SustainaBlue
HEIs stands for Higher Education Institutions

Marine Debris in Circular Blue Economy

1a. Introduction to Marine Debris and Circular Economy

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Project: 101129136 — SustainaBlue — ERASMUS-EDU-2023-CBHE

Universiti Malaysia Terengganu
UMT

SustainaBlue
HEIs stands for Higher Education Institutions

PROJECT PARTNERS

Malaysia

Universiti Malaysia Terengganu UMT

Universiti Sains Malaysia

APEX

Persatuan Kemajuan Akuakultur Malaysia
Malaysia Aquaculture Development Association

Indonesia

Universitas Indonesia
Veritas, Probitas, Iustitia

ITS Institut Teknologi Sepuluh Nopember

Greece

Πανεπιστήμιο Αιγαίου
University of the Aegean

symplexis

AEGEAN rebreath

Cyprus

University of Cyprus
Oceanography Centre

Center for Social Innovation
www.csicy.com

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Project: 101129136 — SustainaBlue — ERASMUS-EDU-2023-CBHE

SustainaBlue
HEIs stands for Higher Education Institutions

Content

01 Introduction

02 Overview of marine litter, its sources, distribution, and impacts on marine ecosystems.

03 Self-reflection

04 Evaluation

05 Bibliography - Additional Reading

Co-funded by
the European Union

SustainaBlue
HEIs stands for Higher Education Institutions

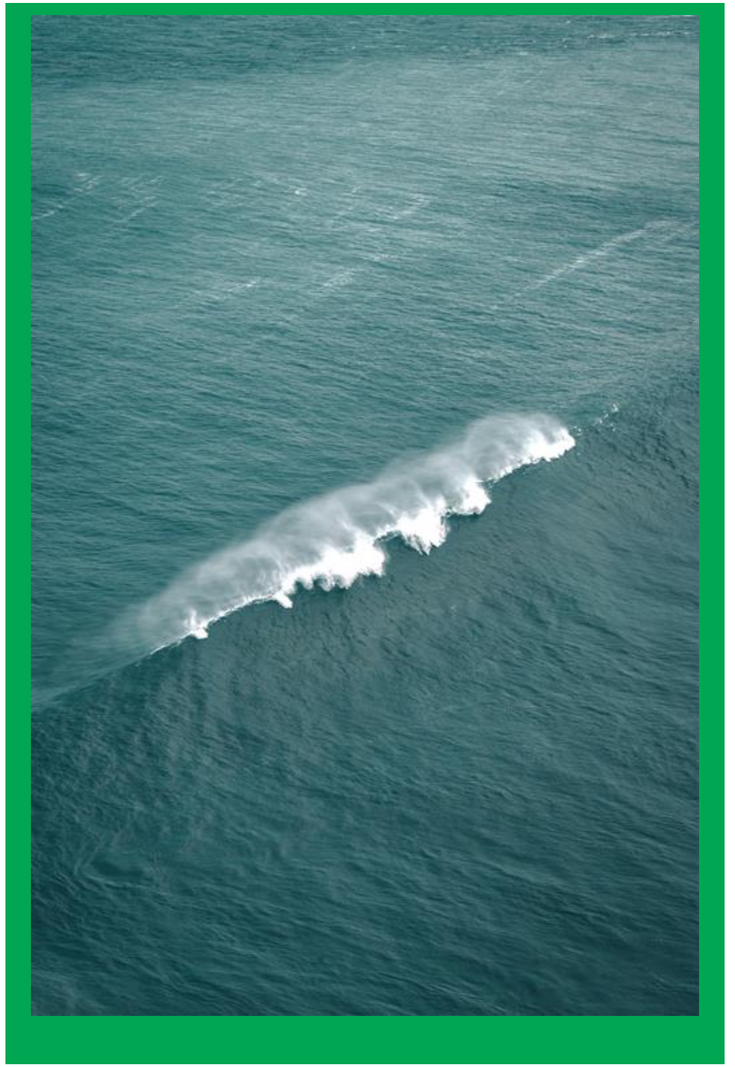
Introduction

Objective:

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

Learning Outcomes:

- **<u>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.



Co-funded by
the European Union

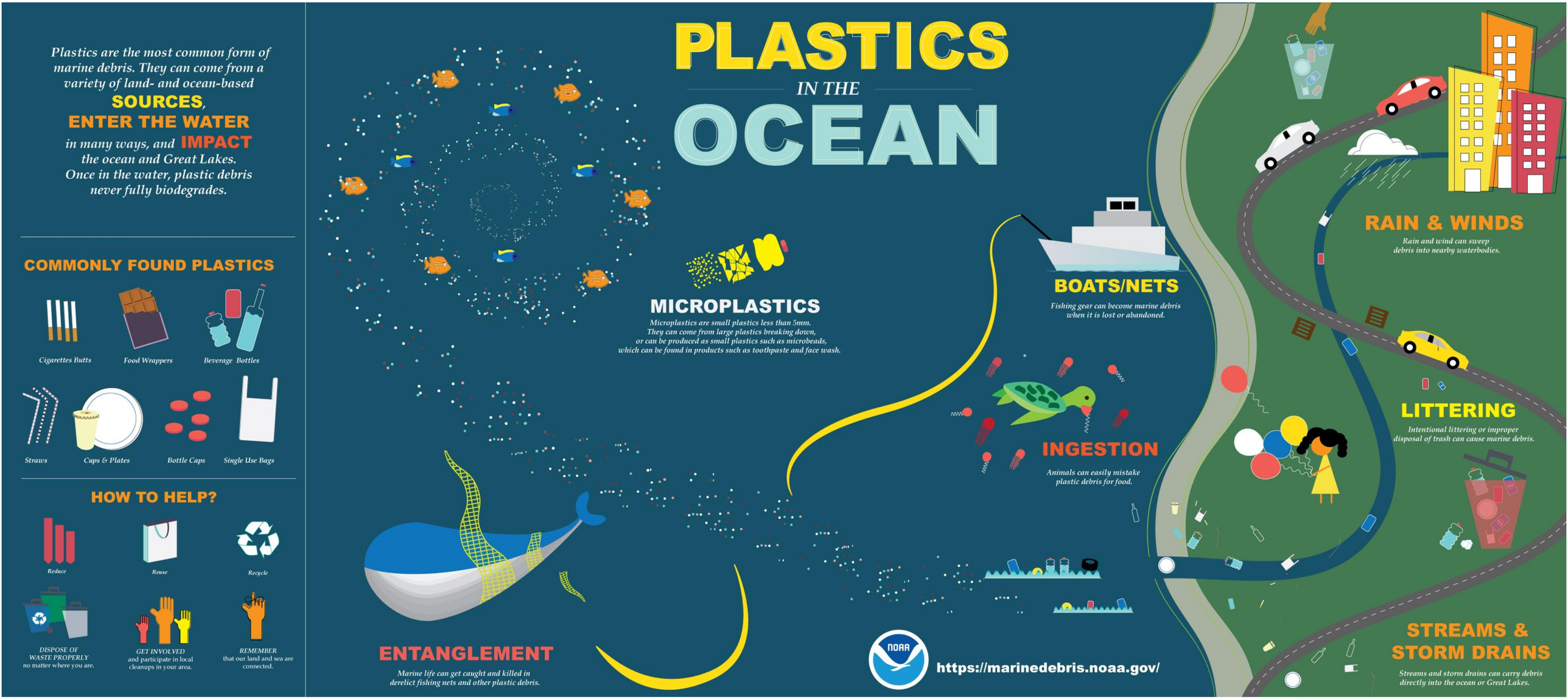
SustainaBlue
HEIs stands for Higher Education Institutions

Marine Litter

- = marine debris
- Any persistent, manufactured or processed solid materials that is discarded, disposed of, or abandoned in the marine or coastal environment.

