

# The Current Global Situation of Plastics and Forecast of Plastic Waste

Lubomíra Kubíková<sup>1</sup> and Stanislav Rudý<sup>2</sup>

<sup>1</sup> University of Economics in Bratislava, Department of Tourism, Faculty of Commerce, Dolnozemska cesta 1, Bratislava 5, 852 35  
Slovak Republic

<sup>2</sup> University of Economics in Bratislava, Department of Corporate Financial Management, Faculty of Business Economics with seat in Košice, Tajovského 13, Košice, 041 30  
Slovak Republic

lubomira.kubikova@euba.sk  
stanislav.rudy@euba.sk

<https://doi.org/10.53465/EDAMBA.2023.9788022551274.128-137>

**Abstract.** Plastics cause one of the most severe problems tourism operators must face. They are relatively cheap, versatile and have a long-lasting material whose durability exceeds the life of the products made from it. As a result, the production of plastic waste is increasing worldwide. The durability of plastics also means that their uncontrolled disposal is problematic because they can last a very long time in the environment. Plastics pose a threat not only to a healthy environment but also to society. This post will focus on the current state of plastics and plastic waste for the monitored period in selected countries. Our findings point out the distribution of plastic production. We investigated the biggest polluters of global mismanaged plastic waste, polluters of global mismanaged plastic waste by continent, the annual global production of plastics, the rate of decomposition of plastic items, and forecast the expected development of plastics production.

**Keywords:** Plastics, Pollution, Circular Economy, Biodiversity.

**JEL classification:** O10, C53, L65

## 1 Introduction

Many governments and organizations are working hard to tackle plastic waste and plastic pollution. The problem is worsening, and efforts to fix it fail to keep up. The solution lies in the production of plastic and its loading. Plastic packaging should be fully reusable, recycled or composted. A circular economy for plastics will also help

in the fight against the climate crisis and the loss of biodiversity. At the same time, it will have a positive social and economic impact. Stopping plastic pollution could be initiated by a plastic pollution treaty that brings together governments, producers and consumers to achieve clear targets for reducing, collecting and recycling plastics and promoting sustainable alternatives. Almost everything around us is made of plastics, and they are synthetic or semi-synthetic polymerization products composed of organic condensation or additive polymers. Plastic waste harms all living things, including humans. Political and financial instruments to support the use of recycled plastics and other ecological alternatives could bring a reduction in plastic production. Waste is generated by each of us, and by sorting and recycling, we save natural resources and energy. In the circular economy, waste is an important raw material. We should not unnecessarily deprive ourselves of material that we can reuse. Plastics are one of the worst recyclable materials and are the biggest burden on our environment, as they appear on the market in many forms and can only be recycled into a lower-quality product. The pollution of water surfaces and the natural environment with plastic waste alarms many ecologically minded people. The success of the invention of plastics in the last century also caused a flood of plastic waste all over the world. We should take more measures to reduce the amount of plastic waste because it is a growing problem. Solutions exist, but they are not without risks. The current pace of plastic production and consumption is unsustainable. In addition to the amount of waste, plastics also increase emissions, and the pace of plastic production is a problem for the whole world. The risks posed by plastics are largely due to unsustainable production and consumption. The pandemic and climate change are increasing public attention to the current plastic crisis. The best option is to move towards a sustainable and circular plastic economy.

## **2 Theoretical background**

Plastics represent a real threat to the environment. The rapid production and consumption of plastic products exceed society's ability to deal with them. The contribution of the author Parker draws attention to the negative effects of plastic pollution, which are the most noticeable in the developing countries of Asia and Africa due to ineffective or non-existent legislation regulating the handling of plastic waste and its disposal (Parker, 2019). However, it should be noted that other countries in the world also have a problem with plastics. According to EPA (2023), plastics represent a growing segment of municipal solid waste; for example, we present the production of plastics in 2018, while the US produced approximately 35.7 million tons of plastics, which was 12.2% of municipal solid waste generation. According to the European Commission (2018), approximately 25.8 million tonnes of plastic waste is produced by Europeans annually, and less than 30% is collected for recycling. In contrast, author Liang et al. (2021) point out China as the world's largest producer and consumer of plastics. In 2019, approximately 27 million tons of plastic waste were produced. For this reason, China has implemented ambitious plans, which their aim is focused on solving this problem. Geneva Environment Network (2023) points out the

Global Plastics Outlook statistics, which highlight the world's production of plastic waste in 2019. The world produced 353 million tonnes of plastic waste. In 2020, the number increased, and 367 million metric tons of plastic waste was generated by the world. It is assumed that plastic waste will increase exponentially in the coming years.

