Impacts of Tourism on Marine Debris and Microplastic Detection at Krabi province, Southern Thailand

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INTRODUCTION

- Thailand ranks 6th globally in producing plastic debris that ends up in the oceans.
- Human activities on land account for 80% of marine debris.
- Microplastics are small fragments of plastic debris, which can be categorized as small (< 1 mm in diameter) or large (1-5 mm in diameter) particles.
- Krabi is a popular tourist destination in Thailand where marine debris and microplastics are a concern.

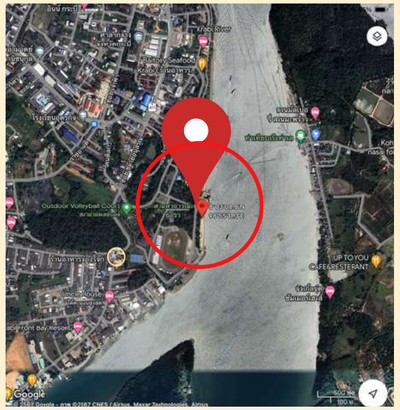
Fig1.Ko Poda

OBJECTIVES

- To survey the type, quantity and source of marine debris
- To compare how cleaning in different beaches affects the amount and density of microplastic waste.

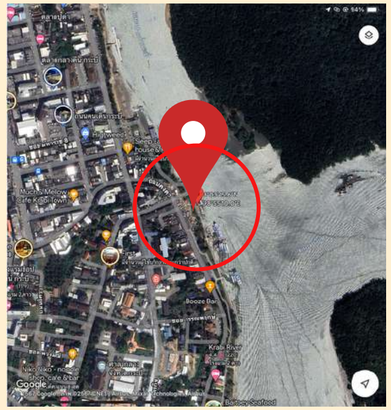
STUDY SITES

Thara Park



GPS position
Lat : 8.052437°N
Long:98.91981°E

Chao Fah Park



GPS position
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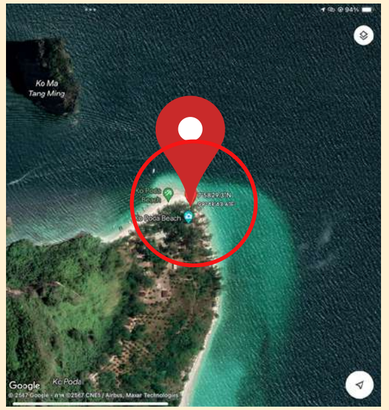
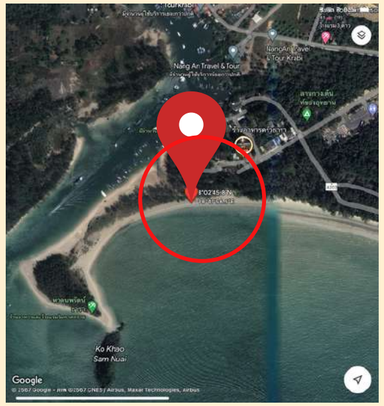
Long:98.919448°E

Ko Poda



GPS position
Lat : 7.9748°N
Long: 98.8121°E

Nopharat Thara Beach

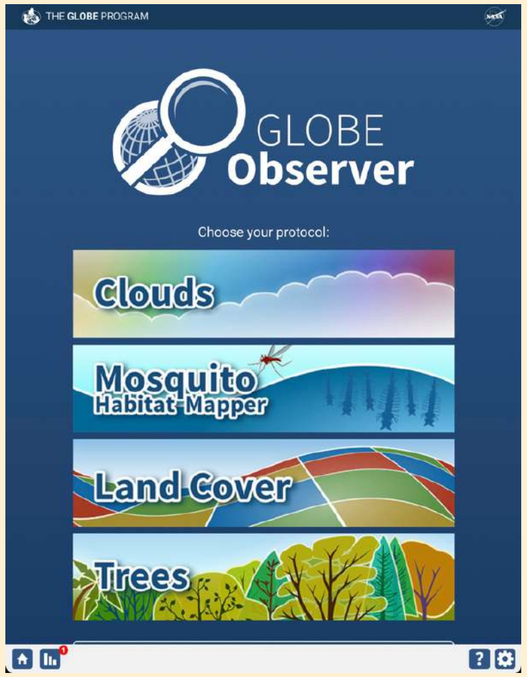


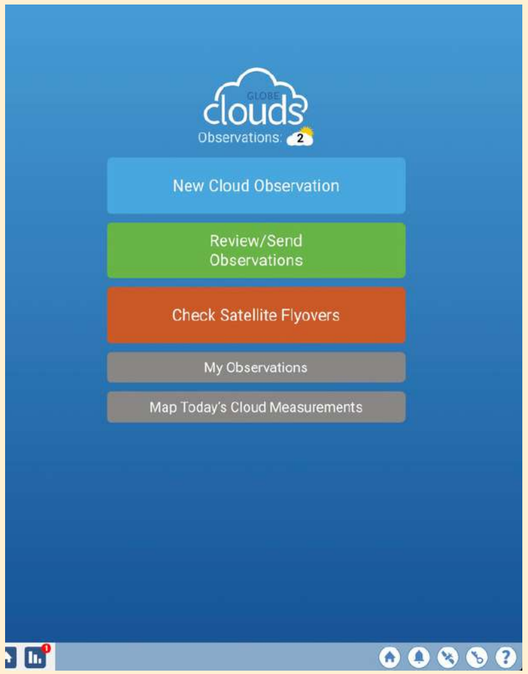
GPS position
Lat :8.046064°N
Long: 98.799021°E