Co-funded by the European Union

@timesofmalta.com



Co-funded by the European Union

Plastics are the most common form of marine debris. They can come from a variety of land and ocean-based sources, enter the water in many ways, and impact the ocean and Great Lakes. Once in the water, plastic debris never fully biodegrades (Credit: NOAA).

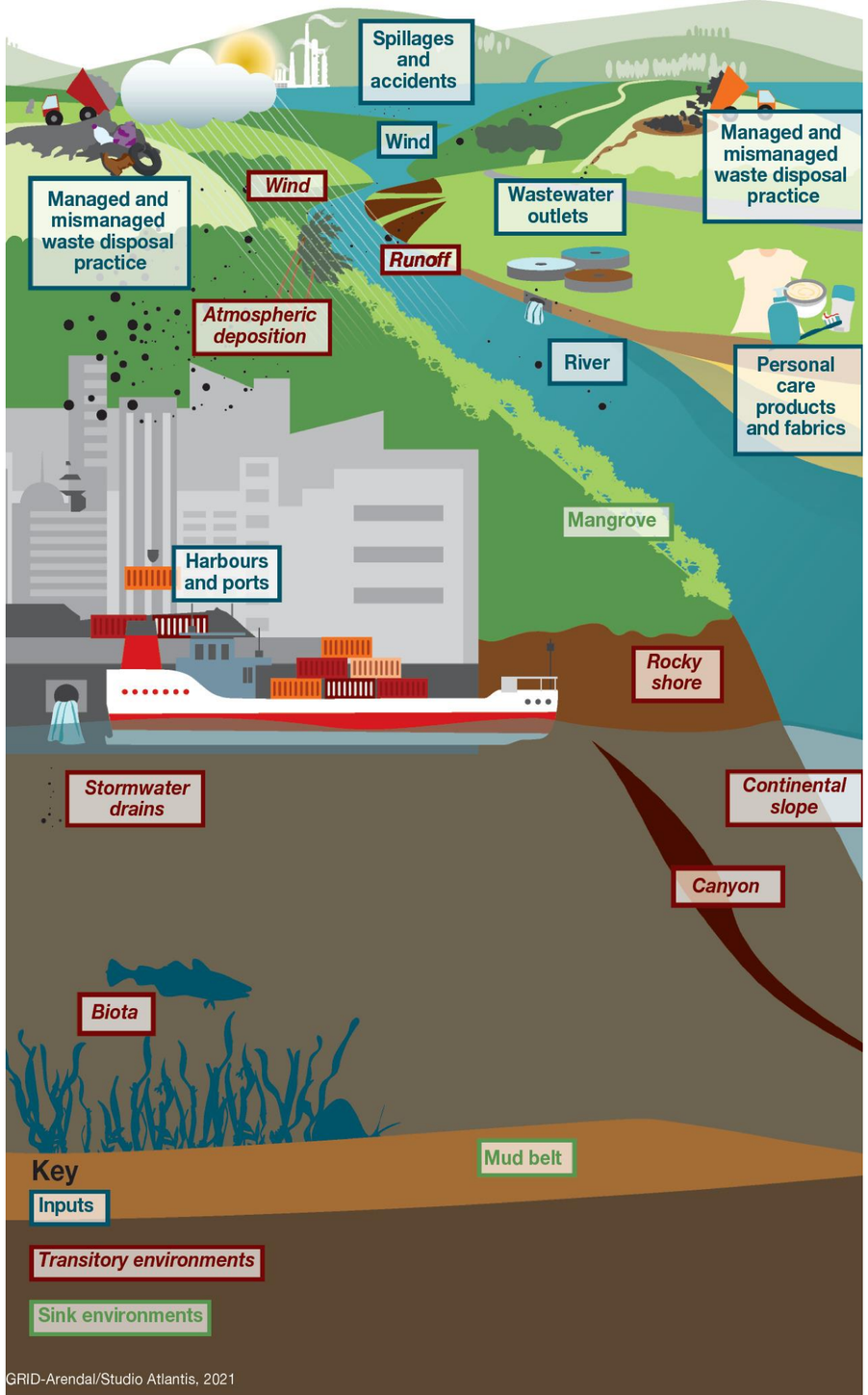
SustainaBlue
HEIs stands for Higher Education Institutions

Source of Marine Litter

A. Land-based sources:

- Littering
- Runoff from rivers
- Sewage and wastewater discharge
- Agriculture runoff
- Coastal tourism and recreation