In addition to the increasing consumption of plastics and subsequent plastic waste generation, another topic needs attention. Authors Williams and Rangel-Buitrago (2022) consider recycling and the circular economy as key aspects leading to the effective disposal of plastics. According to author Liu et al. (2022), plastic pollution negatively affects outdoor recreational activities. Due to the mentioned pollution, China and the European Union are trying to combat this problem by introducing measures aimed at recycling and reuse. According to the Geneva Environment Network (2023), relying only on recycling is an insufficient solution. The fact remains that currently, 14% of plastic waste is collected for recycling. However, the European Commission has a different point of view. According to the European Commission (2023), in accordance with a European Strategy for Plastics in a Circular Economy (2018), the production of plastics and the incineration of plastic waste contribute to an increase of 400 million tons of CO<sub>2</sub> annually. Using recycled plastics can help reduce the dependence on the extraction of fossil fuels to produce plastics and thus contribute to the minimization of CO<sub>2</sub> emissions. An EU action plan for the circular economy, adopted in December 2015, became an important document for plastic problems within EU member countries. The plan was expanded with a new strategy, i.e. the European Strategy for Plastics in a Circular Economy, which was adopted in 2017 as part of an action plan (European Commission, 2023). As part of the set goal, all plastic packaging should be recyclable by 2030. (A European Strategy for Plastics in a Circular Economy, 2018).

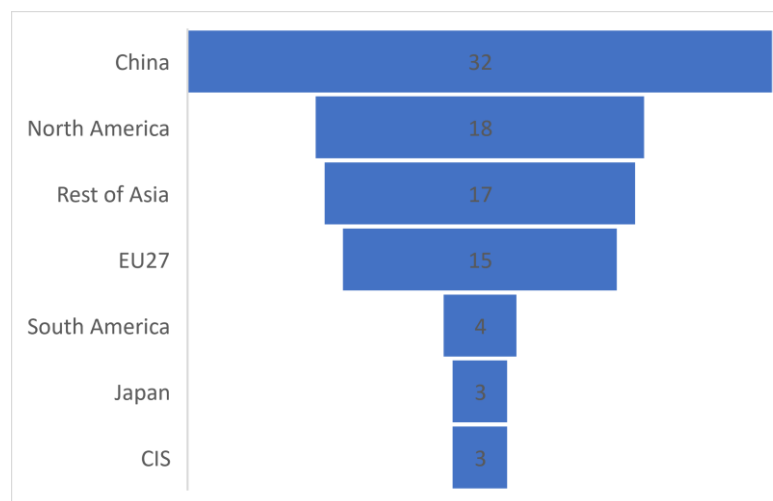
### **3 Methodology**

The main aim of our paper is to identify the current global situation of plastics and plastic waste based on the processing and identification of statistical databases. The methods of deduction, comparison, analysis, deduction, and prediction were used in our paper. For a better presentation of individual data, we used six graphs. The paper is divided into two main parts. In the first part, we present a brief theoretical basis that familiarizes us with the investigated issue. In the second part, we deal more closely with the identification of statistical data. We used various databases such as Statista, Our World in Data, EPA, and Plastic Europe. In this part, we examined the annual global production of plastics in the observed period, the distribution of the global plastics production in 2019, the top 10 polluters of global mismanaged plastic waste in 2019, polluters of global mismanaged plastic waste by continent in 2019 and the rate of decomposition of plastic items of marine litter expressed in years in 2018. In the final part, we present the forecast of the expected development, where we created a structure from time series data by using exponential smoothing models and autoregressive integrated averages. We worked with the most available current data, mainly from 2019 to 2021. Exponential smoothing is one of the oldest and most

studied time series forecasting methods. The time series values follow a gradual trend and display seasonal behaviour in which the values follow a repeated cyclical pattern over a given number of time steps. A statistical model is autoregressive because it predicts future values based on past values. This data allows us to expand the research with a larger sample to compare these results.

