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Marine Debris in Circular Blue Economy

1b. Introduction to Marine Debris and Circular Economy

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Content

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Summary

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Key Definitions

1. **Marine debris** includes any persistent, man-made waste discarded into the marine environment, with plastics (mega, macro and microplastics) as the most dominant form.
2. It causes severe **ecological, economic, and health impacts**, including entanglement of marine life, loss to tourism and fisheries, and toxic bioaccumulation in the food chain.
3. Circular economy is a **sustainable model** that contrasts with the linear "take-make-dispose" approach.
4. **Circular economy** helps address plastic pollution by promoting redesign, reduced use, innovation, and extended producer responsibility.

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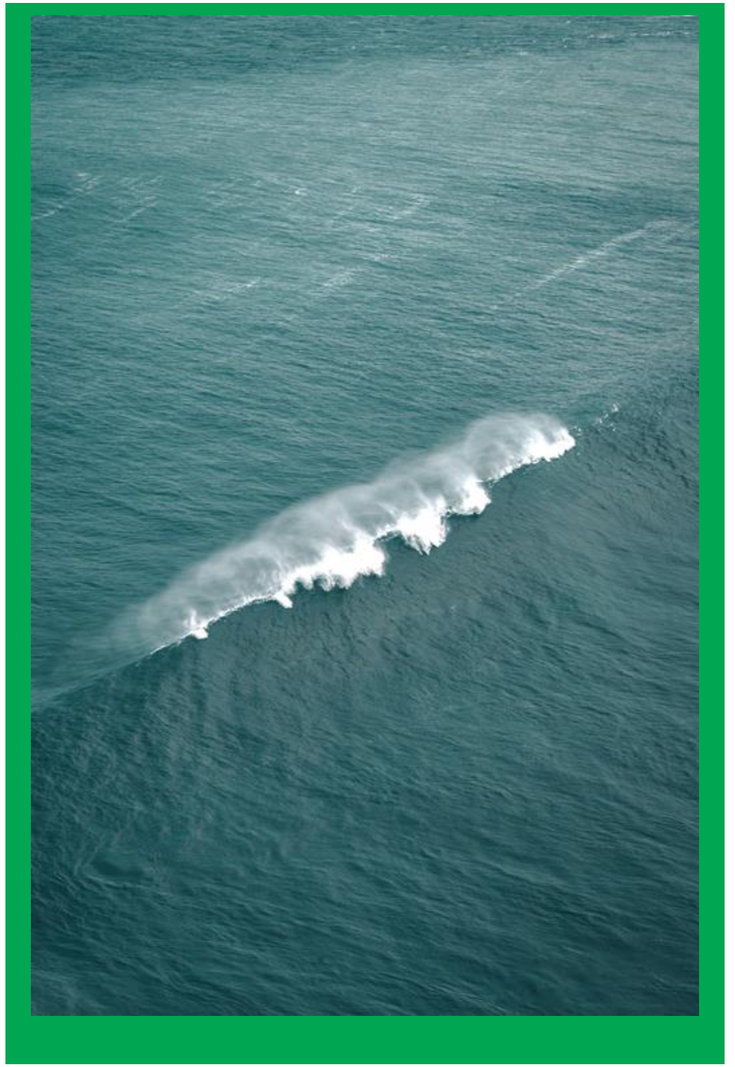
Introduction

Objective:

- To understand the sources and impacts of marine debris by blue economy industries.

Learning Outcomes:

- Overview of marine litter, its sources, distribution, and impacts on marine ecosystems.
- **<u>Introduction to the concept of the circular economy and its relevance to addressing plastic pollution in the ocean.</u>**