= Inadequate waste management

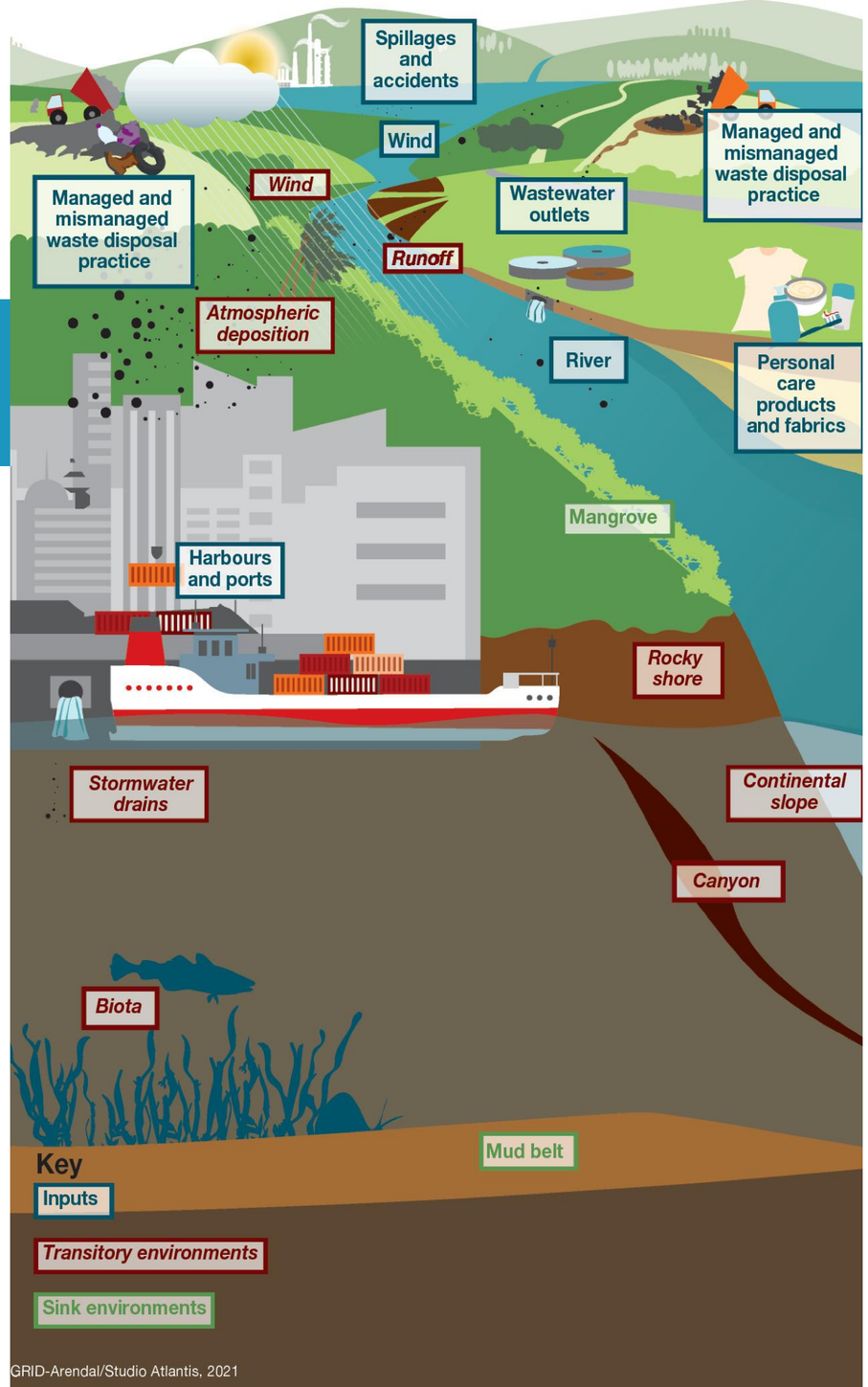


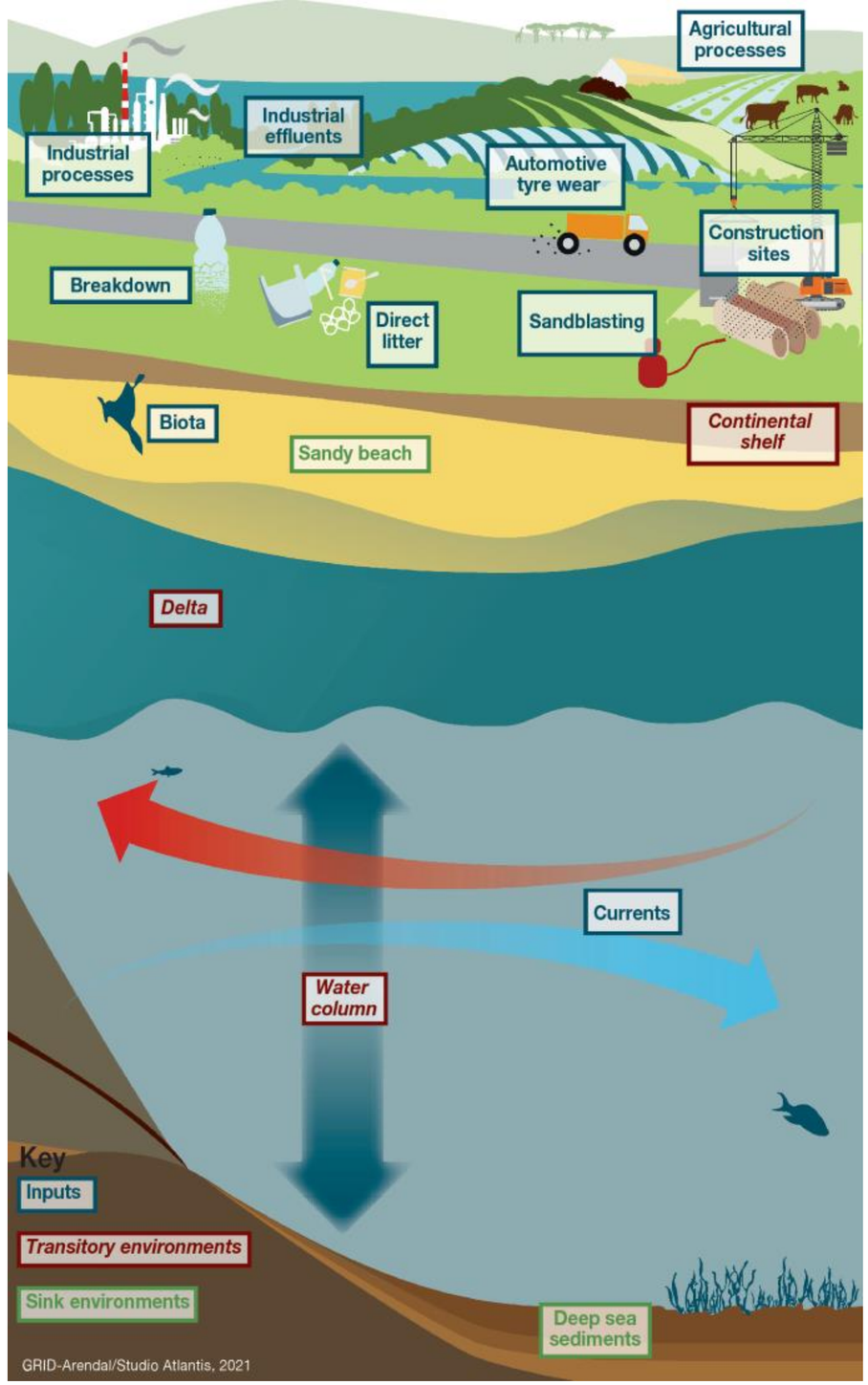
Co-funded by the European Union

SustainaBlue

HEIs stands for Higher Education Institutions

Marine litter has been a global concern for many decades. It is important to understand marine litter sources and distribution pathways for the development of targeted and effective interventions and strategies. This figure display the sources, pathways, and sinks of marine litter from macro-to micro-sized items from case study in African continent.





