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Pollutions in the Oceans

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Abstract: Water covers more than 70% of the earth's surface, with the oceans accounting for 96 percent of that. Many living organisms, such as fish, marine mammals, algae, plants, and so on, call the oceans home. They also assist humans in a variety of ways. However, this environment is currently in grave jeopardy. Over the decades, the fast-growing human population has resulted in a rise in human demands and wants, resulting in more production and waste, as well as more pollutants released into the environment, especially the oceans. This research focuses on the different types and sources of pollution and pollutants in the marine ecosystem, as well as the effects and consequences that pollution can have on water quality and living creatures, particularly pollution from wastes and its influence on oxygen production. An online survey, addressing people of various ages, places, and vocations, is used to investigate people's awareness, and understanding. The quantitative responses are then compiled and analyzed to form a basis for a deeper understanding of how the danger can be mitigated. While the purpose of the study is to increase people's awareness and understandings of the pollution in the oceans and the marine ecosystems and seek measures to decrease the pollution released recommendations will be formulated on the basis of the international literature and the quantitative research's results.

Keywords: pollution; ocean; human; awareness; understandings

1 Introduction

Most people are well aware that the earth we live on is covered by water for more than 70%. Water is fundamental for all living beings and is one of the world's most valuable natural resources. Water derived from natural resources encompasses both saltwater and freshwater, and it can be found in a variety of water bodies in a variety of locations. Oceans are the largest bodies of water.

Oceans are the most diversified environment on the planet, providing innumerable benefits to humans and other living species. First, oceans assist in climate regulation by absorbing carbon dioxide and additional heat, lowering the earth's temperature. Without the oceans, there would be no weather patterns and the temperature would be unstable enough to support life. According to a World Meteorological Organization report, more than 90% of the energy trapped by greenhouse gases ends



up in the oceans. Second, oceans provide a source of food for both animals and humans. It's a food-rich ecosystem that feeds billions of people. It is also a mode of transportation. Although it takes longer than air or land transportation, it is more cost-effective and practical when moving large cargo containers across vast distances. Fourth, oceans are vital to the economy. Fisheries, tourism, and other ocean-related activities generate jobs and increase currency circulation. Fifth, the ocean is the biggest habitat on earth, it is a home to many organisms (NOAA, n.d.; FAO, 2017). The benefits of the oceans are not limited to what was mentioned earlier, but those have been studied and are the most well-known to human.

2 General presentation of water pollution

Goel (2021) defines water pollutant as physical, chemical, or biological factors that cause detriment or damage on aquatic life and on those who consume the water. A factor could be beneficial or harm to the environment depends on the conditions. In some cases, naturally existing chemical elements are essential for the ecosystem, but when they are present in excessive quantity, it leads to water pollution – changing in quality and/or composition to become less suitable for specific purposes.

The cause of pollution in water is mainly from anthropogenic activities. The sources of the water pollution caused from anthropogenic activities could be classified into three major sources, which are domestic, agriculture, and industry (FAO, 2017). Domestic water pollution refers to the discharge of waste and sludge that contain organic matters and soap to the water bodies, usually rivers and seas (eni school energy&environment, n.d.-b). Agricultural water pollution is generally coming from the leakage or the discharge of water that is already polluted from chemicals, fertilizers, and pesticides. Agricultural pollution is threatening because the pollutants are usually not biodegradable. It stays in the water bodies and soil while destroying and damaging lives and the environment (eni school energy&environment, n.d.-a). Agricultural pollution tends to increase as the world's population increases because the demand of food is higher. Industrial water pollution appears to be the most dangerous and threatening. Pollutants from industrial origin contain all kinds of substances that are toxic and non-biodegradable. The industrial pollutants are coming from production processes, accidental breaks or leaks of containers containing polluting products, or the pollutants could be carried by rainfall to the water bodies (eni school energy&environment, n.d.-c).

