



**Asia-Pacific
Economic Cooperation**

Advancing Free Trade
for Asia-Pacific **Prosperity**

Compendium of Policies and Preventive Measures to Reduce Land-based Marine Debris in APEC Economies

APEC Policy Support Unit

December 2019

Prepared by:

Akhmad Bayhaqi and Satvinderjit Kaur Singh
Asia-Pacific Economic Cooperation Policy Support Unit
Asia-Pacific Economic Cooperation Secretariat
35 Heng Mui Keng Terrace
Singapore 119616
Tel: (65) 6891-9600 Fax: (65) 6891-9690
Email: psugroup@apec.org Website: www.apec.org

Ramboll Environ Singapore Pte Ltd

Produced for:

Ocean and Fisheries Working Group
Asia-Pacific Economic Cooperation

APEC#219-SE-01.21



This work is licensed under the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 Singapore License. To view a copy of this license, visit <http://creativecommons.org/licenses/by-nc-sa/3.0/sg/>.

The views expressed in this paper are those of the authors and do not necessarily represent those of APEC Member Economies.

TABLE OF CONTENTS

| | |
|---|------------|
| Executive Summary | iii |
| 1. Introduction | 1 |
| 2. Overview | 2 |
| 2.1 Background to the study | 2 |
| 2.2 Marine debris pollution | 4 |
| 2.3 Study methodology | 5 |
| 3. Measures to Tackle Marine Debris in APEC Economies | 8 |
| 3.1 Australia | 8 |
| 3.2 Brunei Darussalam | 9 |
| 3.3 Canada | 11 |
| 3.4 Chile | 13 |
| 3.5 China | 14 |
| 3.6 Hong Kong, China | 15 |
| 3.7 Indonesia | 17 |
| 3.8 Japan | 18 |
| 3.9 Korea | 19 |
| 3.10 Malaysia | 20 |
| 3.11 Mexico | 21 |
| 3.12 New Zealand | 23 |
| 3.13 Papua New Guinea | 24 |
| 3.14 Peru | 25 |
| 3.15 The Philippines | 26 |
| 3.16 Russia | 27 |
| 3.17 Singapore | 29 |
| 3.18 Chinese Taipei | 30 |
| 3.19 Thailand | 31 |
| 3.20 United States | 33 |
| 3.21 Viet Nam | 34 |
| 4. Measures Taken in Other Economies | 36 |
| 4.1 European Union | 36 |
| 4.2 Norway | 38 |
| 5. Summary of Measures in APEC Economies | 39 |
| 5.1 Survey findings | 39 |
| 5.2 Identification of gaps and needs for marine debris management | 49 |
| 6. Conclusion | 53 |
| Bibliography | 54 |

EXECUTIVE SUMMARY

Marine debris (or marine litter) can be defined simply as ‘litter that ends up in oceans, seas, and other large bodies of water’. It is estimated that 80 percent of all marine debris is made up of plastics, a non-biodegradable, synthetic organic polymer. Additionally, about 80 percent of plastic waste in the oceans comes from land-based sources. Marine debris has been recognised as a growing concern globally with impacts on economies, the environment (including marine organisms and their ecosystems), and potentially, human health.

To support the APEC Chile 2019 priorities, Chile proposed to develop a compendium of preventive measures for marine debris control in APEC economies. Preventive measures in this context are those that aim to reduce the amount of marine debris and contributing materials. To gather information for the compendium, direct survey and secondary research are used. Areas covered include waste management measures, land-based and sea-based marine debris preventive measures, marine debris monitoring, and current measures for plastic waste.

The main findings from the survey responses and secondary research are as follows:

Summary of Measures, Policies and Initiatives Implemented by APEC Economies

- Most economies have established general management of domestic and industrial waste. They have regulations on proper waste management, anti-littering, and prevention of dumping of waste on land (especially beaches) and/or at sea from any ship or vessel.
- With legislation in place, several economies have implemented enforcement regimes that are essential to preventing marine debris pollution. Enforcement efforts target sources of pollution, including industries such as fishery and aquaculture, and even landfill sites near rivers.
- Many economies have implemented economy-wide policies to prevent marine debris pollution through the 3Rs (reduce, reuse and recycle) and reduction of plastic usage.
- Many economies have developed waste management services or infrastructure at strategic locations (such as harbours, ports or villages) and they provide transportation of waste from remote islands to the mainland for disposal and treatment.
- Many economies encourage collaboration and partnerships between the public and private sectors to promote clean-ups, education campaigns, and innovation in alternatives to plastic.
- Most economies provide funding for academia to conduct research on marine debris, including monitoring and clean-up. In some cases, subsidies are provided to local governments to set up waste management infrastructure (recycling stations).
- Research conducted by most economies focus on the impact of marine debris, typically microplastics, its distribution, its impact on biodiversity and health, as well as monitoring methods.
- Many economies conduct beach clean-up activities as a remedial measure, and some economies clean up marine debris floating on the sea or even those on the seabed

(underwater). These activities are targeted at polluted areas and require collaboration among local governments, voluntary groups and public institutions.

Gaps in Marine Debris Prevention

- **Regulatory framework:** There is a need for stricter enforcement, especially aimed at the source of the marine debris (e.g., fisheries or illegal dumping). More has to be done to develop laws specific to the management of plastic waste and recycling.
- **Institutional framework:** There is no clear institutional framework for creating a detailed economy-wide action plan to implement new policies, infrastructure (municipal or recycling facilities), education, research, funding and communication across various relevant stakeholders.
- **Collaboration:** New policies and measures on marine debris may suffer from a lack of engagement by and constructive feedback from stakeholders during the design and implementation stages.
- **Innovation:** Despite the gradual restriction and ban of plastics in many APEC economies, there is a lack of innovation on alternative materials.
- **Awareness:** There is an absence of targeted awareness-raising across known marine debris sources, such as industry sectors (e.g., fisheries, aquaculture or tourism) or community groups (e.g., in rural or coastal areas).
- **Remedial measures:** There is still a lack of coordinated efforts and planning for marine debris clean-up activities, including clean-up protocols, guidance on methodologies and centralisation of marine debris data.
- **Monitoring:** Many economies employ manual counting during beach clean-ups, which suggests the need for more effective and efficient monitoring systems and wider adoption of current technologies.

Overall, APEC economies have implemented a wide range of measures, including both regulatory and non-regulatory instruments, to manage marine debris pollution. Through the compendium, APEC economies would be able to gain a better understanding of current best practices and identify areas for future collaboration.

1. INTRODUCTION

Marine debris (or marine litter) is defined as ‘any persistent solid material that is manufactured or processed and directly or indirectly, intentionally or unintentionally, disposed of or abandoned into the marine environment’.¹ A simpler definition by *National Geographic* says: ‘Marine debris is litter that ends up in oceans, seas, and other large bodies of water’. It is estimated that 80 percent of all marine debris is made up of plastics, a non-biodegradable, synthetic organic polymer.² Experts estimate that about 80 percent of plastic waste in the oceans comes from land-based sources. Marine debris has been recognised as a growing concern globally with impacts on economies, the environment (including marine organisms and their ecosystems), and potentially, human health. Urgent measures are needed to control the increasing flow of plastic waste into the ocean.

Several studies conducted by APEC show that marine debris results in substantial environmental, economic and social costs to APEC economies. The Ocean and Fisheries Working Group (OFWG) previously endorsed the need for a systematic capacity-building programme to address marine debris and approved the Capacity Building for Marine Debris Prevention and Management in the APEC Region Project in 2016.³ To support the APEC Chile 2019 priorities, Chile proposed developing a compendium of preventive measures for marine debris control in APEC economies. Preventive measures in this context are those that aim to reduce the amount of marine debris and contributing materials. The preventive measures and policies on marine debris of APEC economies are gathered through direct survey and secondary research in areas such as waste management measures, land-based and sea-based marine debris preventive measures, marine debris monitoring, and current measures for plastic waste.

This report summarises the findings of the survey and research, and creates a compendium of preventive measures and policies that APEC economies are taking to reduce land-based marine debris. Through the compendium, APEC economies can gain a better understanding of current best practices and will be able to identify areas for future collaboration.

¹ B.D. Hardesty et al., ‘Understanding Debris Sources and Transport from the Coastal Margin to the Ocean’ (EP165651, CSIRO, 2016).

² ‘UN Declares War on Ocean Plastic’, United Nations Environment Programme, 23 February 2017, <https://www.unenvironment.org/news-and-stories/press-release/un-declares-war-ocean-plastic>.

³ ‘Ocean and Fisheries’, Asia-Pacific Economic Cooperation, updated September 2019, <https://www.apec.org/Groups/SOM-Steering-Committee-on-Economic-and-Technical-Cooperation/Working-Groups/Ocean-and-Fisheries>.

2. OVERVIEW

2.1 BACKGROUND TO THE STUDY

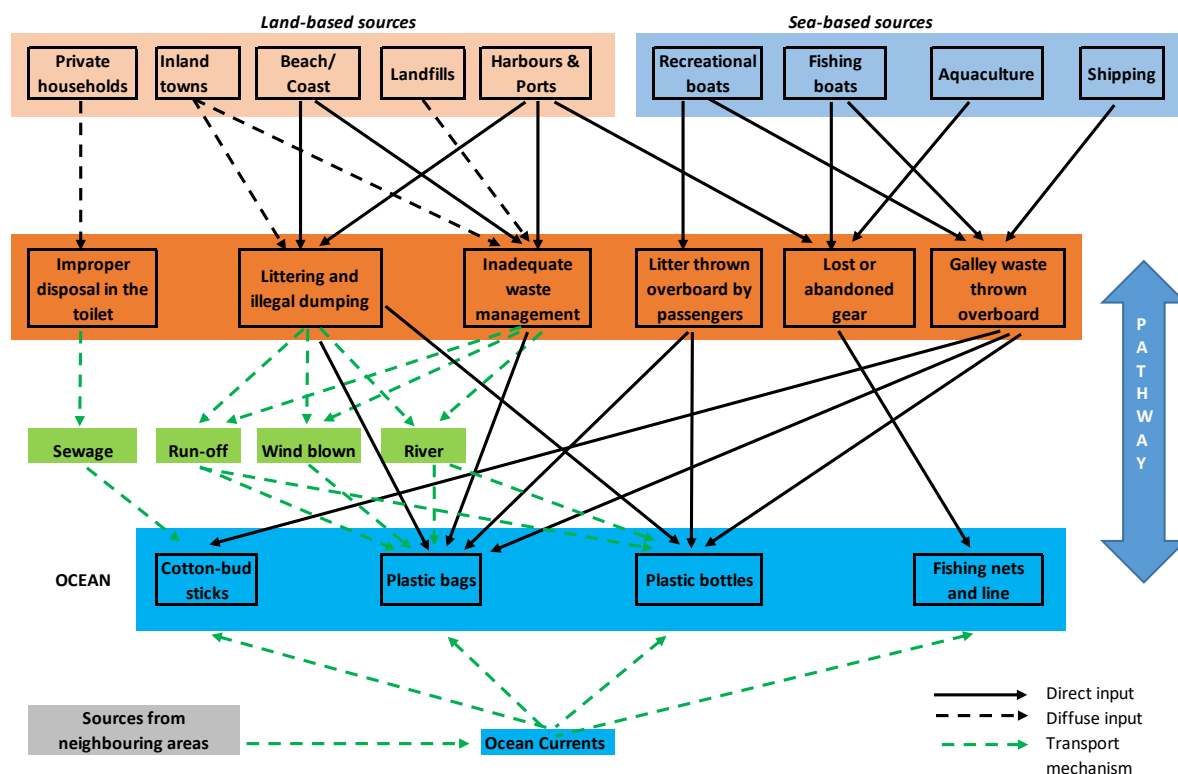
Since 1990, the year APEC Ministers first proposed it as a new area of work, marine debris has been a discussion topic in APEC.⁴ Since then, APEC has held four Ocean-related Ministerial Meetings, and formed the Ocean and Fisheries Working Group (OFWG) and the Virtual Working Group on Marine Debris. At the 2014 Ocean-related Ministerial Meeting, Ministers in their Xiamen Declaration agreed to encourage cooperation on the reduction and mitigation of marine pollution (including from land-based sources and oil spills) and on the continued expansion of efforts to reduce marine debris. In 2016, APEC Leaders encouraged work to address the lack of effective waste management to better manage the marine debris issue.

As a step toward improving waste management, an understanding of APEC economies' current preventive measures and policies to reduce the entry of plastic waste into the sea is required. Veiga et al. divide the origin of marine debris into: (1) sea-based origin: litter that is being directly released into the sea as a result of maritime activities such as shipping, fishing, offshore installations, and dumping of refuse at sea; and (2) land-based origin: litter that originates from the coast such as beach tourism, but also includes sources from more distant areas such as towns or industrial sites that make their way into the sea through certain transport or pathway mechanisms; more specifically, rivers are considered the transport mechanism whereas effluents are regarded as the pathway of entry.⁵ Figure 2.1 provides an example of the 'supply-chain' of waste from land-based and sea-based sources into the ocean.

⁴ '1990 APEC Ministerial Meeting, Singapore, 29 July 1990', Asia-Pacific Economic Cooperation, 29 July 1990, https://www.apec.org/Meeting-Papers/Annual-Ministerial-Meetings/1990/1990_amm.

⁵ J.M. Veiga et al., 'Identifying Sources of Marine Litter. MSFD GES TG Marine Litter Thematic Report' (JRC Technical Report, EUR 28309, Luxembourg: Publications Office of the European Union, 2016), 11, doi:10.2788/018068.

Figure 2.1. Multiple sea- and land-based sources of four common items of marine litter and their potential pathways of entrance into the marine environment



Source: Adapted from J.M. Veiga et al., 'Identifying Sources of Marine Litter. MSFD GES TG Marine Litter Thematic Report' (JRC Technical Report, EUR 28309, Luxembourg: Publications Office of the European Union, 2016), 11, doi:10.2788/018068.

A marine debris survey was conducted to gather APEC economies' responses on the preventive measures they have in place to tackle marine debris. In this way, economies will be able to share their current best practices and find possible ways to collaborate.

The key objective of the survey is to develop a compendium of preventive measures for marine debris management in APEC economies. The scope of this study includes:

- **Improving waste management measures** – by understanding how economies regulate waste management and development laws, and binding management instruments on waste management.
- **Improving the terrestrial environment** – through best practice landfill systems, and incentive schemes for efficient and sustainable waste storage solutions.
- **Preventing the entrance of marine debris** – by understanding how best to apply preventive measures such as regulation of submarine emissaries, emissions of naval artefacts, and industrial waste.
- **Enhancing the monitoring of marine litter** – through a shared understanding of the best monitoring measures and how economies can work together to monitor on a regional basis.

Current measures focusing on plastic waste are also included:

- **Plastic waste prevention policies** – including prevention and control measures such as reducing the unnecessary use of single-use plastic, the content of harmful substances, and the adverse impacts of waste on the environment.
- **Effective management of plastic waste** – according to the principle of hierarchy which may include preparation for reuse, recycle and other forms of recovery (including energy recovery and disposal).

2.2 MARINE DEBRIS POLLUTION

The sources of marine debris can generally be classified into land-based and sea-based. Examples are listed below.⁶

- **Sources of land-based marine debris**
 - landfills
 - rivers and floodwaters
 - industrial outfalls
 - discharge from stormwater drains
 - untreated municipal sewerage
 - littering of beaches or coastal areas
- **Sources of sea-based marine debris**
 - fishing and aquaculture
 - shipping (e.g., transport, tourism)
 - offshore mining and extraction
 - illegal or accidental dumping at sea

Marine debris comprises of many materials including glass, wood, metals and rubber, but plastics make up the majority (80 percent). Plastic is a non-biodegradable polymer that has a wide variety of applications, and due to its low cost, the demand for its production continues to rise. It is estimated that 265 million tonnes of plastics were produced in 2010, and demand is predicted to reach up to 300 million tonnes by 2020.

Due to the lack of proper management, these plastic wastes are expected to end up in the ocean. Plastic waste has accumulated at such a high concentration in the Pacific Ocean (over decades) that a floating mass of waste called the Great Pacific Garbage Patch, covering an area of 1.6 million km² has formed.⁷ It is estimated that more than 150 million tonnes of plastics have accumulated in the world's oceans, while an additional 4.6 to 12.7 million tonnes are added every year.⁸

It is broadly estimated that approximately 80 percent of marine debris is land-based, with some specific regional variations (shipping and fishing are dominant sources of litter in the Northeast

⁶ 'Our Oceans, Seas and Coasts – Descriptor 10: Marine Litter', European Commission, updated 4 October 2019, https://ec.europa.eu/environment/marine/good-environmental-status/descriptor-10/index_en.htm

⁷ L. Lebreton et al., 'Evidence that the Great Pacific Garbage Patch Is Rapidly Accumulating Plastic', *Scientific Reports* 8, no. 1 (2018): 4666, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5864935/>.

⁸ J.R. Jambeck et al., 'Plastic Waste Inputs from Land into the Ocean', *Science* 347, no. 6223 (2015): 768–71, doi:10.1126/science.1260352.

Atlantic). Marine debris has the potential to cause serious economic damage to coastal communities, tourism, shipping and fishing. It was estimated to cost APEC economies approximately USD 1.265 billion in 2008.⁹ More recently, in other regions like the European Union (EU), marine debris was estimated to cost member economies about EUR 630 million per year in the form of coastal and beach clean-ups; while the cost to the fishing industry reached EUR 60 million, around 1 percent of the total revenue of the EU fishing fleet in 2010.¹⁰

Besides economic impacts, marine debris has an immense effect on the environment; for example, it threatens marine life through accidental ingestion and potential entanglement. Even though plastics do not biodegrade, they break down into smaller pieces (size of less than 5mm) called microplastics under the influence of ultraviolet (UV) radiation. These microplastics contain toxic substances that can travel up the food chain and will be ultimately consumed by humans. In some cases, marine debris also pollutes beaches and coastlines, which creates aesthetic problems that threaten the tourism industry.

2.3 STUDY METHODOLOGY

The methodology consists of both primary and secondary research. For the former, a survey questionnaire was developed and administered to all APEC economies; for the latter, a review of secondary data was undertaken to complement and complete the gaps from the survey. They are further described below.

a. Develop questionnaire

A survey questionnaire was developed to address key issues, including:

- Understanding how APEC economies regulate waste management, and develop laws and binding management instruments on waste management
 - Current waste management regulatory framework
 - Specific marine debris regulatory instruments (if any)
 - Proposed/future regulatory changes to address marine debris
- Understanding how the terrestrial environment can be improved to prevent land-based marine debris (preventive measures)
 - Beach litter prevention
 - Best practice landfill systems
 - Incentive schemes for efficient and sustainable waste storage solutions
- Understanding how the marine environment can be improved once land-based marine debris has reached the sea (remedial measures)
 - Mitigation measures at sea
 - Biological/marine-related remedial measures
- Understanding management instruments to prevent and mitigate marine debris at source
 - Policy and regulation
 - Industry-led (e.g., incentive-based or market-based instruments)
 - Government–industry collaboration

⁹ A. McIlgorm, H.F. Campbell and M.J. Rule, 'Understanding the Economic Benefits and Costs of Controlling Marine Debris in the APEC Region (MRC 02/2007)' (APEC Marine Resource Conservation Working Group, 2008), <https://www.apec.org/Publications/2009/04/Understanding-the-Economic-Benefits-and-Costs-of-Controlling-Marine-Debris-In-the-APEC-Region>.

¹⁰ European Commission, 'Descriptor 10: Marine Litter'.

- Facilitation of investment in infrastructure improvements (e.g., investment in sewerage systems, outfalls, etc.)
- Public participation (e.g., clean-up, education)
- Implications of land-based marine debris for APEC economies
 - Biological implications of marine debris, including understanding of key concerns for APEC economies (corals, microplastics, etc.)
 - Socioeconomic implications of marine anthropogenic litter, including identification of key affected sectors for APEC economies (fisheries, tourism, shipping, etc.)
- Enhancing the monitoring of marine debris
 - Current and best monitoring measures for various sources of marine debris:
 - landfills
 - rivers and floodwaters
 - industrial outfalls
 - discharge from stormwater drains
 - untreated municipal sewerage
 - littering of beaches or coastal areas
 - Recent actions taken by APEC economies
- Understanding of the current issues with plastic waste
 - Policy and regulation
 - Adopt the principles of waste hierarchy in plastic waste management
- Recommendations for good practice to be implemented, per sector group, per APEC economy, and collaboratively across APEC economies
 - Suggestions of how economies can work together to manage and monitor on a regional basis

b. Complete gaps using secondary data

A review of secondary data was conducted to bridge any gaps from the survey responses, contextualise the survey results and provide an overview of the topic.

Secondary data was drawn from the following sources:

- APEC economies' legislative websites
- Reference documents:
 - Capacity Building for Marine Debris Prevention and Management in the APEC Region, Workshop Report, Korea 2017
 - Marine Litter in the Wider Caribbean: A Regional Overview and Action Plan (RAPMaLi), United Nations Environment Programme 2014
 - *Marine Anthropogenic Litter*, 2015¹¹
 - The European Union's Marine Strategy Framework Directive (MSFD)
- APEC OFWG publications
- Other relevant secondary sources

While the research focused on APEC economies, reference was made to non-APEC economies, including Norway and the European Union, to highlight good practices and emerging preventative measures and policies in the field.