Co-funded by the European Union

Source or further reading:
Chitaka, et al (2023)

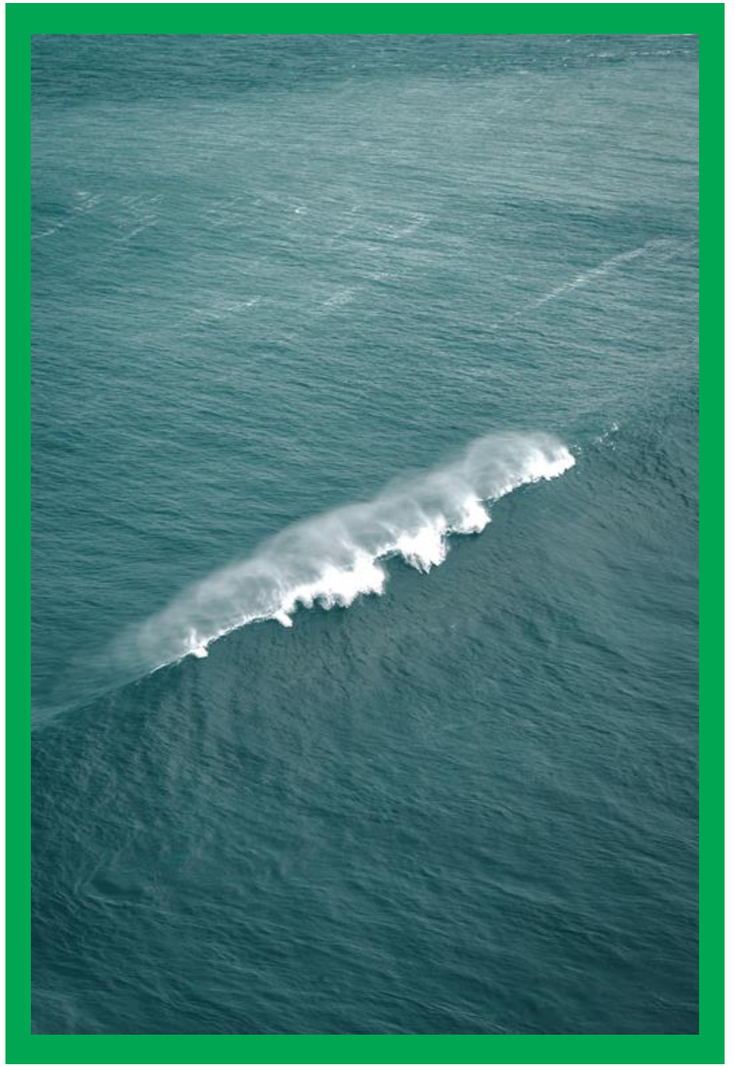
SustainaBlue
HEIs stands for Higher Education Institutions

Source of Marine Litter

B. Sea-based sources:

- Fishing industry
- Cargo residues
- Aquaculture activities
- Off-shore platforms residues
- OR any accidental discharge

= Inadequate waste management



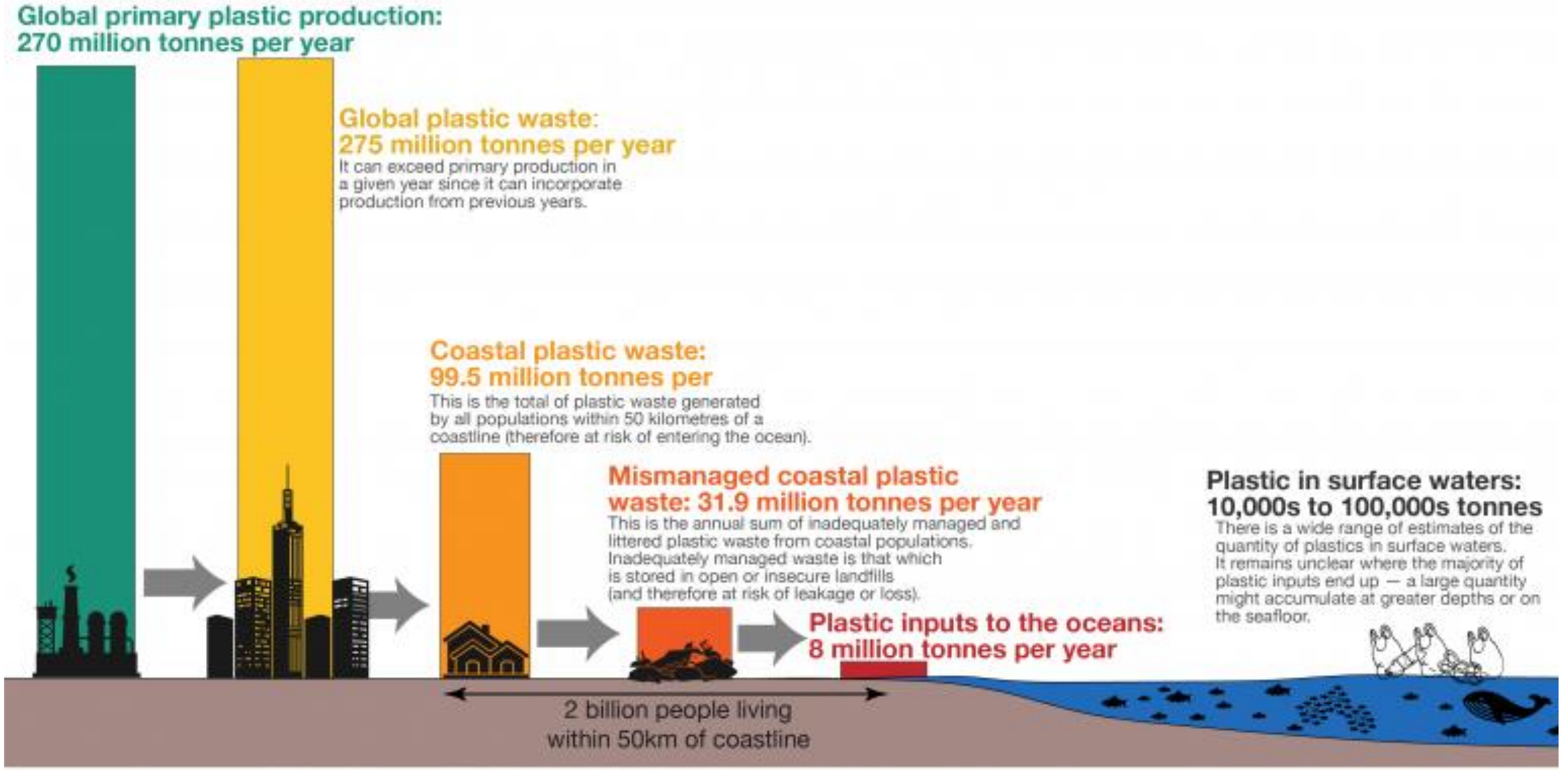
Co-funded by
the European Union

SustainaBlue
HEIs stands for Higher Education Institutions

The pathway by which plastic enters the world's oceans

Our World in Data

Estimates of global plastics entering the oceans from land-based sources in 2010 based on the pathway from primary production through to marine plastic inputs.



Source: based on Jambeck et al. (2015) and Eriksen et al. (2014). Icon graphics from Noun Project.
Data is based on global estimates from Jambeck et al. (2015) based on plastic waste generation rates, coastal population sizes, and waste management practices by country
This is a visualization from OurWorldinData.org, where you will find data and research on how the world is changing.

