Plastic Pollution and Marine Life

SDG14: Life Below Us

Group 8

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Problem Statement

The world's oceans and seas continue to struggle against plastic pollution, endangering the planet's marine ecosystem and billions of livelihoods depending on them. To tackle plastic pollution we need to know where it's coming from. And to spread awareness, we need to study how it affects Earth's precious marine life.

Objective of Analysis

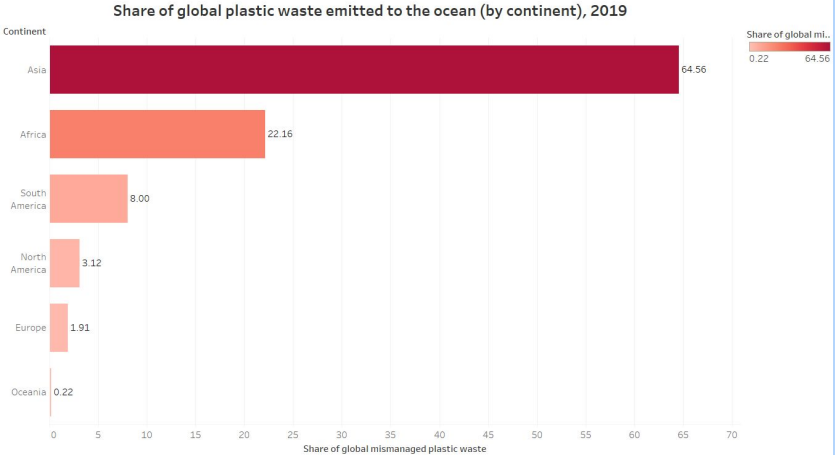
Objective 1

To find out where plastic waste comes from and the relationship between plastic waste emitted to the ocean and countries' economy.

Objective 2

To find out how does plastic impact marine life and what can be done to reduce the effects.

Share of Global mismanaged plastic waste 2019



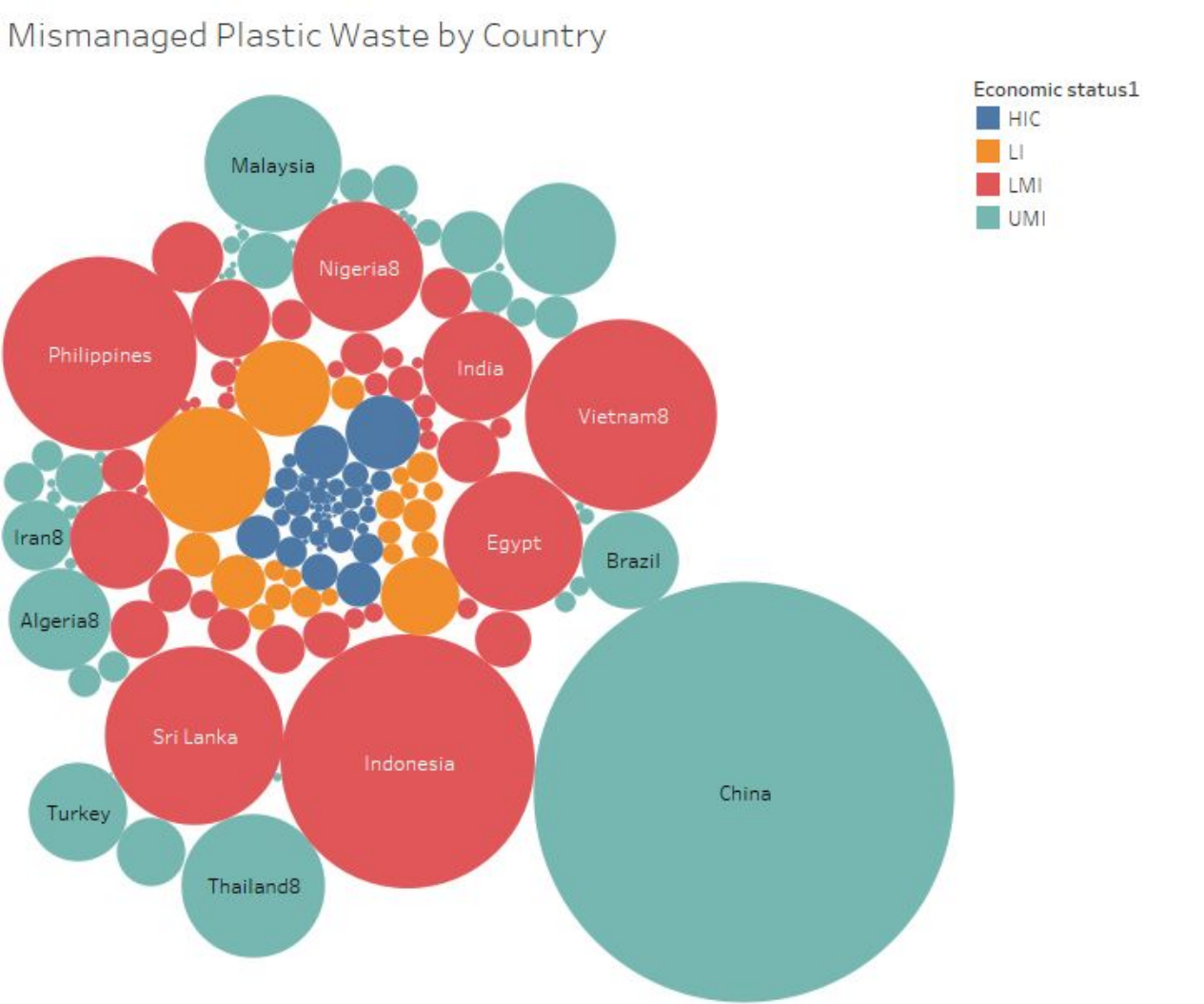
Top 3 Countries in Global mismanaged plastic waste are India (21.04%),China (19.87%) and Brazil (5.34%).