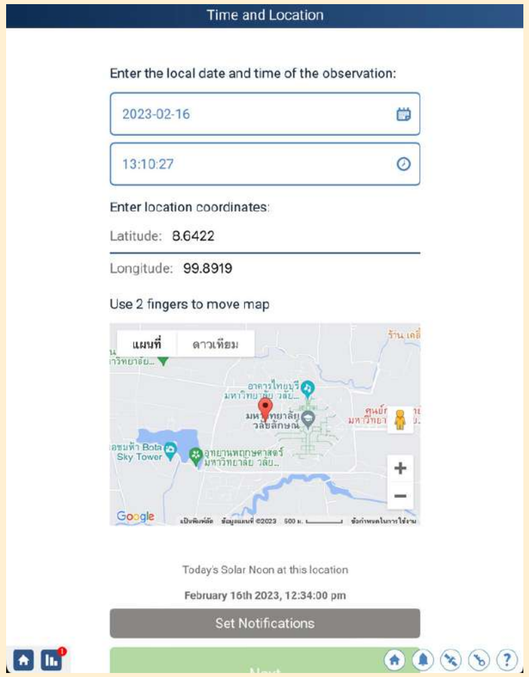
Fig2.Map and coordination of study sites in Krabi province, Thailand.

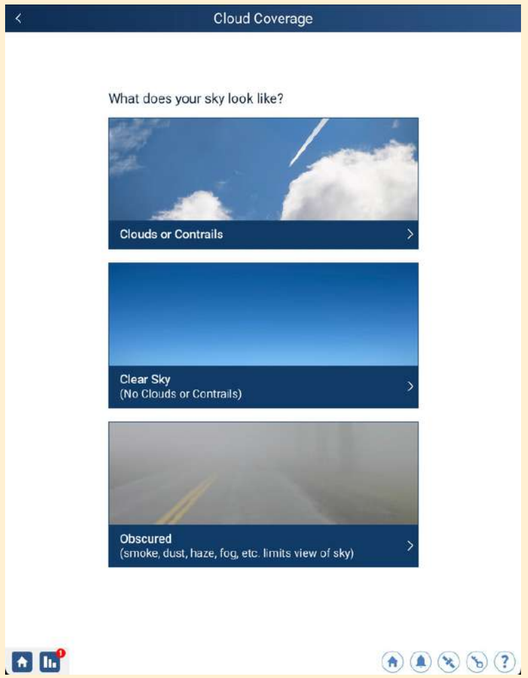
MATERIALS AND METHODS

1 2 3 4









1. choose Cloud App.

2. choose New cloud observation.

3 ,4 Observe the sky, the clouds, and don't forget the clouds at the edge of the clouds.

Fig3.GLOBE Observer: Cloud App.