Co-funded by
the European Union

SustainaBlue
HEIs stands for Higher Education Institutions

Examples of plastic pollution in Southeast Asia:

a) after rainfall under the bridge of Sungai Ciluar, Bogor, Indonesia (photo credit: Muhammad Reza Cordova);

b) in a mangrove forest in Carmen, Cebu, Philippines (photo credit: University of San Carlos, SEAMaP team);

c) in Rambut Island Wildlife Reserve, Jakarta Bay, Indonesia (photo credit: Muhammad Reza Cordova);

d) on a beach in Tanah Merah, Singapore (photo credit: Tai Chong Toh);

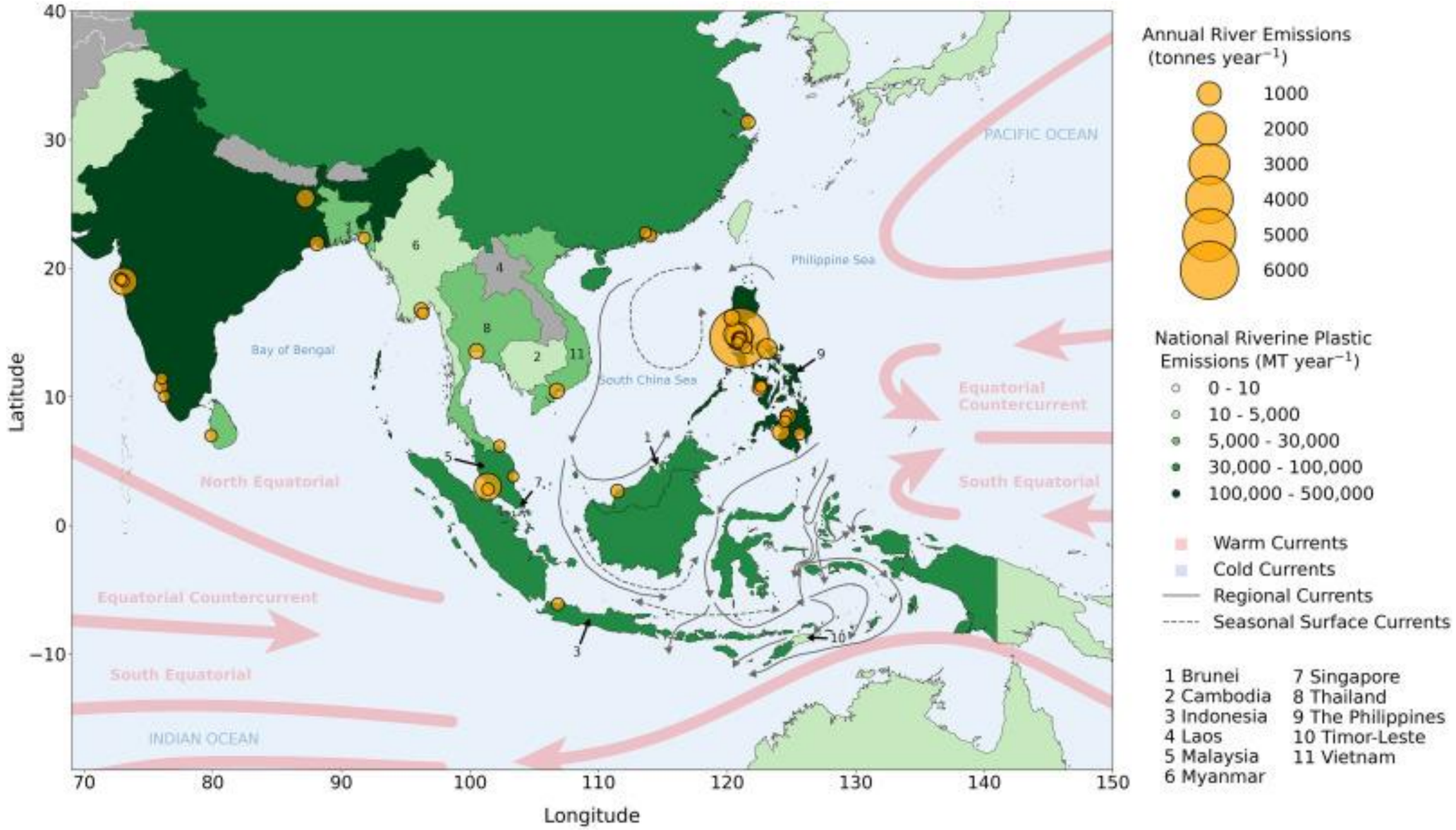
e) on a coral reef in Paiton, East Java, Indonesia during a coastal cleanup (photo credit: Ruly Istaful Khasana); and

f) plastic bottles on the seafloor at Lazarus Island, Singapore (photo credit: Our Singapore Reef).

Source or further reading:
Omeyer et al. (2022)