Asia 64.56%

Africa 22.16%

To relate both visualizations, the reason why Low-to-Middle income countries which mostly coming from Asia and Africa contributed the most in global mismanaged of plastic waste are due to the poor waste management infrastructure available.

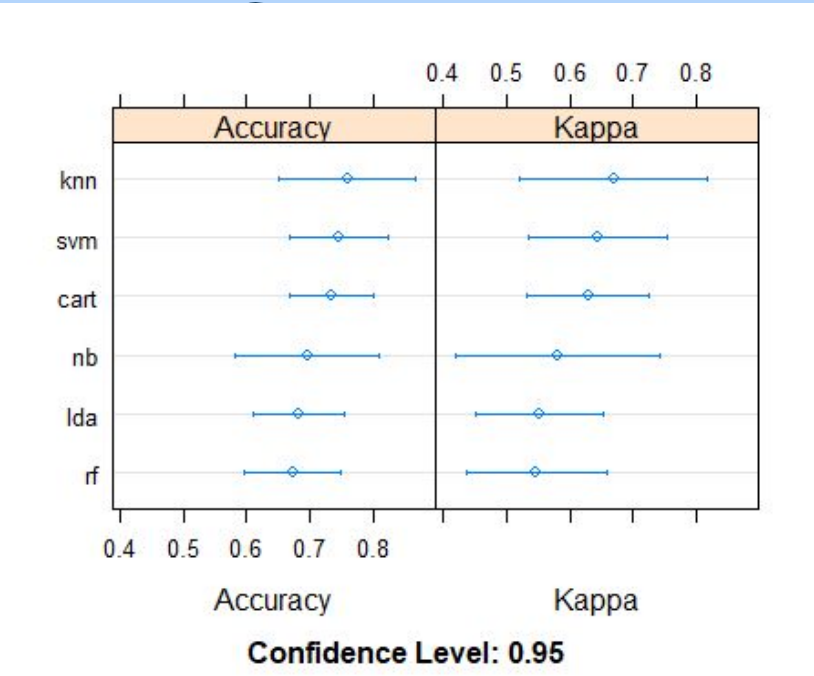
Lebreton, L., & Andrady, A. (2019). Future scenarios of global plastic waste generation and disposal. Palgrave Communications, 5(1), 6. doi:10.1057/s41599-018-0212-7



Analysis shown that most of the Lower Middle Income (LMI) and Higher Middle Income (HMI) countries contribute biggest plastic pollution.