## 4 Result

Plastics form an important part of the functioning of the economy. They are found in every sector. Their usability and practicality make them revolutionary inventions that have been used for several decades (Parker, 2019). However, in addition to their usefulness, we encounter several negatives, significantly burdening the environment and affecting biodiversity. Studies from around the world have not shown any particular country or demographic to be the most responsible. It must be noted that society generally creates the most waste. Although the level of pollution in individual countries varies slightly, individual statistical data show different values that move countries to a higher or lower place in the ranking, but in the end, whether it is plastic waste or something else, these facts trouble all countries. It should not be forgotten that not all countries report all statistical data. (Moore, 2023). In this part of our paper, we graphically point out the current situation of plastics based on the identification of data from statistical databases.



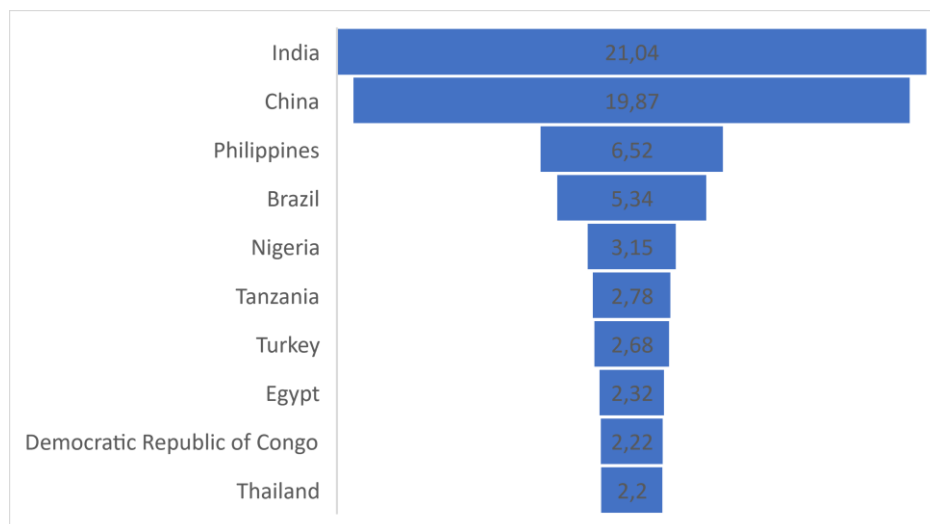
**Graph no.1** Distribution of the global plastics production, 2021 (%)

Source: own processed based on data retrieved from Plastic Europe, 2022

The graph no. 1 shows the distribution of global plastics production, including plastics production from polymerisation and production of mechanically recycled plastics for the observed period in 2021. The graph compares selected countries. The values are expressed in percentages. In 2021, the total of produced plastics reached

390.7 million tonnes (Plastic Europe, 2022). The graph shows that in 2021, China reached almost one-third of the world's plastic production, which is 32%, North America reached 18% and the rest of Asia 17%. The European Union had a share of 15% of plastic production. CIS countries representing the Commonwealth of Independent Countries, such as Azerbaijan, Armenia, Belarus, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Turkmenistan, Uzbekistan, and Ukraine, have reached 3% of plastic production. If we take Asian countries into account, they reached approximately 55% of the total production of plastics. North and South America 22% in total. The following graph no. 2 shows the top 10 polluters of global mismanaged plastic waste in 2019.

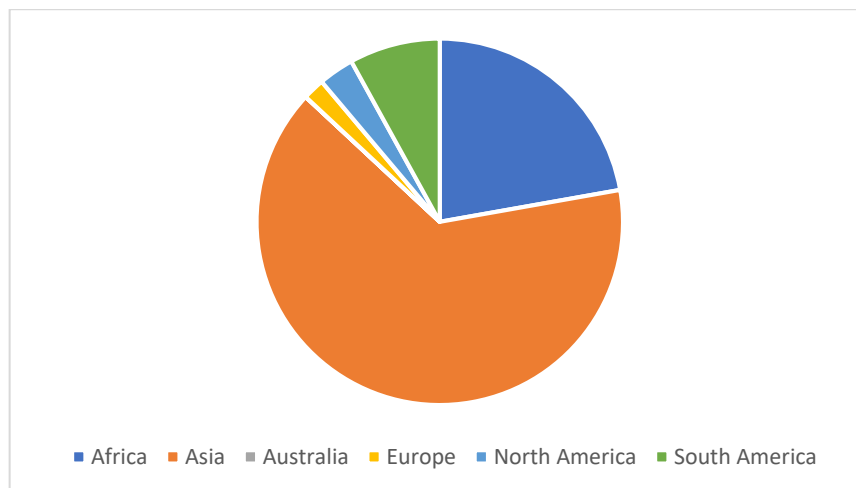
Graph no. 2 shows the top 10 largest global mismanaged plastic waste polluters in 2019. The values are expressed in percentages. Mismanaged plastic waste represents plastic that is either littered or inadequately disposed of. It does not include waste that is exported overseas, where it may be mishandled. In 2019, China and India reached the highest percentage, China 21.04%, and India 19.87%.