MATERIALS AND METHODS

Data collection

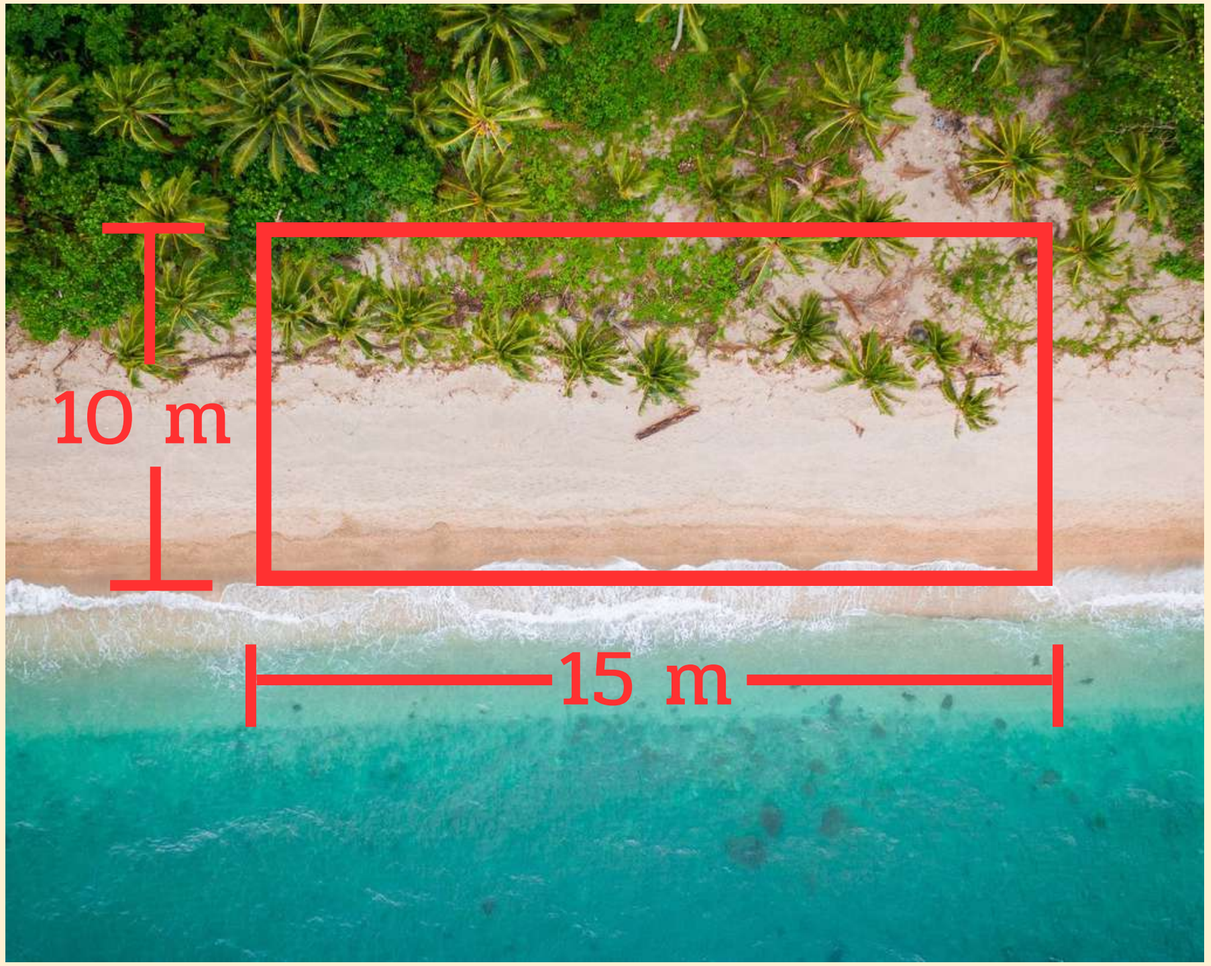


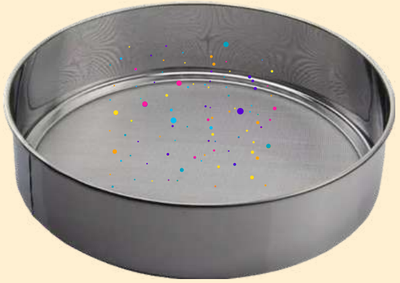
Fig. 4 Data exploration area design.

MATERIALS AND METHODS

Data collection from sand

Randomly collect sand into 3 bags of 1.5 kg.

Put sand and water in a bucket and stir.Then wait for the sand to settle



Use a sifter to scoop up the microplastics that float up.

Microplastics debris were extracted by the use of tweezers for the analysis of the types of microplastics

MATERIALS AND METHODS

Data collection from seawater

Measure water into a 50 ml measuring cup and pour it into a petri dish.

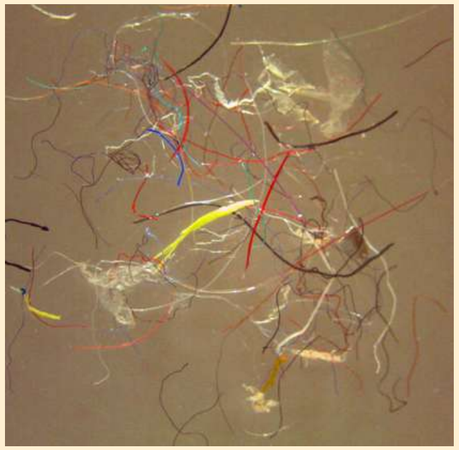
Spray steam out with an ultrasonic machine using ultrasonic frequencies.

Microplastics debris were extracted by the use of tweezers for the analysis of the types of microplastics

MATERIALS AND METHODS

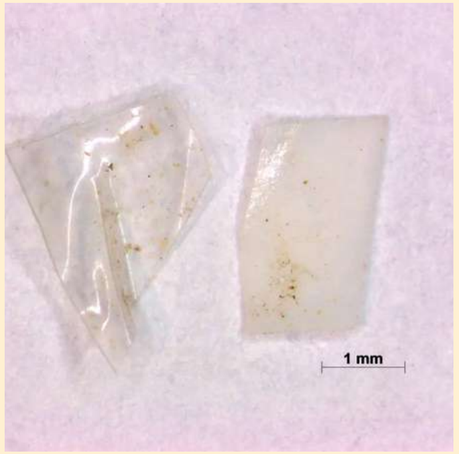
Data collection

4 types of microplastics



fiber

foam



film

fragments

Fig. 5 Types of Microplastics.

RESULTS AND DISCUSSIONS

Beach areas	Data of collection	Marine debris (items/m^2)	Marine plastic debris (items/m^2)	Clean Coast Index (CCI)
Thara Park	February	531(3.540)	492(3.280)	65.60
Chao Fah Park	February	771(5.140)	674(4.493)	89.87
Nopharat Thara Beach	February	59(0.393)	48(0.320)	6.40
Ko Poda	March	89(0.593)	56(0.373)	7.47

The Clean Coast Index (CCI)

0 - 2	indicated very clean beaches
2 - 5	clean
5 - 10	moderately clean
10 - 20	dirty
> 20	extremely dirty

Formula for calculating CCI

CCI = CM × K

$$CM = \frac{\text{Number of marine plastic debris}}{\text{Number of study areas (m^2)}}$$