¹¹ M. Bergmann, L. Gutow and M. Klages, eds, *Marine Anthropogenic Litter* (SpringerLink, 2015), <https://link.springer.com/content/pdf/10.1007%2F978-3-319-16510-3.pdf>.

c. Review of survey responses

Completed questionnaires were received from the following APEC economies:

1. Canada
2. Chile
3. China
4. Japan
5. Korea
6. New Zealand
7. Peru
8. Singapore
9. Chinese Taipei
10. United States

The completed questionnaires were analysed, and the main findings summarised in this report. A summary of the survey responses is provided as an annex to this report.

3. MEASURES TO TACKLE MARINE DEBRIS IN APEC ECONOMIES

This section summarises the responses of the marine debris survey from 10 APEC economies and is completed with additional secondary data where available. For the remaining APEC economies, an overview of their key measures is highlighted using available secondary data and literature.

It should be noted that some of the findings are based on secondary data from various sources stated in the methodology and efforts have been made to verify data validity.

3.1 AUSTRALIA

Marine debris is listed as a key process threatening marine life under Australia's Environment Protection and Biodiversity Conservation Act,¹² and a Threat Abatement Plan¹³ has been established to understand the impact of microplastics pollution and discover new waste management technologies. The Threat Abatement Plan provides guidance on actions toward marine debris prevention based on the following objectives:¹⁴

- Contribute to long-term prevention of the incidence of marine debris.
- Understand the scale of impact of marine plastic and microplastic on key species, ecological communities and locations.
- Remove existing marine debris.
- Monitor quantities, origins, types and hazardous chemical contaminants of marine debris, and assess the effectiveness of management arrangements for reducing marine debris.
- Increase public understanding of the causes and impacts of harmful marine debris, including microplastic and hazardous chemical contaminants, to bring about behavioural changes.

The Threat Abatement Plan complements Australia's National Waste Policy 2018¹⁵ to mitigate marine debris by tackling marine debris at the source, improving waste reduction and recycling, and encouraging industry to establish Extended Producer Responsibility for their products.¹⁶

¹² Australian Government, 'Environment Protection and Biodiversity Act 1999, Compilation No. 51' (2016), <https://www.legislation.gov.au/Details/c2016c00777>.

¹³ 'Threat Abatement Plan for the Impacts of Marine Debris on Vertebrate Marine Life', Australian Government, accessed 13 November 2019, <http://environment.gov.au/marine/publications/threat-abatement-plan-impacts-marine-debris-vertebrate-marine-life>.

¹⁴ Australian Government, 'Threat Abatement Plan for the Impacts of Marine Debris on the Vertebrate Wildlife of Australia's Coasts and Oceans' (Commonwealth of Australia, 2018), <https://www.environment.gov.au/system/files/resources/e3318495-2389-4ffc-b734-164cdd67fe19/files/tap-marine-debris-2018.pdf>.

¹⁵ Australian Government, '2018 National Waste Policy: Less Waste More Resources' (Commonwealth of Australia, 2018), <https://www.environment.gov.au/system/files/resources/d523f4e9-d958-466b-9fd1-3b7d6283f006/files/national-waste-policy-2018.pdf>.

¹⁶ 'Product Stewardship', Australian Government, accessed 13 November 2019, <http://www.environment.gov.au/protection/waste-resource-recovery/national-waste-reports/national-waste-report-2013/product-stewardship>.

Australia has also committed to a target of 100 percent recyclable, compostable or reusable packaging by 2025 to reduce waste.¹⁷ The Australian Packaging Covenant is the main economy-wide instrument governing the reduction of environmental impacts of consumer packaging. The Covenant has developed a strategic plan to work on developing sustainable packaging and design, diverting packaging from landfills through consumer education and packaging disposal labelling, and improving packaging sustainability performance through research and sharing of knowledge across industries.

To reduce plastic waste at its source, Australia has established other measures such as voluntary phasing out of microbeads from personal care and cosmetic products, encouraging the ban of single-use plastic bags in all its regions, and implementing container deposit schemes to keep plastics out of the environment and landfills.¹⁸

Regionally, Australia has participated in marine debris prevention efforts, including the Pacific Ocean Litter Project (POLP)¹⁹ and APEC's initiative on this issue.²⁰ The POLP aims to reduce sources of single-use plastics and focus on reduce and refuse (rather than recycle) approaches to waste management within the Pacific Island economies.

The key remedial actions for Australia are the routine clean-up of beach and waterways at numerous locations, even in remote and polluted areas. Collected marine debris is recorded in the Australian Marine Debris Database²¹ that contains information on quantities, types of marine debris, and frequency of clean-up and changes over time in an area. This data will aid in identifying solutions that are customised to a specific area. Funding is also provided for larger scale clean-ups such as that for the Great Barrier Reef.

3.2 BRUNEI DARUSSALAM

The following are the key features of waste management in Brunei Darussalam:²²

- In general, landfill is the most common waste disposal method. The current generation of landfill sites are generally not equipped with leachate treatment or gas collection systems.
- Waste is being collected door-to-door as well as from commercial and light industrial areas.
- The development of a modern waste management system for Brunei Darussalam began with the rehabilitation of the Sungai Akar dump site into a public park. Part of the development included the construction of 35 gas vents and flare pipes along with a

¹⁷ 'Australia's 2025 National Packaging Targets', Australian Packaging Covenant Organisation, accessed 13 November 2019, <https://www.packagingcovenant.org.au/who-we-are/australias-2025-national-packaging-targets>.

¹⁸ 'Plastic Microbeads', Australian Government, accessed 13 November 2019, <https://www.environment.gov.au/protection/waste-resource-recovery/plastics-and-packaging/plastic-microbeads>.

¹⁹ 'Pacific Ocean Litter Project', Australian Government, accessed 13 November 2019, <http://www.environment.gov.au/marine/international-activities/pacific-ocean-litter-project>.

²⁰ McIlgorm, Campbell and Rule, 'Understanding the Economic Benefits and Costs of Controlling Marine Debris'.

²¹ 'Australian Marine Debris Database', Australian Marine Debris Initiative, accessed 13 November 2019, <http://amdi.tangaroablue.org/>.

²² S. Shams et al., 'Integrated and Sustainable Solid Waste Management for Brunei Darussalam' (IET, 2014), 2, doi:10.1049/cp.2014.1066.

subsoil pipe network to a leachate treatment plant. Before discharging into natural waters, the leachate and septic sludge is broken down in several stages. Phase three of this development plan included the establishment of an energy incinerator provided it passed the required feasibility studies.

Brunei Darussalam, as a member of the Association of Southeast Asian Nations (ASEAN), has ratified the Bangkok Declaration on Combating Marine Debris in ASEAN Region, a commitment to strengthening efforts for marine debris reduction.²³ Under its National Development Plan,²⁴ Brunei Darussalam has planned to reduce waste by increasing the recycling rate in the economy. This can be achieved through the introduction of an integrated waste management system and more landfill disposal sites at certain locations.

The key preventive measure for marine debris in Brunei Darussalam was the introduction of the 'No Plastic Bag Weekend' campaign which restricted the use of polythene plastic bags from Friday to Sunday. The initiative has now been extended to include all days of the week, through the 'No Plastic Bag Everyday' initiative.²⁵ This initiative is part of the government policy on zero waste which also aims to gradually phase out the import of plastic bags, and their distribution at retail outlets.²⁶

The following are some regulations concerning sea pollution in Brunei Darussalam:²⁷

- Prevention of Pollution of the Sea Order 2005 – gives effect to the International Convention for the Prevention of Pollution from Ships, 1973; regulates the prevention, reduction and control of pollution of the sea and pollution from ships in line with international agreements.
- Prevention of Pollution of the Sea Regulations – requires inspection of all ships to verify the validity of their Certificate for the Carriage of Noxious Liquid Substances in Bulk.
- Prevention of Pollution of the Sea (Reporting of Pollution Incidents) Regulations – obligates the master of the ship to report discharges of harmful substances into any part of the sea.
- Prevention of Pollution of the Sea (Garbage) Regulations – prohibits the disposal of all plastics into the sea outside special areas, including but not limited to synthetic ropes, synthetic fishing nets, plastic garbage bags and incinerator ashes from plastic products which may contain toxic or heavy metal residues. Within special areas, this also includes all other garbage, including paper products, rags, glass, metal, bottles, crockery, dunnage, lining and packing materials.

²³ Association of Southeast Asian Nations (ASEAN), 'Bangkok Declaration on Combating Marine Debris in ASEAN Region', 22 June 2019, <https://asean.org/storage/2019/06/2.-Bangkok-Declaration-on-Combating-Marine-Debris-in-ASEAN-Region-FINAL.pdf>.

²⁴ Ministry of Development of Brunei Darussalam, 'Strategic Plan 2018–2023' (Bandar Seri Begawan: Ministry of Development, 2018), <http://www.mod.gov.bn/Shared%20Documents/LATEST%20SP%202018%20-%202023.pdf>.

²⁵ D. Norjidi, 'Monday Added to "No Plastic Every Day" Initiative in Brunei', *Borneo Bulletin*, 31 December 2018, <http://annx.asianews.network/content/monday-added-%E2%80%98no-plastic-every-day%E2%80%99-initiative-brunei-88906>.

²⁶ N.A. Ahmad, N.Q. Kamis and S.S.A. Mahdini, 'Brunei's Sustainable Measures for a Successful Environmental Development', *Asian Journal of Legal Studies in Environment* (31 August 2016), <https://alsajournal.com/2016/08/31/brunei-moving-forward-bruneis-sustainable-measures-for-a-successful-environmental-development/>.

²⁷ Ahmad, Kamis and Mahdini, 'Brunei's Sustainable Measures for a Successful Environmental Development'.

Campaigns on anti-littering and reduction of use of disposable and styrofoam products (i.e., containers) were launched to prevent marine debris at the source.²⁸ Brunei Darussalam also plans to introduce the ‘polluter pays principle’ to promote environmental accountability.²⁹

According to Ahmad, Kamis and Mahdini, it is necessary for the government to formulate legislation in line with the existing global standards to protect the environment.³⁰ This may include laws enforcing stricter waste management, allowing only non-recyclable materials into landfills, mandatory source separation, and recycling efforts as well as the usage of recycling bins. Additionally, Lyons, Su and Neo recommend research activities to survey, monitor and identify sources and hotspots of marine plastics in Brunei Darussalam.³¹

3.3 CANADA

Canada has a comprehensive legal framework to contribute to plastic pollution reduction and protection of the environment, species and habitat. Notably, Canada has banned the import, manufacture and sale of plastic-microbead containing toiletries used to exfoliate and cleanse. This is complemented by waste management and pollution legislation and programmes at the subnational level, such as Extended Producer Responsibility and anti-litter laws. Waste management – collection, storage, transportation, treatment (recycling and composting) and disposal (primarily landfill) – is a shared responsibility of all levels of government.

Canada also implements its obligations under the key international agreements related to waste and reducing marine pollution, including the Basel Convention, the International Convention for the Prevention of Pollution from Ships (MARPOL), the London Convention and Protocol and the UN Convention on the Law of the Sea. Canada has also adopted supporting international commitments such as the Food and Agriculture Organization of the United Nations (FAO) Code of Conduct for Responsible Fisheries, the UN Environment Assembly Resolutions and marine litter action plans under the G7, G20 and International Maritime Organization.

Canada has a strategic approach to move toward its zero plastic waste vision with collaboration from the government, industry, non-profit organisations, the public and others with the implementation of various economy-wide initiatives.

Canada championed the Ocean Plastics Charter under its G7 presidency in 2018, bringing together leading governments, businesses and civil organisations to commit to take actions to reduce plastic pollution, and take a more resource-efficient and lifecycle approach to plastic stewardship, on land and at sea. In support of the Ocean Plastics Charter, Canada has announced CAD 100 million in funding to address marine plastic litter, including CAD 6

²⁸ ‘No Styrofoam: Reducing the Use of Styrofoam Containers’, Department of Environment, Parks and Recreation, Ministry of Development, Brunei Darussalam, accessed 13 November 2019, <http://www.env.gov.bn/SitePages/No%20Styrofoam.aspx>.

²⁹ ‘Don’t Destroy Our River’, Department of Environment, Parks and Recreation, Ministry of Development, Brunei Darussalam, accessed 13 November 2019, <http://www.env.gov.bn/SitePages/Don't%20Destroy%20Our%20River.aspx>.

³⁰ Ahmad, Kamis and Mahdini, ‘Brunei’s Sustainable Measures for a Successful Environmental Development’.

³¹ Y. Lyons, T. Su and M.L. Neo, ‘A Review of Research on Marine Plastics in Southeast Asia: Who Does What?’ (2019), <https://www.gov.uk/government/publications/a-review-of-research-on-marine-plastics-in-sea-who-does-what>.

million for the World Economic Forum Global Plastic Action Partnership (GPAP), CAD 65 million through the World Bank PROBLUE fund to address plastic waste in developing countries and CAD 20 million for an International Plastics Innovation Challenge.

Complementing the Ocean Plastics Charter, Canada launched the Canada-wide Strategy on Zero Plastic Waste which outlines 10 areas of action to keep all plastics in the economy and out of landfills and the environment. The Strategy focuses on a lifecycle approach through greater prevention, collection and value recovery to develop a more circular plastic economy and to reduce plastic pollution.

In June 2019, Canadian Environment Ministers released the first of two phases of the Action Plan on Zero Plastic Waste. Phase 1 will focus government efforts across a broad range of activities including achieving consistent Extended Producer Responsibility programmes; a roadmap to address single-use and disposable plastics; support for recycling infrastructure and innovation in plastics manufacturing; and tools for green procurement practices. Phase 2, coming in 2020, will identify actions to: improve consumer, business and institutional awareness; reduce waste and pollution from aquatic activities; advance science; capture and clean up debris in the environment; and contribute to global action.

To contribute to the Strategy and the Ocean Plastics Charter, Canada is taking major steps to reduce plastic pollution and drive ambitious action from governments and businesses across the economy. Actions include working with provinces and territories to develop consistent Extended Producer Responsibility programmes; investing in innovative Canadian technologies and global solutions to address plastic pollution, including providing over CAD 10 million to small- and medium-sized enterprises (SMEs) to develop Canada-made solutions to reduce plastic waste; reducing plastic waste from federal operations, by diverting 75 percent of plastic waste by 2030, eliminating unnecessary use of single-use plastics in operations, meetings and events and purchasing more sustainable products; supporting community-led action and citizen-science activities; working with industry to prevent and retrieve abandoned, lost or discarded fishing gear; and accelerating research on the lifecycle of plastics and the impact on human and ecological health.

Canada plans to ban single-use plastics that cause harm (where warranted and based on scientific evidence) and to take other actions to reduce plastic waste. The development of any regulatory measures, including which products will fall under the single-use definition, will be informed by science and socioeconomic considerations. Stakeholders will be consulted throughout the development, management and review of potential regulations or other measures.

In support of new innovative technologies to tackle marine debris, Canada provided funding for projects in areas such as food packaging, construction waste, marine vessels and fishing gear. Beside technologies, Canada also funds education and awareness-raising projects, clean-up and fishing gear removal activities, community projects, and research on marine debris and plastics.

Canada is also advancing science to fill priority research gaps and provide the evidence needed to support decision making. In June 2018, the Canadian Plastics Science Agenda was published, providing a framework that spans the lifecycle of plastics to inform future science and research investments in detecting plastics in the environment; understanding and mitigating

potential impacts on wildlife, human health and the environment; and advancing sustainable plastic production, recycling and recovery.

3.4 CHILE

Chile has several laws and regulations on the proper management of land-based waste, including collection, sorting, recycling, storage, transportation and disposal of general and domestic wastes, which may indirectly lead to marine debris pollution. Specific laws and regulations that address marine debris pollution include the prevention of illegal dumping of wastes (e.g., from ships or aquaculture facilities) into waterways or at beaches.

Chile has adopted several international conventions, including MARPOL, the London Convention and the UN Convention on the Law of the Sea for management of marine debris. Chile has also established a National Work Group to address marine debris and microplastics issues.

Chile's main sources of land-based marine debris are household and general litter, while sea-based marine debris largely arises from illegal dumping of plastic by the aquaculture industry.

Chile's main preventive measure for marine debris is a law that prohibits the sale of plastic bags in its coastal areas. Reduction in plastic usage will decrease the amount of plastics that will end up in the sea. Another measure is to increase awareness of the impact of marine debris on the environment. This is done through campaigns organised by non-governmental organisations (NGOs) or private organisations with government support.

A key remedial measure for marine debris in Chile, like many other economies, is its beach clean-up programmes. The most recognised is an economy-wide event, conducted during the International Coastal Cleanup, that is organised by The General Directorate of the Maritime Territory and Merchant Marine (DIRECTEMAR). Other remedial measures adopted by Chile include:

- Establishment of programmes for the identification and mapping of marine debris across the coastline of Chile
- Promotion of collaboration between private, public and academia for monitoring and collection of marine debris
- Strengthening enforcement of MARPOL Annex V (e.g., marking and disposal of fishing gear)
- Increasing awareness within the aquaculture, fishery and shipping industries (i.e., the top polluters in terms of marine-based debris in Chile)
- Provision of adequate waste reception facilities onshore
- Development of voluntary programmes for plastic packaging reduction on board shipping vessels.

Starting in 2019, Chile's Maritime Authority has been monitoring anthropogenic litter at 13 beaches with the support of marine biologists and environmental engineers from the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP).

Plastic waste in Chile is collected, transported and disposed of together with the rest of the waste generated at the household level, mainly to be disposed of in landfills. Along with the

above, there are systems of voluntary delivery, through green points or clean points where polyethylene terephthalate (PET) plastic could be dropped off for subsequent recycling.

Chile has made a public pledge to move toward a ‘new plastics economy’, and in October 2018 it signed the Global Commitment of the New Economy of Plastics to implement measurable policies and report tangible progress by 2025.

3.5 CHINA

Municipal solid waste generated in China is increasing due to its large population, economic growth and rapid urbanisation. China had been for decades the world’s largest waste importer, until the recent import ban on solid wastes including plastics, unsorted paper and textile. China has since shifted its focus toward better municipal waste management.

China has laws that govern proper waste management, including laws on source reduction, collection, sorting, recycling, storage, transportation, treatment and disposal. Its legal framework on marine waste management includes laws that aim to reduce both land- and sea-based debris. For example, the disposal of garbage on beaches and seashores is prohibited; and all vessels and ports within China’s jurisdiction are required to have garbage storage facilities and measures to prevent any waste discharge into the sea.

China is part of the international convention, MARPOL, and has incorporated regulations relevant to marine debris prevention into its domestic legislation. An example is the provision of adequate waste facilities at ports and terminals to meet the needs of arriving ships. Other conventions signed by China include the London Convention, the UN Convention on the Law of the Sea and the Basel Convention.

China has highlighted in the survey that the main sources of land-based marine debris are household and general litter, while sea-based marine debris is from the aquaculture industry.

Key preventive measures for land-based marine debris are enforcement of laws on illegal waste dumping in waterways and use of prohibited materials (e.g., foam floats). Water policemen are deployed to patrol the waterways to prevent illegal dumping of waste into the sea, but this may not be effective for rural streams that are inaccessible. To mitigate marine debris at its source, China restricts the use of disposable plastic bags (thickness <0.025mm) and promotes the use of recyclable and biodegradable plastics. Additionally, China plans to implement mandatory domestic solid waste classification and treatment systems.

China provides funding for studies on plastic product substitution and alternative packaging that can biodegrade in the environment. Financial support is provided to municipalities to improve solid waste management technologies. China also provides financial support to central and provincial governments to prevent and control marine pollution (e.g., Blue Bay Action Plan).

Remedial measures for China include conducting clean-ups or submarine debris salvage by targeting areas with large amounts of marine debris, such as mangroves and specific sea areas including harbours and aquaculture sites. To understand the extent of marine debris pollution, China conducts beach surveys, and submarine and sea surface trawls at its environmental monitoring stations.

The current practice in China for plastic waste is to recycle valuable plastics while disposing those of low economic value in landfills. With the development of plastic waste classification (or sorting), the proportion of waste being incinerated and recycled has increased. The measure to increase plastic recycling is economy-wide and requires collaboration between garbage recyclers, consumers and local governments.

3.6 HONG KONG, CHINA

Hong Kong, China has set up an interdepartmental working group to focus on the discussion and handling of marine debris and marine environmental incidents, and to enhance cooperation between government departments.³² The working group has formulated a three-pronged long-term strategy to tackle the marine debris problem: reducing waste generation at the source, preventing refuse from entering the marine environment and removing refuse from the marine environment.³³ Since the establishment of the working group in 2012, additional efforts and resources have been devoted to enhance debris clean-up at sea and along coastlines; enforce laws against littering at sea; organise and support various community activities and awareness programmes on clean shorelines; and provide facilities and supportive measures to prevent waste from entering the sea.

To tackle waste generation at the source, Hong Kong, China conducts community education and improves awareness of the importance of keeping shorelines clean. Its efforts include making promotional videos and organising beach clean-up activities and roving exhibitions aimed at instilling habit changes, thus reducing waste and preventing it from entering the sea. Funding is allocated through the Environment and Conservation Fund (HKD 10 million in 2019/2020) to support community projects related to clean shorelines.