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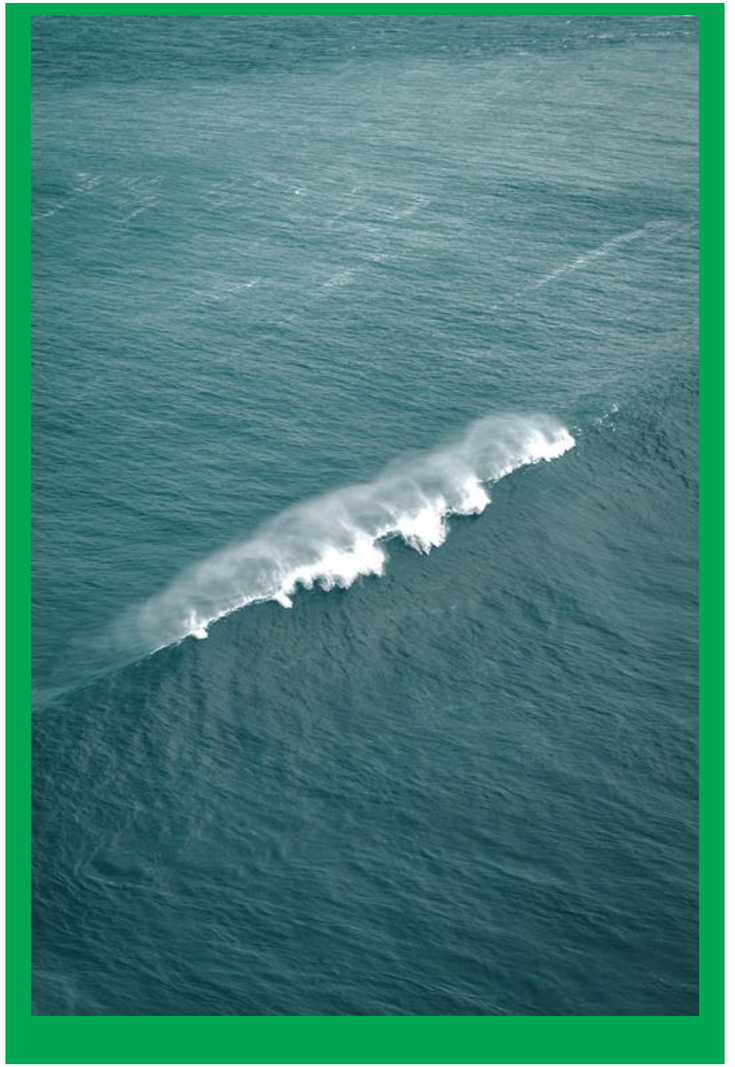
Learning Outcomes

At the end of the Topic, student should be able to:

1. define marine debris and its types
2. understand the concept of circular economy
3. explore the connection between plastic pollution and circular economic
4. examine global and regional efforts in integrating circular economy in marine pollution management and mitigation



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Introduction

What is Marine Debris?

Definition: Any persistent, manufactured or processed solid material discarded, disposed of, or abandoned (directly, indirectly, intentionally or unintentionally) in the marine and coastal environment. (NOAA, n.d)

Examples: **Plastics (plastic bags, cigarette butts, food wrappers, SUPP etc)**, metals, glass, rubber, cloth, **derelict/discarded/ghost fishing gears.**

Sources: **Land-based** (urban runoff, littering) and **ocean-based** (fishing, aquaculture, vessels, shipping, oil platforms)

Source: Own record (Sabiqah T. Anuar)

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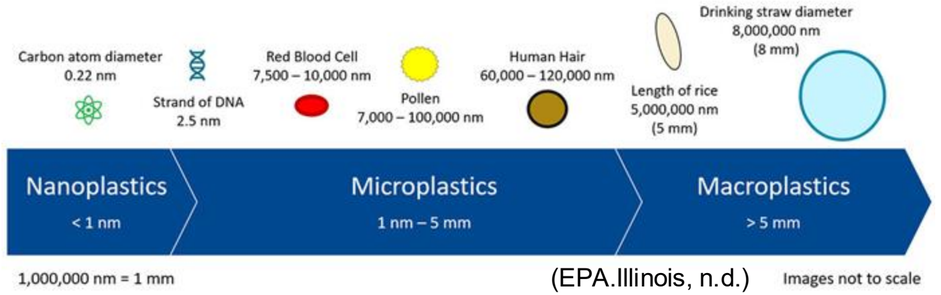
Source: Own record (Sabiqah T. Anuar)



(EPA.Illinois, n.d.)

Source: Own record (Sabiqah T. Anuar)

Source: Own record (Sabiqah T. Anuar)

Do we know:

- Millions metric tons of plastic waste entered aquatic ecosystems from land around the world and enter the ocean annually (Borrelle et al. UNEP, 2021)

- Marine debris ranges from large items (such as abandoned vessels, construction waste, and household appliances) that damage sensitive habitats,
- to microscopic microplastics that invisible to the naked eye.