**Graph no.2** Top 10 polluters of global mismanaged plastic waste, 2019 (%)

Source: own processed based on data retrieved from Our World in Data 2021

Raking of the top 10 also includes countries such as the Philippines, Brazil, Nigeria, Tanzania, Turkey, and Egypt. Democratic Republic of Congo and Thailand closed the list of the top 10 largest global mismanaged plastic waste polluters. They reached approximately 2%. These countries are on this list because they do not have sufficient legislation to regulate how waste should be properly treated and, subsequently, how it should be disposed of. In the case of individual continents, we can draw attention to the following data in graph no. 3.

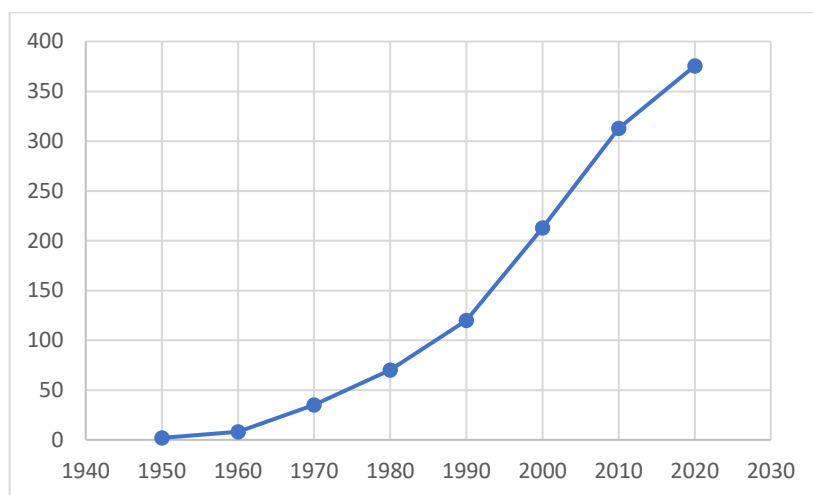


**Graph no. 3** Polluters of global mismanaged plastic waste by continent, 2019 (%)

Source: own processed based on data retrieved from Our World in Data, 2019

Graph no. 3 shows the percentage of polluters of global mismanaged plastic waste in 2019. The graph shows that Asia's biggest polluter reached approximately 65%. Africa came in second place and reached 22%. Lower percentages were reached by continents such as South America 8%, North America 3.12%, and Europe 1.91%. The best results were achieved by Australia, which reached only 0.1%. The results confirmed the necessity of introducing effective regulations addressing how to properly handle and dispose of plastic waste. The best results were achieved in continents where government officials or other competent actors work on different strategies, regulations or legislation regulating plastic issues. However, this still does not mean that the problem of plastic waste is solved.