To encourage the participation of community organisations and volunteers, Hong Kong, China has established a Clean Shoreline Liaison Platform with different media and channels to coordinate and promote shoreline clean-up actions, provide support to related activities and share the clean-up results.

Various government departments in Hong Kong, China are taking measures to prevent the release of waste into the marine environment. Measures taken include providing waste recycling bins at piers and promenades; conducting trial deployments of waste-trapping devices at stormwater channels; and taking preventive measures at wholesale fish markets, for example, setting up foam box collection points, installing barriers along seawalls and promoting recycling.

Different government departments are responsible for cleaning up the sea, beaches, marine parks and other coastal sites. Locations that are more prone to refuse accumulation and require dedicated actions to remove debris are identified as priority sites and are subject to enhanced cleaning frequency. Cleaning efforts at non-priority sites will be strengthened according to need. In 2018, a total of 15,460 tonnes of marine debris were collected.

³² 'Inter-departmental Working Group on Marine Environmental Management', Clean Shorelines, accessed 13 November 2019, https://www.epd.gov.hk/epd/clean_shorelines/node/12.html.

³³ Environmental Protection Department of Hong Kong, China, 'Investigation on the Sources and Fates of Marine Refuse in Hong Kong: Study Report (Kowloon: Mott MacDonald, 2015), https://www.epd.gov.hk/epd/clean_shorelines/sites/default/files/common2015/MarineRefuseStudyReport_ENG_Final.pdf.

In terms of regional cooperation, the Hong Kong–Guangdong Marine Environmental Management Special Panel was set up to enhance exchange and communication through regular meetings on various regional marine environmental matters. The Special Panel established a notification and alert mechanism allowing one side to notify the other of possible surges of marine debris due to heavy rain or other environmental events.

Hong Kong, China is also committed to enhancing its overall waste management programme, with a priority on tackling plastic waste in relation to marine pollution. New initiatives that have already been implemented or are in the pipeline include the Producer Responsibility Scheme, Municipal Solid Waste Charging and a Recycling Fund.

The Producer Responsibility Scheme³⁴ is a key waste management strategy that requires manufacturers, importers, wholesalers, retailers and consumers to share the responsibility for the collection, recycling, treatment and disposal of end-of-life products to reduce their environmental impacts.

The first initiative under the Producer Responsibility Scheme was the Plastic Shopping Bag Charging Scheme in 2009 to reduce indiscriminate use of plastic shopping bags.³⁵ Another, currently being implemented progressively, promotes recycling of glass beverage containers, turning waste into resource.³⁶ Hong Kong, China also plans to introduce an initiative focused on plastic beverage containers and will consult the public after working out the proposed framework.³⁷ In parallel, a pilot scheme on the application of reverse vending machines will be launched to assess their effectiveness in plastic beverage container collection.

Another initiative under the Producer Responsibility Scheme focuses on waste electrical and electronic equipment and aims to provide a long-term solution to potential land contamination and to environmental problems arising from mishandling of regulated electrical equipment (REE) during delivery, storage and dismantling, while encouraging waste reduction and recycling efforts.³⁸ Consumers with REE will be provided with easy access to recycling facilities while sellers will have to arrange for REE removal for consumers. Suppliers of REE are required to be registered and to pay a recycling levy. Recyclers of REE must obtain a waste disposal licence for storage, treatment, reprocessing or recycling of abandoned REE.

In addition, Hong Kong, China has proposed to implement Municipal Solid Waste Charging based on the quantity of waste generated.³⁹ The goal of quantity-based waste charges is to

³⁴ ‘Producer Responsibility Schemes’, GovHK, last reviewed March 2019, <https://www.gov.hk/en/residents/environment/waste/management/prs.htm>.

³⁵ ‘Plastic Shopping Bag Charging Scheme’, Environmental Protection Department, The Government of Hong Kong Special Administrative Region, accessed 13 November 2019, https://www.epd.gov.hk/epd/english/environmentinhk/waste/pro_responsibility/env_levy.html.

³⁶ ‘Producer Responsibility Scheme (PRS) on Glass Beverage Containers’, Environmental Protection Department, The Government of Hong Kong Special Administrative Region, accessed 13 November 2019, https://www.epd.gov.hk/epd/english/environmentinhk/waste/pro_responsibility/gprs.html.

³⁷ ‘Producer Responsibility Scheme on Plastic Beverage Containers’, GovHK, last reviewed March 2019, <https://www.gov.hk/en/residents/environment/waste/management/prsplastic.htm>.

³⁸ Environment Bureau of Hong Kong, China, ‘Safe and Sustainable: A New Producer Responsibility Scheme for Waste Electrical & Electronic Equipment’ (consultation document, Hong Kong SAR Government, 2010), https://www.gov.hk/en/residents/government/publication/consultation/docs/2010/WEEE_Consultation.pdf.

³⁹ ‘Municipal Solid Waste Charging’, GovHK, last reviewed March 2019, <https://www.gov.hk/en/residents/environment/waste/management/mswcharging.htm>.

create a financial incentive to drive behavioural changes in waste generation and to reduce overall waste disposal.

There is also a Recycling Fund to promote the recovery and recycling of waste by facilitating the recycling industry in upgrading its operational capabilities and efficiency for sustainable development.⁴⁰

3.7 INDONESIA

The traditional waste management approach in Indonesia focuses on collection, transport and disposal, with less emphasis on recycling. As such, the focus is usually on the final treatment at the ultimate disposal processing facilities. The current waste management regulation separates waste management into two key activities: (1) waste reduction; and (2) waste management. Waste reduction involves restrictions on waste generation, waste recycling and reuse of potential waste; while waste management includes sorting, collecting, transporting, processing and processing waste.⁴¹ Indonesia implemented a law ordering the closure of all open dumping sites by 2013 and requiring different levels of the government to provide financing to the waste sector.⁴²

Indonesia has established a roadmap toward a Clean-from-Waste Indonesia (*Indonesia Bersih Sampah 2025*) which aims to reduce 30 percent of the economy's waste and divert waste from going into landfills.⁴³ Programmes that have been implemented include the 2020 Zero-Waste Indonesia programme, which introduces regulation on payment for plastic bags, and the Integrated Waste Management Facility for Reduce-Reuse-Recycle (TPST 3R).

A key challenge in waste management in Indonesia is related to low waste collection rates in certain areas – as low as 15 percent. Only 40 percent of solid waste was collected in 2001. Another challenge concerns the lack of funding. Allocations by local governments toward waste management only reach USD 5–6 per capita/per annum, significantly lower than the international benchmark of USD 15–20 per capita/per annum. This lack of investment leads to inefficiencies and much higher operating costs, hence preventing businesses from participating in the sector. Lastly, enforcement of solid waste laws and standards is weak.⁴⁴

Specific to tackling waste that has encroached on the marine environment, Indonesia has established the National Action Plan on Marine Debris, with the aim of reducing 70 percent of

⁴⁰ 'Overview', Recycling Fund, last updated 25 October 2019, <https://www.recyclingfund.hk/en/overview.php>.

⁴¹ M. Arnani, 'Sampah dan Plastik Jadi Ancaman, Seperti Apa Kebijakan Pemerintah?' [Garbage and Plastic Become Threats, What Is Government Policy Like?], *Kompas.com*, 22 November 2018, <https://nasional.kompas.com/read/2018/11/22/15323351/sampah-dan-plastik-jadi-ancaman-seperti-apa-kebijakan-pemerintah?page=all>

⁴² World Bank, 'Indonesia Marine Debris Hotspot Rapid Assessment (Synthesis Report)' (Jakarta: World Bank, 2018), <http://documents.worldbank.org/curated/en/983771527663689822/pdf/126686-29-5-2018-14-18-6-SynthesisReportFullReportAPRILFINAL.pdf>.

⁴³ PT Wasteforchange Alam Indonesia, 'Everything You Need to Know About 2025 Clean-from-Waste Indonesia', waste4change, accessed 13 November 2019, <https://waste4change.com/everything-you-need-to-know-about-clean-from-waste-indonesia-2025/>.

⁴⁴ World Bank, 'Indonesia Marine Debris Hotspot Rapid Assessment (Synthesis Report)'.

marine plastic debris by 2025.⁴⁵ Indonesia has collaborated with the Global Plastic Action Partnership (GPAP) to develop a roadmap of solutions which includes reducing over-packaging, inventing recyclable plastic or substitute materials, and increasing recycling and waste collection rates. The Indonesian government implemented a pilot to levy an excise on plastic shopping bags in order to reduce plastic consumption.⁴⁶ Efforts are now being made to gain approval for the levy.

The government is currently working to investigate the use of emerging technologies in combatting marine debris. One such effort is to use plastic waste in the construction of asphalt. Several Plastic Tar Road pilots were implemented in 2017.⁴⁷

Marine debris monitoring and mapping are being conducted by Divers Clean Action, a youth NGO, in collaboration with the Indonesian Institute of Sciences (Lembaga Ilmu Pengetahuan Indonesia).⁴⁸

3.8 JAPAN

Japan has established comprehensive legislation for waste management, including on sorting, recycling, storage, collection, transport, disposal, incineration and composting of wastes. Japan also has specific legal frameworks to address marine debris, including prevention of waste discharge from ships and offshore facilities, and measures to promote the smooth treatment of marine debris and effective reduction of its generation.

Japan adopted some measures from international treaties to address marine debris issues, including MARPOL, the London Convention and 1996 Protocol, and the Ballast Water Management Convention. Restrictions defined in these conventions are secured by the domestic law relating to the Prevention of Marine Pollution and Maritime Disaster.

Japan developed the National Action Plan for Marine Plastic Litter to realise a world without additional pollution by plastic litter. Measures from the action plan include:

- Promotion of a proper waste management system
- Prevention of littering, illegal dumping and unintentional leakage of waste into the oceans
- Collection of scattered waste on land
- Recovery of plastic litter from the oceans
- Innovation in development of alternative materials
- Collaboration with stakeholders
- International cooperation for promoting measures in developing economies
- Survey of the actual situation and the accumulation of scientific knowledge

⁴⁵ P. Borongan and P. Kashyap, 'Country Profile Indonesia, Managing Municipal Solid Waste and Packaging Waste' (Bonn: GIZ, 2018), https://www.giz.de/de/downloads/giz2018_Indonesia-Country-Profile_web.pdf?

⁴⁶ C. Rogers, 'Indonesia, a Top Plastic Polluter, Mobilizes 20,000 Citizens to Clean Up the Mess', *Mongabay*, 4 September 2018, <https://news.mongabay.com/2018/09/indonesia-a-top-plastic-polluter-mobilizes-20000-citizens-to-clean-it-up/>.

⁴⁷ N.P. Purba et al., 'Marine Debris in Indonesia: A Review of Research and Status', *Marine Pollution Bulletin* (2019): 134–44.

⁴⁸ Marine Debris Indonesia, Home Page of the Marine Debris Database, accessed 13 November 2019, <https://marinedebris.id/Sea>.

Additionally, Japan's Ministry of the Environment funded research on marine plastic litter being conducted by Kyushu University from 2018 to 2020. The research aims to understand the distribution of plastics in the ocean from its coasts to a global scale; the ecological impact of marine plastics; and improved measuring methods for marine plastics.

Partnerships and joint efforts among the government, private institutions and the public have also been established to improve prevention of marine debris pollution. For example, the Marine Plastic Public Private Innovation Partnership was set up to support the development of innovations such as substitute materials. An economy-wide clean-up campaign, UMIGOMI Zero Week, which was organised as a joint effort with the Nippon Foundation, recorded more than 400,000 participating to reduce marine waste.

Marine debris monitoring is implemented under the Act on Promoting the Treatment of Marine Debris Affecting the Conservation of Good Coastal Landscapes and Environments to Protect Natural Beauty and Variety and Marine Environment.⁴⁹ Besides beach debris, Japan monitors floating debris and seabed debris in the ocean. As part of the Act, the central and local governments must endeavour to conduct periodic investigations into the circumstances and causes of marine debris in order to promote effective policies required for the control of marine debris generation.

3.9 KOREA

Korea has legislation governing proper waste management including collection, storage, transportation, treatment and disposal. Its legislation specific to marine debris includes regulations on the prevention of waste discharge into the sea. Some measures in Korea's legislation are adopted from international conventions such as MARPOL. Other international conventions Korea is a party of include the UN Convention on the Law of the Sea and the London Convention.

The main sources of land-based marine debris in Korea are derived from tourism and coastal recreation activities, while sea-based marine debris is mainly derived from fishing activities.

The Management Strategy for Marine Plastic Waste was established in May 2019 to reduce 50 percent of the current marine plastic volume by 2030. This goal is to be achieved through the establishment of action plans, including on reducing waste by targeting sources of marine plastic waste; improving the collection of marine plastic from ships; expediting processing and recycling of marine plastic; strengthening foundations for plastic waste management, and improving social perception of marine waste (awareness training). For example, Korea introduced the Comprehensive Strategy for Management of Recyclable Waste to improve product lifecycle planning, including manufacturing, distribution, collection and recycling.

⁴⁹ Ministry of the Environment of Japan, '4th Fundamental Plan for Establishing a Sound Material-Cycle Society' (Government of Japan, 2018), https://www.env.go.jp/en/recycle/smcs/4th-f_Plan.pdf

The main preventive measures implemented include:

- Restriction on use of plastic packaging (and voluntary reduction of packaging by major distribution companies)
- Prevention of the sale of plastic bags at departmental stores, retail stores, large shopping facilities
- Reduction of disposable products to minimise waste generated and the collection of garbage from major streams in Korea

These policies and measures developed by Korea follow a systematic approach, are tailored to local circumstances, and consider the budget as well as feedback from stakeholders (e.g., experts and environmental groups).

The main remedial actions by Korea are beach clean-ups and collection of floating waste from the ocean. These clean-up activities involve local governments, voluntary groups and public institutions. An example is the implementation of a coastal clean-up programme by the Korea Ocean Environment Management Corporation (KOEM). Since collected marine debris mostly originates from fishery-related activities, education and awareness-raising among fishers have been established. Fishers are also compensated for collecting debris found during fishing or voluntary collection of discarded fishing gear. Marine debris is monitored as part of these beach clean-up activities by various public and private organisations, and voluntary groups.

Korea also has the Marine Product Development Fund, which allocates funds for marine waste treatment projects. Research on the environmental risk of marine plastic is being conducted by the Korea Institute of Ocean Science and Technology (KIOST); it is surveying domestic pollution caused by marine microplastics and analysing its influence on marine organisms.

3.10 MALAYSIA

In 2005, Malaysia adopted the National Strategic Plan for Solid Waste Management 2005–2020, which contains the following principles:⁵⁰

- Federalisation of the solid waste management function
- Privatisation of the solid waste management service
- Sustainable waste management through reduction, reuse and recycling with the use of appropriate technologies, facilities and equipment to provide a sustainable and comprehensive solid waste management service
- Adoption of service standards
- Cooperation across different levels of the government
- Development of a social framework for increasing public awareness, building partnerships across different stakeholders, considering social equity in relation to charges, and developing technical and managerial capabilities in solid waste management

⁵⁰ United Nations Development Programme (UNDP), 'Malaysia Developing a Solid Waste Management Model for Penang' (Kuala Lumpur: UNDP, 2008).

Malaysia has adopted numerous preventive strategies, including a 3R campaign and ‘No Plastic Bags’ days where a charge is levied on their use. Some states have further embraced the ‘No Plastic Bags’ campaign by extending it to all days of the week.⁵¹

Malaysia has established a phased and holistic approach toward managing single-use plastic pollution through its Roadmap Towards Zero Single-use Plastics 2018–2030.⁵² The action plans for the Roadmap include introducing a levy on plastic manufacturers; creating a circular economy for single-use plastics; providing incentives for eco-friendly alternatives; conducting research and development on plastic alternatives; and promoting communication, education and public awareness. The Roadmap will first target introducing pollution charges on plastic straws and bags, and subsequently, on plastic containers and cutlery.

The Green Technology Financing Scheme was introduced in 2010 to create enabling conditions for the growth of a green economy. In addition to an approved financing amount, the scheme also provides capped interest rate rebates on loans from participating financial institutions.⁵³

According to a study by the United Nations Environment Programme in 2017,⁵⁴ Malaysia is currently designing an Extended Producer Responsibility-based policy regime to encourage producers to take responsibility for collecting, recycling and disposing waste.

There are several key challenges related to waste management in Malaysia, including the lack of reliable data on waste composition and generation, low recycling rates, continued usage of landfills, and low public participation.⁵⁵

3.11 MEXICO

The General Act for Ecological Protection of the Environment (LGEEPA) enacted in 1988 is the key environmental legislation in Mexico. It promotes (1) the right of every person to live in an environment that is appropriate to self-development, wellbeing and health; (2) the principles of environmental policy and instruments to ensure the preservation, restoration and improvement of the environment; (3) the preservation and protection of biodiversity; (4) the establishment and management of natural protected areas; (5) the sustainable utilisation, preservation and restoration of soil, water and other natural resources in a way that allows for

⁵¹ A. Pariatamby, ‘State of the 3Rs in Asia and the Pacific, Country Chapter: Malaysia’ (Secretariat of the Regional 3R Forum in Asia and the Pacific, United Nations Centre for Regional Development (UNCRD) and Institute for Global Environmental Strategies (IGES), November 2017).

⁵² Ministry of Energy, Science, Technology, Environment and Climate Change (MESTECC) of Malaysia, ‘Malaysia’s Roadmap Towards Zero Single-Use Plastics 2018–2030: Towards a Sustainable Future’ (Putrajaya: MESTECC, 2018), <https://www.mestecc.gov.my/web/wp-content/uploads/2019/03/Malaysia-Roadmap-Towards-Zero-Single-Use-Plastics-2018-20302.pdf>.

⁵³ P. Yatim, S.L. Ngan and H.L. Lam, ‘Financing Green Growth in Malaysia: Enabling Conditions and Challenges’, *Chemical Engineering Transactions* 61 (2017):1579–84, <https://www.aidic.it/CET/17/61/261.pdf>.

⁵⁴ A. Jain, ‘Summary Report: Waste Management in ASEAN Countries (United Nations Environment Programme, 2017), https://wedocs.unep.org/bitstream/handle/20.500.11822/21134/waste_mgt_asean_summary.pdf?sequence=1&isAllowed=1.

⁵⁵ J. Sreenivasan et al., ‘Solid Waste Management in Malaysia – A Move Towards Sustainability, Waste Management – An Integrated Vision’ (IntechOpen, 26 October 2012), <https://www.intechopen.com/books/waste-management-an-integrated-vision/solid-waste-management-in-malaysia-a-move-towards-sustainability>; Pariatamby, ‘State of the 3Rs in Asia and the Pacific, Country Chapter: Malaysia’.

economic profits and social activity together with ecosystem preservation; and (6) the prevention and control of air, water and soil pollution.⁵⁶

According to Vega, Ojeda-Benitez and Quintanilla-Montoya, the urban cleaning systems in Mexico consist of the following elements:⁵⁷

- Storage in the generating source: In the form of temporary waste storage facilities in homes, stores, industries, markets and hospitals.
- Manual and mechanical sweeping: Mostly done using wheelbarrows or carts with metal barrels, brooms, brushes and collecting pans. Those done mechanically with sweeping machines are usually used in main avenues, shopping areas and speedways.
- Garbage collection: 84 percent is collected by waste collection services, with around 50 percent having adequate final disposal. This happens generally in metropolitan areas and medium-sized cities. The majority of cities are not equipped with a route design; and municipalities suffer from insufficient resources and planning to increase adequately the collection scope, especially in peripheral locations.
- Transportation and transfer: Consist of the collection vehicle's full trip until the treatment or final disposal site, and the municipal waste system's transportation to the transfer sites for subsequent transfer to the treatment or final disposal site. In large metropolitan areas, more than 75 percent of the collected waste is transported using a transfer station.
- Treatment and final disposal: Most of the collected waste ends up in controlled open-air dumps or (sanitary) landfills.

Key challenges in the urban cleaning system and municipal solid waste include deficient or poor quality home storage (may result in leaks when being transported to the collection trucks); inefficient collection routes; high cost of land; the population's rejection of the construction of landfills; and lack of control and sanitary standards in the final disposal sites posing significant health and environmental risks.⁵⁸

With respect to improving marine debris management, the following issues are seen to be high on the agenda:⁵⁹

- Lack of data and information concerning the definite or official number of islands, cays or reefs, and on the exact length of its coastline, has led to jurisdictional problems between different levels of government.
- Ineffective domestic policies are worsened because international conventions hold little power over specific domestic policies and are only allowed jurisdiction when other economies have not fulfilled their obligations to protect and preserve their ecosystems.
- Fragmented decision-making procedures with duplication and overlap, preventing interagency cooperation and the development of an effective ocean policy.
- Lack of domestic standards to regulate marine debris pollution, to gauge the areas in need of mitigation and to assess overall success of debris pollution abatement measures.

⁵⁶ Cartron et al., 2005, cited in: B.R. Rupe, 'Domestic and International Environmental Policy in Mexico: Compounding Issues for the Marine Environment' (MA thesis, University of Iowa, 2014), <https://doi.org/10.17077/etd.ntihs4ga>.

⁵⁷ C. Vega, S. Ojeda-Benitez and A. Quintanilla-Montoya, 'Waste Management System in Mexico: History, State of the Art and Trends', *Journal of Solid Waste Technology and Management* (January 2006).