Co-funded by the European Union

SustainaBlue
HEIs stands for Higher Education Institutions



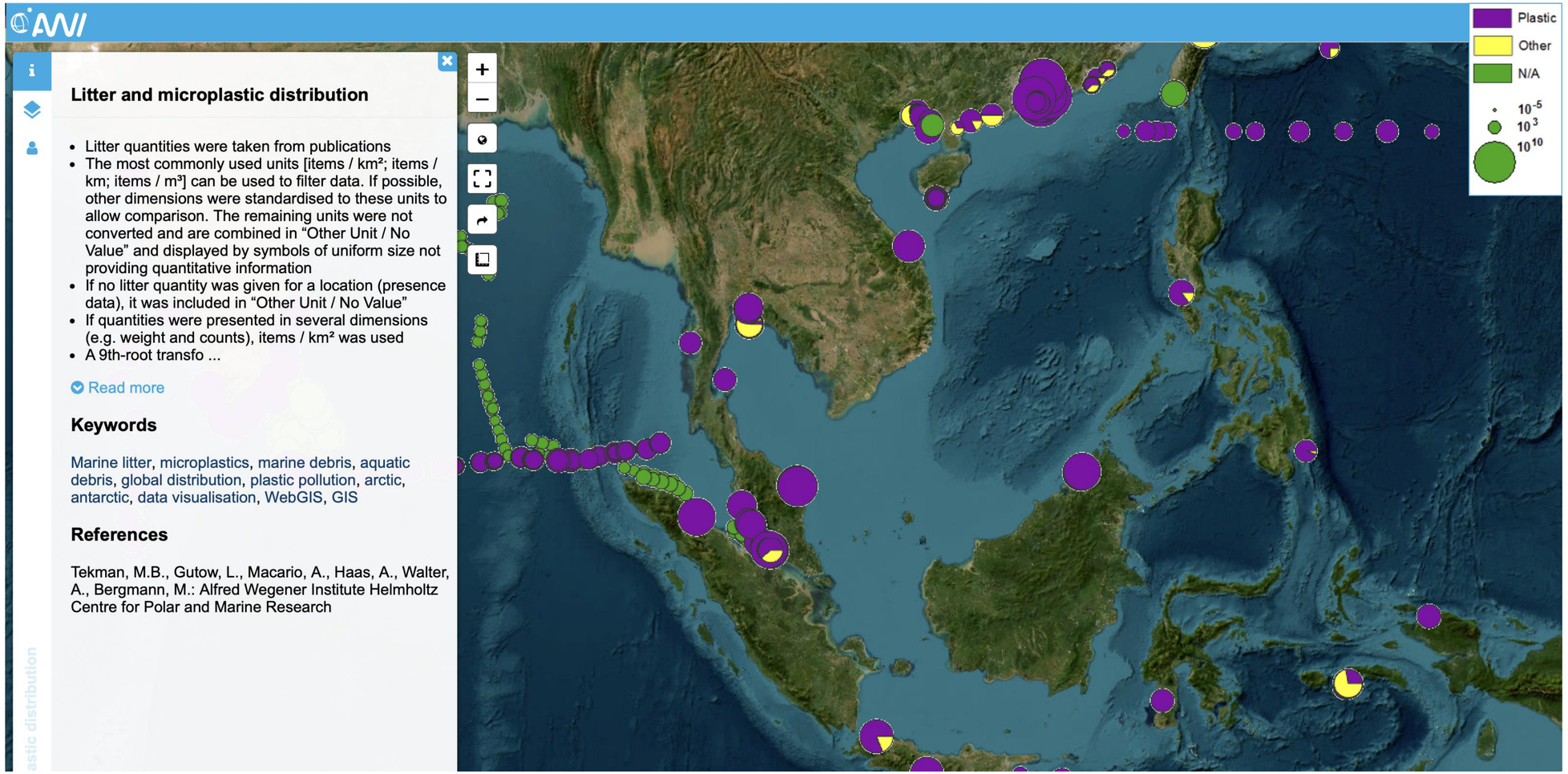
Co-funded by the European Union

Map of Southeast Asia showing the principal ocean currents of the region and plastic emissions per country and river. The chloropleth map represents total plastic emitted into the ocean (millions of tonnes per year), while the scatter plot (orange) shows the geospatial distribution of the relative individual river emissions (tonnes per year). Global surface warm ocean currents are represented by the thick red arrows. Regional surface currents of the Indonesia Through Flow affecting the dispersal of marine plastic litter are represented with thin grey arrows. Data on plastic emissions from Meijer et al. (2021). Omeyer et al. (2022)

SustainaBlue
HEIs stands for Higher Education Institutions

Distribution of Marine Litter

Distribution of litter types in different realms (1,426 publications)



https://ikhapp.org/stories-and-research-brief/litterbase-online-portal-for-marine-litter/

Co-funded by the European Union

SustainaBlue
HEIs stands for Higher Education Institutions

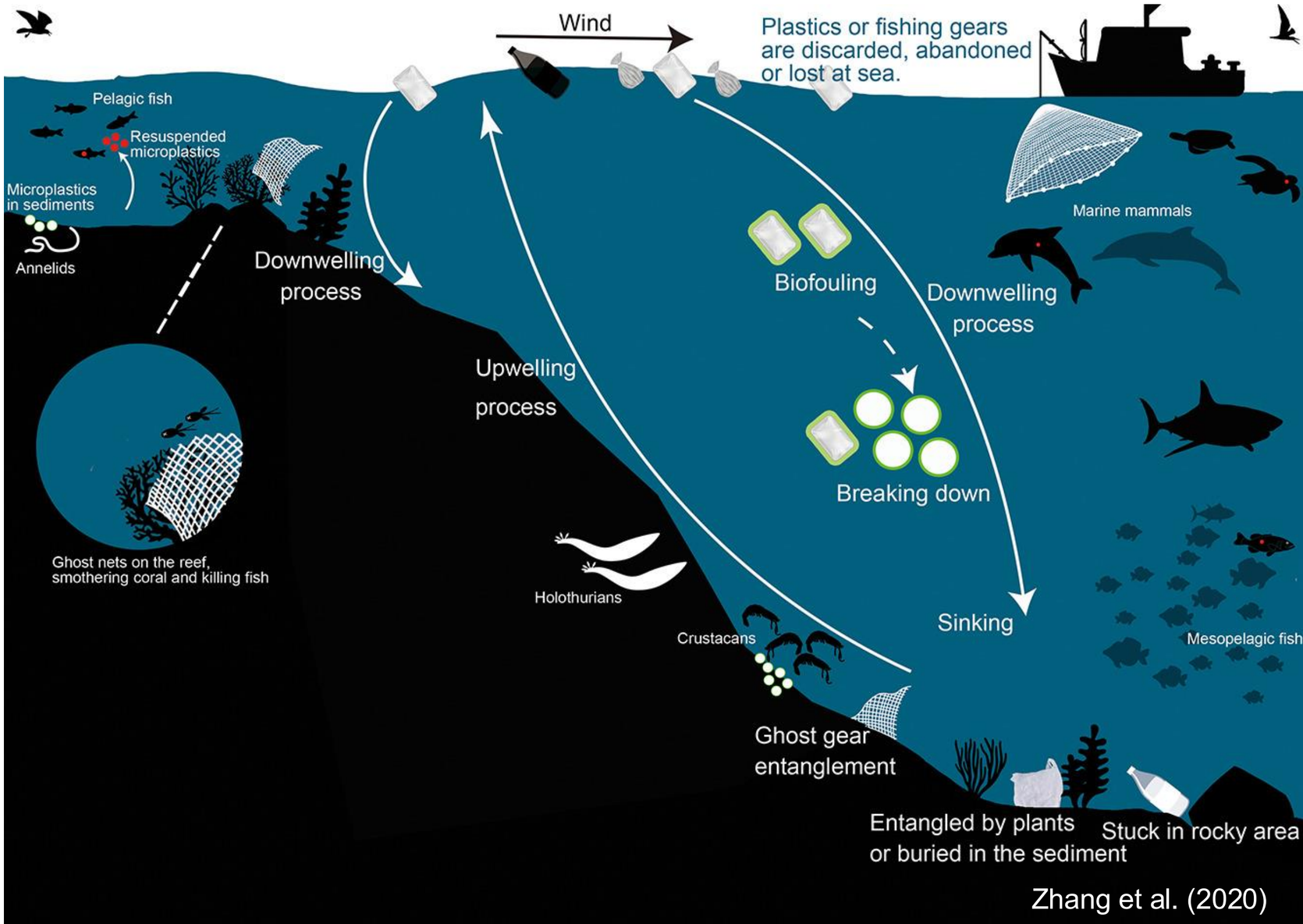
Video:

https://www.dw.com/en/online-maps-fight-environmental-destruction/video-51081278

Co-funded by
the European Union

SustainaBlue
HEIs stands for Higher Education Institutions

The plastic items found on the coastal sea bed were probably transported and moved during upwelling and downwelling processes and finally deposited on the seafloor due to the effect of biofouling. The accumulation of macro- and mesoplastics could have detrimental impacts on seafloor ecosystems.