The cause of marine pollution is from human, as mentioned in the previous paragraph, but the introduction of the substances from human into the marine could be done directly or indirectly. The sources of the pollution in the oceans are mainly



land-based, it is said to be 80% of the pollution in the marine environment (NOAA, 2021).

One of the most threatening pollutions in the marine ecosystem is the runoffs. Runoff is a process occur when water, including rainwater, snow melts, and irrigation, flows along and makes its way to rivers, lakes, ponds, seas, and oceans. Polluted runoff is when the runoff is mixed with chemicals, toxic materials, oil and gas, dust, fertilizers, bacteria, salt, heavy metals, and debris. Rainwater or irrigation washes chemicals and fertilizers in the soil and on land or road surfaces to the water bodies, resulting in runoffs from agricultural and industrial areas. (National Geographic Society, 2012).

Meanwhile, it may not appear to be linked, yet one of the causes of pollution that impacts the oceans is atmospheric pollution. Atmospheric pollution, in this situation, can be defined as pollutants delivered by the wind to the oceans. SO₂ and NO_x from combusting processes, greenhouse gases that could raise ocean temperatures and contribute to ocean acidification, and light dust and debris mixed with dangerous chemicals and heavy metals are examples of atmospheric pollution (Islamic University of Gaza, n.d.).

The shipping industry also contributes a significant amount of maritime pollution. Not only can carbon dioxide, greenhouse gases, oil spills, discharges, rubbish and sewage, and bilge water (which may contain water, oil, urine, detergents, solvents, chemicals, pitch, particles, and other items) that damage the oceans and destroy marine living organisms (Islamic University of Gaza, n.d.), shipping activities may contribute to noise pollution, and ship collisions may result in the death of marine mammals in the vicinity (IMO, n.d.). Ocean dumping, deep sea mining, oil spills and gas leaks from oil and gas drilling, and offshore mining are some of the other forms of marine pollution.

2.1 Types of water pollution

Depending on the indication utilized, water pollution can be identified and categorized into a variety of categories. It can be divided into three categories based on its source: point-source, nonpoint-source, and transboundary (Mayer, 2019). Physically, chemically, and biologically, it can also be classed based on the properties of the water that are influenced. Pollutants and their sources could be used to define pollution kinds. Table 1 summarizes the contaminants and their sources.



Table 1 Type and source of marine pollution (data source: GDRC, n.d.)

Type of pollutants	Sources
Excessive nutrients	Runoffs, sewage, forestry, agriculture, land use, airborne from power plants, car, et cetera
Sediment and residue	Erosion from mining, forestry, agriculture, and coastal dredging and mining
Pathogens	Runoffs, sewage, and livestock
Non-native species	Ballast water, canals linking bodies of water, and fishery
Toxins that persist, such as PCBs, heavy metals, DDT, and others	Industrial discharge, wastewater discharge, land-based sources, pesticides from agricultural activities, forestry, domestic waste, and runoff from landfills
Oil	Cars, heavy machinery, industries, oil tanker operation, shipping activities, accidental spills, and offshore drilling
Plastics	Fishery, cargo and cruise ships, shipping activities, oceans dumping, ocean littering, atmospheric pollution, landfills, and industrial waste
Radioactive substances	Discarded nuclear submarine and military waste, atmospheric pollution, and industrial waste
Thermal	Colling water from power plants and industrial origins
Noise	Shipping activities, supertankers, and large vessels and machinery

source: GDRC, n.d.

One of the most threatening pollutants is plastic. Plastics that are released into the oceans became harmful and toxic to marine organisms and the ocean itself overtime as it does not breakdown easily and release chemicals to the oceans. Plastics are frequently infused with chemicals to make them stronger, more flexible, and long-lasting. These additives extend the product's life, making it more difficult to break down; some could take up to 400 years to break down (Parker, 2021a).

