Marine Debris Pollution: Citizen Scientists Taking Charge!

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UNESCO World Heritage Site (Georgetown)

UNESCO Biosphere Reserve (Penang Hill)

Centre for Marine and Coastal Studies (CEMACS)
Universiti Sains Malaysia
Penang: Pride of its Citizens

Nature ● Environment ● Diversity ● Culture ● History ● Festival ● Arts
Penang: Pride of its Citizens

Asam Laksa
Beef Noodles
Hokkien Mee
Naan
Wan Tan Mee
Roti Canai
Fruit
Penang (and the World): A persistent problem

Look closer: Plastics and trash on the beach strandline
Plastic Pollution
Paying attention to the plastic pollution threatening our marine environment
Unlikely places

Sea birds - Albatross
Plastic Pollution

Present situation
The ocean is teeming with microplastic – a million times more than we thought, suggests new research

Microplastics have spread right to the sea bed, study finds

A study in London, UK, discovered microplastics suspended in the air throughout the city. The study suggests that cities could be a source of microplastic pollution as the AIRBORNE PLASTIC PARTICLES ENTER SOIL AND BODIES OF WATER, INCLUDING THE OCEAN, THROUGH RAIN AND SNOW (Wright et al., 2020 Environment International).

Microplastics and even smaller nanoparticles have been found in many of the food and beverage products we consume. Scientists found that COMMON PLASTIC TEABAGS CAN RELEASE MORE THAN 11 BILLION MICROPLASTIC AND 3 BILLION NANOPOLYSTIC PARTICLES INTO YOUR BEVERAGE (Hernandez et al., 2019 Environmental Science & Technology).

Plastic Bag Found at the Bottom of World’s Deepest Ocean Trench

Even one of the most remote places on Earth couldn’t hide from the scourge of plastic trash.

Rubber dust from car tires is one of the most common sources of microplastics in the coastal waters off California, USA, according to scientists (Sutton et al., 2019 San Francisco Estuary Institute). Another study found that toxins in these TIRE PARTICLES CAN REDUCE THE SURVIVAL RATE OF SOME FISH HATCHLINGS and cause deformities in their embryos. These particles may become more toxic to organisms as water temperature and turbulence from storm events increase with climate change (Kolomietsa et al., 2020 Environmental Science & Technology).
Recent evidence indicates that humans constantly inhale and ingest microplastics; however, whether these contaminants pose a substantial risk to human health is far from understood. The lack of crucial data on exposure and hazard represents key knowledge gaps that need to be addressed to move forward.
Microplastics in the marine ecosystem

Microplastic in water → Filter filters Plankton → Fish larvae → Larger fish

Plastic waste

Fish for HUMAN consumption
Pollution Solution?

There’s more to it than what meets the eye
Taking care of the world's ocean garbage problem is one of the largest environmental challenges mankind faces today.

**FOUNDED 2013**
Dutch inventor Boyan Slat founded The Ocean Cleanup at the age of 18 in his hometown of Delft, the Netherlands.

**NON-PROFIT FOUNDATION**
We are a registered charity as a 'Stichting' in the Netherlands, and a 501(c)(3) in the US.

**HQ ROTTERDAM**
The Ocean Cleanup's team consists of more than 90 engineers, researchers, scientists and computational modelers working daily to rid the world's oceans of plastic.

**WHY WE NEED TO CLEAN THE OCEAN'S GARBAGE PATCHES**

**ENGINEERING, GENERAL 2 October 2019**
THE OCEAN CLEANUP SUCCESSFULLY CATCHES PLASTIC IN THE GREAT PACIFIC GARBAGE PATCH

**Concentration of microplastics with and without cleanup in the Great Pacific Garbage Patch.**

https://theoceancleanup.com/oceans/
CLEANING UP THE GARBAGE PATCHES

The combination of natural forces and a sea anchor create a drag, which makes the system move consistently slower than the plastic, while allowing the plastic to be captured.

Models show that a full-scale cleanup system roll-out could clean 50% of the Great Pacific Garbage Patch in just five years.

After fleets of systems are deployed into every ocean gyre, combined with source reduction, The Ocean Cleanup projects to be able to remove 90% of ocean plastic by 2040.

Crazy to think that only a year ago, this was still harmful trash in the middle of the ocean, and now it's something useful and beautiful.

Boyan Slat, CEO
THE INTERCEPTOR

The Interceptor is The Ocean Cleanup’s answer for river plastic waste. It is the first scalable solution to prevent plastic from entering the world’s oceans from rivers.