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Types and Impacts of Marine Debris

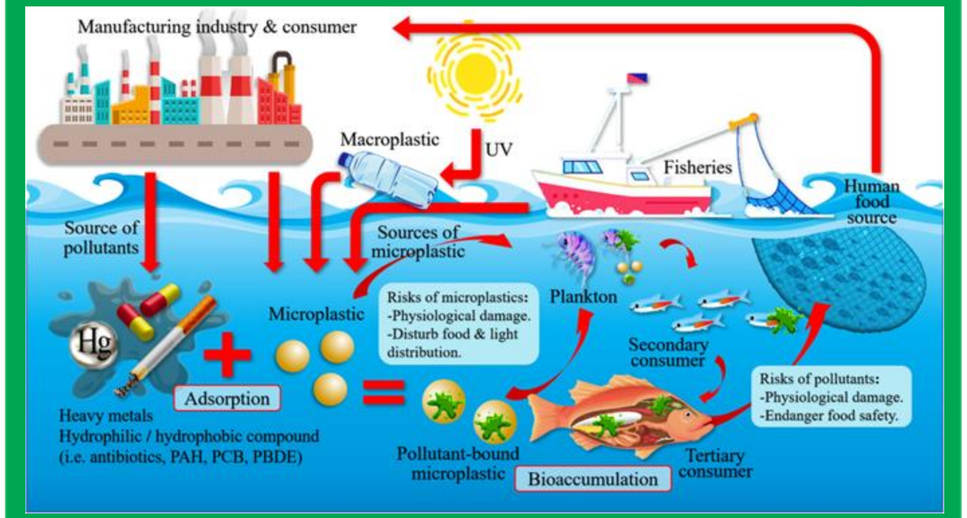
Types and Impacts of Marine Debris

Types: Macroplastics (>5 mm) vs. Microplastics (<5 mm)

Impacts: **Ecological**- Entanglement, ingestion, habitat disruption

Economic- Tourism losses, fisheries damage, navigation hazards, food and water security

Human health- Toxins, bioaccumulation, biomagnification, bioavaibility, seafood safety, water safety



Tan et al (2021)

Plastics degrade slowly, fragmenting into smaller plastic particles. They are easily transported and carried by wind, rivers, and currents into the sea.

Marine debris threatens ecosystems and human health!!

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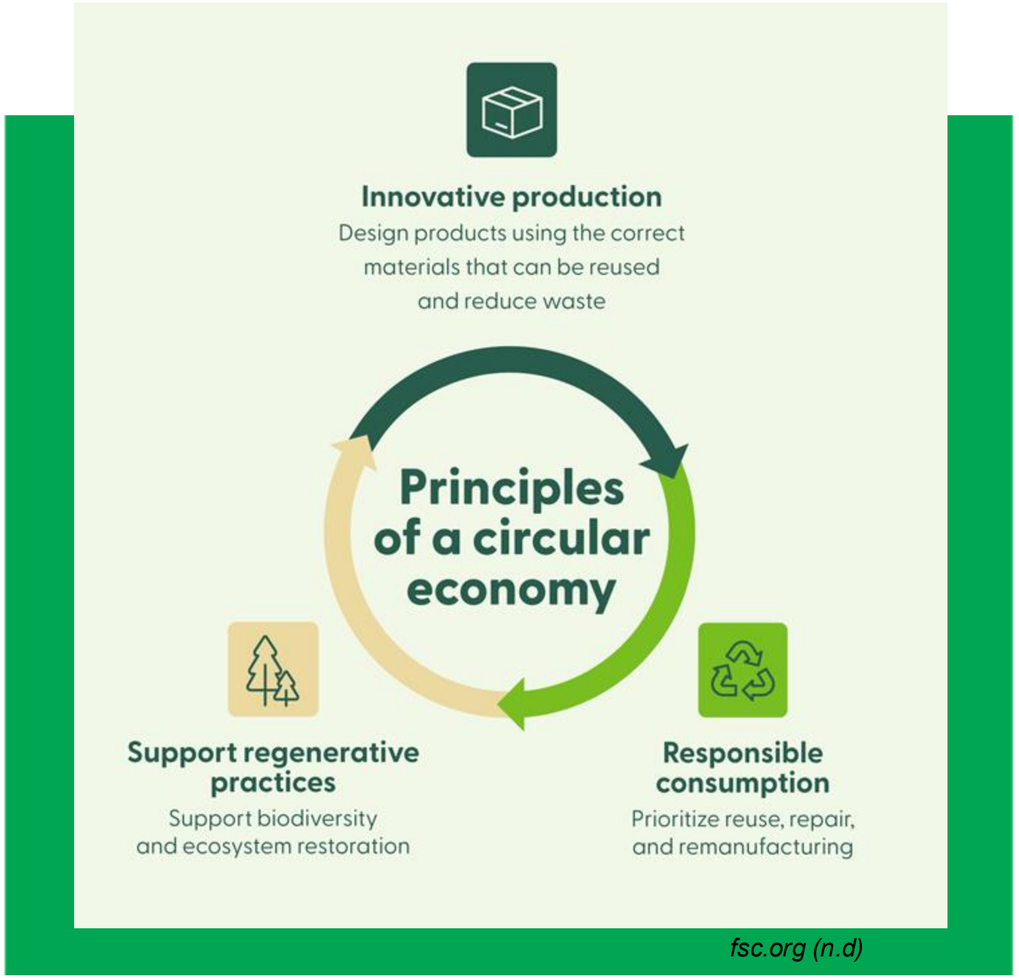
Circular Economy & Plastic Pollution