K (constant number) = 20

$$CM = \frac{56}{150} = 0.37$$

CCI = 0.37 × 20 = 7.47

RESULTS AND DISCUSSIONS

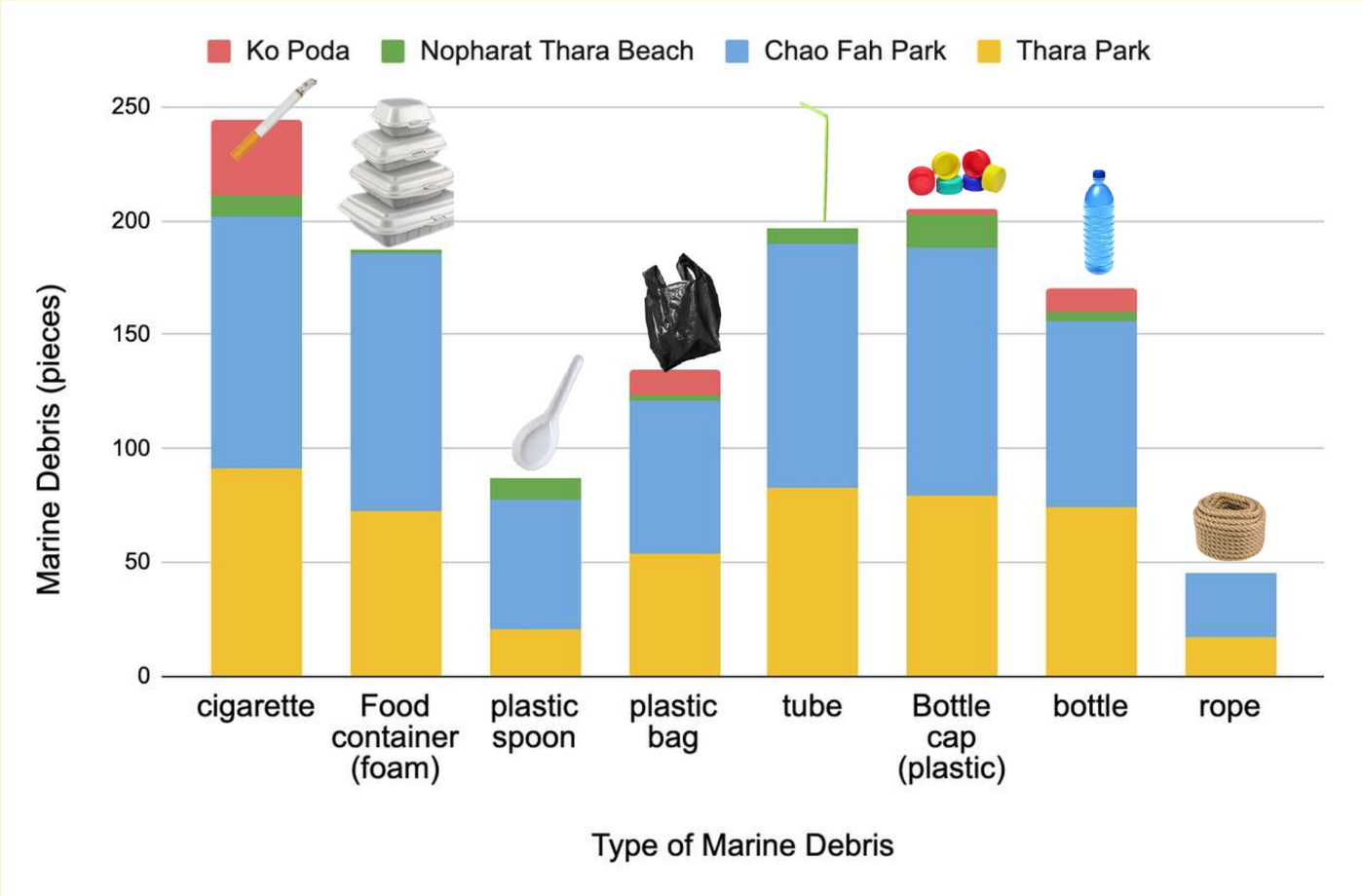


Fig. 6 Types and amounts of marine debris at three beaches at Krabi, Southern Thailand.

Fig.7 Thara Park

Thara Park found the most waste :

- Cigarette
- Tube
- Bottle cap (plastic)