3 Pollution's effects on aquatic environment

Changes in water or aquatic ecosystems that make the water unsuitable or dangerous to humans and/or other living species are referred to as water pollution. Eutrophication, which may result in decreased biodiversity in the aquatic ecosystem, and plastic pollution, which degrades the seafloor, are some of examples (Pohl et al., 2020), toxic chemicals and heavy metal that kill and damage fish, aquatic invertebrates, crustaceans, zooplankton, algae, and marine mammals (IPEN, 2021; Han et al., 2020; Zeitoun, 2014), ocean acidification effects on marine ecosystems (Kroeker et al., 2013; Guinotte and Fabry, 2008), impacts on oxygen production, adverse effects on human health, and effects on the economy (OECD Water - Water, n.d.). Since waters are one of the most important habitats for living species and a valuable resource for humans, water pollution affects more than just life. Awareness of people based on quantitative data

4 Methodology

The goal of the study is to learn more about people's knowledge and understanding of pollution in the oceans and marine ecosystems, as well as to find ways to reduce pollution. Quantitative data was obtained through an online survey (Google Form) that targeted people of various ages, localities, and jobs to better understand people's knowledge and understandings. The 16-question survey of demographic and ocean pollution-related data (see Annex) was produced in two languages: English and Thai. The survey was then distributed using the snowball sampling technique, in which participants were requested to forward the surveys to more recipients. The data was collected and processed using SPSS 13 software, which is a statistical analysis program for social research. The study was based on the hypothesis that individuals who live near water bodies and/or work or study in an environment-related sector will have a better comprehension and awareness of pollution in the oceans.

4.1 Primary data

There are 226 responses from participants, representing a wide range of ages, localities, jobs, and points of view. However, these responses do not represent the worldwide population; rather, they reflect the participants' understandings and awareness.

Age: because the snowball sample technique began with a group of university students earning a bachelor's degree, the largest age group that participated in the survey was 20–24 years old.

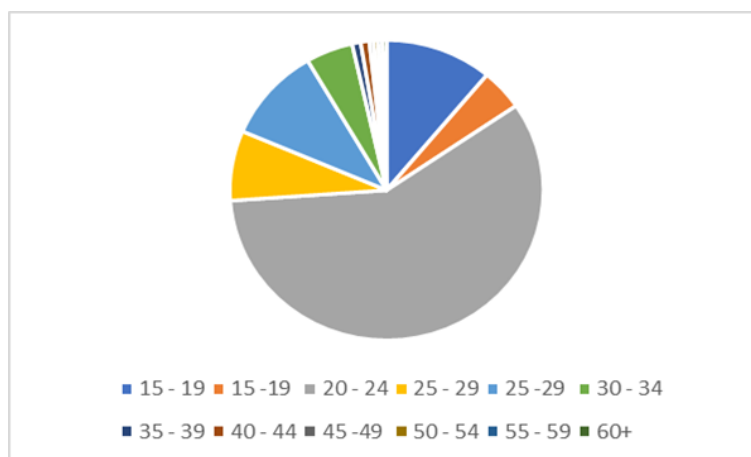


Figure 1 Age range of the participants

Localities: the majority of the participants were Asian, 181 participants from 226, which is 80.1%. Followed by 21 participants from Africa (9.3%), 12 participants from North America (5.3%), 9 participants from Europe (4.0%), 2 participants from Australia (0.9%), and 1 participant from South Africa (0.4%).