⁵⁸ Vega, Ojeda-Benitez and Quintanilla-Montoya, 'Waste Management System in Mexico'.

⁵⁹ Rupe, 'Domestic and International Environmental Policy in Mexico'.

Mexico is working toward gradually reducing single-use plastic products and packaging. Most progress has been made at the state level. States like Mexico City, Baja California and several others have already implemented or are working toward implementing bans on the use of single-use plastics in commercial establishments and on the distribution of polystyrene.⁶⁰ The bans will be phased in over time to allow businesses to find alternatives to single-use plastics.

Recently, the Mexican government has started to focus on tackling marine pollution through education. A publication providing people with information on several marine issues is published on the government website on a biweekly basis.⁶¹ The Mexico City government also announced the implementation of the 2019–2014 environment and climate change programme with 145 billion pesos (USD 7.3 billion) in investments. The programme will focus on efforts to clean up local rivers and water sources, and turn the city into a zero-waste area, among others.⁶²

3.12 NEW ZEALAND

New Zealand has established a legal framework for waste management that includes collection, storage, transportation, treatment and disposal. Specific laws and policies are also in place to address marine debris pollution through prevention of waste dumping at coastal marine areas (including from any ships and offshore facilities) and a ban on single-use plastic shopping bags.

International conventions such as MARPOL, the London Convention, the Basel Convention and the UN Convention on the Law of the Sea have been adopted in New Zealand laws to restrict discharges and dumping into the marine environment.

Several measures were implemented through regulations under the Waste Minimisation Act to target reduction of marine debris at the source. For example, the Act bans the use of single-use plastic shopping bags and applies to all new single-use plastic shopping bags with handles that are made of plastic up to 70 microns thick.⁶³ The Act also bans the sale and manufacture of wash-off products containing plastic microbeads.

Government funding plays an essential role in New Zealand's strategy to reduce marine debris pollution. The Waste Minimisation Act also imposes a levy on all waste disposed into landfills to generate funding to help the local government, communities and businesses minimise waste. Half of the levy money goes to territorial authorities (city and district councils) to spend on promoting or implementing the waste minimisation activities set out in their Waste Management and Minimisation Plans. The remaining levy money (minus administrative costs) is put into a Waste Minimisation Fund for waste minimisation initiatives. Examples of projects that have received funding include Keep New Zealand Beautiful and Sustainable Coastlines. Additionally, New Zealand has provided a Wellbeing Budget to help the Ministry for the Environment improve resource efficiency and shift New Zealand to a zero-waste economy.

⁶⁰ H. Lovells, 'Legislative Reforms Seek to Reduce Single-use Plastic Waste', Lexology, September 2019, <https://www.lexology.com/library/detail.aspx?g=6e5875a0-57ce-4e1c-96de-39e5677cdcad>.

⁶¹ 'Nuestro Ambiente', Gobierno de Mexico, accessed 13 November 2019, <https://www.gob.mx/semarnat/documentos/nuestro-ambiente?idiom=es>.

⁶² 'Mexico City Outlines US\$7bn Environment, Climate Change Plan', BNamericas, 6 June 2019, <https://www.bnamericas.com/en/features/mexico-city-outlines-us7bn-environment-climate-change-plan>.

⁶³ 'Single-use Plastic Shopping Bags Are Banned in New Zealand', Ministry for the Environment of New Zealand, 1 July 2019, <https://www.mfe.govt.nz/waste/single-use-plastic-shopping-bags-banned-new-zealand/>

Besides the government, institutions have also provided numerous funding opportunities for driving innovations in addressing marine debris issues.

New Zealand has developed materials recovery and local re-processing facilities to shift toward a more efficient circular economy, where products are designed to have a long life and materials can be easily recovered, reused, recycled and remanufactured.

In general, the marine debris preventive measures that are most relevant to New Zealand include improved enforcement to tackle improper disposal into waterways, the ban on certain items or materials, and implementation of deposit-refund schemes (e.g., Extended Producer Responsibility). New Zealand has also participated in Operation Clean Sweep and developed guidelines to help manufacturers and distributors prevent loss of plastic pellets to the environment.

Remedial measures adopted by New Zealand to address marine debris pollution are beach and seafloor clean-up activities. These clean-up activities are conducted by international and charitable organisations (e.g., Sustainable Coastlines, Ghost Fishing New Zealand and Project Baseline) with volunteers. Marine debris monitoring data collected during these activities are made publicly available.

3.13 PAPUA NEW GUINEA

The Environment Act 2000 is the key legislation for environmental protection in Papua New Guinea. It regulates the environmental impacts of development activities and the management of domestic water resources. Its implementation involves several environmental regulations under the Department of Environment and Conservation through the Conservation and Environment Protection Authority and also allows provincial and local governments to develop environmental legislation, policies and bylaws for waste management.⁶⁴ The Asian Development Bank notes in a 2014 report that the regulatory framework could be improved by having a single legislative document to facilitate more effective planning, management and operation of the solid waste management sector as well as to enhance policies and guidelines for effective operations in cities.⁶⁵

Local governments are solely responsible for the supply of waste management services, for which they may levy local taxes and charges to cover expenses with limited support from the central government. However, the revenue collection rates are low resulting in many communities suffering from lack of efficient and regular collection services.⁶⁶ Additionally, despite the large geographic area, there are no transfer stations. Moreover, illegal dumping and burning of waste are quite common due to the lack of public awareness and education.⁶⁷

⁶⁴ Pacific Region Infrastructure Facility (PRIF), 'Papua New Guinea Country Profile in the Solid Waste and Recycling Sector' (Sydney: PRIF, 2018), <https://www.theprif.org/documents/papua-new-guinea-png/waste-management/papua-new-guinea-png-profile-solid-waste-and>.

⁶⁵ Asian Development Bank (ADB), 'Solid Waste Management in the Pacific: Papua New Guinea Country Snapshot' (Manila: ADB, 2014), <https://www.adb.org/sites/default/files/publication/42664/solid-waste-management-png.pdf>.

⁶⁶ PRIF, 'Papua New Guinea Country Profile'.

⁶⁷ ADB, 'Solid Waste Management in the Pacific: Papua New Guinea'.

Specific to the marine environment, Papua New Guinea has the Dumping of Waste at Sea Act 1979, which regulates the issuance of permits to vessels and specifies penalties for noncompliance. Additionally, the Prevention of Pollution of the Sea Act 1979 and Prevention of Pollution at Sea Regulation 1980 regulate oil and other substances and give effect to a number of international conventions.⁶⁸ Papua New Guinea is also in a multilateral partnership, the Coral Triangle Initiative – along with Indonesia; Malaysia; the Philippines; the Solomon Islands; and Timor-Leste – which aims to carry out sustainable management of marine resources.⁶⁹ Papua New Guinea also adopted the Solid Waste Management Strategy for the Pacific 2010–2015 which embraces the integrated solid waste management principle, covering the 4Rs (refuse, reduce, reuse, recycle), collection and disposal.⁷⁰

There is a lack of plastic recycling infrastructure in Papua New Guinea.⁷¹ Like many other economies, it has imposed a ban on importing or manufacturing single-use plastic bags.⁷² Due to the lack of compliance with this ban, Papua New Guinea has extended the ban to all plastic bags, including biodegradable ones. Manufacturers who wish to continue to import or produce plastic bags are required to pay a levy to cover costs of managing plastic waste.⁷³

3.14 PERU

Peru has several laws and regulations on proper waste management including on collection, sorting, recycling, storage, transportation and disposal. The main laws and regulations to prevent marine debris pollution prohibit discharge of wastes from ships and provide aquaculture facilities in marine waters. Peru is also part of international conventions such as MARPOL, the UN Convention on the Law of the Sea and the London Convention.

Peru's main source of land-based marine debris is domestic effluents while the main source of sea-based marine debris is residual effluents from offshore industries.

Regarding preventive measures for plastics, Peru has promulgated laws to encourage governmental entities to reduce use of single-use plastics and instead use biodegradable plastics. Several Natural Protected Areas have also prohibited the use of single-use plastics. The distribution of plastic bags to commercial stores and markets has been restricted as well. Furthermore, the Ministry of Environment of Peru has launched a website to recognise companies that sell eco-friendly alternatives to plastic products, or that avoid the use of plastics in their production processes and packaging.

Preventive measures for sea-based plastic wastes include surveillance of fishing vessels by Peru's Authority to prevent waste disposal, and awareness training on proper plastic waste management for artisanal fishers. Fishing plants that have installed submarine emissaries for discharging their effluents into the marine environment have to ensure that the effluents are

⁶⁸ PRIF, 'Papua New Guinea Country Profile'.

⁶⁹ Lyons, Su and Neo. 'A Review of Research on Marine Plastics in Southeast Asia'.

⁷⁰ Secretariat of the Pacific Regional Environment Programme (SPREP), 'Pacific Regional Solid Waste Management Strategy 2010–2015' (Apia: SPREP, 2010), https://www.sprep.org/attachments/Pacific_RSWSMS_2010-2015.pdf.

⁷¹ PRIF, 'Papua New Guinea Country Profile'.

⁷² 'PNG Imposes Full Ban on Plastic Shopping Bags', *RNZ*, 18 April 2018, <https://www.rnz.co.nz/international/pacific-news/355385/png-imposes-full-ban-on-plastic-shopping-bags>.

⁷³ 'Environment Levy Imposed on Plastic Bags', *Papua New Guinea Post-Courier*, 16 April 2018, <https://postcourier.com.pg/environment-levy-imposed-plastic-bags/>.

treated before being discharged; these effluents are processed through treatment systems (in industrial establishments) approved in environmental impact studies. These industrial fishing plants are supervised by the Environmental Assessment and Control Agency (OEFA), which verifies that the treated effluents comply with the maximum permissible limits.

Funding for the management of municipal waste and its disposal is available at the local and provincial levels. Research has focused on assessing the impact of microplastics on Peruvian coastal biodiversity, human health and the sustainability of fisheries' activities in the Peruvian seas.

Peru also conducts beach and seabed clean-ups at critical areas (hotspots) as remedial measures for marine debris. The Ministry of Production develops seabed clean-up programmes for bays with the participation of divers, artisanal fishers, the Ministry of Environment and schools, among others. Peru is also considering the development of a more severe law against offenders responsible for marine debris pollution. Marine debris monitoring is conducted as part of the beach survey on the International Coastal Cleanup.

The Directorate General of Environmental Fisheries and Aquaculture of the Ministry of Production (DGAAMPA-PRODUCE) conducts environmental awareness workshops aimed at artisanal fishers, owners of fishing companies, professionals and the public in general. These annual workshops are held economy-wide and oriented toward the proper management of solid waste, marine debris and single-use plastic bags as well as the use of hydrobiological waste.

3.15 THE PHILIPPINES

The Philippines enacted the Ecological Solid Waste Management Act of 2000 to regulate proper solid waste management at the local government level. The Act recognises the local government unit as the lead implementing agency and aims to achieve a 25 percent waste reduction by 2010 through the establishment of material recovery facilities in all barangays (the lowest level political and administrative body) on the basis of the 3R principle. The Act also prohibited the use of open dumping and encouraged the development of sanitary landfills.⁷⁴

As the Act relies on local governments, Premakumara et al. argue that strong political commitment at the local government level along with adequate allocation of financial and organisational resources is crucial.⁷⁵ Thus, active participation and partnership with businesses and NGOs are also important to ensure the sustainability of the programme.

McKinsey & Company and Ocean Conservancy report that the Philippines has high waste collection rates: 85 percent economy-wide, near 90 percent in some dense urban areas, and above 40 percent for some very rural areas.⁷⁶ This could be attributed to the extensive

⁷⁴ Antonio, 2008, cited in: D.G. J. Premakumara et al., 'Policy Implementation of the Republic Act (RA) 9003 in the Philippines: A Case Study of Cebu City' (*The 1st IWWG-ARB Symposium*, Hokkaido, Japan, 18–21 March 2013).

⁷⁵ Premakura et al., 'Policy Implementation of the Republic Act (RA) 9003 in the Philippines'.

⁷⁶ McKinsey & Company and Ocean Conservancy, 'Stemming the Tide: Land-based Strategies for a Plastic-free Ocean' (McKinsey & Company and Ocean Conservancy, 2015), <https://oceanconservancy.org/wp-content/uploads/2017/04/full-report-stemming-the.pdf>.

involvement of local communities. Nevertheless, in 2018, more than 900 open dump sites were reported to still exist, and many secondary cities and remote islands still did not have waste collection services, and scant waste segregation and recycling efforts,⁷⁷ enabling leakages into the ocean. According to McKinsey & Company and Ocean Conservancy, there are two main drivers of plastic leakage: uncollected waste (75%) and leakages from within the waste-management system due to improper dumping, informal dump sites and lack of proper controls (25%).⁷⁸

The Philippines has implemented the Coastal and Marine Ecosystems Management Plan 2017–2028,⁷⁹ which includes plans to reduce threats to and degradation of coastal and marine ecosystems.

To tackle marine debris pollution, several cities in the Philippines have banned the use of single-use plastic bags, containers and straws.⁸⁰ Additionally, there are measures in place to promote plastic recycling, incentivise plastic segregation in schools and conduct clean-up activities in major polluted areas. The Philippines reportedly mounted the largest volunteer effort in the 2015 International Coastal Cleanup.⁸¹

The government has begun drafting the National Strategy on Marine Litter, which will provide the basis for the subsequent Master Plan on Marine Plastics Management.⁸² The government is also working with NGOs to educate, create awareness and carry out marine conservation and monitoring activities.⁸³

3.16 RUSSIA

In Russia, 81 percent of waste is transported to landfills, 13 percent disposed of in incineration plants and 6 percent processed in an industrial way or recycled. Russian waste management plants mostly include the purchase of industrial presses to compress trash for burial in a landfill, which very much depends on user charges or tariffs with limited opportunity for profit from

⁷⁷ A. Vila, 'Philippines Plastic Pollution: Why So Much Waste Ends Up in Oceans', *South China Morning Post*, 18 October 2018, <https://www.scmp.com/lifestyle/health/article/2168819/philippines-plastic-pollution-why-so-much-waste-ends-oceans>.

⁷⁸ McKinsey & Company and Ocean Conservancy. 'Stemming the Tide'.

⁷⁹ 'DENR Implements Program to Strengthen Coastal and Marine Management', Department of Environment and Natural Resources, Philippines, accessed 18 November 2019, <http://car.denr.gov.ph/index.php/87-regional-articles-default/267-denr-implements-program-to-strengthen-coastal-and-marine-management>.

⁸⁰ Republic of the Philippines, 'House Bill no. 6892: Ban on Single-use Plastic Products', 2018, http://www.congress.gov.ph/legisdocs/basic_17/HB08692.pdf.

⁸¹ Ocean Conservancy, 'Together for Our Ocean: International Coastal Cleanup 2017 Report' (Ocean Conservancy, 2017), https://oceanconservancy.org/wp-content/uploads/2017/06/International-Coastal-Cleanup_2017-Report.pdf.

⁸² A.E. Pawlowska, 'Opening Remarks at the Marine Plastics Conference in the Philippines', World Bank, 4 April 2019, <https://www.worldbank.org/en/news/speech/2019/04/04/opening-remarks-by-agata-e-pawlowska-at-the-marine-plastics-conference-in-the-philippines>.

⁸³ 'About Marine Conservation Philippines', Marine Conservation Philippines, accessed 13 November 2019, <https://www.marineconservationphilippines.org/about-marine-conservation-philippines/>.

selling recyclables, which limits further business interest. There are more than 240 waste processing factories with low-cost technology adoption and lack of environmental standards.⁸⁴

According to a 2014 report by the Organisation for Economic Co-operation and Development (OECD), the key challenge for municipal solid waste management in Russia is the lack of collection and transportation services as well as accommodation (temporary storage) facilities, particularly in municipal areas and villages.⁸⁵ The market for solid domestic waste is limited and regulation is lax; there are only a few players and any number of firms can offer their service to any household.⁸⁶ There is also a lack of a separate waste collection or sorting process.⁸⁷ As separate waste collection or sorting is the first and most important step in waste recycling and treatment, its absence results in slow development and competition for solid waste processing station facilities. A further challenge in the waste recycling sector is the size of financial investment needed, and the specific technologies and equipment necessary to comply with strict environmental emission requirements.

Based on secondary data, Russia faces the challenge of overflowing landfills due to increasing waste (municipal and imported) and a lack of recycling systems and infrastructure.⁴² In order to reduce the amount of waste going into landfills, Russia has implemented an economy-wide solid waste management and recycling system including waste recycling facilities and collection bins for plastic and other wastes. As part of the project, Russia also aims to liquidate all unauthorised landfills in cities by 2024.⁸⁸ The government has pledged to build 220 waste processing plants across the economy by 2024 with 60 percent of Russia's solid household waste going into these plants.⁸⁹

According to Vasilevskaia,⁹⁰ recent amendments give local governments in Russia the authority to collect, transport, process and dispose solid household waste while providing local citizens and NGOs with more influence in the development of infrastructure, and the location of waste collection points and recycling plants.⁹¹ Russia has also implemented a law which adopts the Extended Producer Responsibility⁹² principle wherein producers or importers of goods are responsible for the entire lifecycle of a product, that is, its collection after use, recycling and final disposal.⁹³

⁸⁴ These statistics are taken from: Meridian Dobra Environmental Charitable Foundation, 'Solving the Problem of Municipal Solid Waste Management in Russia' (2014), <http://meridiandobra.ru/wp-content/uploads/2018/11/recycling-in-russia-eng.pdf>.

⁸⁵ Organisation for Economic Co-operation and Development (OECD), 'Policy Roundtables: Waste Management Services 2013' (DAF/COMP(2013)26, OECD, 2014), 184, <http://www.oecd.org/daf/competition/Waste-management-services-2013.pdf>.

⁸⁶ OECD, 'Policy Roundtables: Waste Management Services 2013', 183.

⁸⁷ O. Fedotkina et al., 'Circular Economy in Russia: Drivers and Barriers for Waste Management Development', *Sustainability* 11, no. 20 (2019): 5837.

⁸⁸ Netherlands Embassy in Russia, 'Waste Management in Russia' (Moscow: Netherlands Embassy, 2018), <https://www.rvo.nl/sites/default/files/2018/09/waste-management-in-russia.pdf>.

⁸⁹ E. Gershkovich, 'How Russia's Attempt to Solve Its Trash Crisis Is Backfiring', *The Moscow Times*, 12 December 2018, <https://www.themoscowtimes.com/2018/12/12/how-russias-attempt-to-solve-its-trash-crisis-is-backfiring-a63795>.

⁹⁰ D. Vasilevskaia, 'Marine Plastic Pollution: Can Law Help?' *Legal Dialogue*, 22 October 2018, <https://legal-dialogue.org/marine-plastic-pollution-can-law-help>.

⁹¹ Vasilevskaia, 'Marine Plastic Pollution: Can Law Help?'

⁹² 'Russian EPR Law: Legal Requirements and Compliance', CEEREC, 2 November 2017, <https://ceerec.eu/ussian-epr-law-legal-requirements-and-compliance/>.

⁹³ International Finance Corporation (IFC), 'Waste in Russia: Garbage or Valuable Resource? Scenarios for Developing the Municipal Solid Waste Management Sector' (Moscow: IFC, 2014),

Additionally, the Russian government is supporting policies that advance separate waste collection and waste recycling, promote the use of recycled materials, and prohibit mixed waste burial at landfills with less emphasis on landfilling and waste incineration.⁹⁴

3.17 SINGAPORE

Singapore has a comprehensive waste management legal framework that encompasses solid waste collection, storage, transportation, treatment and disposal (incineration and landfill). The regulatory system aims to prevent and reduce marine debris pollution through the management of land-based marine debris, prevention of water pollution by ships, and management of water quality in inland water bodies and coastal areas. International conventions such as MARPOL, the UN Convention on the Law of the Sea and the Basel Convention have been adopted by Singapore.

Singapore adopts a multipronged strategy which includes prevention, legislation, enforcement, monitoring and education to advance environmental management. This is achieved through a comprehensive legal framework (policy and regulations), integrated public waste infrastructure and partnerships within the people, public and private sectors.

The key preventive measure implemented by Singapore is strict regulations on waste management and disposal. An example is the anti-littering enforcement regime where offenders are served with heavy penalties and corrective work orders. Singapore also educates and encourages people and industries to practice the 3Rs. This is essential as Singapore has only one active landfill, and it is necessary to reduce the volume of waste going in. As such, Singapore's integrated waste management and collection system attempts to minimise waste at its source. All other incinerable wastes that are not segregated at their source for recycling are disposed of at waste-to-energy (WtE) plants for energy recovery. Modern flue gas treatments are also fitted at these plants to control the emissions.

As part of MARPOL obligations, the Maritime and Port Authority of Singapore (MPA) deploys garbage collection craft daily at scheduled times to collect garbage from ships at the anchorages. Further, inspections are conducted on both Singapore-registered ships and foreign-registered ships in Singapore's port to ensure that they comply with the regulations on garbage disposal and that anti-pollution measures are in place. Ships are also required to maintain garbage records and management plans for verification by inspectors. MPA's Port Inspectors also patrol Singapore's port waters to ensure that ships in the Port of Singapore do not illegally discharge waste, oil, garbage and sewage.

