

*Name: Nadya Low Kai En and Zori Rebecca Singer*  
*Age: 12, 12 respectively*  
*School: Pei Tong Primary School*  
*Country of residence: Singapore*  
*Theme: Loss of Biodiversity, Environmental Pollution*  
*Sub-theme: Horseshoe Crabs*

## **The Horseshoe Crab - An Unlucky Species?**

The Earth's oceans, covering 71% of its surface, represent the planet's most extensive ecosystem. Throughout time, oceans have sustained life in all forms, hosting diverse marine organisms. Responsible for generating half of the oxygen we breathe, regulating climate patterns, reducing atmospheric carbon to mitigate global warming, and driving the water cycle, the oceans play a pivotal role in sustaining life on Earth. [1] Despite their importance, we have taken their resources for granted, leading to dire consequences.

Between 1970 and 2012, marine life populations plummeted by nearly 50%. Overfishing, pollution and climate change pose significant threats, perpetuating this alarming decline. [1] Among the species affected, the horseshoe crab stands out.

### **The unique case of the Horseshoe Crab**



Figure 2: Horseshoe crab being harvested for its blue blood [5]

Horseshoe crabs are "living fossils," which have remained almost unchanged for at least 445 million years, long before dinosaurs. [6]

These animals' milky-blue blood contains the only known natural source of *limulus ameobocyte lysate*, a unique substance that detects a deadly toxic contaminant called *endotoxin*. Even a tiny amount of *endotoxin* can make vaccines or injectable drugs dangerous or even deadly. [8] The crab's blue blood is used to detect and prevent this deadly contamination and make our medicines safe.

According to Barbara Brummer, State director for The Nature Conservancy in New Jersey: "All pharmaceutical companies around the world rely on these crabs. When you think about it, your mind is boggled by the reliance that we have on this primitive creature,". [8]

The crabs' special gift has also led to their population dwindling due to overharvesting and exploitation. This has resulted in their classification as Endangered on the IUCN Red List of Threatened Species. [3]

During their breeding season, some 700,000 horseshoe crabs are removed from beaches and forced to bleed in order to extract their blue blood for use in biomedical research. After rounding up the crabs and bleeding them for medical needs, pharmaceutical companies return the crabs to the oceans. However, up to 30% of bled crabs die even after they are put back into the water. [7] This practice, combined with overharvesting of the crabs for fishing bait, has caused a drastic decline in the species in the region in the past few decades. [8]

## Impact of plastic pollution on horseshoe crab

To make matters worse, the population of the horseshoe crabs is also negatively impacted by the impact of plastic pollution.

Research indicates that plastic usage has increased 20 fold in the last five decades and is forecast to double again within the next two decades. If current plastic production rates persist and proper disposal methods are not implemented, by 2050, the quantity of plastic in the world's oceans could surpass that of fish. [2] Plastic items such as straws and bags can travel hundreds of kilometers through drainage, ultimately reaching marine ecosystems. [4] It is estimated that 8.8 million tons of plastic waste enter the ocean annually, with this amount expected to double by 2025.

Plastic pollution affects nearly all marine environments, ranging from sandy shores to the deepest ocean depths. Every breeding season, horseshoe crabs migrate from deeper waters to the shallows, frequently becoming trapped in stray plastic bags and abandoned fishing lines while exploring these habitats.



Figure 1: Horseshoe crabs on the beach [9]

Research on the diet of horseshoe crabs shows that filter feeders, such as clams, mussels, and oysters, swallow tiny plastic particles, which are then transferred up the food chain to the horseshoe crab. [4] Horseshoe crabs and their coastal habitats have been directly impacted by plastic pollution. This, in turn, impacted many other animals in the ecosystem that depend on horseshoe crab eggs and adult crabs for survival causing declining population numbers of these creatures.