Jambeck, J. R., Geyer, R., Wilcox, C., Siegler, T. R., Perryman, M., Andrady, A., . . . Law, K. L. (2015). Plastic waste inputs from land into the ocean. 347(6223), 768-771. doi:doi:10.1126/science.1260352

MODEL ANALYSIS



For data **Plastic Waste Admitted to Ocean VS GDP Per Capita**, we use multiple algorithms model to evaluate our data such as:

- **K-Nearest Neighbour**
- **Support Vector Machine**
- **Classification and Random Tree**
- **Linear Discriminant Analysis**
- **Naive Bayes**
- **Random Forest**

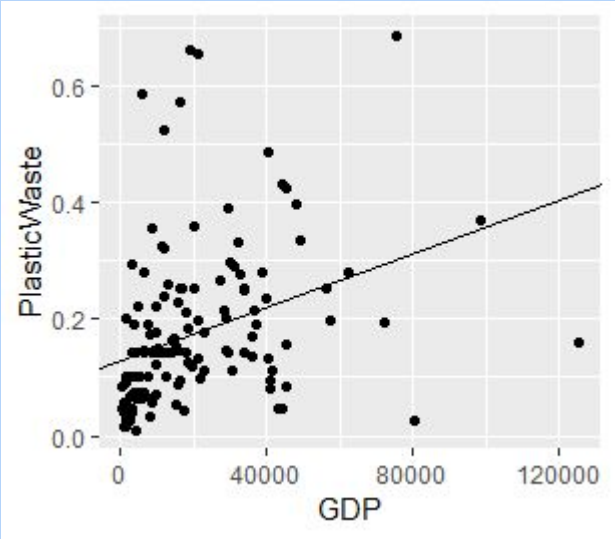
From the result, we compare and found that K-Nearest Neighbour had highest accuracy and Kappa Coefficient.

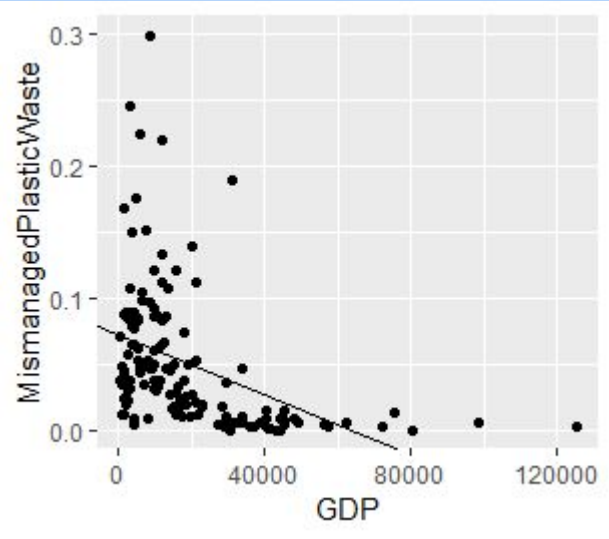
REGRESSION ANALYSIS

Ritchie, H., & Roser, M. (n.d.). Plastic Pollution - Our World in Data. Our World in Data; ourworldindata.org. Retrieved June 11, 2022, from https://ourworldindata.org/plastic-pollution

To identify the relationship between the country's GDP and the plastic waste produced. 2 Hypothesis:

- The higher the GDP, the higher waste produced per person.
- The higher the GDP, the higher waste mismanaged per person.