Managing plastic and packaging waste is one of the key priorities for Singapore. Starting with upstream reduction, the government, industry and NGOs jointly launched the Singapore Packaging Agreement to reduce packaging waste. Singapore will be introducing mandatory reporting of packaging data, including plastics, and 3R plans for packaging in 2020. This also builds on an existing mandatory waste reporting framework for large shopping malls and hotels, which will be expanded to all large industrial and commercial premises by 2020. The mandatory packaging reporting framework will also lay the foundation for an Extended

<http://documents.worldbank.org/curated/pt/702251549554831489/pdf/Waste-in-Russia-Garbage-or-Valuable-Resource.pdf>.

⁹⁴ Fedotkina et al., 'Circular Economy in Russia'.

Producer Responsibility framework which ensures producers are responsible for the collection and recycling of the packaging materials for their products and for managing packaging waste (including plastics).

Singapore also supports ground-up initiatives on reducing packaging use through funding support. One such initiative was a campaign which aimed to encourage consumers to use reusable bags and containers when they take away food, beverages and groceries. To encourage residents to recycle, all residential premises have convenient access to recycling services, including the collection of plastic recyclables, through the National Recycling Programme. Recyclables including plastics are collected through a commingled system, then sorted, baled and sent for recycling.

Singapore's approach has been to reduce the excessive use of all types of disposables (not only single-use plastics), as all of these disposables have an environmental impact; and to promote the use of reusable materials. Singapore does not target plastics alone, as this may simply result in their substitution by other types of materials which could be more harmful to the environment.

The key remedial measures for marine debris are focused on coastal and inland water bodies and submarine clean-up exercises. Waterway clean-ups are conducted through routine cleaning regimes in all inland waterways. Litter traps and float booms have also been installed where appropriate as part of the drainage network to trap debris and litter from flowing out into the sea.

There are marine debris monitoring programmes established in Singapore that aim to gather information on marine debris washed on Singapore's shores and their trends. The data will help to inform management approaches and policies.

Singapore is developing the local recycling industry to better extract resources from waste and close the waste loop domestically. The National Environment Agency (NEA) is currently studying recycling solutions and technologies and assessing their suitability for adoption in Singapore. For example, mechanical recycling to turn waste plastics into plastic pellets for manufacturing new products, or chemical recycling to turn plastic waste into chemical feedstock or fuel are being considered.

3.18 CHINESE TAIPEI

Chinese Taipei has laws regulating the collection, storage, transportation, treatment and disposal of wastes. Policies related to marine debris aim to prohibit discharge of litter at harbour areas, regulate waste discharge at port reception facilities, maintain the marine ecology, safeguard public health and sustainably use marine resources.

Along with NGOs, the government has established a Marine Debris Governance Platform to develop an action plan for reduction of marine debris pollution. The platform focuses on social collaboration, participation, research, source reduction, waste prevention and removal.

The main source of land-based marine debris in Chinese Taipei is tourism and coastal recreation activities while sea-based marine debris arises from port activities.

The key preventive measure established by Chinese Taipei is the promotion of public awareness on marine pollution (environmental education). Chinese Taipei subsidises local governments to set up recycling stations in villages and harbours to promote plastic recycling. Subsidies are also provided for transportation of garbage from remote islands. Moreover, inspections of landfill sites near to the river (less than 1 kilometre) are conducted to prevent trash overflow.

Chinese Taipei has been recognised for its strong progress in recycling efforts. Starting with a 70 percent trash collection rate, nearly full landfills and non-existent waste recycling in the 1990s, Chinese Taipei has managed to reduce waste to 850 grammes daily per person and reach an over 50 percent recycling rate; and its incinerators are running below capacity. This progress has been achieved through an efficient waste management framework comprising of citizens and manufacturers, and behaviour-changing initiatives like providing disincentives for generating trash.

To mitigate marine debris at its source, there are bans and restrictions on the use of certain plastic materials such as microbeads in cosmetic and personal care products; straws; and single-use plastics (including those for packaging) in various commercial areas.

As part of Chinese Taipei's Marine Debris Governance Platform, the remedial actions include targeted marine debris clean-ups on the sea surface and the seabed at certain hotspots including coastlines, rivers and irrigation channels. Funding is provided to local governments to conduct these clean-ups. Moreover, fishers are encouraged to set up Environmental Protection Fleets for retrieving floating marine debris, and ensuring its proper disposal during sightseeing, leisure and fishing activities. Volunteers with scuba diving skills are also encouraged to assist in safe underwater waste removal.

Chinese Taipei has conducted various research on marine debris including marine debris monitoring, and microplastics pollution and its impact on biodiversity. Surveys have also been conducted to understand the use of disposable plastics in the economy. Various methodologies are deployed to monitor marine debris including visual surveys, satellite telemetry and unmanned aerial vehicles. Chinese Taipei's Ocean Conservation Administration focuses on monitoring and removing marine debris from the sea floor.

3.19 THAILAND

Most of the marine debris in Thailand originates from both inland plastic waste and solid waste that is dumped directly into the ocean. In 2018, 7.15 million tons of solid waste were disposed of inappropriately, for example, through open dumping or open burning in waste disposal sites, illegal dumping in public areas and throwing into water bodies. Solid wastes that are disposed of inappropriately through open dumping or illegal dumping may result in the contamination of inland wastes into the sea; i.e., leachate from solid waste landfills.⁹⁵ Most municipal solid waste facilities are operated by the government and impose limits on dumps with a capacity of

⁹⁵ J.W. Kindt, 'Solid Wastes and Marine Pollution', *Catholic University Law Review* 34, no. 1 (1985): 37–100, <https://scholarship.law.edu/cgi/viewcontent.cgi?article=2086&context=lawreview>.

less than 50 tons per day.⁹⁶ All incinerators for energy production are operated by the private sector (six sites), whereas there are 16 public incinerators with air pollution control systems.⁹⁷ To improve waste and pollution management, Thailand established the 20-Year Pollution Management Strategy, the Pollution Management Plan 2017–2021 and the Master Plan on Waste Management 2016–2021.⁹⁸

As part of the Plastic Waste Management Road Map 2018–2030,⁹⁹ Thailand has committed to reducing at least 50 percent of marine plastic and ensuring that 100 percent of plastic waste is reusable by 2027.¹⁰⁰ To achieve this goal, Thailand established the Thailand Public Private Partnership for Plastic and Waste Management (PPP Plastic)¹⁰¹ strategy to reduce plastic waste and marine debris through stakeholder engagement, promotion of education and behavioural change, and improvements in waste segregation and the management system for plastic recycling.¹⁰² With this roadmap, Thailand announced the progressive elimination of various plastics including microbeads, cap seals and oxo-degradable plastics and other types of single-use plastics.¹⁰³

Thailand is embracing the 3R concept by introducing returnable plastic crate trays in supermarkets to be cleaned and re-used and it is experimenting with selling carbonated beverages in glass bottles which will be returned for reuse using a deposit system.¹⁰⁴ It is also encouraging the use of innovative materials to reduce waste, for example, using cassava roots to make boxes, trays and cups.¹⁰⁵ Municipal solid waste to energy plants in Thailand are successful in reducing the amount of waste and also improving the quality of waste created in order to meet pollution control standards.¹⁰⁶ Policy specific to marine debris management in 2018 includes reducing or preventing the amount of solid waste being thrown into the sea by certain target groups such as commercial and local fishing boats, coastal communities and tourism companies and tourists.¹⁰⁷

⁹⁶ T. Kamuang and O. Siriratpiriya, 'State of the 3Rs in Asia and the Pacific: Country Chapter – Kingdom of Thailand' (Nagoya: United Nations Centre for Regional Development (UNCRD), 2017), <http://www.uncrd.or.jp/content/documents/5695%5bNov%202017%5d%20Thailand.pdf>.

⁹⁷ These statistics are taken from: Ministry of Natural Resources and Environment of Thailand, 'Booklet on Thailand State of Pollution 2018' (Bangkok: Pollution Control Department, 2018).

⁹⁸ Ministry of Natural Resources and Environment of Thailand, 'Thailand Makes an Effort to Protect Marine Environment from Marine Debris and Land-based Pollution', United Nations, accessed 13 November 2019, <https://oceanconference.un.org/commitments/?id=18208>.

⁹⁹ 'Roadmap on Plastic Waste Management', The Government Public Relations Department of Thailand, 19 April 2019, https://thailand.prd.go.th/1700/ewt/thailand/ewt_news.php?nid=7831&filename=index.

¹⁰⁰ 'The Alliance Launches in Thailand and Southeast Asia, Where the Need Is Greatest', Alliance to End Plastic Waste, 27 August 2019, https://endplasticwaste.org/latest/the-alliance-launches-in-thailand-and-southeast-asia-where-the-need-is-greatest/#_ftn1.

¹⁰¹ 'Thailand Pledges to Cut Sea Debris by 50%', *Bangkok Post*, 6 March 2019, <https://www.thephuketnews.com/thailand-pledges-to-cut-sea-debris-by-50-70602.php?#3wTSBbPFcrju0fIo.97>.

¹⁰² P. Poopair, 'Thailand PPP Plastic: Thailand Public Private Partnership for Plastic and Waste Management' (presented at the *Circular Living Symposium 2019*, Bangkok, Thailand, 28 June 2019), <https://gccircularliving.ptggroup.com/storage/symposium/speakers/presentation/pranee-poopair-thailand-public-private-partnership-for-plastic.pdf.pdf>.

¹⁰³ Thai Embassy in Washington, DC, 'Thailand Will Ban Three Plastics This Year', 29 April 2019, <https://thaiembdc.org/2019/04/29/thailand-will-ban-three-plastics-this-year/>.

¹⁰⁴ Thai Embassy in Washington, DC, 'Thailand Reducing Plastic Waste with Innovative Materials', 12 November 2018, <https://thaiembdc.org/2018/11/12/thailand-reducing-plastic-waste-with-innovative-materials/>.

¹⁰⁵ Thai Embassy in Washington, DC, 'Thailand Reducing Plastic Waste'.

¹⁰⁶ S. Boonpa and A. Sharp, 'Waste-to-energy Policy in Thailand', *Energy Sources, Part B: Economics, Planning, and Policy* 12, no. 5 (2017): 434–42, doi: 10.1080/15567249.2016.1176088.

¹⁰⁷ Ministry of Natural Resources and Environment of Thailand, 'Booklet on Thailand State of Pollution 2018'.

Thailand established a plastic material flow database¹⁰⁸ to collect plastic production, consumption and waste management data to provide a better understanding of the lifecycle of plastics and to advance effective solutions for the issues identified.¹⁰⁹

Thailand is also part of a global initiative to clean-up oceans. Upcycling the Oceans¹¹⁰ is an effort that encourages local fishers to take part in removing plastic from the surrounding marine environment. The plastic collected is then recycled into thread to make environment-friendly products.

3.20 UNITED STATES

The United States has a comprehensive legislative framework for waste management that covers the collection, storage, transportation, treatment and disposal of solid wastes. It is a party to several international conventions to minimise marine pollution including MARPOL, the London Convention and the Land-Based Sources Protocol to the Cartagena Convention.

The key preventive measure for the United States is the Marine Debris Act, which requires the National Oceanic and Atmospheric Administration (NOAA) Marine Debris Program to investigate and prevent the adverse impact of marine debris through five main pillars: prevention, research, removal, regional coordination and emergency response. The Marine Debris Program supports outreach and education initiatives that create awareness and change behaviour to prevent marine debris pollution. It also supports community-based projects to clean up marine debris from local shorelines and remove vessels.

In terms of research, the Marine Debris Program monitors marine debris quantities and types on shorelines and supports projects to understand marine debris baselines, chemicals in plastics, debris detection, plastic ingestion by wildlife, economic implications, and ways to minimise the impact of derelict fishing gear. The Marine Debris Program supports local marine debris initiatives through coordination among 10 regions within the United States. Its staff in each region guide action planning and provide expertise to ensure that stakeholders have the best information available. Finally, the Marine Debris Program supports regionally focused emergency response planning efforts and coordinates with partners during an acute marine debris event.

The United States Environmental Protection Agency (EPA) has developed the Sustainable Materials Management (SMM) approach, which utilises and reuses materials efficiently over their entire lifecycle. The EPA also focuses on managing waste through source reduction, reuse, recycle, composting and energy recovery. To prevent marine debris pollution, the EPA has also implemented the Trash Free Waters Program across the economy and internationally. Trash Free Waters works with stakeholders locally and at the city, state and regional levels to identify problems and prioritise low-tech, low-cost solutions to prevent and reduce marine litter and debris. These projects range in scale from removing tires in a local waterway to installing storm

¹⁰⁸ 'Thailand Pledges to Cut Sea Debris by 50%'.

¹⁰⁹ C. Bureecam, T. Chaisomphob and P. Sungsomboon, 'Material Flows Analysis of Plastic in Thailand', *Thermal Science* 22 (2017): 5, doi:10.2298/TSCI160525005B.

¹¹⁰ 'Upcycling the Oceans', Ecoalf, accessed 13 November 2019, <https://ecoalf.com/en/p/upcycling-the-oceans-15>.

capture devices in storm drains in an urban area. The measures aim to prevent and reduce marine litter and debris in waterways, where trash can ultimately end up in the oceans.

NOAA provides grant funding through a competitive programme for local-level activities within the United States to prevent the introduction of marine debris into the marine and coastal environment. Projects awarded through this grant competition actively engage and educate a target audience in hands-on programmes designed to raise awareness, reduce barriers to marine debris prevention (e.g., lack of access to waste receptacles or alternatives to single-use items), and encourage and support changes in behaviour to ensure long-term prevention of marine debris.

Currently, NOAA's research programme is focused on three areas: understanding the fate and transport of debris (movement in the coastal and marine environments), impacts of debris on species, and impacts on coastal and marine habitats.

The main remedial measure is the marine debris removal programme funded by NOAA. It has developed a Fishing for Energy Partnership with the private sector and industries to minimise the impacts of derelict fishing gear. The programme provides the fishing community no-cost options for disposing of old or unwanted gear; and the old nets, line and ropes are converted into energy. NOAA is also prepared for emergency responses to map and survey marine debris following natural disasters (e.g., hurricanes).

NOAA has established a Marine Debris Monitoring and Assessment Project, which compiles marine debris quantities and type in the marine environment. With regular marine debris monitoring, the effectiveness of existing marine debris prevention initiatives can be assessed and inform targets of future mitigation efforts.

3.21 VIET NAM

Municipal solid waste in Viet Nam is managed by the provincial and municipal governments.¹¹¹ Collection and transportation services for municipal solid waste are available in urban areas but may be limited in rural areas. The majority of municipal solid waste from urban areas end up in landfills while those from rural areas are burnt or incinerated by the locals. According to Thang, the current waste management framework in Viet Nam includes open dumps or tips into landfills, incineration, waste-to-energy and recycling; however, all plastics may not be recyclable or recycled due to insufficient waste streams. Viet Nam has developed a plastic waste collecting system to help reduce the dumping of solid wastes into the marine environment.¹¹²

The National Strategy on Integrated Management of Solid Waste was recently revised to include stricter control over hazardous waste; the collection and treatment of solid waste

¹¹¹ N. Truong, 'Solid Waste Management in Vietnam: Current Situation, Challenges and Strategies for Development' (bachelor's thesis, Metropolia University of Applied Sciences, 2018), https://www.theseus.fi/bitstream/handle/10024/147214/Truong_Ngan.pdf?sequence=1&isAllowed=y.

¹¹² L.D. Thang, 'Overview of Marine Plastic Debris in Vietnam in Relation to International Context' (presented at *FIG Working Week 2019: Geospatial Information for a Smarter Life and Environmental Resilience*, Hanoi, Vietnam, 22–26 April 2019), https://www.fig.net/resources/proceedings/fig_proceedings/fig2019/papers/ts01d/TS01D_le_dai_10174.pdf.

generated in rural areas; and the use of only 100 percent eco-friendly plastic bags in supermarkets and trade centres.¹¹³

Viet Nam has adopted preventive measures from international conventions including the Basel Convention and MARPOL by, for example, requiring ships to have adequate oil filtration systems.¹¹⁴

Viet Nam is developing a National Action Plan to address the marine debris issue.¹¹⁵ It will implement policies and measures to reduce 50 percent of marine debris by 2025 and clean up 50 percent of lost or broken fishing equipment.¹¹⁶ The plan will focus on promoting reuse of plastic products, enhancing recycling efforts and building a circular economy. Some measures considered include collecting lost or broken fishing equipment and restriction on single-use plastic bags at tourism sites and coastal service facilities.

As a remedial action, Viet Nam has initiated shoreline clean-up operations in coastal areas and organised public awareness campaigns to inform residents and tourists on marine debris prevention.¹¹⁷ There is a Vietnam Environment Protection Fund¹¹⁸ that provides financial resources for hosting environmental events, developing clean energy and collecting data, among others. The government has plans to establish a National Natural Resources and Environment Monitoring Database using advanced technology in order to help in policymaking.¹¹⁹ The impact of microplastics on human health is a topic being considered for future research.

Specific challenges for marine debris regulation concern the lack of practical experience and specific regulations and guidelines on management, and issues with the collection and handling of plastic waste. Currently, plastic bags are still used and disposed widely by the community. Infrastructure facilities for classification, recycling, reuse and waste treatment are lacking. It is important for manufacturing companies to put more effort into environmental protection and technical requirements to produce environmentally friendly goods.¹²⁰ Better data collection efforts will also help in identifying and mapping hotspots with marine debris and plastic waste.

¹¹³ Vietnam Environment Administration, 'Revision of the National Strategy on Integrated Management of Solid Waste', Vea, 17 May 2018, <http://vea.gov.vn/en/laws/LegalDocument/Pages/Revision-of-the-National-strategy-on-integrated-management-of-solid-waste.aspx>.

¹¹⁴ V.T. Pham, 'Vietnam Law on Marine Environment Protection and the Implementation of Marpol Convention 73/78 in Current Period', *Journal of Law, Policy and Globalization* 46 (2016): 67–73, <https://pdfs.semanticscholar.org/f3ca/e889d57c8b1b5cdbc02eccbc601204ce470a.pdf>.

¹¹⁵ 'Action Plan for Marine Debris Reduction to Be Built', *The Voice of Vietnam*, 9 August 2019, <https://english.vov.vn/society/action-plan-for-marine-debris-reduction-to-be-built-401352.vov>.

¹¹⁶ V.T. Pham, 'Vietnam Law on Marine Environment Protection'.

¹¹⁷ Ocean Cleanup Campaign Launched in 28 Coastal Locales across Vietnam', *The Voice of Vietnam*, 14 July 2018, <https://english.vov.vn/society/ocean-cleanup-campaign-launched-in-28-coastal-locales-across-vietnam-379058.vov>.

¹¹⁸ Home Page, Vietnam Environment Protection Fund, accessed 13 November 2019, <https://www.vepf.vn/>.

¹¹⁹ Vietnam Environment Protection Fund, 'Vietnam to Develop Natural Resources, Environment Monitoring Database', 31 October 2017, <https://www.vepf.vn/news/environmental-news/vietnam-to-develop-natural-resources-environment-monitoring-database-766.html>.

¹²⁰ Thang, 'Overview of Marine Plastic Debris in Vietnam in Relation to International Context'.

4. MEASURES TAKEN IN OTHER ECONOMIES

4.1 EUROPEAN UNION

The European Union (EU) established the Marine Strategy Framework Directive¹²¹ in 2008 to ensure that their members' marine waters are maintained in 'good environmental status' by 2020. Eleven qualitative descriptors of the marine environment were provided, of which Descriptor 10 was related to marine litter. This legislation was specifically designed to protect the marine environment and the natural resources and to create a framework for the sustainable use of marine waters. As part of the legislation, EU members have to ensure that specific marine debris targets are met by 2020.

The European Strategy for Plastics in a Circular Economy¹²² was also passed to initiate transformation in plastic designs, production, usage and recycling in the EU. The key measures identified to create an innovative and sustainable plastic industry include the following:

- **Improving the economics and quality of plastics recycling:** Plastics should be designed to ensure that they can be easily reused or recycled. Plastic packaging should be a priority area for recyclability design as the EU is committed toward making all plastic packaging in the market reusable or easily recycled by 2030. This can be achieved through the Extended Producer Responsibility strategy which will provide incentives to reward sustainable designs. The EU also requires products to meet the recyclability and the Eco-design Directive. This will enable easier recycling of plastic components in electrical appliances and electronics.

In order to drive demand for recycled plastics, the EU will standardise quality standards for sorted or recycled plastic waste. Collaboration with the chemical sector, for example, is required to ensure plastics can be recycled to higher quality standards for food applications. The EU will also provide funding for research on identifying contaminants in plastics and decontamination of plastics through Horizon 2020.

To support the integration of recycled plastics in EU markets, the EU will explore and target sectors (e.g., automotive or construction) which may use recycled content in their applications. The EU will also consider rewarding the packaging sector for use of recycled content and integrating recycling content into the Green Public Procurement criteria.

- **Curbing plastic waste and littering:** The EU has stipulated legislation to reduce consumption of plastic bags and their contribution toward marine debris. The EU legislation on enhancing waste collection systems is essential to prevent littering which may lead to marine debris. The EU will promote easy access to tap water which will also reduce the need for bottled water.

¹²¹ 'Our Oceans, Seas and Coasts – Legislation: The Marine Strategy Framework Directive', European Commission, updated 8 August 2019, https://ec.europa.eu/environment/marine/eu-coast-and-marine-policy/marine-strategy-framework-directive/index_en.htm

¹²² European Commission, 'Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: A European Strategy for Plastics in a Circular Economy', 16 January 2018, <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1516265440535&uri=COM:2018:28:FIN>.