RESULTS AND DISCUSSIONS

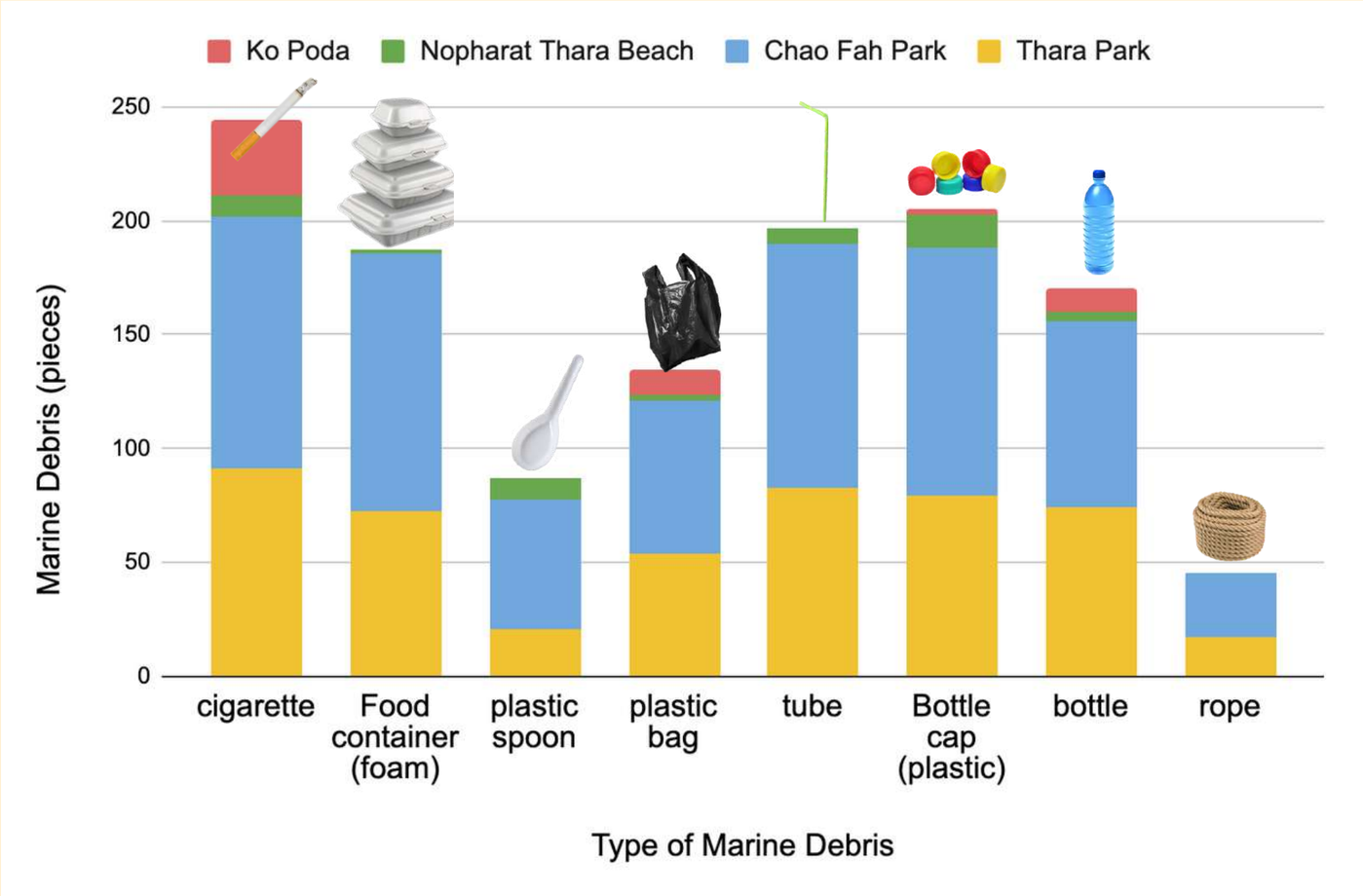


Fig. 6 Types and amounts of marine debris at three beaches at Krabi, Southern Thailand.

Fig.8 Chao Fah Park

Chao Fah Park found the most waste :

- Food container (foam)
- Cigarette
- Bottle cap (plastic)

RESULTS AND DISCUSSIONS

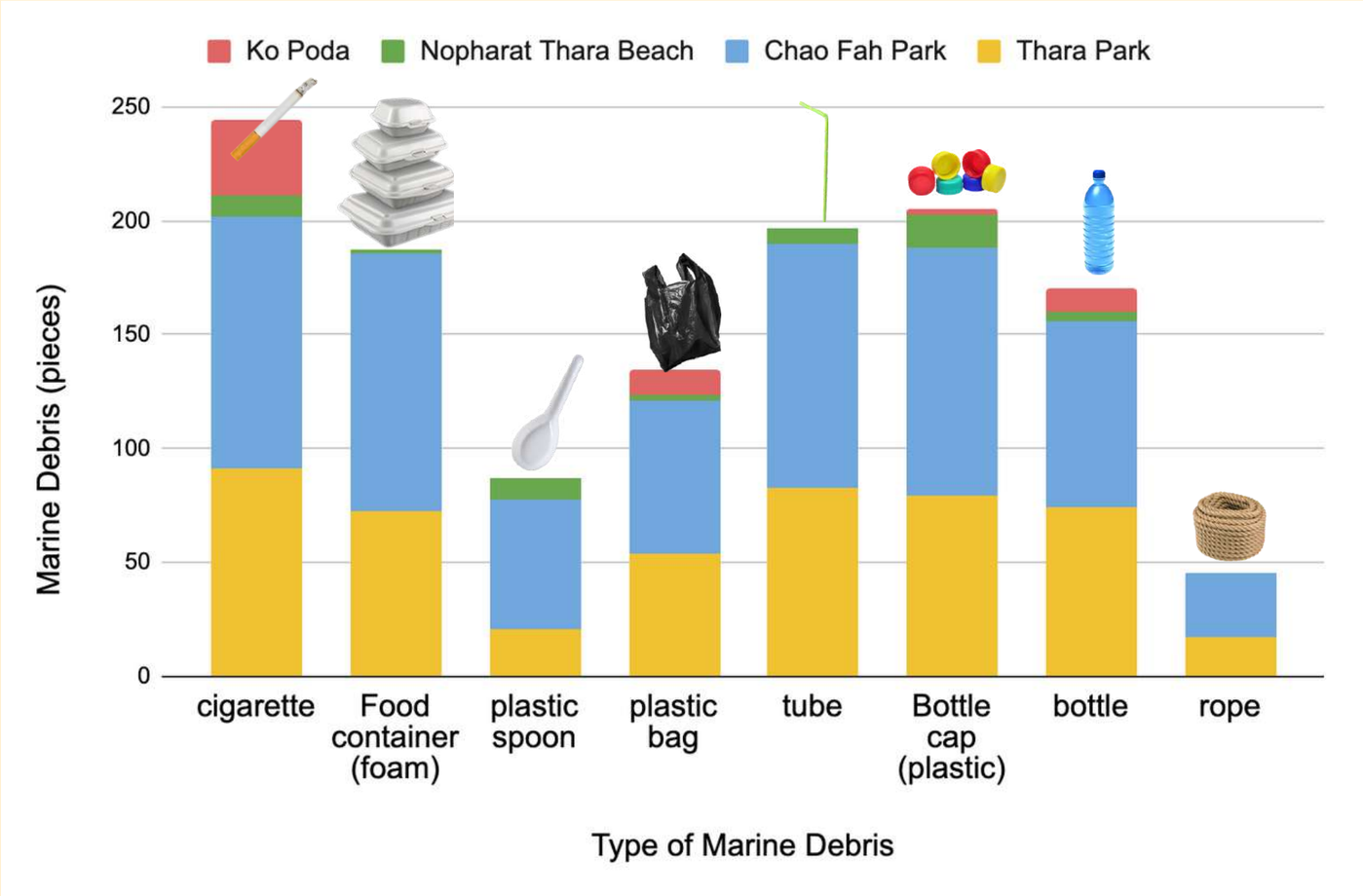


Fig. 6 Types and amounts of marine debris at three beaches at Krabi, Southern Thailand.