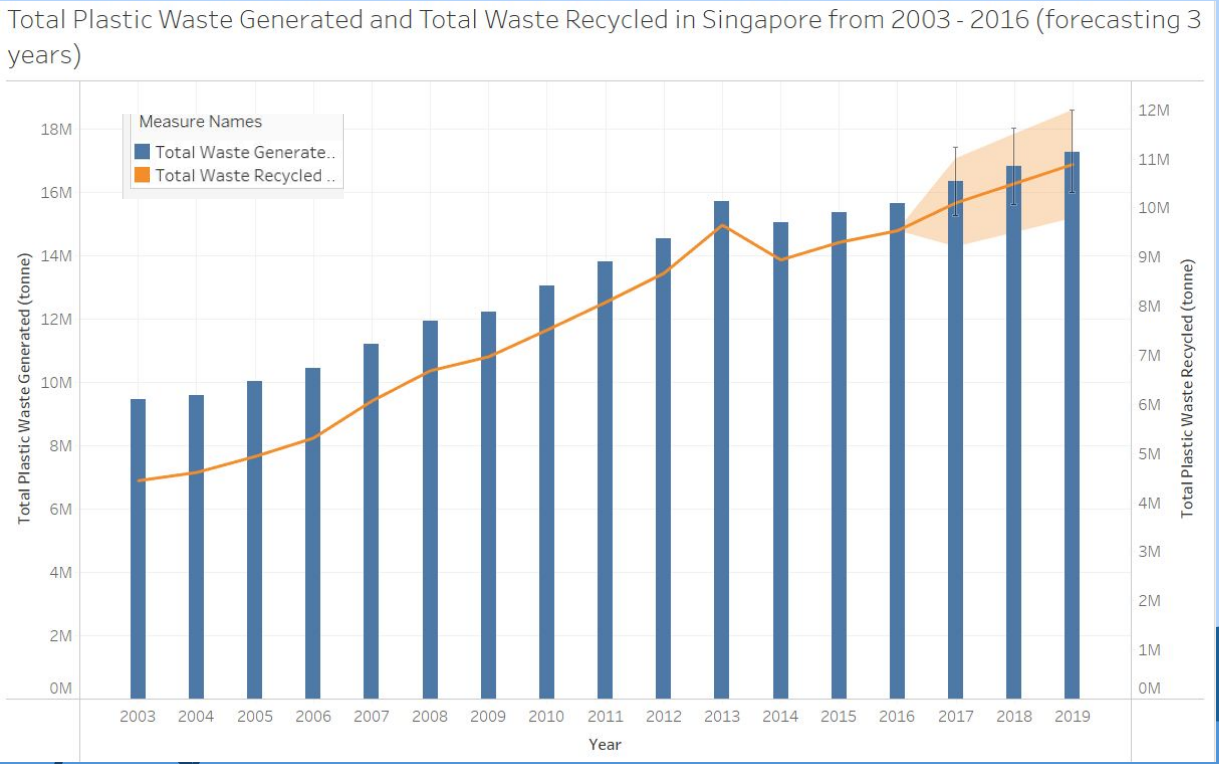




- Generated waste **tend to** increase with country's GDP per capita
- Mismanaged waste **does not** increase with an increase in country's GDP per capita
- P-value < 0.001 (significance level), null hypothesis: there is no relationship between the two variables is rejected.

Singapore - what we can learn from them

- Singapore is one of the countries that have high GDP but low plastic waste per capita (0.194kg per/person/day) which accounts to 0.0203% global plastic waste in 2010.
- Almost all of Singapore's non-recyclable waste is incinerated, with the ash and some solid waste shipped to a man-made island nearby that doubles as a nature reserve.



- The National Environment Agency of Singapore was implementing initiatives aimed at increasing recycling rates and reducing waste at the source.
- These have included increasing the number of recycling bins and awareness campaigns.
- Based on the chart, although they generate lot of plastic waste but their plastic management is able to reduce most of them from polluting the sea and the 3 years forecasted trend shows it will keep going up to keep up with the waste.

https://www.kaggle.com/code/kingabzpro/singapore-recycling-and-waste-management/data