What is the Circular Economy?

Definition: An economic model aimed at eliminating waste and the continual use of resources (Sariatli, 2017)

Examples: *Developed with* **core principles:**

- **Design out waste and pollution (Minimize waste to the landfills)**
  - **Keep products and materials in use (3Rs, 5Rs, 7Rs)**
  - **Regenerate natural systems**
  - **Contrast with Linear Economy (Take-Make-Dispose)**



fsc.org (n.d)

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How does Circular Economy relate to Plastic Pollution ?

Circular economy promotes:

- *Reduction in plastic production and use*
- *Reuse and repair of plastic products*
- *Recycling and responsible end-of-life management*
- *Supports sustainable development and blue economy goals*.

Circular economy offers viable long-term solutions!

Example:

- Product redesign(Biodegradable packaging, Invention of modular materials)
- Extended Producer Responsibility (EPR)
- Reverse logistics and plastic take-back schemes
- Innovation in materials: Bioplastics, Bio-based materials, reusable alternatives
- Many more!

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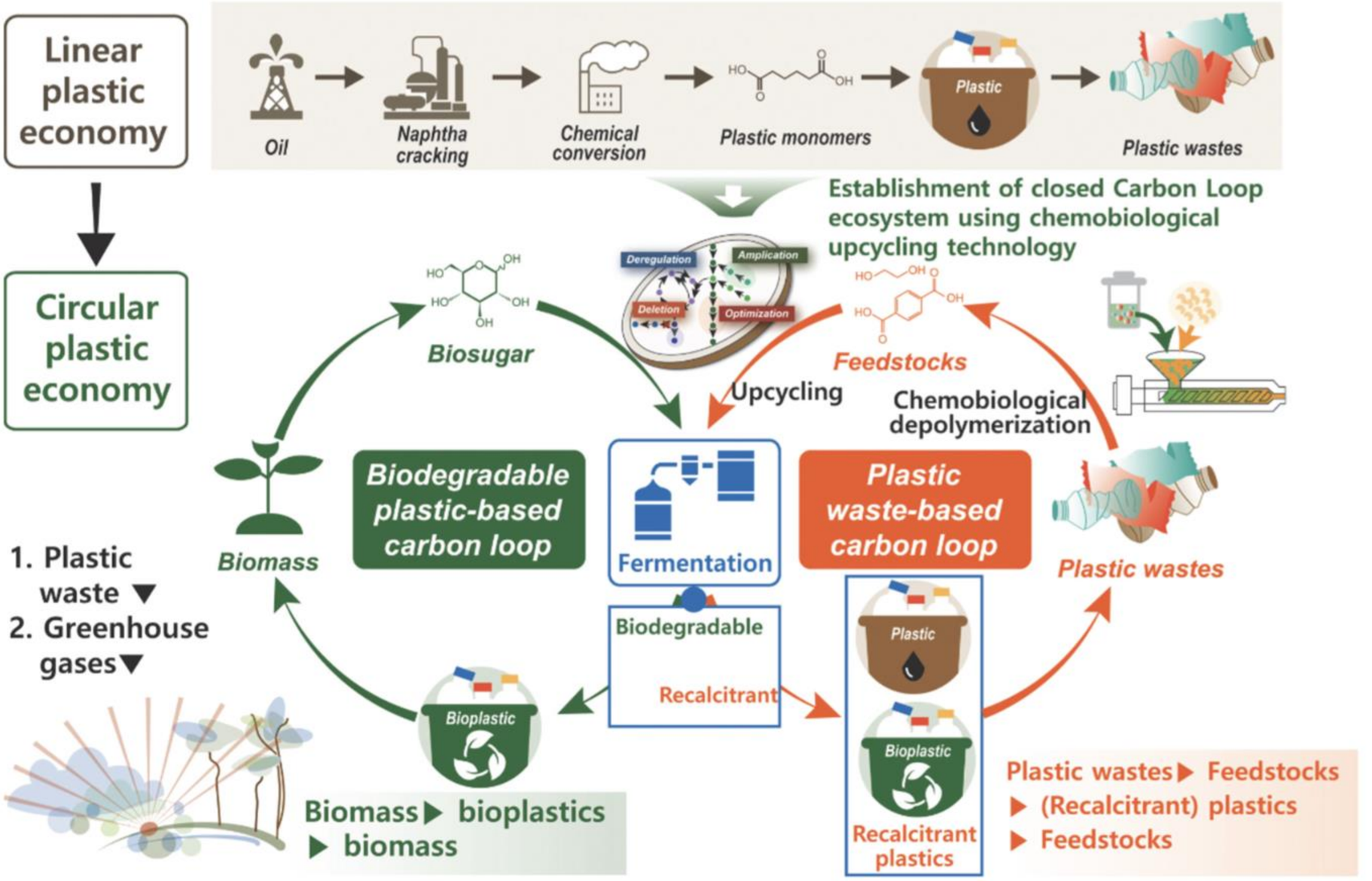
The lifecycle of plastics includes two main models: (i) the linear economy, where plastics made from fossil fuels become waste in the environment, and (ii) the circular economy, where plastic waste is processed into valuable chemicals, helping to protect the environment.

Plastic upcycling technologies are instrumental in solving current plastic waste problems, in addition to biodegradable plastic production technology, because all conventional plastics cannot be replaced by biodegradable plastics.