Fig.9 Nopharat Thara Beach

Nopharat Thara Beach found the most waste :

- Bottle cap (plastic)
- Cigarette
- Plastic spoon

RESULTS AND DISCUSSIONS

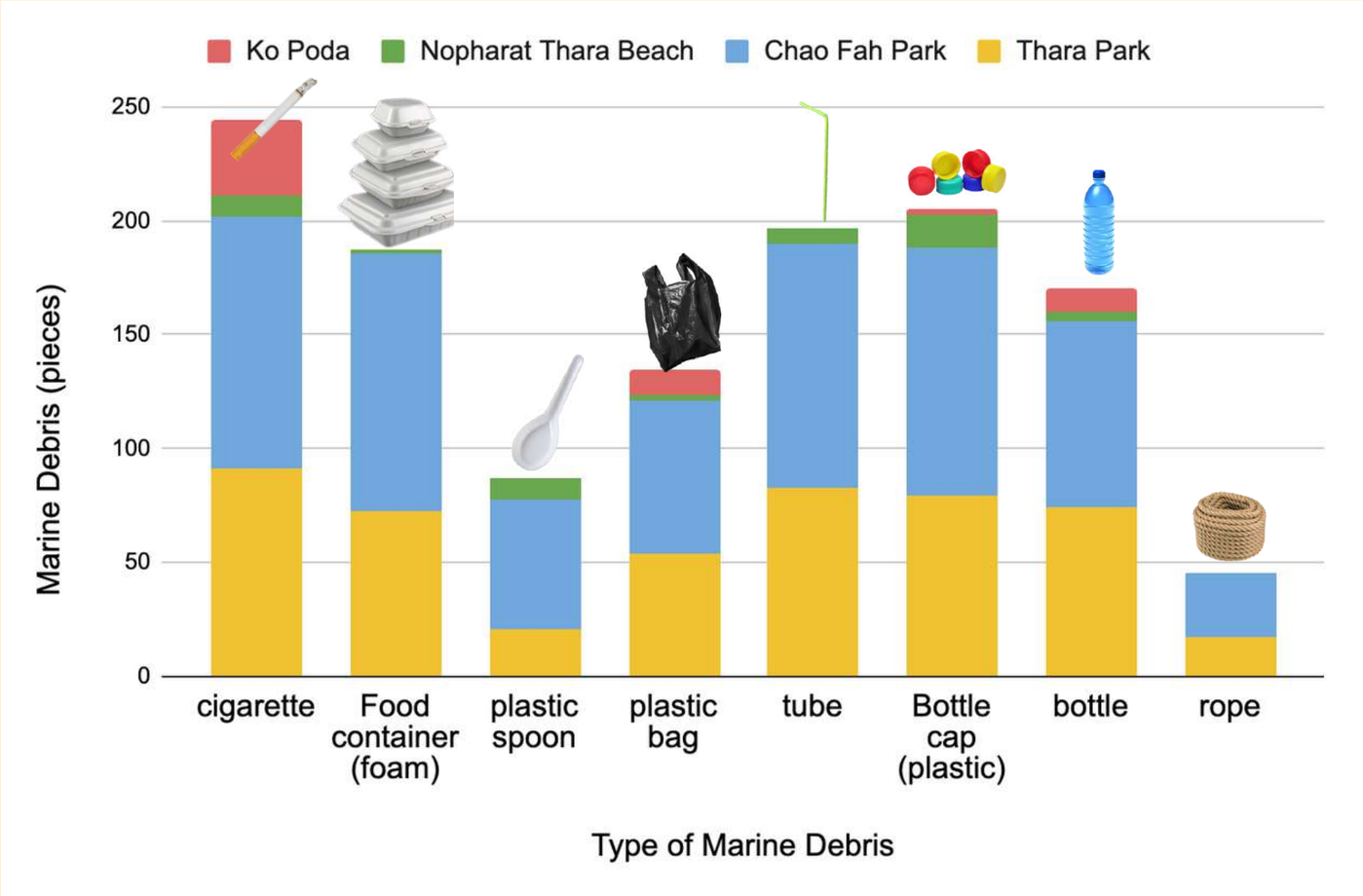


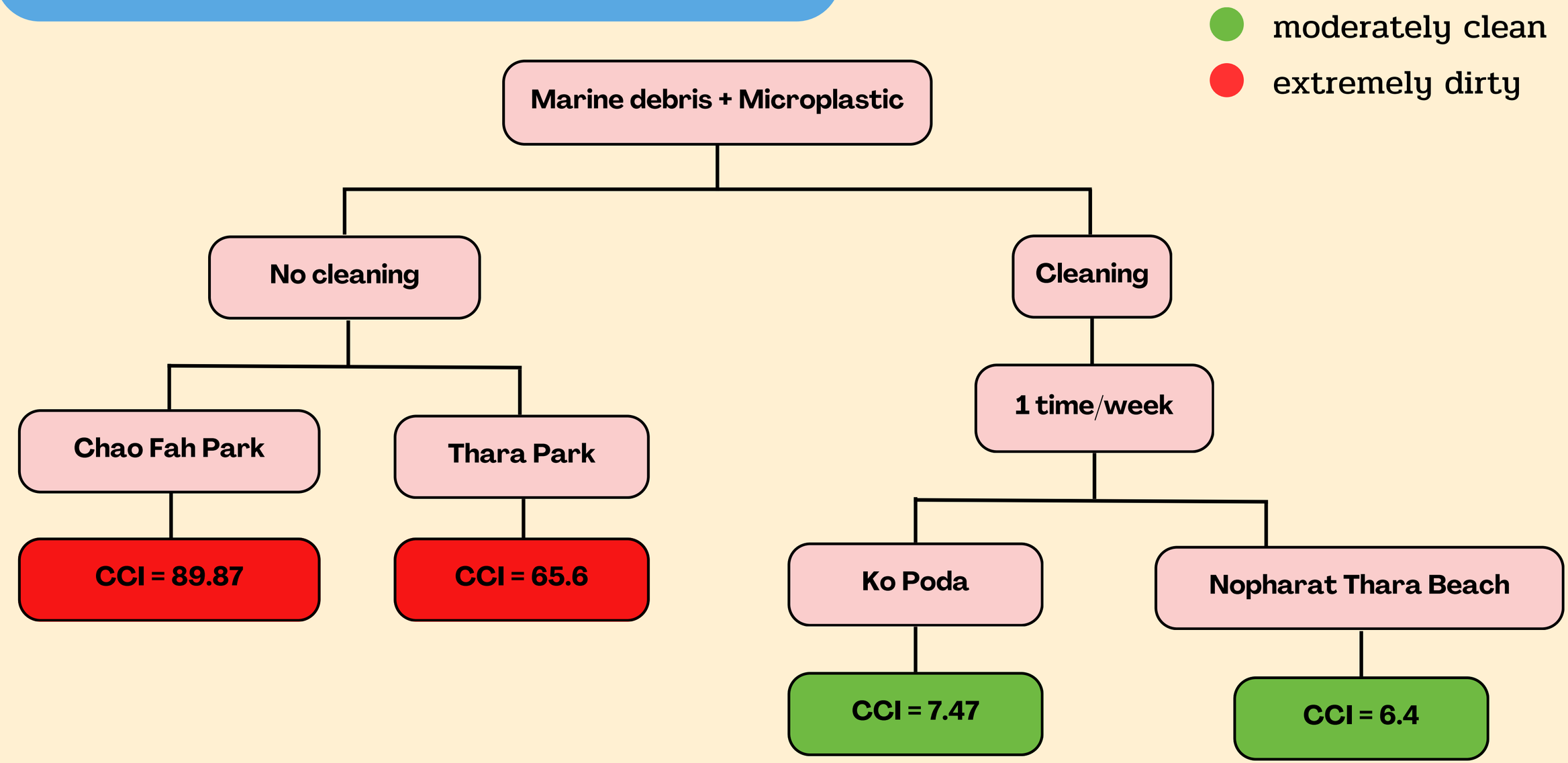
Fig. 6 Types and amounts of marine debris at three beaches at Krabi, Southern Thailand.

Fig..10 Ko Poda

Ko Poda found the most waste :

- Cigarette
- Plastic bags
- Bottle

CONCLUSION


moderately clean
extremely dirty
Marine debris + Microplastic
No cleaning
Cleaning
Chao Fah Park
Thara Park
1 time/week
CCI = 89.87
CCI = 65.6
Ko Poda
Nopharat Thara Beach
CCI = 7.47
CCI = 6.4

CONCLUSION

The data shows us the dirtiness from highest to lowest

- Chao Fah Park has the highest CCI because this beach has no cleaning routine and it close to a fishing village, meaning this beach is extremely dirty. Resulting in the dirtiest beach of all beaches. The majority microplastic is foam.
- Thara Park is a public pier, public park, meaning that this beach is extremely dirty. The majority microplastic is foam.
- Ko Poda is a tourist island, but it has cleaning once a week. Due to the lack of trash cans resulting to be some trash remaining on the island, but this beach is still moderately clean. All of the microplastics are foam.
- Nopharat Thara Beach is a beach with high tourism with a park near the beach area. There are also staffs looking after the beach, meaning this beach is moderately clean.The majority microplastic is film.

