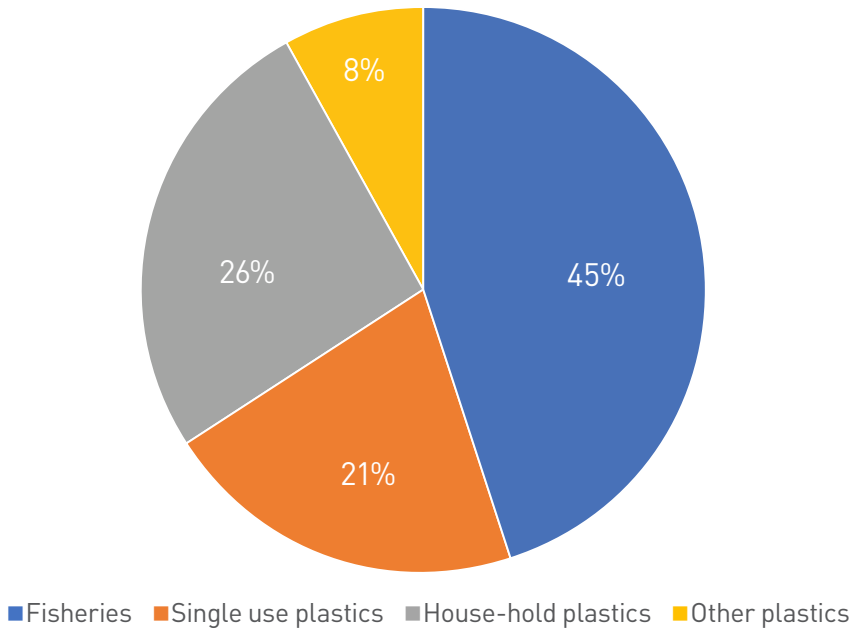

Figure 2. The proportion of plastic item number by waste source

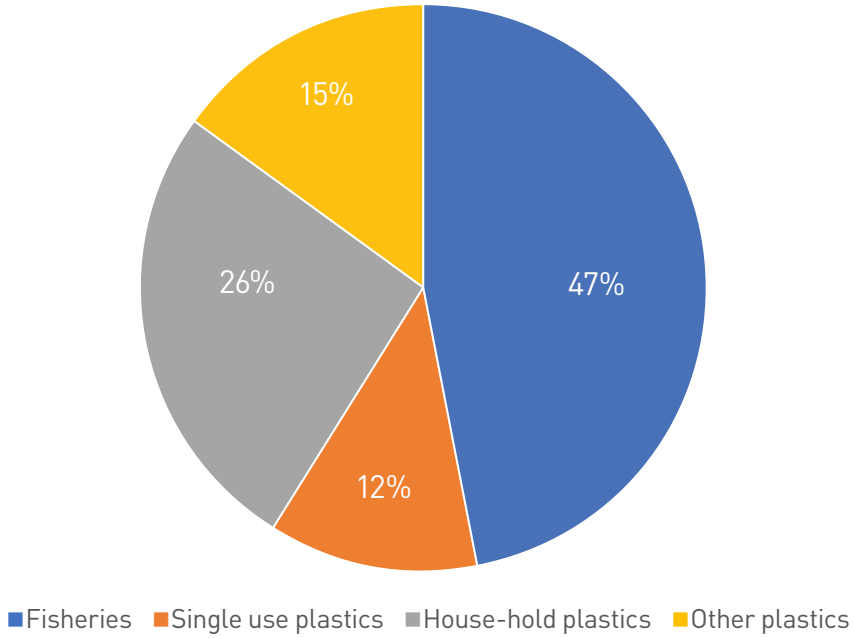

Figure 3. The proportion of plastic waste mass by waste sources

Assessing the plastic pollution levels of survey beaches

Through 4 survey phases in 43 beaches and 11 locations, the CCI shows that the majority of beaches suffer from heavy plastic pollution. In the 1st phase, 72.7% of the beaches were rated very polluted (CCI>20). This figure went down to 53% in the 2nd phase and went up again to 60.6% and 63.6% in phase 3 and phase 4. The (10<CCI<20) pollution level was quite uncommonly encountered in the first phase (6%), but substantially increased in phases 2, 3, and 4. Therefore, the number of beaches with bad environmental quality (ranked polluted and above) stayed relatively the same from 25 to 26 beaches in all four phases (75% to 79%). The number of beaches that were rated moderate to clean ranged only from 7 to 8 beaches (22 to 25%), among which only 1 to 3 beaches were rated very clean (3% to 9%).