The EU has encouraged the design of biodegradable and compostable plastics but noted that these plastics only degrade under specific conditions. Efforts to label biodegradable or compostable plastics will be carried out by the EU to educate the public on the conditions of its use. The use of oxo-degradable plastics will be restricted since they have similar environmental impacts to conventional plastic.

The EU has considered banning products that have intentionally added microplastics. It will also identify new ways to prevent microplastics pollution by capturing microplastics from wastewater treatment plants and synthetic textile industries. Microplastics in drinking water will also be tested to assess their health impacts.

The EU provides funding for anti-littering awareness campaigns and initiatives such as beach clean-ups. To prevent sea-based marine debris, the EU will develop a strategy to manage waste from ships, and measures for reducing abandoned fishing gear and marine litter from aquaculture. Furthermore, the introduction of Enhanced Producer Responsibility in targeted areas will reduce littering and promote recycling.

- **Driving innovation and investment toward circular solutions:** This strategy requires large investments in infrastructure and innovation to drive transformation in the plastics value chain. For example, digital watermarking of plastics will allow easier sorting and traceability of plastics. Innovations are essential especially for materials that can biodegrade in fresh or seawater. The EU is considering using alternative bio-based feedstocks (i.e., biomass) to produce plastics and to conduct lifecycle analysis to assess its impact.

A large amount of funds has been allocated by the EU to plastic-related innovation priorities. A Strategic Research and Innovation Agenda on plastics will be established to provide guidance for funding of research and innovation beyond 2020. Besides innovative projects, the EU will also invest in modern, scaled up, and economically viable recycling plants.

Enhanced Producer Responsibility schemes will be well-designed to provide financing for plastic collection and treatment costs. They could also provide incentives for businesses that develop sustainable plastic products. Benefits of Enhanced Producer Responsibility include improving recycling efficiency, promoting product design for recycling, reducing litter, and encouraging better conversation among local governments, manufacturers and recyclers.

- **Harnessing global action:** As marine debris is a transboundary issue, international cooperation is crucial in tackling the problem. The EU supports several international initiatives that take action to combat marine debris (from the G7, G20, the United Nations, MARPOL and the Regional Sea Conventions). The EU also participates actively in the United Nations Environment Assembly working group on international responses to fight against marine debris and microplastics. The EU is planning to launch a project to reduce marine debris in Southeast Asia, where marine debris is a growing concern.

With the world's highest plastic recycling rates, the EU is positioned to lead the development of the plastic circular industry worldwide, sharing modern recycling technologies and solutions to prevent marine debris. The EU is also considering developing international standards to enhance industry confidence in recycled plastics.

4.2 NORWAY

Norway has also set combatting marine debris as a high priority in its agenda. Apart from proper waste management and anti-littering, Norway has implemented other legislation for marine debris prevention.

A key preventive measure for marine debris is the implementation of the Producer Responsibility Scheme. This has helped Norway achieve the highest recycling rate, at 97 percent, for plastic drinking bottles. Producer responsibility for beverage packaging requires the producer to cover costs for collection, treatment and prevention of packaging waste. Consumers are required to purchase the beverage with a 'deposit' at point of sale and claim a cash refund when the packaging is returned. As a result, reverse vending machines can be found in every grocery store in Norway. This system ensures a high return rate of plastic bottles by charging lower taxes for bottles and cans depending on their return percentages.¹²³

Norway is also considering the implementation of this Producer Responsibility Scheme for plastic products used by the aquaculture and fisheries industries, which implies that the producers of fishing nets will be responsible for the disposal of their fishing nets as well as their clean-up if they contribute to marine debris.¹²⁴

Norway has also launched the Norwegian Development Program to combat marine litter and microplastics.¹²⁵ The main objective of the programme is to prevent and reduce marine debris pollution in developing economies. An example is the funding commitment through the PROBLUE fund which aims to improve waste management systems in developing economies with inadequate infrastructure.

Norway has a Fishing for Litter initiative where fishing vessels collect marine debris during fishing operations and return them to port facilities for disposal or recycling for free. The initiative contributes to marine debris clean-up efforts and provides information on quantities and types of marine debris.

¹²³ O. Elvestuen, 'How to Reduce the Impacts of Plastic Products on the Marine Environment?' Government.no, 13 July 2018, <https://www.regjeringen.no/en/aktuelt/brussels-speech-on-marine-litter/id2607330/>

¹²⁴ Elvestuen, 'How to Reduce the Impacts of Plastic Products on the Marine Environment?'

¹²⁵ Ministry of Foreign Affairs of Norway, 'The Norwegian Development Program to Combat Marine Litter and Microplastics', Government.no, updated October 2019, https://www.regjeringen.no/en/dokumenter/marine_litter/id2642037/.

5. SUMMARY OF MEASURES IN APEC ECONOMIES

5.1 SURVEY FINDINGS

Based on the survey responses and secondary data, most APEC economies have implemented a range of measures, both through regulatory and non-regulatory instruments, to manage the marine debris issue. A summary of the survey responses and secondary research for each APEC economy is provided in Table 5.1. A brief overview of the measures in APEC economies by category is also provided:

Laws and regulations

- General management of domestic and industrial waste has been established in most economies. These regulations include proper waste management, anti-littering, prevention of dumping of waste on land (especially beaches) and/or at sea from any ships and vessels.
- Laws specific to the management of plastic waste and recycling are not adopted by many economies.
- Measures regarding marine debris or plastics waste management from international conventions have been incorporated into legislation by many economies.

Enforcement

- With legislation in place, several economies implemented enforcement regimes that are essential to preventing marine debris pollution. Enforcement is targeted against the source of pollution including industries such as fisheries, aquaculture and even landfill sites near rivers.

Policies

- Many economies implemented economy-wide policies to prevent marine debris pollution through the 3Rs and reduction of plastic usage.
- Restriction or ban of certain plastic items (i.e., single-use plastics, straws and microbeads).
- Only one economy, Peru, has highlighted that offshore submarine emissaries, in this case, for fishery plants, are required to submit environmental impact studies and plans to prevent waste pollution.

Initiatives

- Several economies have developed initiatives to increase public awareness of marine debris issues through education. These public campaigns can be led by the government or in collaboration with non-governmental organisations (NGOs).
- Many economies have developed waste management services or infrastructure at strategic locations such as harbour, port or village areas, and provide transportation of waste from remote islands to the mainland for disposal and treatment.

Collaboration and partnerships

- Many economies encourage collaboration and partnerships between the public and private sectors to promote innovation in alternative plastic, clean-up and education campaigns.

Financial support

- Most economies provide funding for academia to conduct research on marine debris including monitoring and clean-up. In some cases, subsidies are provided to local governments to set up waste management infrastructure (recycling stations).

Research

- Research conducted by most economies is focused on the impact of marine debris, typically microplastics, its distribution, its impact on biodiversity and health, as well as monitoring methods.

Remedial measures

- Many economies conduct beach clean-up activities as a remedial measure, and some clean up marine debris floating on the sea or even those on the seabed (underwater). These clean-up activities are targeted at polluted areas and require collaboration between local governments, voluntary groups and public institutions.

Marine debris monitoring

- Monitoring methods adopted by economies are limited to manual counting during beach clean-ups. Only Chinese Taipei monitors marine debris using satellite telemetry and unmanned aerial vehicles.

Table 5.1. Summary of preventive measures from APEC economies

| APEC Economy | Preventive and Remedial Measure | |
|-------------------|-----------------------------------|--|
| | Topic | Description |
| Australia | Regulatory Framework and Policies | <ul style="list-style-type: none"> • Marine debris listed as a key threatening process to marine life under the Environment Protection and Biodiversity Conservation Act; Threat Abatement Plan developed to provide guidance on actions to prevent marine debris pollution. • Established National Waste Policy (mitigating marine debris at source, waste reduction, recycling, Extended Producer Responsibility) • Implemented Australian Packaging Covenant, an economy-wide instrument to reduce packaging waste • Banned single-use plastics |
| | Initiatives | <ul style="list-style-type: none"> • Voluntary phasing out of microbeads from personal care and cosmetic products • Implement container deposit schemes |
| | Remedial Actions | <ul style="list-style-type: none"> • Regular beach and waterway clean-ups (including in remote and polluted areas) |
| Brunei Darussalam | Regulatory Framework | <ul style="list-style-type: none"> • Restrict use of plastic bags |
| | Initiatives | <ul style="list-style-type: none"> • Awareness campaigns, including ‘No Plastic Bag Everyday’, anti-littering, reducing disposable and styrofoam products. |
| Canada | Regulatory Framework and Policies | <ul style="list-style-type: none"> • Established proper waste management system – collection, storage, transportation, treatment (incineration, recycling or composting), disposal (landfill) • Introduced regulations to prevent waste discharge from ships and prohibit dumping of plastic waste at sea • Banned microbeads in toiletries • Adopted a Canada-wide Action Plan for Extended Producer Responsibility • Implemented Strategy for Sustainable Packaging • Introduced economy-wide Strategy on Zero Plastic Waste |
| | Collaboration | <ul style="list-style-type: none"> • Championed the Ocean Plastics Charter, which brings together government, business and civil organisations to work on eliminating plastic pollution and improving the management of plastics across their lifecycle • Central and local governments are working collaboratively with Indigenous communities, industry, NGOs, academia and others to implement the Canada-wide Strategy on Zero Plastic Waste |
| | Funding | <ul style="list-style-type: none"> • Support innovative technologies in areas such as food packaging, construction waste, marine vessels and fishing gear removal to reduce waste • Provide funding for education and awareness-raising projects, clean-up activities, community projects, and research on marine debris or plastic |
| | Remedial Actions | <ul style="list-style-type: none"> • Conduct shoreline clean-ups and fishing gear removal activities |

| APEC Economy | Preventive and Remedial Measure | |
|--------------|-----------------------------------|--|
| | Topic | Description |
| Chile | Regulatory Framework and Policies | <ul style="list-style-type: none"> Established proper waste management system – collection, transportation, treatment (recycling), disposal (landfill) Prohibit dumping of waste on beaches (land-based) Prevent illegal dumping from ships and aquaculture facilities at ports, rivers and lakes (sea-based) Ban plastic bags in coastal areas |
| | Enforcement | <ul style="list-style-type: none"> Strengthen enforcement of MARPOL Annex V (e.g., ensure proper marking and disposal of fishing gear) |
| | Initiatives | <ul style="list-style-type: none"> Provide adequate waste reception facilities onshore Developed voluntary programmes to reduce plastic packaging onboard shipping vessels Increase awareness of marine debris pollution within the aquaculture, fishery and shipping industries Collaborate with NGOs and private organisations to organise (government-led) educational campaigns |
| | Remedial actions | <ul style="list-style-type: none"> Conduct beach clean-up activities |
| | Monitoring | <ul style="list-style-type: none"> Identify and map marine debris along Chile's coastline Promote collaboration between private, public and academia for monitoring and collection of marine debris |
| China | Regulatory Framework and Policies | <ul style="list-style-type: none"> Established proper waste management system – sorting, collection, storage, transportation, treatment (incineration, recovery or recycling), disposal (landfill) Regulate construction waste management (environmental impact assessment with preventive and mitigation measures and monitoring plan) Prohibit dumping of waste on beaches and into the ocean Provide waste storage facilities at ports Ban disposable plastic bags Mandatory domestic solid waste classification and treatment system Regulate the recovery and disposal of waste electrical product |
| | Enforcement | <ul style="list-style-type: none"> Prevent illegal dumping of waste into waterways |
| | Funding | <ul style="list-style-type: none"> Enhance solid waste management technology Research on biodegradable packaging Local and provincial governments to control marine pollution |
| | Collaboration | <ul style="list-style-type: none"> Increase recycling through collaboration between garbage recycler, consumer and local governments |
| | Remedial actions | <ul style="list-style-type: none"> Beach, submarine and sea surface trawl in polluted areas |

| APEC Economy | Preventive and Remedial Measure | |
|------------------|-----------------------------------|--|
| | Topic | Description |
| Hong Kong, China | Regulatory Framework and Policies | <ul style="list-style-type: none"> • Introduced Plastic Shopping Bag Charging • Implemented Producer Responsibility Scheme on waste electrical and electronic equipment and glass beverage containers progressively • Proposed to implement municipal solid waste charging based on quantity of waste generated |
| | Research | <ul style="list-style-type: none"> • Consultancy study on personal care and cosmetic products containing microbeads commenced in 2018 to increase understanding of the latest international developments in the control practices related to such products, to solicit local stakeholders' views on control regimes and make recommendations on control strategies |
| | Initiatives | <ul style="list-style-type: none"> • Increase public awareness to keep shorelines clean |
| | Funding | <ul style="list-style-type: none"> • Provide financial support for upgrading recycling infrastructure |
| Indonesia | Regulatory Framework and Policies | <ul style="list-style-type: none"> • Established National Action Plan on Marine Debris • Established Integrated Waste Management Facility for Reduce-Reuse-Recycle (TPST 3R) |
| | Collaboration | <ul style="list-style-type: none"> • Collaborate with Global Plastic Action Partnership to reduce overpackaging, invent recyclable plastic and increase recycling rates |
| | Research | <ul style="list-style-type: none"> • Investigate the use of emerging technologies in combatting marine debris |
| | Monitoring | <ul style="list-style-type: none"> • Monitoring conducted by NGO in collaboration with government agencies |
| Japan | Regulatory Framework and Policies | <ul style="list-style-type: none"> • Established proper waste management system – collection, storage, transportation, treatment (sorting, recycling, crushing, incineration or composting), disposal (landfill) • Prevent dumping of waste on beaches (land-based) • Prevent dumping of waste from ships or any offshore facilities into ocean • Stipulate remedial actions and provide funding to clean up marine debris and develop a monitoring plan |
| | Partnership | <ul style="list-style-type: none"> • Promote multistakeholder partnerships locally and internationally (i.e., support innovation in alternative plastic and economy-wide clean-up campaign) |
| | Collaboration | <ul style="list-style-type: none"> • International cooperation for promoting measures in developing economies |
| | Research | <ul style="list-style-type: none"> • Distribution of marine plastic locally and globally • Impact of marine plastic • Improvement of marine plastic measuring method |
| | Remedial Actions | <ul style="list-style-type: none"> • Promote clean-up activities |
| | Monitoring | <ul style="list-style-type: none"> • Marine debris monitoring implemented as part of law • Monitor beach, floating and seabed debris |

| APEC Economy | Preventive and Remedial Measure | |
|--------------|-----------------------------------|--|
| | Topic | Description |
| | | <ul style="list-style-type: none"> Local governments investigate the cause of marine debris and promote effective policies to control marine debris generation |
| Korea | Regulatory Framework and Policies | <ul style="list-style-type: none"> Established proper waste management system – collection, storage, transportation, treatment (recycling, incineration and waste-to-energy), disposal (landfill) Prevent discharge of waste from ships into the ocean Restrict use and sale of plastic packaging Improve plastic waste collection from ships Strengthen waste management system Expedite processing and recycling of marine plastic |
| | Initiatives | <ul style="list-style-type: none"> Increase public awareness of marine debris Awareness-raising for fishers (marine debris originates from fishing activities) |
| | Remedial actions | <ul style="list-style-type: none"> Beach and ocean surface clean-up Involve local government, voluntary groups and public institutions Compensate for voluntary collection of discarded fishing gear |
| | Funding | <ul style="list-style-type: none"> Developed marine waste treatment project and surveys on microplastic pollution |
| Malaysia | Regulatory Framework and Policies | <ul style="list-style-type: none"> Established action plans toward zero single-use plastics Pollution charges for single-use plastics |
| | Initiatives | <ul style="list-style-type: none"> Create circular economy for single-use plastics Incentivise eco-friendly alternatives Education and public awareness initiatives |
| | Funding | <ul style="list-style-type: none"> Green technology funding schemes to promote growth of green economy |
| | Research | <ul style="list-style-type: none"> Research on plastic alternatives |
| Mexico | Regulatory Framework and Policies | <ul style="list-style-type: none"> Banned single-use plastics |
| | Education | <ul style="list-style-type: none"> Biweekly publications informing people on a number of marine issues |
| New Zealand | Regulatory Framework and Policies | <ul style="list-style-type: none"> Established proper waste management system – collection, storage, transportation, treatment (recycling), disposal (landfill) Prevent discharge of waste from ships or offshore facilities into the ocean Banned single-use plastic shopping bags |

| APEC Economy | Preventive and Remedial Measure | |
|------------------|-----------------------------------|--|
| | Topic | Description |
| | | <ul style="list-style-type: none"> Banned wash-off products containing plastic microbeads |
| | Funding | <ul style="list-style-type: none"> Established waste minimisation fund from levy on waste disposed in landfill to support innovation in addressing marine debris issues |
| | Enforcement | <ul style="list-style-type: none"> Illegal discharge into waterways |
| | Infrastructure | <ul style="list-style-type: none"> Developed material recovery and local reprocessing facilities |
| | Initiatives | <ul style="list-style-type: none"> Extended Producer Responsibility Guidelines to help industries prevent loss of plastic pellets to the environment |
| | Remedial actions | <ul style="list-style-type: none"> Beach and seafloor clean-up activities |
| Papua New Guinea | Regulatory Framework and Policies | <ul style="list-style-type: none"> Banned import and manufacture of single-use plastic bags |
| | Collaboration | <ul style="list-style-type: none"> Work toward sustainable management of marine resources under a multilateral partnership |
| Peru | Regulatory Framework and Policies | <ul style="list-style-type: none"> Established proper waste management system –collection, storage, transportation, treatment (recovery or recycling), disposal (landfill) Prevent discharge of waste from ships and aquaculture industries into the ocean Reduce use of single-use plastics among governmental entities Environmental impact studies on fishery plants that install submarine emissaries offshore |
| | Enforcement | <ul style="list-style-type: none"> Surveillance of fishing vessels for illegal waste disposal |
| | Initiatives | <ul style="list-style-type: none"> Awareness training for fishers on proper plastic waste management |
| | Funding | <ul style="list-style-type: none"> Funding for local and provincial governments to establish proper waste management and disposal |
| | Research | <ul style="list-style-type: none"> Impact of microplastics on biodiversity, human health and sustainability of fishery activities |
| | Remedial actions | <ul style="list-style-type: none"> Beach and seabed clean-up in polluted areas Considering severe laws against people responsible for marine debris pollution |
| | Monitoring | <ul style="list-style-type: none"> Marine debris monitoring as part of beach survey |
| The Philippines | Regulatory Framework and Policies | <ul style="list-style-type: none"> Banned single-use plastic bags |
| | Initiatives | <ul style="list-style-type: none"> Implemented an economy-wide programme to reduce threats and degradation of coastal and marine ecosystems Encourage recycling/transforming of waste into other products Incentivise plastic segregation in schools and reprimand households that do not practise it |
| | Collaboration | <ul style="list-style-type: none"> Work with NGOs to educate and carry out marine conservation and monitoring activities |

| APEC Economy | Preventive and Remedial Measure | |
|----------------|-----------------------------------|---|
| | Topic | Description |
| Russia | Regulatory Framework and Policies | <ul style="list-style-type: none"> Established producer responsibility for manufacturers of imported goods |
| | Initiatives | <ul style="list-style-type: none"> Enhance solid waste management and recycling system through provision of waste recycling facilities and collection bins for plastic and other wastes Aim to liquidate all unauthorised landfills in cities by 2024 |
| | Infrastructure | <ul style="list-style-type: none"> Plan to build 220 waste processing plants across the economy by 2024 |
| | Collaboration | <ul style="list-style-type: none"> Allow local citizens and NGOs to have a greater influence on the development of infrastructure, and the location of waste collection points and recycling plants |
| Singapore | Regulatory Framework and Policies | <ul style="list-style-type: none"> Established proper waste management system – collection, storage, transportation, treatment (recycling, incineration and waste-to-energy), disposal (landfill) Strict anti-littering law Regulate any water pollution from land-based sources Prevent pollution from ships into the ocean Forbid discharge of any debris from marine outfall of a water reclamation or desalination plant Mandatory plastic packaging reporting and reduction plan |
| | Initiatives | <ul style="list-style-type: none"> Encourage people and industries to practice the 3Rs |
| | Infrastructure | <ul style="list-style-type: none"> Convenient access to recycling services Enhance local recycling industry |
| | Funding | <ul style="list-style-type: none"> Initiate campaigns to encourage consumers to use reusable bags |
| | Remedial actions | <ul style="list-style-type: none"> Coastal and inland water bodies and submarine clean-up exercises Installation of litter traps and float booms as part of drainage network |
| | Monitoring | <ul style="list-style-type: none"> Identify marine debris at seashores |
| Chinese Taipei | Regulatory Framework and Policies | <ul style="list-style-type: none"> Established proper waste management system – collection, storage, transportation, treatment (recycling, reuse or incineration), disposal (landfill) Prevent waste discharge at harbour areas Regulate waste discharge at port facilities Banned certain plastic items (i.e., microbeads, straws, single-use plastics) |
| | Enforcement | <ul style="list-style-type: none"> Inspect landfill site near rivers |
| | Initiatives | <ul style="list-style-type: none"> Set up recycling stations in villages and harbours Transport garbage from remote islands Promote public awareness on marine pollution |