Mudondo et al., (2023) Recent Advances in the Chemobiological Upcycling of Polyethylene Terephthalate (PET) into Value-Added Chemicals. Available from: https://www.researchgate.net/publication/365904468_Recent_Advances_in_the_Chemobiological_Upcycling_of_Polyethylene_Terephthalate_PET_into_Value-Added_Chemicals [accessed Jul 10 2025].

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Regional and Global Policies

Regional and Global Policies in Addressing Circular Plastic

-EU Circular Economy Action Plan

The European Commission launched the Circular Economy Action Plan (CEAP) in March 2020 as part of the European Green Deal. It supports the shift to a circular economy by reducing pressure on natural resources, and helping the EU meet its 2050 climate goals and protect biodiversity. The plan covers the full product life cycle, focusing on eco-friendly design, sustainable use, circular practices, and keeping resources in the economy as long as possible.

https://environment.ec.europa.eu/strategy/circular-economy-action-plan_en#objectives

European Commission: Directorate-General for Environment, *EU action against microplastics*, Publications Office of the European Union, 2023, https://data.europa.eu/doi/10.2779/917472

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Regional and Global Policies

- *ASEAN Framework on Marine Debris*

  - The ASEAN Framework of Action on Marine Debris was developed following the 2017 ASEAN Conference and the East Asia Summit. It was officially welcomed by ASEAN Ministers at a special meeting in Bangkok on 5 March 2019. The Framework focuses on four key areas:

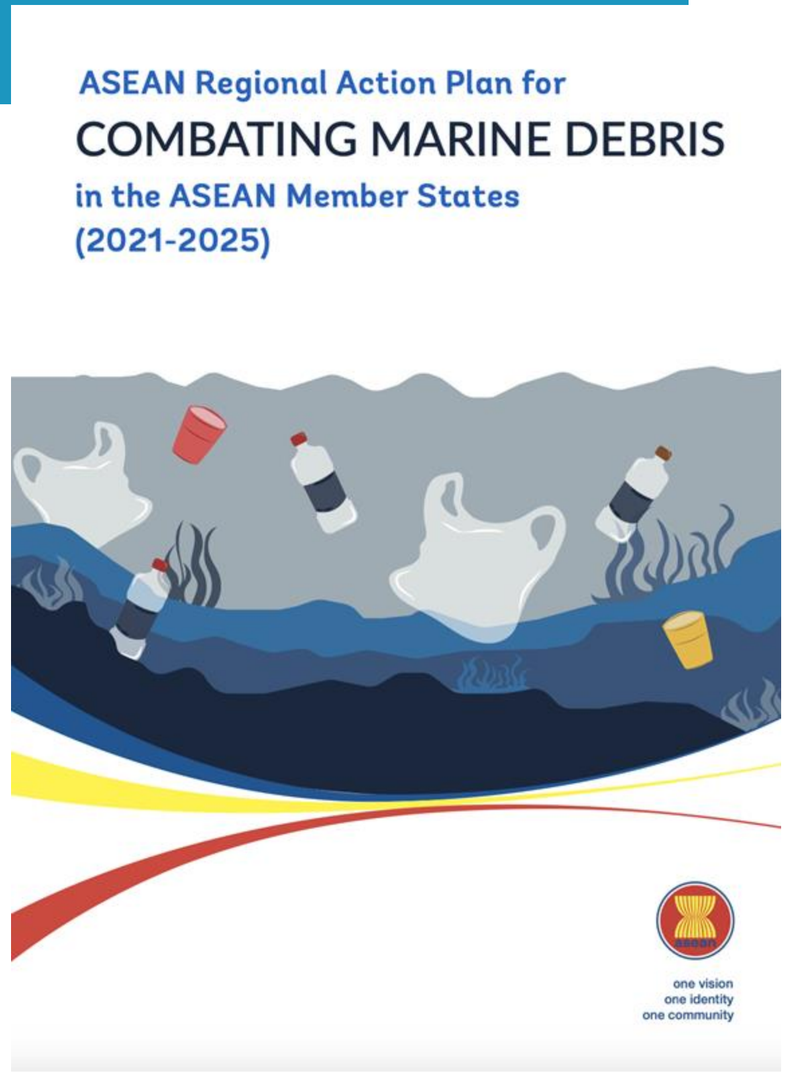
  (i) Policy Support and Planning,

  (ii) Research, Innovation, and Capacity Building,

  (iii) Public Awareness and Education

  (iv) Private Sector Engagement

https://asean.org/wp-content/uploads/2021/01/3.-ASEAN-Framework-of-Action-on-Marine-Debris-FINAL.pdf



https://asean.org/book/asean-regional-action-plan-for-combating-marine-debris-in-the-asean-member-states-2021-2025-2/

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Regional and Global Policies

-Malaysia's Roadmap Towards Zero Single-Use Plastics (2018–2030)

- Malaysian Plastic Sustainability Roadmap (2021-2030)

These two roadmaps are practical national tools that apply circular economy strategies (e.g. redesign, reduce, reuse, recycle, and reprocess) to:

- Transform Malaysia's plastic economy
- Cut down single-use and non-recyclable plastics
- Encourage innovation and shared responsibility
- Prevent ocean plastic pollution by managing plastic across its full life cycle

Both roadmaps aim to reduce mismanaged plastic waste, a major source of ocean plastic, through upstream measures (e.g. design and production), midstream (consumption), and downstream (waste management).

Regional marine debris cooperation and monitoring are embedded in both plans (e.g. via implementation reports and external funding projects)

https://www.nres.gov.my/ms-my/pustakamedia/Penerbitan/MALAYSIA%20PLASTICS%20SUSTAINABILITY%20ROADMAP%202021-2030.pdf

https://ce.acsdsd.org/knowledge/malaysias-roadmap-towards-zero-single-use-plastics-2018-2030/

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CASE STUDY: *Circular Economy and Plastics: A Gap Analysis in ASEAN Member States*

3. Mapping current plastics policies and strategies of ASEAN Member States

Table 4 : Mapping current plastics policies and strategies of ASEAN Member States
See Annex I (Country Briefs) for details