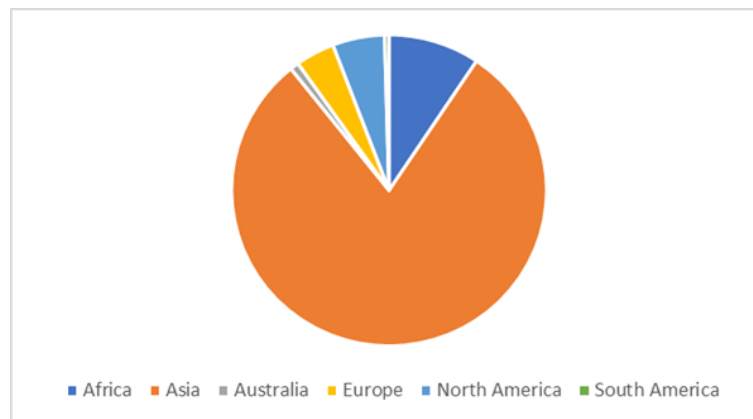


Figure 2 Locations of the participants

Background education: most of the participants has or are pursuing bachelor's degree (66.8%), high school (20.8%), master's degree (8.9%), Ph.D. (0.9%), and diploma (0.4%). 5 participants (2.2%) prefer not to say their educational background. Background education of the participants was asked to determine the hypothesis, if educational levels are related with understandings and awareness of the pollution.

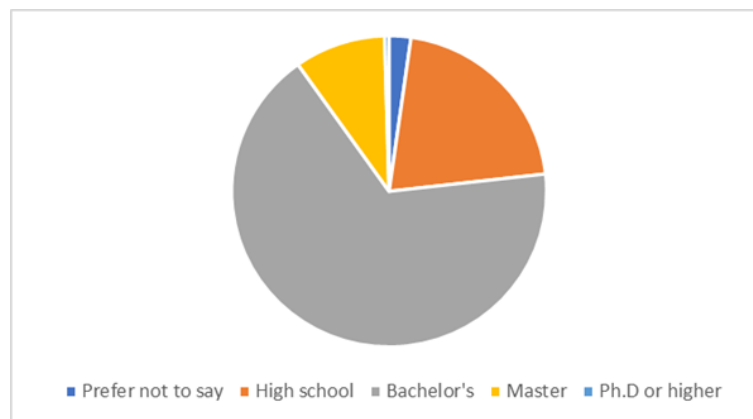


Figure 3 Background education of the participants

Job: job titles are diverse and have many varieties, which is the reason the data is classified as student and people who work. This question was asked to collect

further data about participants' field of studies and/ or work, whether if it is related to the oceans or the environment. This field of data helps to analyze if there are patterns between people who are related to the environment and their understandings and awareness about the pollution. Students were the majority of the participants as the total was 61.5%, while working people are 38.5%.

Faculty and major: this question was asked to determine ration between students who study in field related to environment and ocean and students who study in other fields. This will help to analyze the patter for the hypothesis. The students who study in the related field are calculated as 10.8% and there are 89.2% of students who study in other fields.

Source of oxygen production: participants thought that forests are the main source of oxygen production (50.9%), then oceans (30.5%), Amazon rainforest (14.6%), and mountains (3.6%).

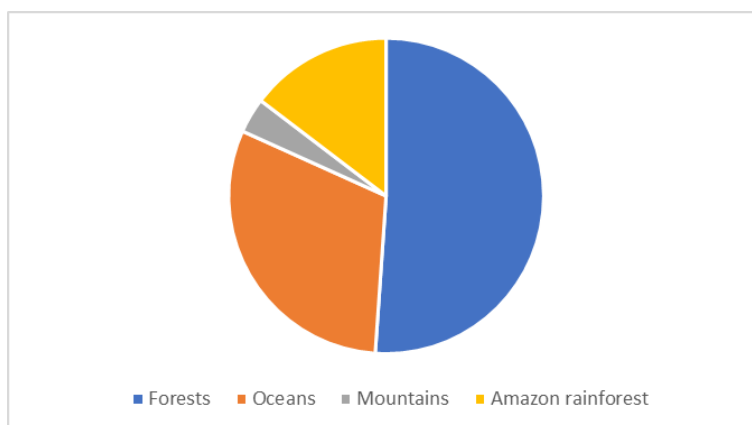


Figure 4 Participants' opinions about source of oxygen production

Quality of the water bodies: 59.3% of the participants think that the quality of the water bodies that they visited were fair, 33.2% think that it was good in quality, and 7.5% think that it was poor in quality.