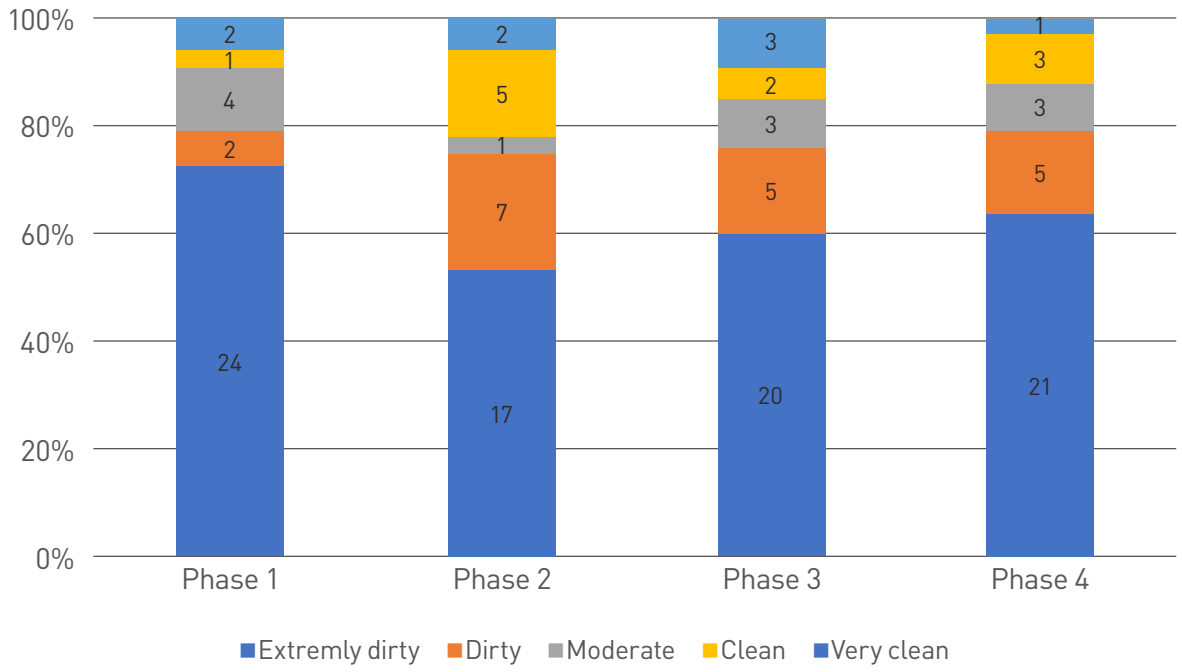

Figure 4. Quality proportions of survey locations according to CCI

Several beaches had an alarming plastic pollution level of over 120, most of which were found in Ly Son and Nha Trang. The most surprising finding was that some island beaches such as Con Dao (CBD1), Cu Lao Cham (CLCB1, CLCB2), Cat Ba (CBB3), Hon Cau (HCB2, HCB3), Bai Tu Long (BTLB1), and Bach Long Vy (BLV) were also suffering from plastic pollution.

CONCLUSION

- The average number and mass of waste found on surveyed beaches were relatively high, reaching an average of 63.25 (pieces/m) and 1.04 (kg/m). Specifically, plastic debris accounted for a huge proportion in terms of number (92%) and mass (58%). In the composition of plastic waste, plastic waste that originated from fishery activities (aquaculture, fishing, trading, etc) accounted for an overwhelming proportion (44.8% in terms of number, 47.6% mass), followed by single-use plastic products (26% number, 26% mass) and plastic generated by other activities (21% number, 12% mass).

- The first survey in 2019 had the highest number of waste items, followed by the fourth survey, and the third survey having the lowest number of items. However, the waste mass in phase 4 was significantly higher than that of the three previous phases. The number and mass of waste on the beaches during the northeasterly monsoon season are similar to that of the southwesterly season.
  Southern beaches (beaches from Hai Van Cape to the end of Kien Giang) had a higher waste mass than the Northern beaches, however, this is not a statistically significant difference.