| APEC Economy | Preventive and Remedial Measure | |
|---------------|-----------------------------------|---|
| | Topic | Description |
| | Remedial actions | <ul style="list-style-type: none"> • Clean-up on sea surface and seabed at certain hotspots • Fund local governments to conduct clean-up • Encourage fishers to retrieve floating marine debris when at sea • Gather volunteers with scuba diving skills for seabed clean-up |
| | Monitoring | <ul style="list-style-type: none"> • Monitor through visual surveys, satellite telemetry and unmanned aerial vehicle |
| Thailand | Regulatory Framework and Policies | <ul style="list-style-type: none"> • Established strategy to reduce plastic waste and marine debris • Restrict certain plastic items (i.e., microbeads, cap seals, oxo-degradable plastics) |
| | Initiatives | <ul style="list-style-type: none"> • Increase public awareness and encourage behavioural change • Enhance plastic recycling management system or infrastructure • Adopt 3R concept and encourage the use of innovative materials to reduce waste • Waste-to-energy plants to reduce amount of waste and improve quality of waste created |
| | Remedial actions | <ul style="list-style-type: none"> • Part of global initiative to clean up oceans by engaging with local fishers |
| United States | Regulatory Framework and Policies | <ul style="list-style-type: none"> • Established proper waste management system – collection, storage, transportation, treatment (reuse, recycling, composting, shredding or incineration), disposal (landfill) • Prevent pollution from ships into the ocean • Developed a marine debris programme with specific focus on marine debris prevention through prevention, research, removal regional coordination and emergency response |
| | Research | <ul style="list-style-type: none"> • Source of marine debris and its baseline • Impacts of marine debris (i.e., chemical, economic and wildlife through plastic ingestion) • Marine debris monitoring • Fishing gear improvement projects |
| | Initiatives | <ul style="list-style-type: none"> • Developed Sustainable Materials Management through maximising materials efficiency over their entire lifecycle • Outreach and awareness-raising to prevent marine debris pollution |
| | Collaboration | <ul style="list-style-type: none"> • Implemented Trash Free Waters Program that requires local, government and regional stakeholders to work together to identify problem and gather solutions for marine debris pollution |
| | Funding | <ul style="list-style-type: none"> • Fund projects that aim to educate and raise awareness on marine debris pollution |
| | Remedial actions | <ul style="list-style-type: none"> • Shoreline clean-up activities • Fishing for Energy project • Map and survey marine debris following natural disasters |

| APEC Economy | Preventive and Remedial Measure | |
|--------------|-----------------------------------|--|
| | Topic | Description |
| | Monitoring | <ul style="list-style-type: none"> Established the Marine Debris Monitoring and Assessment Project that compiles marine debris data to assess effectiveness of existing marine debris prevention initiatives |
| Viet Nam | Regulatory Framework and Policies | <ul style="list-style-type: none"> Prevent waste discharge from ships into ocean Established an economy-wide action plan on marine debris Restrict single-use plastics Adopted plan to impose strict control of hazardous waste and collection and treatment of solid waste generated in rural areas; and ensure use of only 100 percent eco-friendly plastic bags in supermarkets |
| | Initiative | <ul style="list-style-type: none"> Developed plastic waste collection system Public awareness campaign to residents and tourists |
| | Remedial Actions | <ul style="list-style-type: none"> Shoreline clean-up activities |

5.2 IDENTIFICATION OF GAPS AND NEEDS FOR MARINE DEBRIS MANAGEMENT

A review of the various measures implemented by APEC economies to combat marine debris pollution allows identification of several gaps as summarised below.

Regulatory framework and policies

Most APEC economies have passed laws to ensure proper solid waste management which help prevent marine debris pollution. Most economies have established general management of domestic and industrial waste with regulations that include proper waste management, anti-littering, prevention of dumping of waste on land (especially beaches) and/or at sea from any ship or vessel. Minimally, waste management laws must be enforced using appropriate incentives and penalties. Even though regulatory systems are in place, there is a need for stricter enforcement, especially in areas where the source of the marine debris (e.g., fishery or illegal dumping) is occurring or known. Subsidies, taxes and levies could be useful instruments for effective waste management and to modify producers' and consumers' behaviour.¹²⁶ Heavier penalties could help deter industries from creating marine debris pollution.

Legislation could be further improved to include the prevention of all sources of marine debris, including land- or sea-based debris, from entering the ocean. Legislation that is limited in its ability to align with and apply to different levels of governments, especially in coastal and rural areas, could be made more comprehensive. Moreover, insufficient infrastructure especially in rural areas has been highlighted as a key challenge in addressing the marine debris issue in China. Hence, it is necessary for these laws to be supported by adequate waste management infrastructure, particularly in remote and rural areas.

Many economies have drawn from the measures relating to marine debris or plastics waste management found in international conventions, and incorporated them into their legislation. However, economies should consider strengthening the alignment of their policies to these conventions. Challenges remain in domestic implementation. A 2018 report by the United Nations Environment Programme observes that while many economies are party to various international marine-related conventions, domestic implementation in many locations is poor due to low capacity and cultural barriers, among others.¹²⁷ Peru noted a lack of personnel, resources and financial support for surveillance of illegal waste disposal from vessels at sea and at beaches as a challenge. Similarly, Singapore listed controlling discharges into waterways and ensuring proper solid waste management as difficulties to address through its Environmental Protection and Management Act and Environmental Public Health Act.

Several APEC economies have banned single-use plastic items (mainly plastic bags) and institutionalised plastic waste recycling as part of their law to prevent marine debris at its source. However, there are challenges in restricting or banning all types of plastics, including microbeads, oxo-biodegradable or compostable plastics. New Zealand has noted the need to improve the resource recovery system by reviewing the quality of recyclables and the plastic processing capacity, and regulating recycled content in plastic packaging, among others.

¹²⁶ F. Gallo and A. Bongiolatti, 'Preventive Measures to Address the Problem of Marine Litter' (Barcelona: Regional Activity Centre for Cleaner Production, 2013), www.cprac.org.

¹²⁷ United Nations Environment Programme and Coordinating Body on the Seas of East Asia (COBSEA), 'Regional Review of Marine Litter in the East Asian Seas Region, Zerodraft' (23 April 2018).

Not all economies have adopted comprehensive laws specific to the management of plastic waste and recycling. Most economies agreed there is lack of awareness or incentives to separate waste for recycling. Chinese Taipei and Chile regarded the lack of awareness or incentives as their topmost challenge in addressing plastic packaging. To counter this challenge, some economies have imposed strict measures to ensure appropriate recycling. China strictly enforces the classification of plastic garbage in some cities by imposing fines if the classification does not meet requirements. Japan has the National Action Plan for Marine Plastic Litter that focuses on the prevention of marine litter from entering the ocean. Singapore's approach has been to reduce the excessive use of all types of disposables and to promote the use of reusable materials. As such, Singapore does not target plastics alone, as this may simply result in their substitution by other types of materials, which could be more harmful to the environment.

Figure 5.1 provides an overview of marine debris legislation in several APEC economies. It also highlights the exploratory mapping of existing regulatory frameworks to prevent marine debris in certain economies.

Institutional framework

Several APEC economies have committed to economy-wide targets for the reduction of marine debris and plastic waste, and the improvement of recycling rates. However, there is an absence of a clear institutional framework that provides an approach for creating a detailed economy-wide action plan to implement new policies, infrastructures (municipal or recycling facilities), education, research, funding and communication across various relevant stakeholders.

Some economies have adopted economy-wide targets for recycling or plastic reduction. For example, Chile highlighted its commitment to ensuring that 100 percent of plastic containers and packaging are designed to be recyclable, reusable or compostable; and one-third of residential and non-domiciliary plastic containers and packaging are recycled, reused or composted effectively. This requires establishing and communicating a comprehensive action plan to various stakeholders.

Collaboration and partnerships

Marine debris pollution is a complex transboundary environmental issue which has biological, social and economic implications. There is a strong need to establish and strengthen collaborations and partnerships between public and private institutions, locally and internationally. Barriers may inhibit the creation of partnerships at an international level to gather various stakeholders or experts to share their knowledge and experiences in the field, and to develop technologies or solutions to combat marine debris.

Marine debris preventive measures may have an impact on various stakeholders such as industries, consumers, NGOs and the general public. New policies and measures on marine debris may suffer from lack of engagement and constructive feedback from stakeholders during the design and implementation stages. The complexity and severity of the marine debris issue calls for greater collaboration across agencies, organisations and experts. In addressing this barrier, the Chinese Taipei Marine Debris Governance Platform invites relevant agencies and departments to cooperate and participate.

Research and innovation

Several APEC economies have conducted research on microplastics and its impact on the biodiversity and human health within their coastal areas and ocean, but there is insufficient research and understanding on the impact of marine debris on a regional and global scale.

Despite the gradual restriction and ban of plastics in many APEC economies, there is a lack of innovation for alternative materials. This may be due to insufficient funding from government or private institutions, and lack of collaborations among government, the private sector and academia (locally or at the regional or international level).

Education and awareness

In addition to marine debris prevention policies, education and awareness on marine debris pollution is essential to foster behavioural changes in industry and among individuals. China and New Zealand considered it challenging to adjust single-use based consumption and production patterns. To address this issue, many economies are conducting awareness training about the impact of marine debris pollution and the benefits of plastic recycling to various stakeholders. However, there is a lack of targeted awareness-raising across known marine debris sources, such as industry sectors (e.g., fisheries, aquaculture or tourists) or community groups (e.g., in rural or coastal areas). Partnerships with local or international NGOs could be beneficial in addressing this issue as well.

Remedial measures

Remedial measures such as clean-up activities are increasingly initiated by voluntary organisations and industry bodies, either on an ad hoc or structured basis. Many economies have beach clean-up activities as a remedial measure while some also organise clean-up of marine debris floating at sea or on the seabed (underwater).

Generally, there is still a lack of coordinated efforts and planning for marine debris clean-up activities, including clean-up protocols, guidance on methodologies and centralisation of marine debris data. There may be insufficient funding support as clean-up operations are labour and resource intensive. Clean-up operations of floating debris and debris on the seabed should be planned with adequate financial support and resources. Authorities can take the lead and encourage participation from private institutions and the public (volunteers).

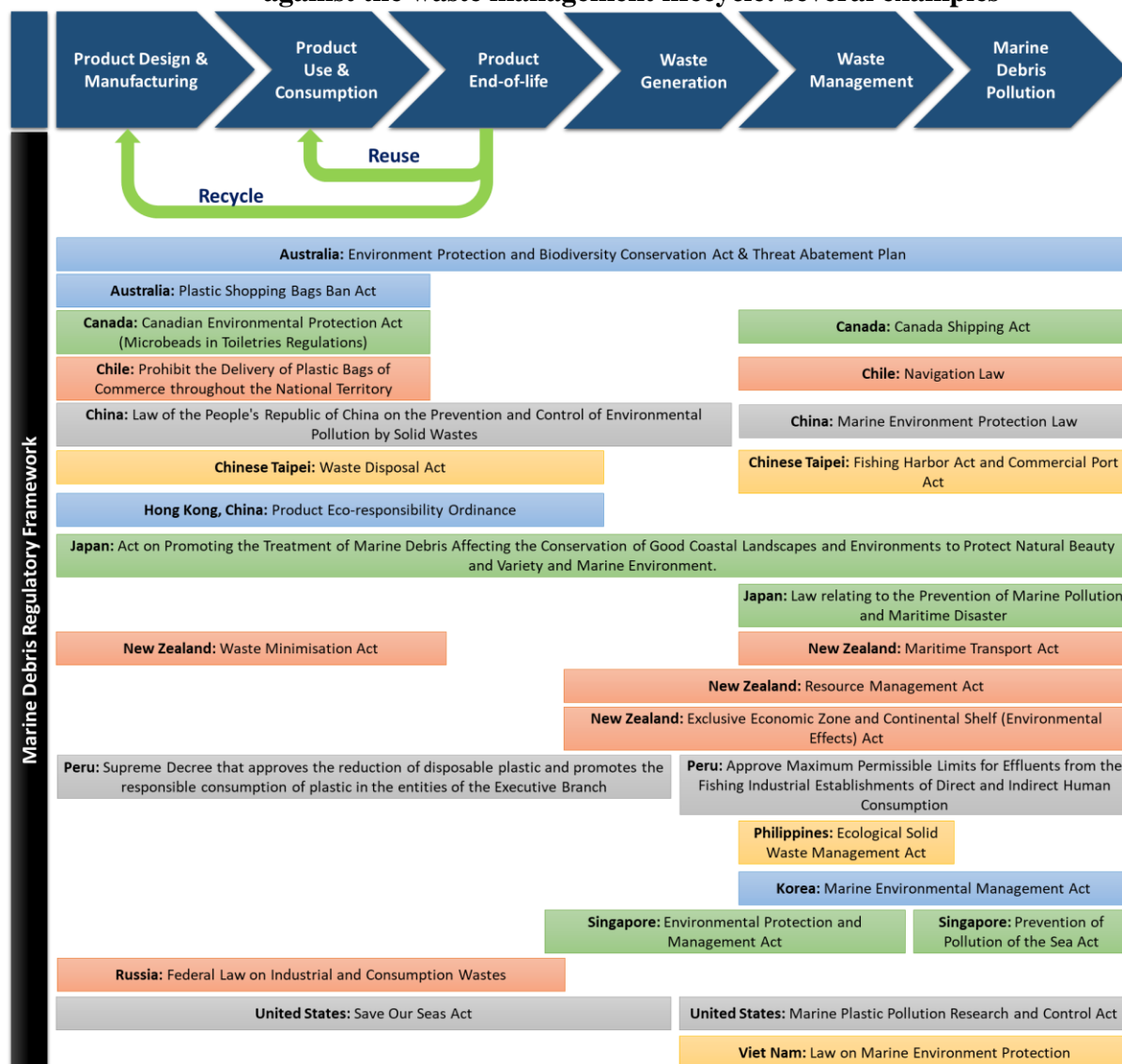
Marine debris monitoring

Many APEC economies are conducting marine debris monitoring, but only as part of their clean-up activities. Methodologies adopted by most economies are limited to visual surveys to identify the type of marine debris. There is a need to have a more effective and efficient monitoring system and wider adoption of current technologies. For example, Chinese Taipei uses technologies such as satellite telemetry and unmanned aerial vehicles to monitor marine debris. Further assessments, such as on source identification and the pathways of the debris, may also be necessary as the data will help in developing effective policies and measures.

New Zealand highlighted the lack of relevant marine debris data as its main challenge to understand the extent of impact and the gaps in materials recovery and waste infrastructure, while Korea focused on accurately measuring the quantity of marine debris. China requires the

government, districts, and solid waste management organisations to report solid waste data including types, production quantity and status of disposal. In overcoming this data deficiency, governments may consider working with local universities. In Singapore, there is an ongoing research collaboration with the National University of Singapore to establish baseline data on marine debris on Singapore’s shores, develop a citizen-science programme to monitor macro-debris and microplastics, and facilitate dialogue with stakeholders to develop recommendations for management approaches.

Figure 5.1. Mapping APEC economies’ marine debris regulatory frameworks against the waste management lifecycle: several examples



6. CONCLUSION

This report provides a snapshot of the preventive measures currently in place in APEC economies to reduce the entry of plastic waste into the sea. The findings from the direct survey and secondary research show that APEC economies have implemented a wide range of measures, including both regulatory and non-regulatory instruments, to manage marine debris pollution. These measures include legislation for proper waste management, and prevention of illegal waste dumping on land and into waterways or oceans, as well as voluntary measures such as beach clean-ups. There is also enforcement against operations that create marine debris pollution. The main policies for marine debris reduction are the promotion of recycling and the reduction of plastic usage.

Several economies have implemented restrictions and bans on certain plastic materials such as single-use plastics, straws and microbeads. These initiatives require a change in behaviour, hence the importance of education in creating public awareness on marine debris, plastic pollution and the benefits of recycling. Governments or relevant authorities have been taking the lead and collaborating with non-governmental organisations (NGOs) or private institutions in these education campaigns. Such partnerships between government and the private sector should extend to research activities to gain a better understanding of the impacts of marine debris or microplastics. Most APEC economies are also conducting remedial measures including beach, sea surface (or floating) and seabed clean-ups to remove marine debris from the ocean.

There is still substantial room for improvement among APEC economies. Stronger enforcement of legislation is necessary with greater collaboration across different levels of governments, agencies, organisations and experts. Several economies have imposed restrictions on the use of plastics, but there is a lack of innovation on alternative plastics; similarly, improved waste segregation systems are in place but there is a lack of awareness or incentives to practise recycling. There is also a need to explore and adopt new technologies for marine debris monitoring to improve data and enable development of informed policies.

BIBLIOGRAPHY

- ‘Action Plan for Marine Debris Reduction to Be Built’. *The Voice of Vietnam*, 9 August 2019. <https://english.vov.vn/society/action-plan-for-marine-debris-reduction-to-be-built-401352.vov>.
- Ahmad, N.A., N.Q. Kamis and S.S.A. Mahdini. ‘Brunei’s Sustainable Measures for a Successful Environmental Development’. *Asian Journal of Legal Studies in Environment* (31 August 2016). <https://alsajournal.com/2016/08/31/brunei-moving-forward-bruneis-sustainable-measures-for-a-successful-environmental-development/>.
- Alliance to End Plastic Waste. ‘The Alliance Launches in Thailand and Southeast Asia, Where the Need Is Greatest’. 27 August 2019. https://endplasticwaste.org/latest/the-alliance-launches-in-thailand-and-southeast-asia-where-the-need-is-greatest/#_ftn1.
- Arnani, M. ‘Sampah dan Plastik Jadi Ancaman, Seperti Apa Kebijakan Pemerintah?’ [Garbage and Plastic Become Threats, What Is Government Policy Like?], *Kompas.com*, 22 November 2018. <https://nasional.kompas.com/read/2018/11/22/15323351/sampah-dan-plastik-jadi-ancaman-seperti-apa-kebijakan-pemerintah?page=all>.
- Asian Development Bank (ADB). ‘Solid Waste Management in the Pacific: Papua New Guinea Country Snapshot’. Manila: ADB, 2014. <https://www.adb.org/sites/default/files/publication/42664/solid-waste-management-png.pdf>.
- Asia-Pacific Economic Cooperation (APEC). ‘1990 APEC Ministerial Meeting, Singapore, 29 July 1990’. July 1990. https://www.apec.org/Meeting-Papers/Annual-Ministerial-Meetings/1990/1990_amm.
- . ‘Ocean and Fisheries’. Updated September 2019. <https://www.apec.org/Groups/SOM-Steering-Committee-on-Economic-and-Technical-Cooperation/Working-Groups/Ocean-and-Fisheries>.
- Association of Southeast Asian Nations (ASEAN). ‘Bangkok Declaration on Combating Marine Debris in ASEAN Region’. 22 June 2019. <https://asean.org/storage/2019/06/2.-Bangkok-Declaration-on-Combating-Marine-Debris-in-ASEAN-Region-FINAL.pdf>.
- Australian Government. ‘2018 National Waste Policy: Less Waste More Resources’. Commonwealth of Australia, 2018. <https://www.environment.gov.au/system/files/resources/d523f4e9-d958-466b-9fd1-3b7d6283f006/files/national-waste-policy-2018.pdf>.
- . ‘Environment Protection and Biodiversity Act 1999, Compilation No. 51’. 2016. <https://www.legislation.gov.au/Details/c2016c00777>.
- . ‘Pacific Ocean Litter Project’. Accessed 13 November 2019. <http://www.environment.gov.au/marine/international-activities/pacific-ocean-litter-project>.
- . ‘Plastic Microbeads’. Accessed 13 November 2019. <https://www.environment.gov.au/protection/waste-resource-recovery/plastics-and-packaging/plastic-microbeads>.
- . ‘Product Stewardship’. Accessed 13 November 2019. <http://www.environment.gov.au/protection/waste-resource-recovery/national-waste-reports/national-waste-report-2013/product-stewardship>.
- . ‘Threat Abatement Plan for the Impacts of Marine Debris on Vertebrate Marine Life’. Accessed 13 November 2019. <http://environment.gov.au/marine/publications/threat-abatement-plan-impacts-marine-debris-vertebrate-marine-life>.
- . ‘Threat Abatement Plan for the Impacts of Marine Debris on the Vertebrate Wildlife of Australia’s Coasts and Oceans’. Commonwealth of Australia, 2018. <https://www.environment.gov.au/system/files/resources/e3318495-2389-4ffc-b734-164cdd67fe19/files/tap-marine-debris-2018.pdf>.
- Australian Marine Debris Initiative. ‘Australian Marine Debris Database’. Accessed 13 November 2019. <http://amdi.tangaroablue.org/>.
- Australian Packaging Covenant Organisation. ‘Australia’s 2025 National Packaging Targets’. Accessed 13 November 2019. <https://www.packagingcovenant.org.au/who-we-are/australias-2025-national-packaging-targets>.
- Bergmann, M., L. Gutow and M. Klages, eds. *Marine Anthropogenic Litter*. SpringerLink, 2015. <https://link.springer.com/content/pdf/10.1007%2F978-3-319-16510-3.pdf>.
- BNamericas, ‘Mexico City Outlines US\$7bn Environment, Climate Change Plan’. 6 June 2019. <https://www.bnamericas.com/en/features/mexico-city-outlines-us7bn-environment-climate-change-plan>.
- Boonpa, S. and Sharp, A. ‘Waste-to-energy Policy in Thailand’. *Energy Sources, Part B: Economics, Planning, and Policy* 12, no. 5 (2017): 434–42. doi: 10.1080/15567249.2016.1176088.
- Borongon, P. and P. Kashyap. ‘Country Profile Indonesia, Managing Municipal Solid Waste and Packaging Waste’. Bonn: GIZ, 2018. https://www.giz.de/de/downloads/giz2018_Indonesia-Country-Profile_web.pdf?
- Bureecam, C., T. Chaisomphob and P. Sungsomboon. ‘Material Flows Analysis of Plastic in Thailand’. *Thermal Science* 22 (2017): 5. doi:10.2298/TSCI160525005B.