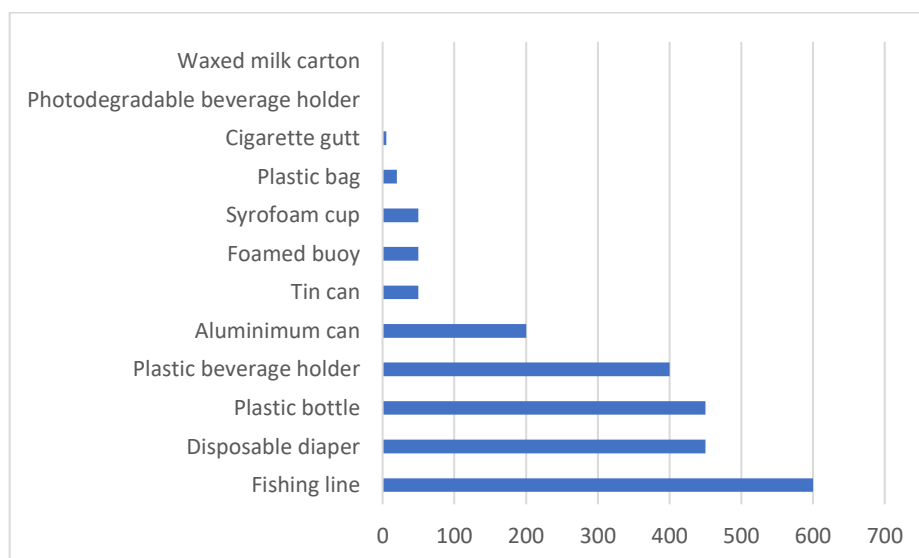
The graph no. 4 shows the increase of global plastic production. The obtained data is measured in million metric tonnes annually in the observed period from 1950 to 2020. As we can identify the data from the graph, the production of plastics has been growing rapidly since 1950; during this period, 2 million plastic wastes were produced. The biggest increase was observed in the 1970s when production reached up to 35 million tonnes. Since 1990, the production of plastics has exceeded a three-digit number, i.e., 120 million tons. In 2000, production reached 213 million tonnes. Since 2010, there has been an increase of 100 million tonnes; in 2020, it reached a value of 367 million tonnes. According to the statistical databases Statista, Our World in Data and One Planet network, the graph shows the annual global production of plastics. Plastic production refers to the annual production of polymer resin and fibres.



**Graph no. 4** Annual global production of plastics in the observed period

Source: own processed based on data retrieved from Statista 2023 and Our World in Data 2019

Data are expressed in million metric tonnes in the observed period 1950 to 2020. More current data for the years 2021 to 2023 are not yet available. The following graph no. 6 shows the rate of decomposition of plastic items of marine litter expressed in years.



**Graph no. 5** The rate of decomposition of plastic items of marine litter expressed in years

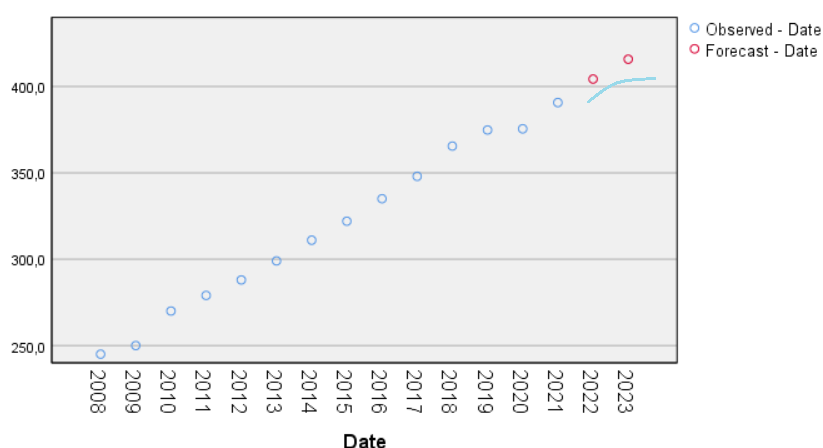
Source: own processed based on data retrieved from Our World Data, 2018

The graph no. 5 shows the rate of decomposition of marine litter items expressed in years. The available data is from 2018. From the graph, we can identify the seriousness of the problem of plastic waste. Each of them spans several years. The waxed milk carton decomposes the fastest, i.e., 0.25 years. Plastic bags for up to 50 years. An even more serious situation occurs when a plastic drink holder, plastic bottle or disposable diaper breaks down. This type of waste has been decomposing for over 200 years. In the case of the fishing line, we are talking about 600 years. Based on statistical data, we can evaluate the severity of the problem. The long-term decomposition of individual plastic waste causes the death of animals because toxic chemical substances can get into their bodies. However, it should be remembered that this problem does not only concern aquatic animals but also humans. Fishing is one of the popular activities that provide various tasty specialities. Toxic substances from fish also enter the human body, which can cause serious health problems.

**Table 1. Forecast values**

Year	Forecast	Lower bounds	Upper bounds
2022	404,3	395,4	413,2
2023	415,8	406,8	424,8

Given the fact that data for 2022 is not yet available, we have predicted possible developments for 2022 and 2023 using SPSS Statistics. The values reflect the development in the graph below.



**Graph no. 6** Forecast of the expected development of plastics production  
Source: own processed based on data retrieved from Statista, 2023

The graph no. 6 shows the forecast of the expected development, where we created a structure from time series data while we used exponential smoothing models and



autoregressive integrated average. The table shows the expected development values, where our global effort should be closer to the lower bound of the predictions, considering the company's sustainable goals, contracts and plans.