- A comparison between the beaches on offshore islands, coastal islands, and the mainland shows that there were statistical differences in the number and mass of plastic debris of the beaches, with the beaches on coastal islands having the lowest number and mass among all the beaches. The average

number and mass of waste on coastal islands were lower than that of the other two location categories. The beaches of Ly Son and Nha Trang had a higher number and mass of waste compared to the beaches in other localities. Among 34 surveyed beaches, only two had a lower number and mass of plastic debris than the world average, while the rest all exceeded it.

- The Coastal Clean Index (CCI) shows that the majority of the beaches included in the survey were heavily polluted with plastics, with more than 70% ranked as very polluted, while clean and very clean beaches only accounted for 10% to 23% of all survey beaches.

RESEARCH

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Assessing Marine Debris Retention and Accumulation Rate at Keelung Islet and the Perceptions of Marine Debris Among Rock Anglers

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Marine debris often accumulate on the edges of land. However, the removal of marine debris accumulated on islets and reefs often pose challenges due to the limitations of infrastructures and the lack of means to access these areas. Keelung Islet is an uninhabited island located in the northeast of Keelung City, Taiwan. Several reefs around the Keelung Islet can only be reached by boats, and only reef anglers visit the reefs for fishing. Due to these characteristics and its surrounding reefs, Keelung Islet creates a special case study to understand marine debris accumulation on uninhabited islands.

In our study, we aim to understand the accumulation of marine debris on Keelung Islet and its surrounding reefs, by focusing on: (1) the retention time and accumulation rate of marine debris on Keelung Islet, and (2) the distribution of marine debris in reef fishing areas around Keelung Islet.

First, we conducted surveys on Keelung Islet from July to October 2020. We set up two 30 meter (m) transect lines in southwest (Transect A) and northwest (Transect B) regions of the islet respectively (Figure 1). Additionally, one marine debris hotspot (Location C) was also surveyed (Figure 1). Since tourists are not allowed to enter these survey areas, we assumed that the accumulation of marine debris in these areas were due to forces of nature. For each survey area, we recorded the number and types of the marine debirs and then calculated their accumulation rate and retention time. We identified 354 items of debris in three survey areas on Keelung Islet, with PET bottles being the most abundant debris, accounting for 71.47%, followed by styrofoam (9.32%). The mean retention time was the

1 Institute of Marine Affairs and Resource Management (IMARM)

longest in the northwest transect (Transect B) (84.87 days per item), while the shortest mean retention time was in Location C (3.31 days per item). The highest mean accumulation rate of marine debris was in the hotspot, Location C (32.63 debris items per week) and the lowest was in the southwest transect (Transect A) (4.66 items per week). Next, we conducted questionnaire surveys from November 2020 to April 2021 to investigate the distribution and types of marine debris for each reef fishing location, as well as the perceptions of rock anglers regarding the issue of marine debris problems in fishing areas. We collected 125 questionnaires from 115 rock anglers. We found that of the surveyed rock anglers, 38% of them reported to not have seen any marine debris in reef fishing areas while angling. These rock anglers also reported that while the amount of debris has been decreasing, PET bottles were reported as the most common debris found in fishing reefs. They also reported that fishing grounds east of Chicken Heart Rock has the highest amount of debris compared to other fishing grounds. About 39% of surveyed anglers reported that an effective way to resolve the issue of marine debris is to enforce anglers to take their trash with them or have them risk getting their fishing license revoked. The results of this study will provide useful information to management agencies that remove accumulated marine debris from the uninhabited islets around Taiwan.