Exists	Does not currently exist	Partially exists or is under development

Country	Plastic-specific Strategy	Ban of single-use plastics	Levy/charge on single-use plastics	Deposit-refund scheme	EPR-based recycling policies	Sorted collection	Voluntary scheme/ pilot projects	Import regulation
Brunei							No Plastic Bag Everyday Initiative	3 percent excise duty imposed on plastic imports
Cambodia			Sub-Decree on Management of Plastic Bags (2017)			Sub-decree on plastic waste management		
Thailand	Thailand Roadmap on Plastic Waste Management (2018-2030)	Phasing out of single-use plastics by 2022 - Products containing Oxo - Plastic cap seals - Plastic bags thinner than 36 micron - Foam containers for foods - Straws and glasses	Tax reduction for retailers using biodegradable plastics - Planning levy or tax on single use plastic products and packages	Studying possibility of deposit-refund system for packaging	Development of WEEE and 3R promotion laws with concepts of EPR and circular economy	The Ministry of Interior and the Ministry of Public Health notifications on municipal solid waste separation and collection	- Pilot project on plastic waste collection in Coastal area - Reduction of plastic bag in department stores and convenience stores	Import ban on plastic wastes
Viet Nam	Planning (National Strategy on ISWM to 2025, vision to 2050)		Levy on non-biodegradable plastics		Not yet applied		Program on control of waste from plastic bags	Trade import regulation for quality; Considering tax for import of single-use plastics
Indonesia	National policy and strategy on solid waste management (including plastic waste) regulated by Presidential Regulation No. 97/2017. National Action Plan on Marine Debris (2017-2025)	Bali Province and 18 cities and regencies have enacted regulations banning single-use plastic including shopping bags, straws, and foam containers for food.	Finalising government regulation concerning excise on plastic shopping bag. Based on modern retailer association initiative, some stores charge IDR200 per plastic shopping bag.	Planning to use DRF scheme for PET bottle and aluminium can.	Finalising ministerial regulation on EPR road map to prevent and reduce product and packaging waste from brand owner manufacturer, retailer, and food/beverages service industry.	Partially implemented in some cities and regencies.	Three pilot projects of take-back and recycle scheme for PET bottle, TetraPak carton, and flexible plastic (sachets and pouches).	Import of waste (any types of waste including plastic waste) is prohibited by Law. However, import of plastic scrap that is ready for recycling is still accepted.
Lao PDR						Mandatory by law but not enforced	Community solid waste management project	
Malaysia	Roadmap towards Zero Single-Use Plastics (2018-2030)	Drinking straw ban	Pollution charge; Ban on non-biodegradable plastics; Levy on plastic bags		Planned –but not yet applied	Pilot level in selected city areas		Taxation of waste plastics
Myanmar	National MSW strategy includes plastics section					Pilot level in selected city areas		Notification No 22/2019 of Ministry of Commerce: all import of wastes to Myanmar is restricted
Philippines	Under development	Partial bans on the use of plastic bags			Proposal under discussion in the Senate	Yes	Local bans on the use of plastic bags	
Singapore					Reporting requirements for packaging data and 3R plans for packaging in 2020	National Recycling Programme	Singapore Packaging Agreement; Schools Recycling Corner Programme; Voluntary commitment to ban plastic straws etc. in food industry	

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CIRCULAR ECONOMY AND PLASTICS:
A GAP-ANALYSIS IN ASEAN MEMBER STATES

Enhanced Regional EU-ASEAN Dialogue Instrument
E-READI

https://asean.org/wp-content/uploads/2021/08/Circular-economy-and-Plastics_A-gap-Analysis-in-ASEAN-Member-States.pdf

UN environment programme

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The New Plastics Economy Global Commitment

Who are the current Global Commitment government signatories? (As of November 2023)

The New Plastics Economy Global Commitment, led by the Ellen MacArthur Foundation and the UN Environment Programme was launched in October 2021 to promote a circular economy in which plastic is kept in use and never ends up as waste or pollution.

Three principles: **eliminate, innovate, circulate**

https://www.unep.org/new-plastics-economy-global-commitment

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Conclusion

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- Marine plastic pollution is a growing environmental and socio-economic challenge, especially in developing countries (i.e: waste management infrastructure is limited.)
- The circular economy offers a transformative solution by shifting from a linear "take-make-dispose" model to one that designs out plastic waste and keeps plastics in circulation (thus avoiding going into the aquatic/sea).
- Circular approaches reduce ocean plastic leakage while promoting innovation, and sustainable economic growth.
- Success implementation of circular economy and related policy depends on strong policy support, public-private collaboration, investment in innovation and infrastructure, and consumer awareness and engagement.
- Transitioning to plastic circular is critical for long-term environmental sustainability and ocean health.

