The Impact of BBC Blue Planet II on Awareness of and Attitude to Plastic Pollution

Being a dissertation submitted in partial fulfilment of the

Requirements for the degree of

MSc

Biological Sciences, Science Communication

In the University of Hull

by

Zahra Mirzakhani BA Geography and Urban Planning

January 2022

Acknowledgements

I would like the opportunity to thank Professor Lorch and Dr Johnson for accepting to supervise this search study, and for their valuable guidance in this respect, and ensuring that this dissertation meets high standards. Dr Johnson was most kind and helpful in developing the Codes used in conjunction with the software, and I am most grateful for it. I am truly indebted to my very dear mother for her relentless encouragement and support in every stage of my education, and for her love for knowledge. She never had a chance to continue her education, but ensured that her dreams were realised for her daughter.

Zahra Mirzakhani

January 2022

Abstract

This research study addresses the issue of environmental pollution caused by plastic waste, which has had extensive negative impact on the ecological systems and human life worldwide. Recent studies have found microplastics in every single aquatic species in the UK, reflecting the extent of harm caused to the biological species, natural environment and human health.

Conservationists should promote pro-environmental behaviour, such as reducing plastic pollution by reducing plastic consumption and disposal. Hence, across the globe, governments, non-governmental organizations (NGOs), and the media have been active in preventing and mitigating the impact of plastic pollution.

Mass media, including the British Broadcasting Corporation (BBC), have been playing a major role in informing the public and creating awareness. In 2017, the BBC Natural History Unit broadcast the BBC Blue Planet II Series, which had involved 39 countries and 125 marine expeditions. The Series, in part, explores the impact of plastic pollution on marine life.

According to some experts, the BBC natural history documentary, Blue Planet II, was watched by millions across the globe, leading to changes in public attitude & awareness of plastic pollution. This dissertation assesses the impact of the BBC Blue Planet II series on public awareness of plastic pollution in the UK, US, Canada and Australia, and contains a comprehensive review of the open literature.

The impact of Blue Planet II on plastic pollution was assessed via analysis of search volumes using Google Trends. Whilst attitudes to plastic pollutions was investigated via textual analysis of online comments within plastics related articles in the to The Guardian and The Times online newspaper.

The quantitative and qualitative data are presented in graphical forms in this research study, and show that an increase in public awareness of plastic pollution did corelate with airing of the BBC Blue Planet II series. However, using the mentioned methods the research we were not able to find evidence for a causal link between the BBC Blue Planet II series and an increase in public awareness of plastic pollution.

Table of contents

List of Figures

List of Tables

Chapter 1 Introduction and background

1.1 Introduction to the dissertation

Since the invention of the first synthetic plastic, a little over a century ago, use of this material has increased exponentially. This is largely due to its extraordinary properties such as strength, lightness and cost-effectiveness. Consequently, the production of plastic increased from 1.5 million metric tons in 1950 to 320 million metric tons in 2017 per year. Over 40% of which is for single-use packaging (Arnaud, 2019; Wright & Kelly, 2017). And a very significant proportion of this plastic (5 million tons annually) finds its way into the oceans (Thompson, 2017).

As a result of discharges and disposal into the marine environment, the geographical distribution of plastic pollution in the world's oceans is growing, making plastic pollution one of the most omnipresent and long-lasting threats to marine ecosystems (Barnes et al, 2009; Jambeck et al, 2015; Vegter et al, 2014). Plastic pollution not only negatively impacts ecosystems, but also social and economic aspects of human life, including aquaculture, navigation, and tourism (Gregory, 2002; Rochman et al, 2013; Werner et al, 2016).

In view of the significant risks posed to the well-being of humans and marine species, researches argue that plastic debris is a disaster for the human, environment and water resources (Barnes et al, 2009). Therefore, the human-caused phenomenon of ocean plastic debris (Pahl et al, 2017) is regarded as a perilous environmental issue (Hartley et al, 2018).

Some experts, however, hold a different perspective. As an example, in the opinion of some environmental experts, plastic pollution does not pose as much risk as other environmental issues, such as climate change, and that is why small steps are being taken to reduce plastic waste (Stafford & Jones, 2019).

1.2 Public opinion on plastic pollution

In terms of public concern and perception, interdisciplinary approaches and in particular collaborations with social and behavioural scientists are largely recognized as being needed to better protect the marine environment (Fletcher et al, 2012; GESAMP, 2016; Jefferson et al, 2015; Koelmans et al, 2019; Pahl & Wyles, 2017; UNEP, 2005).

Developing appropriate interventions to reduce plastic waste input into the ocean requires an understanding of public perceptions of plastics in society and their environmental impacts, as with other anthropogenic threats to the marine environment (Hartley et al, 2015; Pahl & Wyles, 2017).

In order to counter the threat, the reduction in single-use plastics, and end of life considerations in the design and manufacture of plastics are regarded as vital (UNEP, 2016).

Another approach to reducing plastic pollution in the seas is considered to be effective waste management through recycling plastics. This helps reduce the amount of plastic that ends up in landfills and the oceans. It is important, however, to note that waste management is an expensive process. City Council budgets are heavily devoted to solid waste management. It accounts for nearly 20% of municipal budgets in low-income countries, over 10% in middle-income countries, and only 4% in high-income countries (Kaza et al, 2018).

Also, there are a number of non-profit organizations, such as 'The Ocean Clean-up, that claim to have developed and scaled up technologies to remove plastics from the oceans (John, 2020).