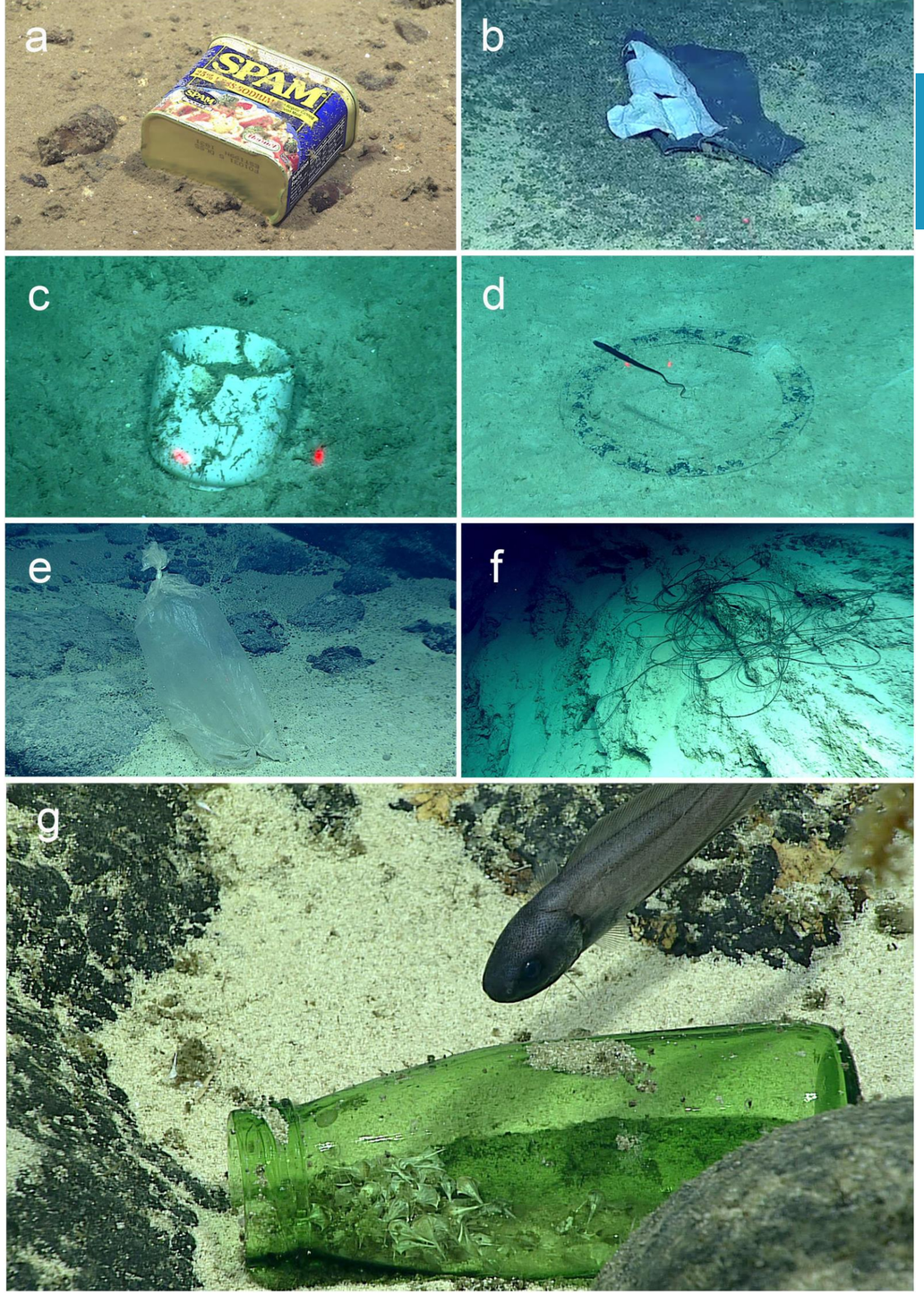


Zhang et al. (2020)

Co-funded by the European Union

SustainaBlue

HEIs stands for Higher Education Institutions



Types of deep-sea debris observed.

(a) Metal debris – a food tin at 4,947 m in Sirena Canyon off the Mariana Islands.

(b) Cloth debris – a piece of canvas at 3,780 m on Enigma Seamount off the Mariana Islands.

(c) Other debris – a ceramic cup at 838 m at CAIMAN/I-203 off the main Hawaiian Islands.

(d) Rubber debris – a gasket at 839 m at CAIMAN/I-203 off the main Hawaiian Islands.

(e) Plastic debris – a plastic bag at 3,767 m on Enigma Seamount off the Mariana Islands.

(f) Fishing debris – fishing line at 453 m on South Palmyra Slope in PRIMNM Kingman Reef and Palmyra Atoll.

(g) Glass debris – a glass bottle at 1,152 m at Titov 2 in PRIMNM Howland and Baker Unit.

The central red lasers points indicate 10 cm scale in b, c, d, and e.

Amon et al. (2020)