2. How it Affects Marine Life - Coral Reefs

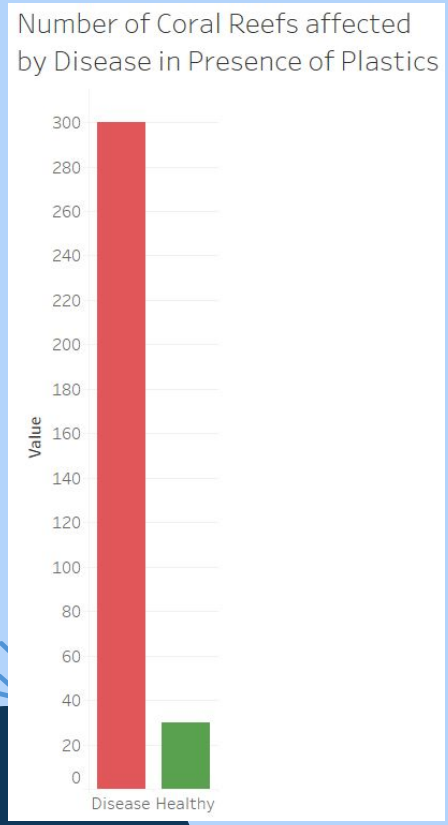


Figure 2.1

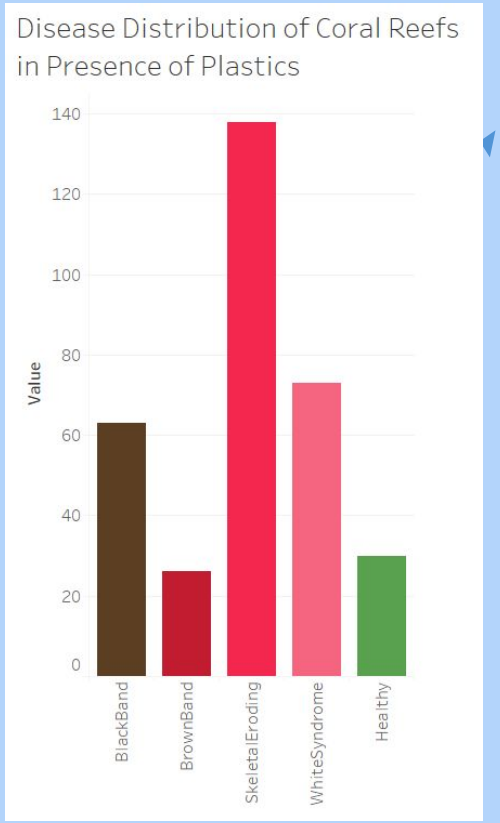


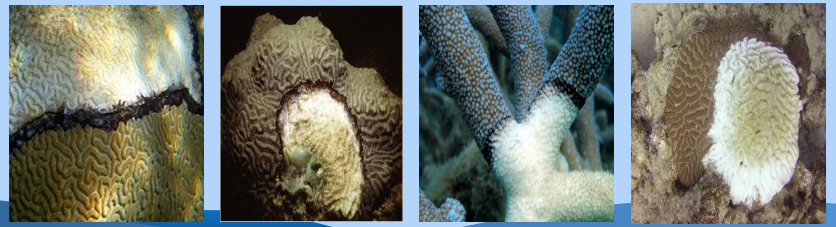
Figure 2.2

91% of coral reefs in contact with plastic suffers from coral-related diseases. [Figure 2.1]

- **19% suffers from Black Band Disease**
- **8% suffers from Brown Band Disease**
- **42% suffers from Skeletal Eroding Band**
- **22% suffers from White Syndrome**

[Figure 2.2]

Lamb, Joleah B. et al. (2018), Data from: Plastic waste associated with disease on coral reefs, Dryad, Dataset, https://doi.org/10.5061/dryad.mp480



2. How it Affects Marine Life - Coral Reefs (cont.)

- The coral species grouped into three broad classifications based on the increasing structural complexity of their colony morphologies (massive < branching < tabular).
- Using GLMER(Fitting Generalized Linear Mixed-Effects Models), plastic debris are more likely to affect coral reefs with greater structural complexity (tabular and branching) than massive. [Figure 2.3]
- However, massive structural coral exhibits the greatest increase in disease risk when it occurs. [Figure 2.4]