- CEEREC. 'Russian EPR Law: Legal Requirements and Compliance'. 2 November 2017. <https://ceerec.eu/ussian-epr-law-legal-requirements-and-compliance/>.
- Clean Shorelines. 'Inter-departmental Working Group on Marine Environmental Management'. Accessed 13 November 2019. https://www.epd.gov.hk/epd/clean_shorelines/node/12.html.
- Department of Environment and Natural Resources of the Philippines, 'DENR Implements Program to Strengthen Coastal and Marine Management'. Accessed 18 November 2019. <http://car.denr.gov.ph/index.php/87-regional-articles-default/267-denr-implements-program-to-strengthen-coastal-and-marine-management>.
- Ecoalf. 'Upcycling the Oceans'. Accessed 13 November 2019. <https://ecoalf.com/en/p/upcycling-the-oceans-15>.
- Elvestuen, O. 'How to Reduce the Impacts of Plastic Products on the Marine Environment?' Government.no. 13 July 2018. <https://www.regjeringen.no/en/aktuelt/brussels-speech-on-marine-litter/id2607330/>
- Environmental Protection Department of Hong Kong, China. 'Investigation on the Sources and Fates of Marine Refuse in Hong Kong: Study Report'. Kowloon: Mott MacDonald, 2015. https://www.epd.gov.hk/epd/clean_shorelines/sites/default/files/common2015/MarineRefuseStudyReport_ENG_Final.pdf.
- . 'Plastic Shopping Bag Charging Scheme'. Accessed 13 November 2019. https://www.epd.gov.hk/epd/english/environmentinhk/waste/pro_responsibility/env_levy.html.
- . 'Producer Responsibility Scheme (PRS) on Glass Beverage Containers'. Accessed 13 November 2019. https://www.epd.gov.hk/epd/english/environmentinhk/waste/pro_responsibility/gprs.html.
- Environment Bureau of Hong Kong, China. 'Safe and Sustainable: A New Producer Responsibility Scheme for Waste Electrical & Electronic Equipment'. Consultation document, Hong Kong SAR Government, 2010. https://www.gov.hk/en/residents/government/publication/consultation/docs/2010/WEEE_Consultation.pdf.
- 'Environment Levy Imposed on Plastic Bags'. *Papua New Guinea Post-Courier*, 16 April 2018. <https://postcourier.com.pg/environment-levy-imposed-plastic-bags/>.
- European Commission. 'Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: A European Strategy for Plastics in a Circular Economy'. 16 January 2018. <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1516265440535&uri=COM:2018:28:FIN>.
- . 'Our Oceans, Seas and Coasts – Descriptor 10: Marine Litter'. Updated 4 October 2019. https://ec.europa.eu/environment/marine/good-environmental-status/descriptor-10/index_en.htm?
- . 'Our Oceans, Seas and Coasts – Legislation: The Marine Strategy Framework Directive'. Updated 8 August 2019. https://ec.europa.eu/environment/marine/eu-coast-and-marine-policy/marine-strategy-framework-directive/index_en.htm.
- Fedotkina, O., E. Gorbashko and N. Vatolkina. 'Circular Economy in Russia: Drivers and Barriers for Waste Management Development'. *Sustainability* 11, no. 20 (2019): 5837.
- Gallo, F. and A. Bongiolatti. 'Preventive Measures to Address the Problem of Marine Litter'. Barcelona: Regional Activity Centre for Cleaner Production, 2013. www.cprac.org.
- Gershkovich, E. 'How Russia's Attempt to Solve Its Trash Crisis Is Backfiring'. *The Moscow Times*, 12 December 2018. <https://www.themoscowtimes.com/2018/12/12/how-russias-attempt-to-solve-its-trash-crisis-is-backfiring-a63795>.
- Government of Mexico, 'Nuestro Ambiente'. Gobierno de Mexico. Accessed 13 November 2019. <https://www.gob.mx/semarnat/documentos/nuestro-ambiente?idiom=es>.
- Government Public Relations Department of Thailand. 'Roadmap on Plastic Waste Management'. 19 April 2019. https://thailand.prd.go.th/1700/ewt/thailand/ewt_news.php?nid=7831&filename=index.
- GovHK. 'Municipal Solid Waste Charging'. Last reviewed March 2019. <https://www.gov.hk/en/residents/environment/waste/management/mswcharging.htm>.
- . 'Producer Responsibility Scheme on Plastic Beverage Containers'. Last reviewed March 2019. <https://www.gov.hk/en/residents/environment/waste/management/prsplastic.htm>.
- . 'Producer Responsibility Schemes'. Last reviewed March 2019. <https://www.gov.hk/en/residents/environment/waste/management/prs.htm>.
- Hardesty, B.D., Q. Schuyler, T.J. Lawson, K. Opie and C. Wilcox. 'Understanding Debris Sources and Transport from the Coastal Margin to the Ocean'. EP165651, CSIRO, 2016.
- International Finance Corporation (IFC). 'Waste in Russia: Garbage or Valuable Resource? Scenarios for Developing the Municipal Solid Waste Management Sector'. Moscow: IFC, 2014. <http://documents.worldbank.org/curated/pt/702251549554831489/pdf/Waste-in-Russia-Garbage-or-Valuable-Resource.pdf>
- Jain, A. 'Summary Report: Waste Management in ASEAN Countries'. United Nations Environment Programme, 2017. https://wedocs.unep.org/bitstream/handle/20.500.11822/21134/waste_mgt_asean_summary.pdf?sequence=1&isAllowed=.
- Jambeck, J.R., R. Geyer, C. Wilcox, T.R. Siegler, M. Perryman, A. Andrady, R. Narayan and K.L. Law. 'Plastic Waste Inputs from Land into the Ocean'. *Science* 347, no. 6223 (2015): 768–71. doi:10.1126/science.1260352.

- Kamuang, T. and O. Siriratpiriya. 'State of the 3Rs in Asia and the Pacific: Country Chapter – Kingdom of Thailand'. Nagoya: United Nations Centre for Regional Development (UNCRD), 2017. <http://www.uncrd.or.jp/content/documents/5695%5bNov%202017%5d%20Thailand.pdf>.
- Kindt, J.W. 'Solid Wastes and Marine Pollution'. *Catholic University Law Review* 34, no. 1 (1985): 37–100. <https://scholarship.law.edu/cgi/viewcontent.cgi?article=2086&context=lawreview>.
- Lebreton, L., B. Slat, F. Ferrari, B. Sainte-Rose, J. Aitken, R. Marthouse, S. Hajbane, S. Cunsolo, A. Schwarz, A. Levivier et al. 'Evidence that the Great Pacific Garbage Patch Is Rapidly Accumulating Plastic'. *Scientific Reports* 8, no. 1 (2018): 4666. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5864935/>.
- Lovells, H. 'Legislative Reforms Seek to Reduce Single-use Plastic Waste'. Lexology. September 2019. <https://www.lexology.com/library/detail.aspx?g=6e5875a0-57ce-4e1c-96de-39e5677cdcad>.
- Lyons, Y., T. Su and M.L. Neo. 'A Review of Research on Marine Plastics in Southeast Asia: Who Does What?' 2019. <https://www.gov.uk/government/publications/a-review-of-research-on-marine-plastics-in-sea-who-does-what>.
- Marine Conservation Philippines. 'About Marine Conservation Philippines'. Accessed 13 November 2019. <https://www.marineconservationphilippines.org/about-marine-conservation-philippines/>.
- Marine Debris Indonesia. Home Page of the Marine Debris Database. Accessed 13 November 2019. <https://marinedebris.id/Sea>.
- McIlgorm, A., H.F. Campbell and M.J. Rule. 'Understanding the Economic Benefits and Costs of Controlling Marine Debris in the APEC Region (MRC 02/2007)'. APEC Marine Resource Conservation Working Group, 2008. <https://www.apec.org/Publications/2009/04/Understanding-the-Economic-Benefits-and-Costs-of-Controlling-Marine-Debris-In-the-APEC-Region>.
- McKinsey & Company and Ocean Conservancy. 'Stemming the Tide: Land-based Strategies for a Plastic-free Ocean'. McKinsey & Company and Ocean Conservancy, 2015. <https://oceanconservancy.org/wp-content/uploads/2017/04/full-report-stemming-the.pdf>.
- Meridian Dobra Environmental Charitable Foundation. 'Solving the Problem of Municipal Solid Waste Management in Russia'. 2014. <http://meridiandobra.ru/wp-content/uploads/2018/11/recycling-in-russia-eng.pdf>.
- Ministry for the Environment of New Zealand. 'Single-use Plastic Shopping Bags Are Banned in New Zealand'. 1 July 2019. <https://www.mfe.govt.nz/waste/single-use-plastic-shopping-bags-banned-new-zealand/>
- Ministry of Development of Brunei Darussalam. 'Don't Destroy Our River'. Department of Environment, Parks and Recreation. Accessed 13 November 2019. <http://www.env.gov.bn/SitePages/Don't%20Destroy%20Our%20River.aspx>.
- . 'No Styrofoam: Reducing the Use of Styrofoam Containers'. Department of Environment, Parks and Recreation. Accessed 13 November 2019. <http://www.env.gov.bn/SitePages/No%20Styrofoam.aspx>.
- . 'Strategic Plan 2018–2023'. Bandar Seri Begawan: Ministry of Development, 2018. <http://www.mod.gov.bn/Shared%20Documents/LATEST%20SP%202018%20-%202023.pdf>.
- Ministry of Energy, Science, Technology, Environment and Climate Change (MESTECC) of Malaysia. 'Malaysia's Roadmap Towards Zero Single-Use Plastics 2018–2030: Towards a Sustainable Future'. Putrajaya: MESTECC, 2018. <https://www.mestecc.gov.my/web/wp-content/uploads/2019/03/Malaysia-Roadmap-Towards-Zero-Single-Use-Plastics-2018-20302.pdf>.
- Ministry of Foreign Affairs of Norway. 'The Norwegian Development Program to Combat Marine Litter and Microplastics'. Government.no. Updated October 2019. https://www.regjeringen.no/en/dokumenter/marine_litter/id2642037/.
- Ministry of Natural Resources and Environment of Thailand. 'Booklet on Thailand State of Pollution 2018'. Bangkok: Pollution Control Department, 2018.
- . 'Thailand Makes an Effort to Protect Marine Environment from Marine Debris and Land-based Pollution'. United Nations. Accessed 13 November 2019. <https://oceanconference.un.org/commitments/?id=18208>.
- Ministry of the Environment of Japan. '4th Fundamental Plan for Establishing a Sound Material-Cycle Society'. Government of Japan, 2018. https://www.env.go.jp/en/recycle/smcs/4th-f_Plan.pdf
- Netherlands Embassy in Russia. 'Waste Management in Russia'. Moscow: Netherlands Embassy, 2018. <https://www.rvo.nl/sites/default/files/2018/09/waste-management-in-russia.pdf>.
- Norjidi, D. 'Monday Added to "No Plastic Every Day" Initiative in Brunei'. *Borneo Bulletin*, 31 December 2018. <http://annx.asianews.network/content/monday-added-%E2%80%98no-plastic-every-day%E2%80%99-initiative-brunei-88906>.
- 'Ocean Cleanup Campaign Launched in 28 Coastal Locales across Vietnam'. *The Voice of Vietnam*, 14 July 2018. <https://english.vov.vn/society/ocean-cleanup-campaign-launched-in-28-coastal-locales-across-vietnam-379058.vov>.

- Ocean Conservancy. 'Together for Our Ocean: International Coastal Cleanup 2017 Report'. Ocean Conservancy, 2017. https://oceanconservancy.org/wp-content/uploads/2017/06/International-Coastal-Cleanup_2017-Report.pdf.
- Organisation for Economic Co-operation and Development (OECD). 'Policy Roundtables: Waste Management Services 2013'. DAF/COMP(2013)26, OECD, 2014. <http://www.oecd.org/daf/competition/Waste-management-services-2013.pdf>.
- Osorio, V.A. 'Marine Litter in the ASEAN Region and Philippine Response as a Member State'. Presented at the *East Asian Seas (EAS) Congress 2018*, Iloilo, Philippines, 27–30 November 2018.
- Pacific Region Infrastructure Facility (PRIF). 'Papua New Guinea Country Profile in the Solid Waste and Recycling Sector'. Sydney: PRIF, 2018. <https://www.theprif.org/documents/papua-new-guinea-png/waste-management/papua-new-guinea-png-profile-solid-waste-and>.
- Pariatamby, A. 'State of the 3Rs in Asia and the Pacific, Country Chapter: Malaysia'. Secretariat of the Regional 3R Forum in Asia and the Pacific, United Nations Centre for Regional Development (UNCRD), Institute for Global Environmental Strategies (IGES), November 2017.
- Pawlowska, A.E. 'Opening Remarks at the Marine Plastics Conference in the Philippines'. World Bank. 4 April 2019. <https://www.worldbank.org/en/news/speech/2019/04/04/opening-remarks-by-agata-e-pawlowska-at-the-marine-plastics-conference-in-the-philippines>.
- Pham, V.T. 'Vietnam Law on Marine Environment Protection and the Implementation of Marpol Convention 73/78 in Current Period'. *Journal of Law, Policy and Globalization* 46 (2016): 67–73. <https://pdfs.semanticscholar.org/f3ca/e889d57c8b1b5cbbd02eccbc601204ce470a.pdf>.
- 'PNG Imposes Full Ban on Plastic Shopping Bags'. *RNZ*, 18 April 2018. <https://www.rnz.co.nz/international/pacific-news/355385/png-imposes-full-ban-on-plastic-shopping-bags>.
- Poopair, P. 'Thailand PPP Plastic: Thailand Public Private Partnership for Plastic and Waste Management'. Presented at the *Circular Living Symposium 2019*, Bangkok, Thailand, 28 June 2019. <https://gccircularliving.pttgcgroup.com/storage/symposium/speakers/presentation/pranee-poopair-thailand-public-private-partnership-for-plastic.pdf.pdf>.
- Premakumara, D.G.J., A.M.L. Canete and M. Nagaishi. 'Policy Implementation of the Republic Act (RA) 9003 in the Philippines: A Case Study of Cebu City'. *The 1st IWWG-ARB Symposium*, Hokkaido, Japan, 18–21 March 2013.
- PT Wasteforchange Alam Indonesia. 'Everything You Need to Know about 2025 Clean-from-Waste Indonesia'. waste4change. Accessed 13 November 2019. <https://waste4change.com/everything-you-need-to-know-about-clean-from-waste-indonesia-2025/>.
- Purba, N.P., D.I. Handyman, T.D. Pribadi, A.D. Syakti, W.S. Pranowo, A. Harvey and Y.N. Ihsan. 'Marine Debris in Indonesia: A Review of Research and Status'. *Marine Pollution Bulletin* (2019): 134–44.
- Recycling Fund. 'Overview'. Last updated 25 October 2019. <https://www.recyclingfund.hk/en/overview.php>.
- Republic of the Philippines. 'House Bill no. 6892: Ban on Single-use Plastic Products'. 2018. http://www.congress.gov.ph/legisdocs/basic_17/HB08692.pdf.
- Rogers, C. 'Indonesia, a Top Plastic Polluter, Mobilizes 20,000 Citizens to Clean Up the Mess'. *Mongabay*, 4 September 2018. <https://news.mongabay.com/2018/09/indonesia-a-top-plastic-polluter-mobilizes-20000-citizens-to-clean-it-up/>.
- Rupe, B.R. 'Domestic and International Environmental Policy in Mexico: Compounding Issues for the Marine Environment'. MA thesis, University of Iowa, 2014. <https://doi.org/10.17077/etd.ntihs4ga>.
- Secretariat of the Pacific Regional Environment Programme (SPREP). 'Pacific Regional Solid Waste Management Strategy 2010–2015'. Apia: SPREP, 2010. https://www.sprep.org/attachments/Pacific_RSWMS_2010-2015.pdf.
- Shams, S., R.H.M. Juani and Z. Guo. 'Integrated and Sustainable Solid Waste Management for Brunei Darussalam'. IET, 2014. doi:10.1049/cp.2014.1066.
- Sreenivasan, J., M. Govindan, M. Chinnasami and I. Kadiresu. 'Solid Waste Management in Malaysia – A Move Towards Sustainability, Waste Management – An Integrated Vision'. IntechOpen, 26 October 2012. <https://www.intechopen.com/books/waste-management-an-integrated-vision/solid-waste-management-in-malaysia-a-move-towards-sustainability>.
- Thai Embassy in Washington, DC. 'Thailand Reducing Plastic Waste with Innovative Materials'. 12 November 2018. <https://thaiembdc.org/2018/11/12/thailand-reducing-plastic-waste-with-innovative-materials/>.
- . 'Thailand Will Ban Three Plastics This Year'. 29 April 2019. <https://thaiembdc.org/2019/04/29/thailand-will-ban-three-plastics-this-year/>.
- 'Thailand Pledges to Cut Sea Debris by 50%'. *Bangkok Post*, 6 March 2019. <https://www.thephuketnews.com/thailand-pledges-to-cut-sea-debris-by-50-70602.php?#3wTSBbPFcrju0fIo.97>.
- Thang, L.D. 'Overview of Marine Plastic Debris in Vietnam in Relation to International Context'. Presented at *FIG Working Week 2019: Geospatial Information for a Smarter Life and Environmental Resilience*, Hanoi,

- Vietnam, 22–26 April 2019. https://www.fig.net/resources/proceedings/fig_proceedings/fig2019/papers/ts01d/TS01D_le_dai_10174.pdf.
- Truong, N. 'Solid Waste Management in Vietnam: Current Situation, Challenges and Strategies for Development'. Bachelor's thesis, Metropolia University of Applied Sciences, 2018. https://www.theseus.fi/bitstream/handle/10024/147214/Truong_Ngan.pdf?sequence=1&isAllowed=y.
- United Nations Environment Programme. 'UN Declares War on Ocean Plastic'. 23 February 2017. <https://www.unenvironment.org/news-and-stories/press-release/un-declares-war-ocean-plastic>.
- United Nations Environment Programme and Coordinating Body on the Seas of East Asia (COBSEA). 'Regional Review of Marine Litter in the East Asian Seas Region, Zerodraft'. 23 April 2018.
- United Nations Development Programme (UNDP). 'Malaysia Developing a Solid Waste Management Model for Penang'. Kuala Lumpur: UNDP, 2008.
- Vasilevskaia, D. 'Marine Plastic Pollution: Can Law Help?' Legal Dialogue. 22 October 2018. <https://legal-dialogue.org/marine-plastic-pollution-can-law-help>.
- Vega, C., S. Ojeda-Benitez and A. Quintanilla-Montoya. 'Waste Management System in Mexico: History, State of the Art and Trends'. *Journal of Solid Waste Technology and Management* (January 2006).
- Veiga, J.M., D. Fleet, S. Kinsey, P. Nilsson, T. Vlachogianni, S. Werner, F. Galgani, R.C. Thompson, J. Dagevos, J. Gago et al. 'Identifying Sources of Marine Litter. MSFD GES TG Marine Litter Thematic Report'. JRC Technical Report, EUR 28309, Luxembourg: Publications Office of the European Union, 2016. doi:10.2788/018068.
- Vietnam Environment Administration. 'Revision of the National Strategy on Integrated Management of Solid Waste'. Ve. 17 May 2018. <http://vea.gov.vn/en/laws/LegalDocument/Pages/Revision-of-the-National-strategy-on-integrated-management-of-solid-waste.aspx>.
- Vietnam Environment Protection Fund. Home Page. Accessed 13 November 2019. <https://www.vepf.vn/>.
- . 'Vietnam To Develop Natural Resources, Environment Monitoring Database'. 31 October 2017. <https://www.vepf.vn/news/environmental-news/vietnam-to-develop-natural-resources-environment-monitoring-database-766.html>.
- Vila, A. 'Philippines Plastic Pollution: Why So Much Waste Ends Up in Oceans'. *South China Morning Post*, 18 October 2018. <https://www.scmp.com/lifestyle/health/article/2168819/philippines-plastic-pollution-why-so-much-waste-ends-oceans>.
- World Bank. 'Indonesia Marine Debris Hotspot Rapid Assessment (Synthesis Report)'. Jakarta: World Bank, 2018. <http://documents.worldbank.org/curated/en/983771527663689822/pdf/126686-29-5-2018-14-18-6-SynthesisReportFullReportAPRILFINAL.pdf>.
- Yatim, P., S.L. Ngan and H.L. Lam. 'Financing Green Growth in Malaysia: Enabling Conditions and Challenges'. *Chemical Engineering Transactions* 61 (2017):1579–84. <https://www.aidic.it/CET/17/61/261.pdf>.