Co-funded by the European Union

SustainaBlue
HEIs stands for Higher Education Institutions

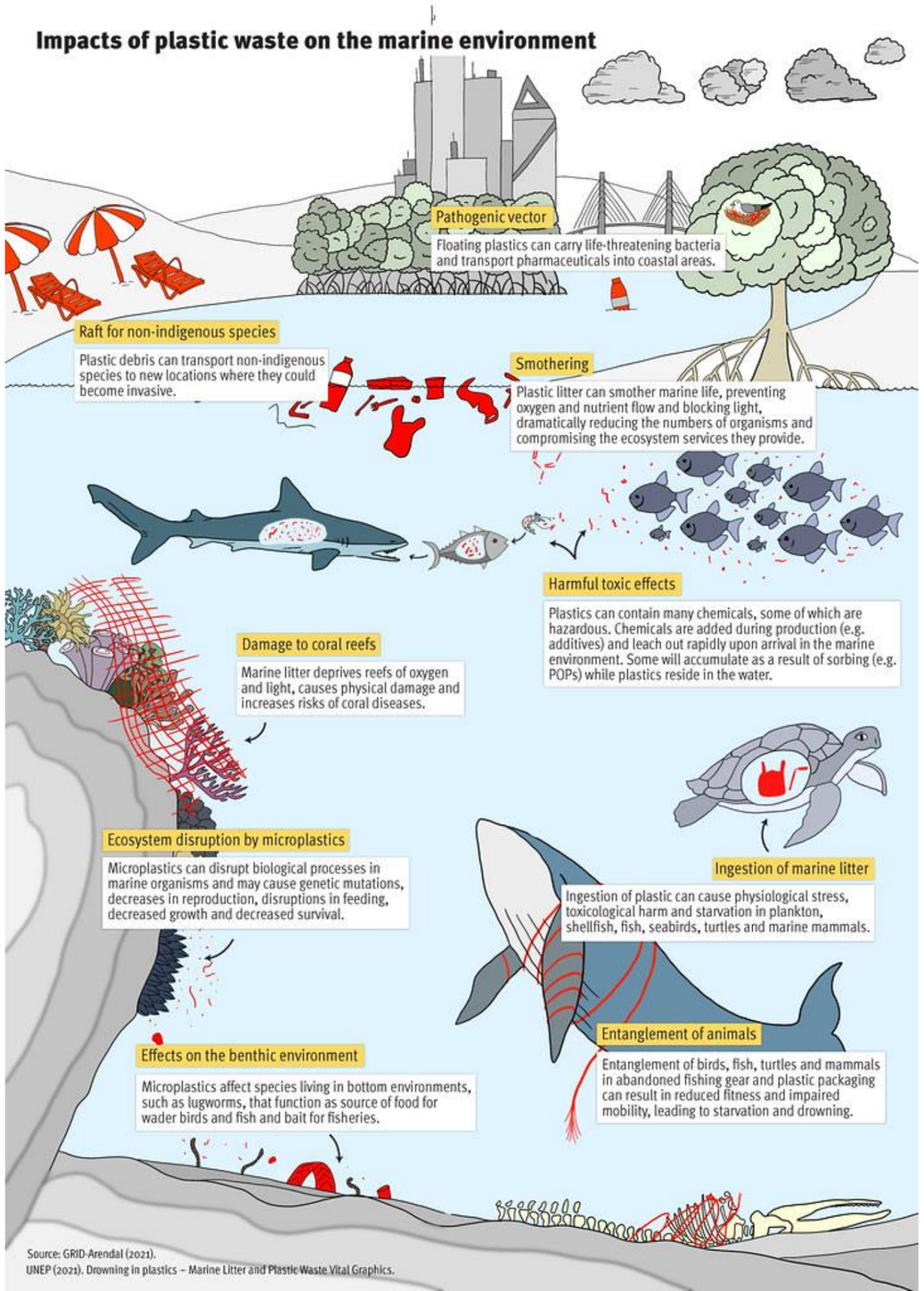
Impact of Marine Litter

A. Marine Life (eg: ingestion, entanglement, and habitat degradation)

B. Economic (eg: fisheries, aquaculture, shipping, and tourism)

C. Human Health (eg: enter the food chain through seafood consumption)

D. Others (eg: disrupt ecosystem services and hider sustainable development goals).



https://www.grida.no/resources/14899

Co-funded by the European Union

SustainaBlue
HEIs stands for Higher Education Institutions

Video:

https://www.youtube.com/watch?v=Lh6loYOoeNk&t=6s

Co-funded by
the European Union

Self-Reflection

SustainaBlue
HEIs stands for Higher Education Institutions

– Understand the sources and impacts of marine litter.

Co-funded by
the European Union

Evaluation

SustainaBlue
HEIs stands for Higher Education Institutions

1. **What is the primary source of marine litter globally?**
   A. Offshore oil drilling
   B. Shipping accidents
   C. Land-based activities
   D. Deep-sea mining
2. **Which of the following best describes how marine litter is distributed in the ocean?**
   A. Evenly across all ocean areas
   B. Concentrated only in coastal regions
   C. Influenced by ocean currents and wind patterns
   D. Found only near river mouths
3. **What is one major ecological impact of plastic marine litter on marine organisms?**
   A. Increased biodiversity
   B. Enhancement of coral reef growth
   C. Entanglement and ingestion leading to injury or death
   D. Providing nutrients to the food web

Co-funded by the European Union

Evaluation

SustainaBlue
HEIs stands for Higher Education Institutions

1. **Which of the following is NOT a common type of marine litter?**
   A. Plastic bottles
   B. Fishing gear
   C. Aluminum cans
   D. Lava rocks
2. **How does microplastic pollution impact the marine food web?**
   A. It promotes fish growth
   B. It increases water oxygen levels
   C. It is ingested by marine organisms, potentially accumulating up the food chain
   D. It dissolves harmlessly in seawater

Co-funded by the European Union

Further Reading

Luttenberger, L. R., Ančić, I., Luttenberger, A., & Kosovac, I. (2023). Marine Litter and the Circular Economy. https://doi.org/10.56080/jms231102

Chassignet, E. P., Xu, X., & Zavala-Romero, O. (2022). Global Lagrangian dataset of Marine litter. https://doi.org/10.5281/zenodo.6310459

Wu, J. (2022). Marine Litter Sources and Distribution Pathways (pp. 35–89). Springer eBooks. https://doi.org/10.1007/978-3-031-08626-7_2

Brink, P. ten, Schweitzer, J.-P., Watkins, E., Janssens, C., Smet, M. D., Leslie, H. A., & Galgani, F. (2018). Circular economy measures to keep plastics and their value in the economy, avoid waste and reduce marine litter. Economics : The Open-Access, Open-Assessment e-Journal, 1–15. https://www.econstor.eu/handle/10419/173128

Galgani, F., Hanke, G., & Maes, T. (2015). Global Distribution, Composition and Abundance of Marine Litter (pp. 29–56). Springer International Publishing. https://doi.org/10.1007/978-3-319-16510-3_2

Co-funded by the European Union

Bibliography

Chitaka, T.Y., Onianwa, P.C., Nel, H.A. (2023). Marine Litter Sources and Distribution Pathways. In: Maes, T., Preston-Whyte, F. (eds) The African Marine Litter Outlook. Springer, Cham. https://doi.org/10.1007/978-3-031-08626-7_2

Omeyer, L.C.M., Duncan, E.M., Aiemsomboon, K., Beaumont, N., Bureekul, S., Cao, B., Carrasco, L.R., Chavanich, S., Clark, J.R., Cordova, M.R., Couceiro, F., Cragg, S.M., Dickson, N., Frailler, P., Ferrarp, G., Fletcher, S., Fong, J., Ford, A.T., Gutierrez, T., Hamid, F.S., & Godley, B.J., (2022) Priorities to inform research on marine plastic pollution in Southeast Asia. Science of the Total Environment, 841, 156704. https://doi.org/10.1016/j.scitotenv.2022.156704

Zhang, F., Yao, C., Xu, J., Zhu, L., Peng, G., Li, D., (2020) Composition, spatial distribution and sources of plastic letter on the East China Sea floor. Science of the Total Environment, 742, 140525. https://doi.org/10.1016/j.scitotenv.2020.140525

Amon, D.J., Kennedy, B.R.C., Cantwell, K., Shure, K., Glickson, D., Shank, T.M., Rotjan, R.D. (2020) Deep-Sea Debris in the Central and Western Pacific Ocean. Frontiers in Marine Science. https://doi.org/10.3389/fmars.2020.00369

Co-funded by the European Union

SustainaBlue
HEIs stands for Higher Education Institutions

THANK YOU

JENNIE LEE

jennie@umt.edu.my

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Project: 101129136 — SustainaBlue — ERASMUS-EDU-2023-CBHE