It is 100% solar-powered, extracts plastic autonomously, and is capable of operating in the majority of the world’s most polluting rivers.

KLANG RIVER

Klang, Selangor, Malaysia

The Klang River runs through Kuala Lumpur. According to our research, the Klang River is one of the 50 most polluting rivers worldwide.

1/4

Conveyor belt in the Interceptor™

1/2

The Interceptors™ will be placed in strategic locations in rivers to make sure the main plastic flow is intercepted, meanwhile allowing for boats to pass.

2/4

Operational Interceptor™ in Klang River, Malaysia

When the interceptor is almost full, it automatically sends a text message to the local operators to come and collect the waste. Operators then remove the barge, bring it to the side of the river, empty the dumpsters, send off the debris to local waste management facilities, and return the barge back into the Interceptor™.
MALAYSIA’S ROADMAP TOWARDS ZERO SINGLE-USE PLASTICS 2018-2030

Towards a sustainable future

THE PRINCIPLES

- **Shared Responsibility**
  - The responsibility to eliminate single-use plastics waste from the natural environment has to be shared by all the stakeholders including the government, industries, civil society and the consumers.

- **Sustainable Development**
  - This Roadmap will support the wider national agenda on sustainable development that includes the consideration of economic, technology, environment, development and social factors.

- **Precautionary Principle**
  - Plastics, as reported have an impact on biodiversity, environment and human health and some of these impacts are still being studied. When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically.

- **Participatory**
  - Planning and execution of the Roadmap will be carried out by engaging all the relevant stakeholders in an open and transparent manner.

- **Good Governance**
  - Good governance with appropriate mechanisms including accountability and transparency is crucial for the implementation of the Roadmap.

- **Living Document**
  - This Roadmap will be updated from time to time taking into account advances in technology and real-time circumstances in accordance with national priorities.

A multi-stakeholder partnership which brings together all the actors working on marine litter and plastic pollution prevention and reduction.

Centre for Marine and Coastal Studies

Research, Education, Awareness, Community, Collaboration, Engagement

CEMACS

Global Partnership on Marine Litter

pogo

Partnership for Observation of the Global Ocean

CEMACS pledge

TRASH2TREASURE

Plastic Repurposing Campaign

SEND US YOUR PLASTIC!

- Bread Tags
- Bread Bags
- Foil Packaging
- Snack Bags
- Straws
- PET Bottles
Empowering the public: Calling on Citizen Scientists!

Members of public assisting scientist to collect data

Initiatives:

Collecting data besides trash

1. International Coastal Cleanup Day: annual strategy
2. COLLECT: POGO & Local school
3. Pulau Gazumbo: an island revived
Penang’s World Cleanup Day 2018

Volunteers: 1,100

Trash collected: 1,539 kg (2 hours)

Location:
coastal area near Queensbay Mall and second Penang bridge

Top items collected:
Cigarette butts
Straws
Plastic bags

15 September 2018
Covid-19 version cleanup: 2020

COVID-19 RELATED ITEMS FOUND DURING 2020 INTERNATIONAL COASTAL CLEANUP MONTH (19 SEPT-18 OCT)

- Face Mask: 115
- Gloves: 49
- Plastic Face Shield (PPE): 6

12 Locations  88 Participants
International Coastal Cleanup Day
18 Sept 2021

Volunteers: 12

Trash collected: 51.5 kg (1 hour)

Top trash:
- Plastic bags (242)
- Plastic beverage bottles (141)
- Straws (79)
- Covid-19 related: Mask (10)
International Coastal Cleanup Day 2021

Using social media and YouTube to reach the public

Video tutorial https://www.youtube.com/watch?v=oCE3DRz-XWg
INTERNATIONAL COASTAL CLEAN UP
2021

These are the top ten items collected:

- Beverage bottles (plastic): 2001
- Food wrappers (candy, chips, etc.): 842
- Bottle caps (plastic): 794
- Grocery bags (plastic): 757
- Cigarette butts: 745
- Take away containers (plastic): 709
- Straws/Stirrers: 510
- Take away containers (Foam): 388
- Forks, knives, spoons: 343
- Lid plastics: 317

143 PEOPLE
27 GROUPS
12,256 TOTAL ITEMS
#2 Calling on Citizen Scientists: COLLECT
Citizen Observation of Local Litter in Coastal ECosysTems