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Evaluation

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1. Which of the following best describes the **main difference** between a linear and a circular plastic packaging system?
A) Linear systems prioritize biodegradability, while circular systems focus on incineration.
B) Linear systems follow a take-make-use-dispose model, while circular systems aim to keep materials in use through recycling and reuse.
C) Circular systems use more plastic, while linear systems minimize plastic usage.
D) Circular systems are only applicable to biodegradable materials.

2. In a circular packaging system for a shampoo bottle, what is the **most likely outcome** of the bottle after use?
A) It is sent to a landfill.
B) It is incinerated for energy.
C) It is collected, recycled, and used to produce a new bottle.
D) It is exported as waste.

3. Which of the following is **not** a benefit of a circular plastic packaging system compared to a linear system?
A) Reduces plastic leakage into the marine environment
B) Minimizes resource extraction
C) Increases landfill dependency
D) Encourages design for recyclability

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Evaluation

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4. For a food container made of plastic, what environmental impact is most associated with a linear system?
A) Reduced carbon footprint
B) High levels of reuse
C) Greater reliance on virgin plastics and waste accumulation
D) Closed-loop recycling efficiency

5. Which of the following is a major challenge in applying circular economy principles in developing countries?
A) Lack of interest in environmental issues
B) Excessive government control
C) Overuse of biodegradable materials
D) Limited waste management infrastructure and recycling systems

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Further Reading

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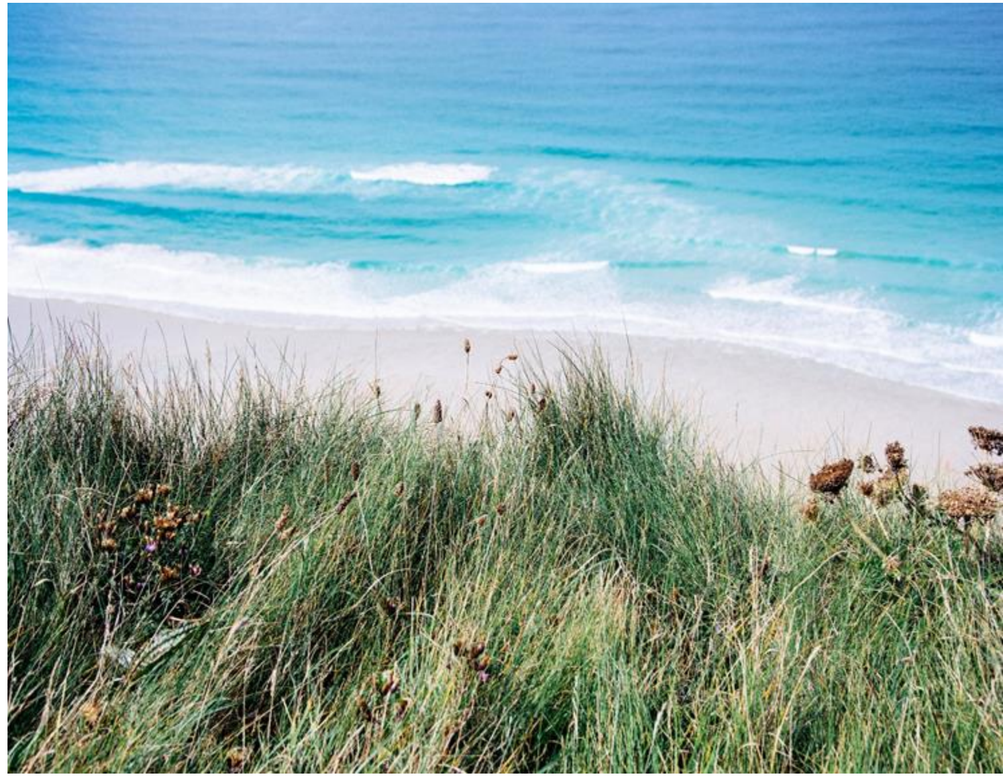

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