CONCLUSION

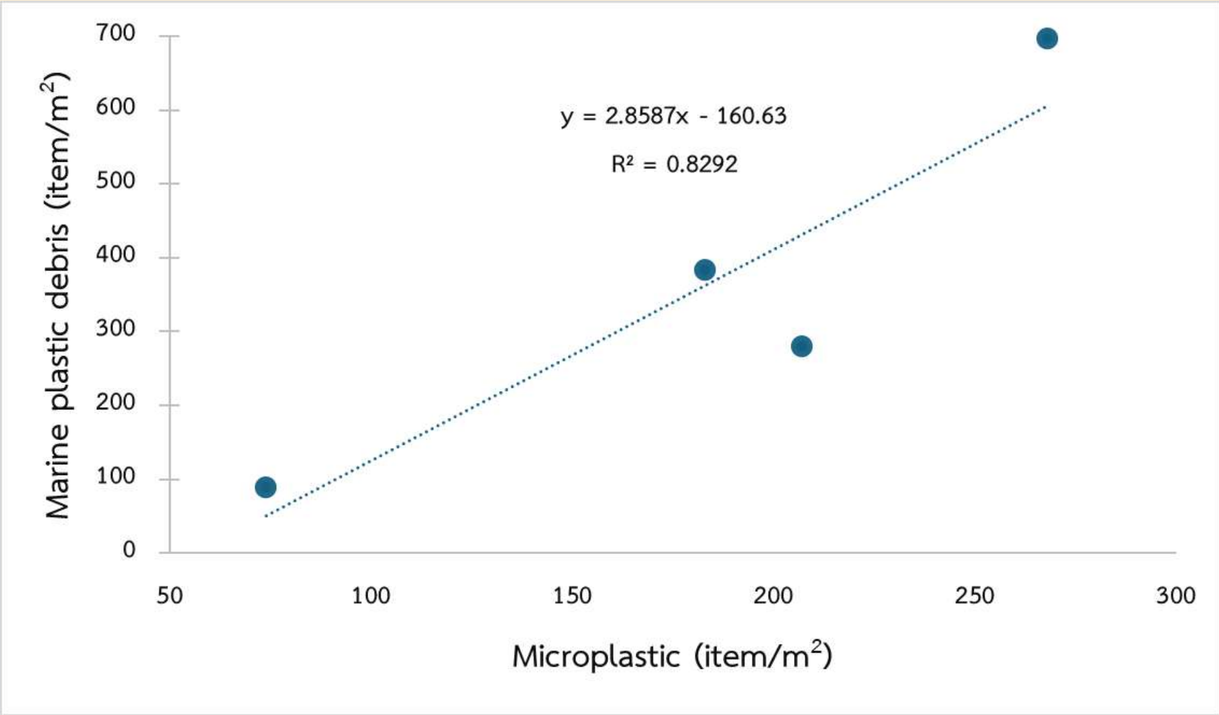


Fig. 11 Correlation between marine plastic debris and microplastic debris concentrations on the beaches.

- The amount of plastic debris in the sea is positively related to the amount of microplastic debris. (Linear regression: y = 2.8587x, R^2 = 0.8292)
- It is clear that plastic particle concentrations are extremely high on beaches with no clean-up activities. On the contrary Beaches with the highest cleaning frequency had the smallest microplastic fragments in the area.
- Proper and complete removal of large plastic debris can help reduce the microplastic burden in coastal sediments.

CONCLUSION

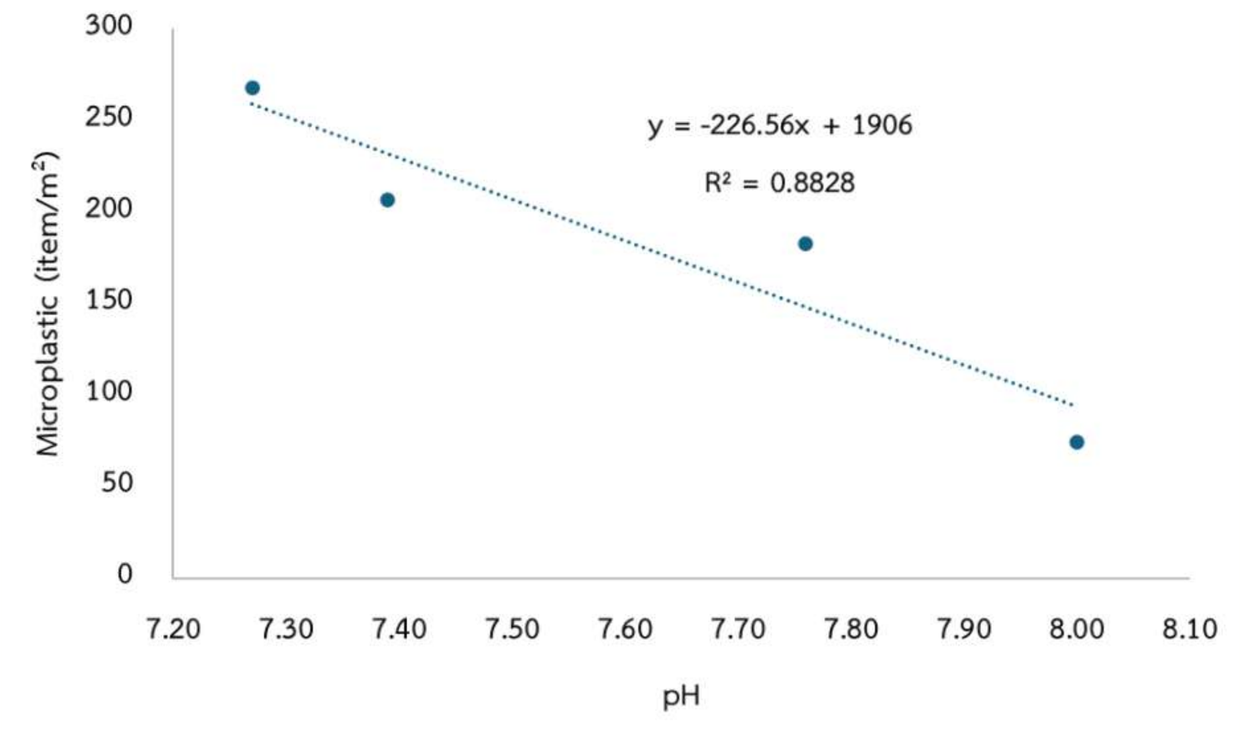


Fig. 12 Correlation between pH and microplastic debris concentrations on the beaches.

- The amount of microplastic related to pH of the sea water.
- If there are lot of waste in a sea, there will be more carbon dioxide that makes chemical reactions with sea water into hydrogen ion. Resulting the sea water to be an acid solution.
- The most microplastic is in Thara park has pH about 7.27, and with the least microplastic is in Ko Poda has pH about 8.00.

CONCLUSION

Fig.13 Cumulus

- The most visible cloud is the Cumulus
- Season change is between early February to late February.
- Temperatures are unstable during this period.
- Unstable temperatures cause convection.
- Convection forms Cumulus clouds.
- Which leads to speedy currents of wind causing litter to wash up on the shore.
- Litter waste eventually breaks down into smaller particles known as microplastics.

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