**Project Collaborators**

- Nubi Olubunmi Ayoola (NIOMR), Nigeria
- Francis Emile Asuquo (UNICAL), Nigeria
- Zacharie Sohou (IRHOB), Benin
- Kouame Lazare Akpetou (CURAT), Cote d'Ivoire
- Pericles Neves Silva, Ivanice Monteiro (IMar), Cabo Verde
- Soukaina Zizah, Mohammed Malouli, Mostapha Benomar (INRH), Marrocos
- Aileen Tan Shau Hwai (CEMACS), Malaysia
- Marine Severin (VLIZ), Belgium
- Pavanee Angelee Annasawmy, (Lynker technologies) France
- Sophie Seeyave, Lilian Anne Krug, Fiona Beckman (POGO)
- Other POGO collaborators (Japan, Portugal, Belgium, Angola, UK)

**Project PIs**

- Edem Mahu
  University of Ghana, Ghana
- Ana Catarino
  VLIZ, Belgium
COLLECT Africa

Distribution of litter types in different realms (1,093 publications)

Timeline of Main Tasks:

Citizen Observation of Local Litter in Coastal ECosytems

- T -3
- T -2
- T -1
- T 0
- T 1
- T 2
- 2 x Time (weeks)

Consent forms

- Information session at school:
  - 1st Questionnaire (before info)
  - Video (intro to plastic pollution)
  - Short SOPs (videos & 2-pager)
  - Q & A (local POGO collaborators)

Process samples
- Data
- Photos

Field activity - Saturday (from high to low tide)

2nd Questionnaire
Citizen Scientists Training

Information session with students:

- Video tutorial
- Infographic sheet
#2 Calling on Citizen Scientists: COLLECT Malaysia

1. acquire data on marine plastic debris distribution and abundance

2. training citizen scientists (secondary school students) and promoting knowledge transfer between local communities, researchers and members of the Partnership for Observation of the Global Ocean (POGO).
Citizen Scientists

First school in Malaysia to undertake COLLECT: Prince of Wales Island International School, Penang

Upcycling, repurposing plastic wastes into new material
Marine Plastic Debris
#3 Calling on Citizen Scientists: Gazumbo Island

Pulau Gazumbo was created during the construction of the first Penang bridge and has the largest seagrass meadow in the Straits of Melaka. (Penang Seagrass Project Facebook pic)

Chief minister Chow Kon Yeow said the state government will be working to gazette the Island as a sanctuary, to be called the “Middle Bank Marine Sanctuary”. 
Middle Bank Marine Sanctuary: Gazumbo Island
#3 Calling on Citizen Scientists:

Gazumbo Island

The harsh reality!
#3 Calling on Citizen Scientists:
Gazumbo Island

Volunteers: 35

Trash collected: 768.4 kg (3 hours)

Location:
Gazumbo Island

Top items collected:
Recyclable Plastic bottles - 366.4kg
Non-recyclable items - 251.0kg
Glass - 78.0kg
Ghost nets - 73.0kg
What can we do?

Be responsible
Be considerate
Start now, do something
Spread the knowledge
Lifestyle adjustments
Take action!
Time to act: Behavioural change

Rope and netting that were found inside the dead whale in Scotland. Scottish Marine Animal Stranding Scheme

Sewage surfer by Justin Hofman (US)

This tiny estuary seahorse ‘almost hopped’ from one bit of bouncing natural debris to the next, bobbing around on a reef near Sumbawa Island, Indonesia. As a brisk surface wind picked up, the seahorse took advantage of something that offered a stable raft: a waterlogged plastic cottonbud. Finalist 2017, The Wildlife Photojournalist Award: Single Image

Photograph: Justin Hofman/2017 Wildlife Photographer of the Year
Get creative: start today

Beach Clean-up
App: Ocean Swell
Be a citizen scientist

Recycle
App: Riicycle
Get rewards

Talk about it!
Start your own podcast
Engage your circle

Highlight people from different industries on how to address this problem

Stay connected
Recycling, Zero waste communities
Support and education
“Turn off the plastic tap”

Start with ONE small action.

The best time to act is NOW.

WE can make a change!
Research, Education & Community Engagement @CEMACS
MSc and PhD research at CEMACS, USM

Open for registration to local and international scholars
Internship and Volunteers welcome too!
Selamat Datang: Welcome to visit us at CEMACS, USM

We warmly welcome you to Malaysia!
Centre for Marine and Coastal Studies
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Connect with us!
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