## **Hearing from others**

Schools have been encouraging students to play a part in marine conservation. Mdm Angela Tay, a teacher formerly in charge of the Environmental Science Club in Pei Tong Primary School for the past 4 years, has this to say when asked about what her students do to promote marine conservation:

*“By leaving a box in every classroom, we encourage the whole school to carry out recycling of paper and plastic bottles to ensure that unused paper and unused plastics do not have to go into the incinerator or be discarded straight away into the sea.”*

According to Mdm Tay, students would eventually assume leadership roles in the world. Therefore, it is important to educate them on the importance of preserving marine ecology and maintaining diversity, whether on land or at sea, which is crucial for sustaining the human race.

Mdm Tay also noted the reliance on the diversity of various organisms to produce medicines required to combat various diseases, the horseshoe crab's contribution to the production of the Covid-19 vaccine.

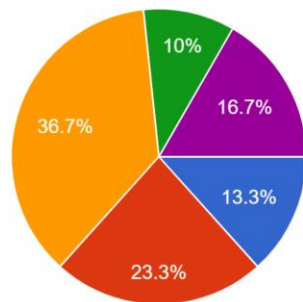
She stressed that while there has been a necessity to use horseshoe crab blood for vaccine manufacturing, nature should be respected, and effort made to reduce the impact on horseshoe crab populations. For example, cooperation during government-imposed lockdowns prevented widespread infections.

## **Survey**

Following the interview with Mdm Tay, we conducted a survey amongst our fellow classmates to understand their awareness about horseshoe crabs and the students' involvement in marine conservation. The survey resulted in several interesting conclusions.[12]

On a scale of 1-5, do you think you play a part in helping marine conservation

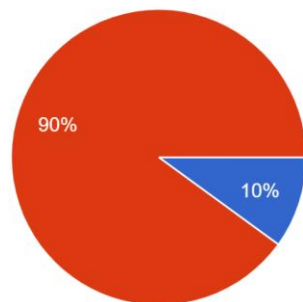
30 responses



- 1 (I don't help at all)
- 2 (I help rarely)
- 3 (I help occasionally)
- 4 (I help most of the time)
- 5 (I always help whenever I can)

Do you think that we are doing enough to help our oceans?

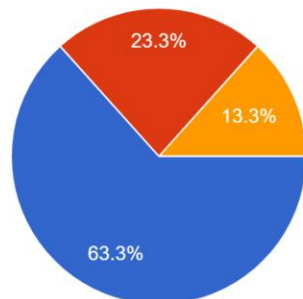
30 responses



- YES
- NO

Are you aware of the animal known as the horseshoe crab?

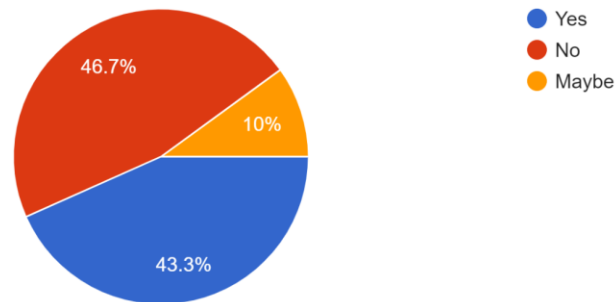
30 responses



- Yes, I know about them.
- Yes, I have heard about them but I am not too sure.
- No, I have not heard about them.

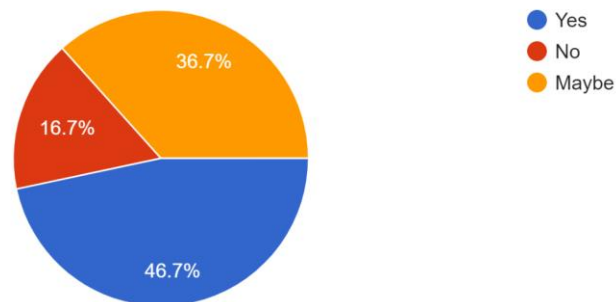
Are you aware of the role they play on the survival of the human race?