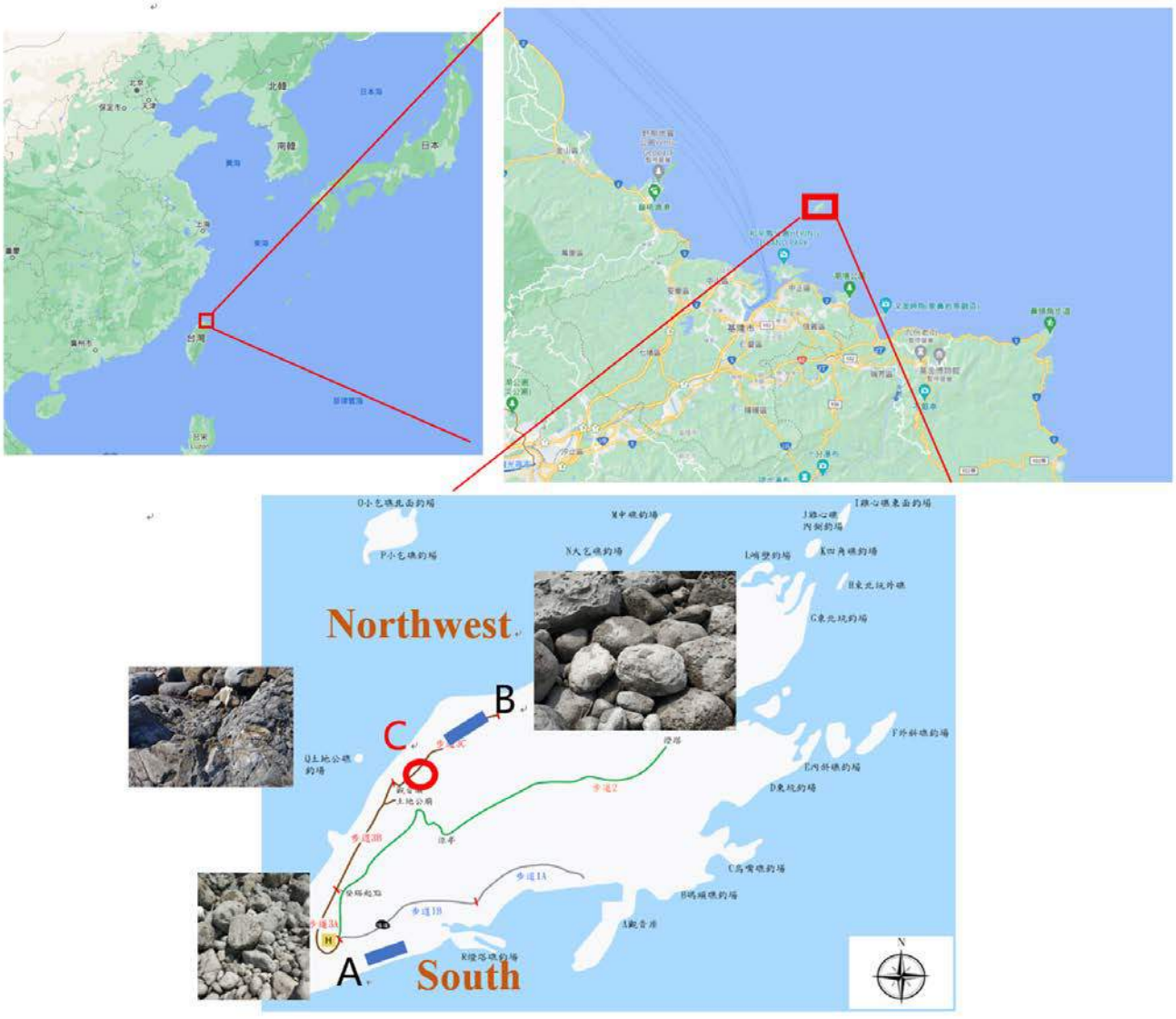

Figure 1. The survey areas on Keelung Islet.