Human responsibility: 93.40% of the participants think that humans are responsible for the health of the oceans, while 6.6% think that they do not have anything to do with the health of the oceans.

Human activities' impact on the oceans on a scale of one to five, one represents no impact at all and five represents a significant impact: 66.4% of the participants think that human activities have had a significant impact on the oceans, 23.0% on a scale of 4, 10.2% on a scale of 3, and 0.4% on a scale of 2.

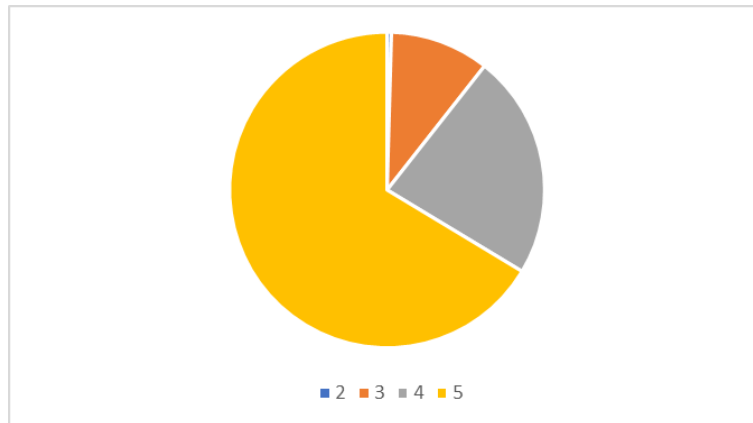


Figure 5 participants' opinions about impact of human activities on the oceans

Knowledge and understandings on a scale of one to five, one represents not being informed at all and five represents being well informed: 4.0% of the participant think that they are well informed, 34.1% think that they are fairly informed, 43.8% think that they are somewhat informed, 15.0% think that they are slightly informed, and 3.1% think that they are not informed at all.

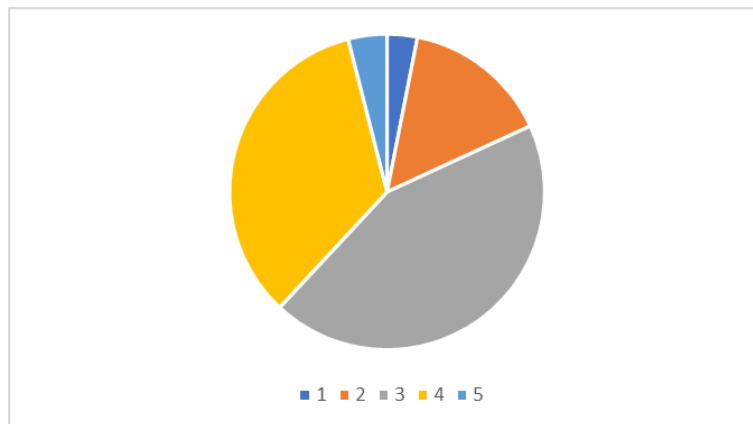


Figure 6 Participants' understandings about marine pollution

4.1.1 Cross tabulation

Cross tabulations are used to examine the relationship between demographic data and the participants' perceptions and awareness. It should be noted that the results of the analysis do not reflect the views of the entire world's population. It just represents the views of 226 individuals. One of the interesting finds from many

cross tabulations is from the cross tabulation between background education and participants' opinion about importance of the oceans.