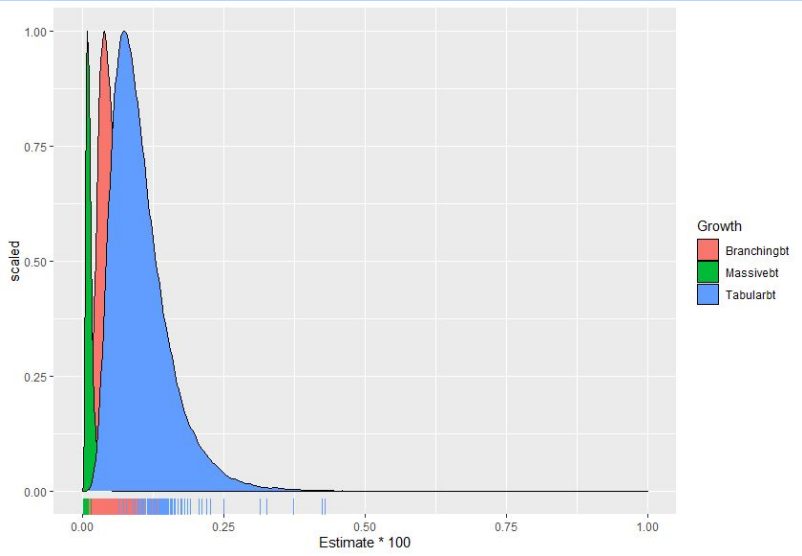


Figure 2.3: Likelihood of contact with plastic debris

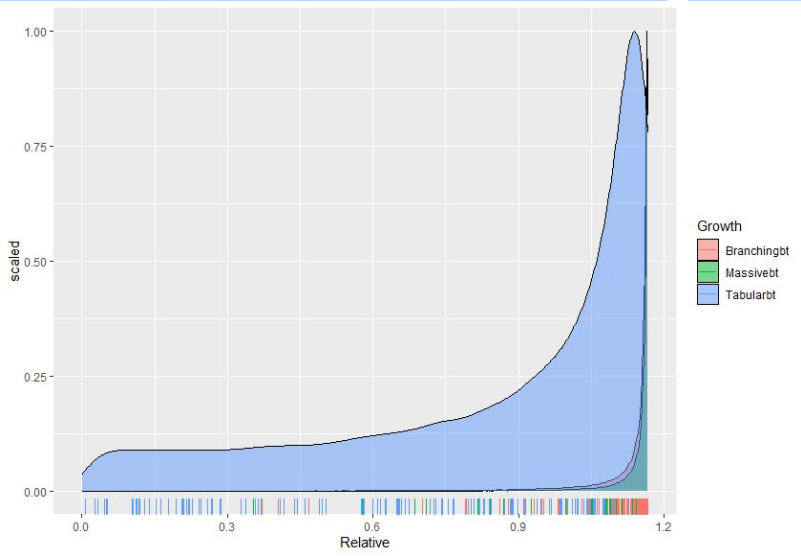


Figure 2.4: Disease likelihood with plastic debris

2. How it Affects Marine Life - Turtle

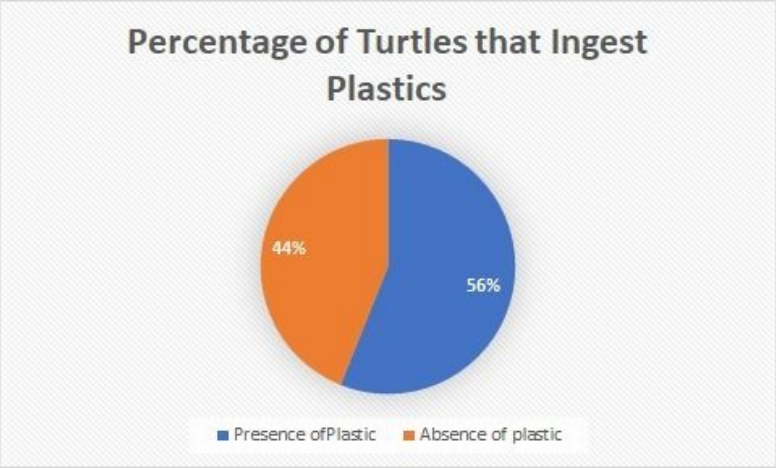


Figure 2.5

Out of 223 green turtle from reefs area in Brazil, it is found that 56% of them have traces of plastics in the stomach. [Figure 2.5]

- The accumulation of plastic in stomach led to plastic-induced satiety, which will reduce the food intake by turtles.
- This will causes them to have emaciation and nutritional deficiency that could lead to death.

Santos, Robson; Vieira, Júlia; Machovsky-Capuska, Gabriel; Kuwai, Gabriela; Félix Sobral, Mañana; Andrades, Ryan; Demetrio, Guilherme (2020), “Data for: Exploring plastic-induced satiety in foraging green turtles ”, Mendeley Data, V1, doi: 10.17632/vdcjvc3vk4.1

Solution & Recommendation

Individual

Reduce individual use of single-use plastics - implementing 3 R

National

Establishing comprehensive managed systems of government-protected areas

Implement plastic management policies and systems from other successful countries i.e. Singapore, Sweden

Global

Increased international cooperation to protect vulnerable habitats.

Conclusion

PROBLEM

Plastic debris injures and kills fish, seabirds and marine mammals

SOURCE

Main sources of plastic debris found in the ocean are land-based (low-middle income countries)

IMPLICATION

Causing fatalities as the result of ingestion, starvation, suffocation, infection, drowning, and entanglement

KEY ACTION

All of global members need to work together in conserving our biodiversity