30 responses



Do you think a pollution-free and clean ocean is possible?

30 responses



## **Analyzing survey results**

The survey results showed that majority of people contribute to marine conservation only occasionally. Vast majority of respondents did not think that they were doing enough to contribute to marine conservation and to help our oceans. Our community is aware of the ongoing problem facing humanity from sea pollution.

While most people have heard about horseshoe crabs, the majority of them were not aware of the important part they play in the survival of humanity and did not realise that people are heavily dependent on them for vaccinations.

About half the students believe that it's possible to keep the oceans pollution-free, yet the other half either disagreed or were unsure. This shows that we each need to continue to play our part in conserving our oceans and marine ecology.

## **Solutions**

There are some ongoing solutions for the overharvesting of horseshoe crabs. Horseshoe crab bait fisheries can be managed better to ensure that populations are large enough to support the needs of other species that depend on horseshoe crab eggs as an essential food source. Policies that reform the horseshoe crab bleeding industry to reduce mortality and other impacts can be implemented. Pharmaceutical companies can be encouraged to adopt a synthetic alternative to horseshoe crab-derived LAL in testing procedures. [10]

Environmental conservation can help in preventing the emergence of another global pandemic, which resulted in demand for horseshoe crabs' blood by pharmaceutical companies. We can also help the oceans and the horseshoe crabs by simply reducing our carbon footprint. Simple measures such as insulating our homes, using less water and switching to renewables can reduce our carbon footprint and slow down the impact of climate change on our oceans.

## **Conclusion**

Human activity over the last 200 years has had a major negative impact on our oceans and certain species. [11] Yet, there is an opportunity to reduce this impact. After all, do we really want to be held responsible for the extinction of yet another precious animal that is a living fossil? Do we want to prevent our future generation from marvelling at the unique ancient creatures known as horseshoe crabs?

## **Sources**

[1]

<https://www.wwf.sg/nature-biodiversity/marine-conservation/>

[2]

<https://www.washingtonpost.com/news/morning-mix/wp/2016/01/20/by-2050-there-will-be-more-plastic-than-fish-in-the-worlds-oceans-study-says/>

[3]

<https://www.iucn.org/news/species-survival-commission/202006/international-horseshoe-crab-day-a-celebration-flagship-species-coastal-habitat-conservation#:~:text=The%20world's%20horseshoe%20crab%20populations,from%20coastal%20reclamation%20and%20development.>

[4]

<https://www.criver.com/eureka/the-environmental-burden-of-plastics-microplastics>

[5]

<https://www.wired.com/2011/06/st-processcrab/>

[6]

<https://myfwc.com/research/saltwater/crustaceans/horseshoe-crabs/facts/#:~:text=Horseshoe%20crabs%20are%20%E2%80%9Cliving%20fossils,are%20to%20crabs%20or%20lobsters!>

[7]

<https://defenders.org/wildlife/horseshoe-crab#:~:text=Overharvest%20and%20exploitation%20by%20the,blue%20blood%20of%20biomedical%20purposes.>

[8]

<https://www.nationalgeographic.com/animals/article/covid-vaccine-needs-horseshoe-crab-blood>

[9]

<https://horseshoecrab.org/poems-tales-images/artist-gallery/ariane-mueller/>

[10]

[eviverestore.org/coalition-forms-to-save-the-horseshoe-crab/](http://eviverestore.org/coalition-forms-to-save-the-horseshoe-crab/)

[11]

<https://www.futurelearn.com/info/blog/how-to-reduce-your-carbon-footprint-tips>

[12]

[https://docs.google.com/forms/d/1j4wTiJzzcDMuu10tBhAoZxIsiUKHD9ILfYBMcd3K6o0/viewform?edit\\_requested=true#responses](https://docs.google.com/forms/d/1j4wTiJzzcDMuu10tBhAoZxIsiUKHD9ILfYBMcd3K6o0/viewform?edit_requested=true#responses)