## **5 Conclusion**

Plastics play an irreplaceable role in modern society. The increased use of plastic aids in recent years led to an increase in plastic waste, which was also contributed to by the more intensive use of packaging when delivering food or other products. In addition to plastic waste, plastics also cause a carbon footprint. The current way of producing, using, and disposing of plastic is fundamentally flawed because this system lacks accountability, leading to ever-increasing plastic pollution of the environment. Most plastics do not break down naturally in any meaningful way, so the plastics we've already made will be with us for thousands of years; millions of metric tons of plastic are produced around the world every year. Half of the plastic waste is currently recycled, incinerated or thrown into landfills, but a large part also ends up in our oceans or nature. In 2021, countries produced approximately 390.7 million tonnes globally. Asian countries reached approximately 55% of the total production of plastics, and North and South America 22% in total. Plastics are one of the seven key areas that the European Commission considers essential for achieving a circular economy. However, it is also challenging for other countries to introduce effective strategies or plans to solve plastic issues.

## **Acknowledgements**

The paper is part of the project PMVP I-22-106-00, "Analysis of the attitudes of consumers of tourism services towards waste and their consequences for the sustainable development of tourism in the V4 countries", solution period 2022, responsible researcher: Ing. L. Kubíková

## **References**

1. A EUROPEAN STRATEGY FOR PLASTICS IN A CIRCULAR ECONOMY. {SWD(2018) 16 final} 2018. [online]. Accessible from <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52018DC0028&from=PT>
2. EPA. United States Environmental Protection Agency. Plastics: Material-Specific Data. 2022. [online]. Accessible from <https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/plastics-material-specific-data>
3. EUROPEAN COMMISSION. The Commission's plan for plastics. 2023. [online]. Accessible from [https://research-and-innovation.ec.europa.eu/research-area/environment/circular-economy/plastics-circular-economy\\_en](https://research-and-innovation.ec.europa.eu/research-area/environment/circular-economy/plastics-circular-economy_en)

4. Geneva Environment Network. Plastic Waste Management | Plastics and the Environment Series. 2023. [online]. Accessible from <https://www.genevaenvironmentnetwork.org/resources/updates/plastic-wastemanagement/>
5. Liang Y., et al. An analysis of the plastic waste trade and management in Asia. *Waste Management*. Volume 119, p. 242-253. 2021. [online]. Accessible from <https://www.sciencedirect.com/science/article/abs/pii/S0956053X20305602>
6. Liu H. et al. Impact of plastic pollution on outdoor recreation in the existence of bearing capacity and perspective management. *Environmental Research*. Volume 214, Part 2, 113819. 2022. [online]. Accessible from <https://doi.org/10.1016/j.envres.2022.113819>
7. Moore CH. plastic pollution. *Britannica*. 2023. [online]. Accessible from <https://www.britannica.com/science/plastic-pollution>
8. OUR WORLD IN DATA. Share of global mismanaged plastic waste. 2019. [online]. Accessible from <https://ourworldindata.org/grapher/share-of-global-mismanaged-plastic-waste?tab=table>
9. OUR WORLD IN DATA. Global plastics production. 2019. [online]. Accessible from <https://ourworldindata.org/grapher/global-plastics-production>
10. OUR WORLD IN DATA. Decomposition rates of marine debris items. 2018. [online]. Accessible from <https://ourworldindata.org/grapher/decomposition-rates-marine-debris>
11. Parker L. The world's plastic pollution crisis explained. *National Geographic*. 2019. [online]. Accessible from <https://www.nationalgeographic.com/environment/article/plastic-pollution>
12. PLASTICS EUROPE. Plastics – the Facts 2022. 2022. [online]. Accessible from <https://plasticseurope.org/knowledge-hub/plastics-the-facts-2022/>
13. STATISTA. Annual production of plastics worldwide from 1950 to 2021. 2023. [online]. Accessible from <https://www.statista.com/statistics/282732/global-production-of-plastics-since-1950/>
14. Williams T. A., Rangel-Buitrago N. The past, present, and future of plastic pollution. *Marine Pollution Bulletin*. Volume 176, 113429. 2022. [online]. Accessible from <https://doi.org/10.1016/j.marpolbul.2022.113429>