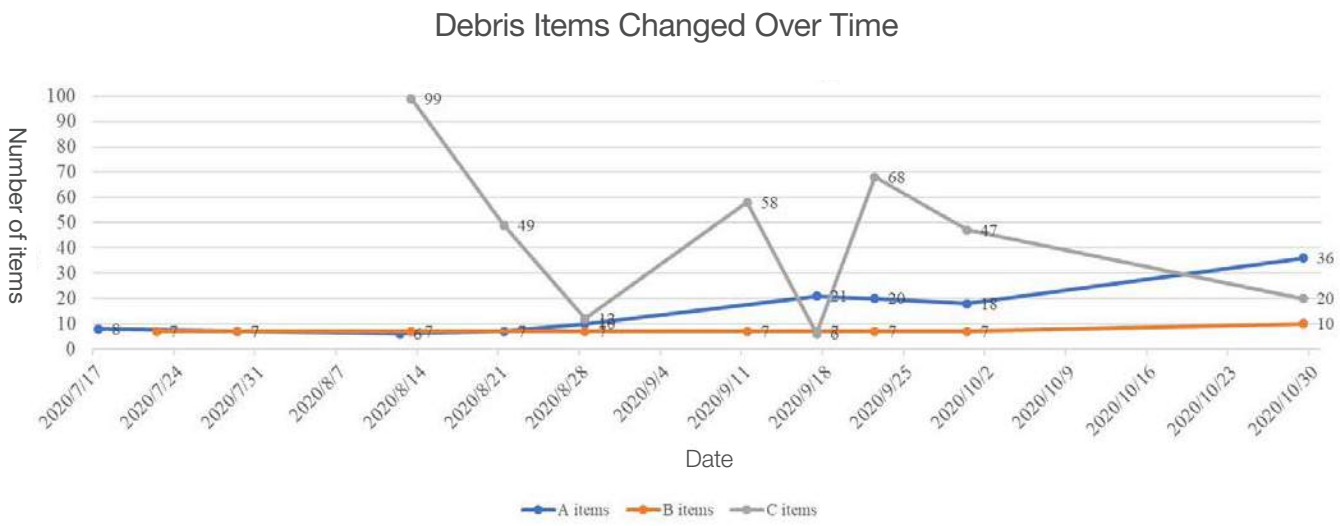

Figure 2. The number of items changed in the three survey areas on Keelung Islet.

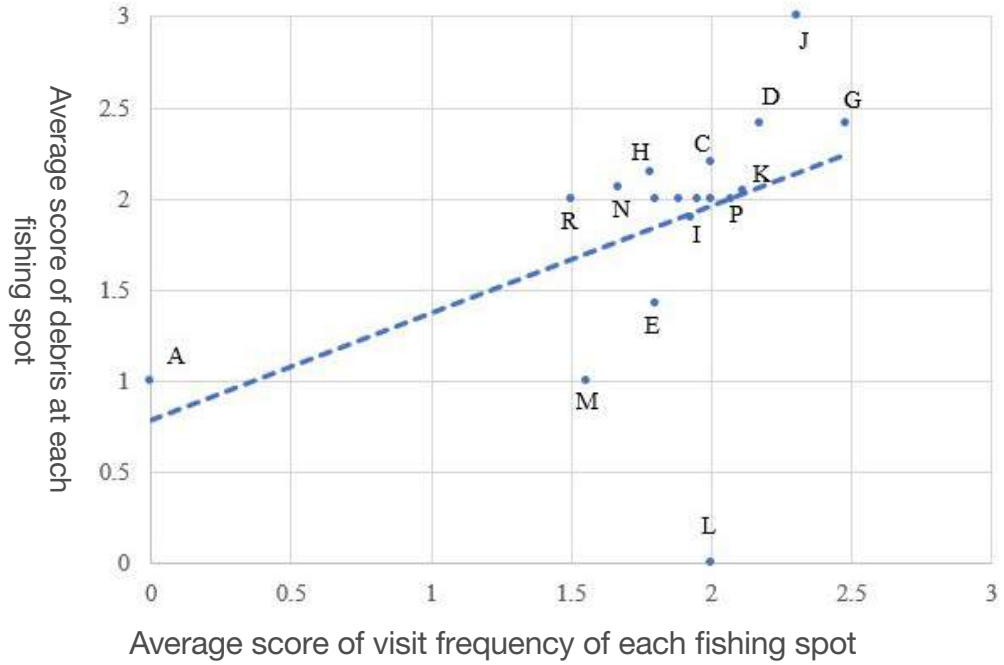

Figure 3. The frequency of visits to each reef fishing area versus the amount of debris in each reef fishing area reported by surveyed anglers.

*For the score of X and Y axes, surveyed fishers were asked to rank the frequency of visit for each fishing spot and the debris of each fishing spot. This then turned into scores. The most visited fishing spot or the fishing spot with most debris got a score of 3, the second most visited fishing spot or the fishing spot with the next most debris got a score of 2, and the least visited fishing spot or the fishing spot with the least debris got a score of 1.

The frequency of visiting a fishing spot and the debris of each fishing spot	Score
Top 1	3
Top 2	2
Top 3	1

Introducing Indonesian Waste Platform (IWP)

As a non-profit organization established in 2015, **Indonesian Waste Platform (IWP)** boasts a strong network of stakeholders actively participating in all provinces of Indonesia. By being the glue that holds cross-sectoral stakeholders together, IWP takes on a collective approach to address issues of waste and climate change under a common agenda. The core principles under this collective approach include: aligning stakeholders to the common agenda; sharing methodologies to mitigate waste and climate change; mutually reinforcing the activities of stakeholders; and engaging in active communication with stakeholders. In 2018, with involvement of international organizations, governmental and non-governmental organizations, business owners, students, and educators as participating stakeholders, IWP also co-founded the International Waste Platform which now enjoys the membership of more than 6,000 stakeholders from 31 countries. Through this national and international network, members of IWP and the International Waste Platform advocate for the international standardization of recycling codes and for the harmonization of marine litter monitoring and data collection.