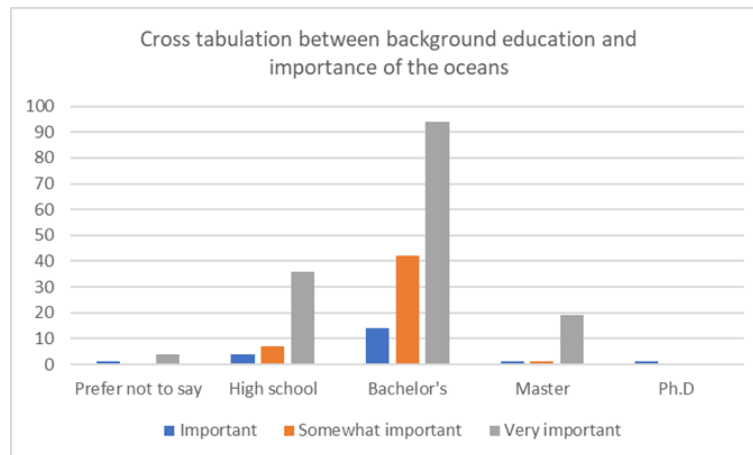


Figure 7 Relationship between background education and importance of oceans

4.1.2 Group statistics and independent sample t-test

The tests were conducted from the data based on the focus of participants who know that the main oxygen production is from the oceans and the participants who does not know. The level of significance set in this test was 0.05. The only group that has statistically significance difference value is the group of “What was the quality of lakes, rivers, seas, or oceans you visited”. The group has significance value of 0.000, which is less than the level of significance set in the first place. This indicate that the value that we should be dealing with is equal variances assumed and the significance value (2-tailed) is 0.02, which is considered as statistically significance difference. The other groups' values do not indicate any statistically significance difference. Full analyzation of groups statistics and independent sample t-test can be found in Appendix B – Group Statistics, and Appendix C – Independent Samples T-Test.

4.2 Results

Statistical tests were used to discover if participants who live near water bodies and/or work or study in an environment-related sector have a better understanding and awareness of ocean pollution. The independent samples t-test shows results that there are no significance difference values, which means there is no pattern in the relationship between participants' location and background education with their awareness and understanding about the ocean pollution.



Conclusion

Oceans are huge body of saltwater that is a habitat for many lives and provides many benefits to living organisms, include humans. However, human activities for instance, agriculture, industry, fisheries, water transportation, and many more are contributing to pollution in the ocean. The pollution creates many adverse effects to the oceans and living organisms that has symbiotic relationship with it. The effects of the pollution could harm and kill marine organisms, which could lead to major problem such as reduction of oxygen productivity. Marine pollution could also have impacts on human health, economy, and society.

The survey was conducted to understand people's awareness and understanding of the pollution in the oceans and the marine ecosystems. The responses of 226 participants indicate that they are not well aware and understand on how the oceans are important to human and what are the problems oceans are facing. This is a result of 226 participants, and it does not indicate understandings and awareness of global population as a whole.

Marine pollution and any other pollution are created from human. Thus, human should be the one who resolve the problems. Pollution developed to the point that the marine ecosystem is in danger over time, clearly, it would also take time to resolve and restore the oceans to be safe again. The pollution can be reduced starting at one person. Reduce the demand for new things as much as possible, reuse to cut the production, and recycle to lessen the amount of new raw materials. Certainly, one person would not help to resolve the whole problems. The cooperation and participation of government, policy makers, entrepreneurs, researchers, scientists, and every global citizen are needed to make changes happen.

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Annex

A) Questionnaire

The survey consists of 16 questions, including demographical questions and questions related to ocean pollutions. The questions are as follow:

1. What is your age?
2. Where is your home located?
3. What is your educational background?
4. If you are a university student, please specify your major or faculty
5. What is your job title?
6. Where do you think is the main source of oxygen production?
7. How often do you go to lakes, rivers, seas, or oceans per year?
8. What was the quality of lakes, rivers, seas, or oceans you visited?
9. Do you think oceans are important to human?
10. Do you think humans are responsible for the health of the oceans?
11. Do you think that human activities have an impact on the oceans?
12. To what extent do you believe that you are informed about local and global problems of the oceans?
13. In your opinion, which of the following activities created the most pollution to the oceans?
14. Are you willing to change or adjust your lifestyle to be more ocean-friendly and/or eco-friendly?
15. Based on your consumption, are you considering on buying sustainable and/or eco-friendly products?
16. If you are considering on buying sustainable and/or eco-friendly products, why is that so?