IWP is also an active leader in enhancing environmental education. By collaborating with local governments, IWP provides training for educators to advance waste and climate change literacy. Programs like Green Indonesia equip teachers with 30 lesson plans on environmental education, and initiatives like Plastic Free Campus help students embrace sustainable consumption through reducing single-use plastics. In addition to these activities in schools, IWP's engagement with communities extend to rural and remote regions in Indonesia as well. Utilizing their wealth of knowledge and expertise, the team at IWP collaborates with local governments and non-governmental stakeholders to improve Indonesia's waste management. This includes minimizing the impact of waste generated from tourism, establishing collection points for recyclables, raising awareness on the harmful impacts of open burning plastics, and supplying appropriate waste management equipment.

Lastly, IWP continuously raises public awareness for reducing single-use plastics and promotes the use of reusable and refillable products. By providing free downloadable posters exposing the dangers of open burning and urging the reduction of plastic waste, IWP tirelessly searches for ways to educate and communicate with its community members. To learn more about IWP's work and its partnerships visit *www.indonesianwaste.org* or find them on Instagram *@indonesian.waste.platform.*

What is Asia Pacific Civil Forum on Marine Litter?

Asia Pacific Civil Forum on Marine Litter is a network established in 2009, made of NGO groups dedicated to protection of marine environment from marine litter in Asia Pacific countries.

Network member groups are:

Japan Environmental Action Network (JEAN)
Our Sea of East Asia Network (OSEAN)
Taiwan Ocean Cleanup Alliance (TOCA)
Shanghai Rendu Ocean NPO Development Center
Kewkradong Bangladesh
ICC Philippines
Tangaroa Blue Foundation
Ocean Conservancy
Greenhub
Indonesian Waste Platform

To the readers,

East Asian countries are connected to each other environmentally, geographically, historically, or culturally through shared regional seas. The East Asian region is one of the most dynamic economic centers with some of the busiest shipping lanes in the world. With the spread of mass production and consumption over the last decades came the huge increase in solid waste generation. There are, however, not enough waste treatment facilities and management measures, which makes the region vulnerable to marine debris pollution.

Entering the seas in large amounts, floating debris has become a source of concerns and conflicts among some neighboring countries. This transboundary environmental problem requires concerted efforts of all the relevant stakeholders beyond sectoral and political boundaries. In this regard, OSEAN (Our Sea of East Asia Network) and JEAN (Japan Environmental Action Network), the marine debris NGOs in Korea and Japan, have shared a vision in which people in the East Asia could act together as one community in protecting our precious marine ecosystems. We believe that NGOs in the East Asian countries have an important role in sharing experiences and acting together to address the marine debris issue in the region from the bottom up.

The city governments of Shimonoseki and Nagato, and JEAN co-organized '2009 Marine Litter Summit - Shimonoseki•Nagato Meeting' on October 16-18, 2009, in Shimonoseki, Japan. OSEAN suggested in the meeting to start an 'East Asian Civil Forum on Marine Litter' through which relevant NGOs and organizations in the East Asia could share experiences and information and work together on the marine debris problems. OSEAN and JEAN have reached a consensus to launch the forum and publish biannual newsletters. So we have launched the East Asian Civil Forum on Marine Litter and we are delivering marine debris news from member countries via e-mail to people who are concerned with this problem on local, national, and regional levels. In late 2012 now, we have four members above. We hope that the forum could provide a venue for all of us to share our vision, experiences, and creative actions.

This is the first effort to link the East Asian people beyond geographical and language barriers to a common goal of protecting our seas from marine debris pollution. NGOs and organizations that have interests and passion to make our seas clean and healthy are more than welcome to join us. For more information, you can contact us at *osean@osean.net.* Please let us know if you have any problem in receiving the newsletter. These articles are also available online at *http://www.osean.net/en/bdlist/marine.php.*

Secretariat,
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