In a study on effects of plastics on human health, conducted in 2018, Hartley et al, examined perceptions of plastic pollution in particular. As part of the survey, participants were asked to rate how damaging they thought marine litter was to the marine environment, the appearance of the coast, tourism, shipping, and human health. According to the participants, the marine environment was perceived to be most threatened, and the human health was regarded as the third threatened domain (Hartley et al, 2018).

In addition, a Eurobarometer survey published in 2014 found that approximately 93% of the residents of the EU member state countries believe that "more efforts are needed by the authorities to limit plastic pollution"(Commission & Environment, 2014). Nevertheless, with regards to the marine environment in particular, only a few comprehensive research studies have been undertaken (Heidbreder et al, 2019).

Meanwhile, a study carried out on 15 countries in 2015 found that Europeans and Australians were more concerned with plastic pollution in the oceans, and were particularly concerned with the impact of marine plastic pollution on human health (Davison et al, 2021).

A growing body of research is being built on the public's understanding of the aquatic environment, which highlights gaps in awareness. For instance, it is found that the public is unaware of the significance of the marine environment, and it is assumed that raising public awareness will lead to behavioural change (McKinley & Fletcher, 2012; Steel et al, 2005).

Furthermore, there have been a number of studies analysing the public perceptions of the extent of ocean pollution in encompassing a number of countries. These studies have focused on broader threats to the marine environment, namely climate change, industrial pollution, and

overfishing, with limited consideration of plastic pollution (Gelcich et al, 2014; Lotze et al, 2018; Potts et al, 2016).

It is noteworthy that although extensive research has been conducted on plastic pollution, the emphasis has been on the impact on the marine environment and much less so on human health. This may explain why the specific issue of the plastic pollution of the oceans is not taken as seriously by the public, as it could be.

1.3   Plastic pollution impact on human health

According to (Vethaak & Leslie, 2016), several of the chemical compounds found in plastics, such as bisphenol A, phthalates and some of the brominated flame retardants, have been found to disrupt the human hormone system when ingested or inhaled. Scientists have identified that phthalates leach out of plastics, causing disruptions to androgen functions. For instance, a number of studies have linked phthalates exposure to testicular dysgenesis syndrome (TDS) (Ahamed et al, 2001; Foster et al, 2001). The term 'TDS' refers to a spectrum of reproductive disorders which affect male fetal development (Skakkebaek et al, 2001).

Furthermore, as reported in 2015 by the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection, consuming seafood and terrestrial foods, drinking water and breathing in air can all expose humans to plastic particles (GESAMP, 2015). These can cross cell membranes, the blood-brain barrier, and the placenta, damaging the lungs and gut (Galloway & Galloway, 2015), and also cause cell damage, inflammation, and impairment of energy allocation in human (Galloway & Galloway, 2015; GESAMP, 2015).

According to literature review conducted in this study, the impact of plastic pollution on public health has not been fully researched, notwithstanding the large body of research work on plastic pollution in general. More research needs to be conducted to stablish the mechanisms by which plastic pollution affects human health.

It is believed that mass media could significantly influence public perception (Leiserowitz, 2005), educate individuals, and increase the awareness of environmental issues (Warren, 2012; Wijesekara et al, 2018). Several studies claim that the, mass media is one of the most important sources of news for the public, and is crucial in shaping society's attitudes specially towards wildlife and environment (Chong & Druckman, 2007; Gore & Knuth, 2009).

Considering how influential mass media is and how little public perception there is of environmental issues, conservation organizations are focusing on media-based strategies to raise awareness of environmental issues (Thomas-Walters et al, 2020). One way is wildlife

reporting and natural documentaries such as Blue Planet II series. According to some research, nature documentaries promote positive changes by raising viewers' awareness of environmental issues (Nolan, 2010), and improving conservation support (Lin, 2013).

Also, documentary films have traditionally served as a tool for social changes (Karlin & Johnson, 2011), particularly in the field of wildlife filmmaking, as they are often able to convey complex ideas about environmental issues to a wide demographic group (Janpol & Dilts, 2016).

Despite this, their ability to influence specific behaviours has not been well documented. A documentary, for example, may change behaviour, but the relationship between information and behaviour change can be complex and uncertain, according to behavioural scientists (Braun et al, 2018; Fishwick, 2016; Kollmuss & Agyeman, 2002).

There are many ways in which nature documentaries can inspire changes. They, for instance, have been shown to increase environmental awareness towards the species they depict, which relates to responsible environmental behaviour (Barbas et al, 2009). To examine how documentaries have impact on people awareness, researchers targeted conservation messages on viewers' behaviour, using self-reports of changes in behaviour or intentions to change (Beattie et al, 2011; Hofman & Hughes, 2018; Howell, 2011; Lin, 2013).

Although, these measures generally report positive effects, but their reliability and validity are questioned, and real-world evidence (although difficult to quantify) would strengthen the case (Steg & Vlek, 2009).

1.4 Impact of media content on interest in and perceptions of plastic pollution

Today, reading news online is a habit for many people, and mass media has increased its ability to reach a global audience at an instant. Currently, the majority of newspapers publish an online edition, which offers widespread access to breaking news all over the world. Some experts argue that media output is one of the most important sources of information for people, especially when it comes to complex issues that may be difficult to observe or explain directly (Happer & Philo, 2013; Swain, 2012).

It is believed that mass media could significantly influence public perception (Leiserowitz, 2005), educate individuals, and increase the awareness of environmental issues (Warren, 2012; Wijesekara et al, 2018). Several studies claim that the mass media is one of the most important sources of news for the public, and is crucial in shaping society's attitudes specially towards wildlife and environment (Chong & Druckman, 2007; Gore & Knuth, 2009).

Considering how influential mass media is and how little public perception there is of environmental issues, conservation organizations are focusing on media-based strategies to raise awareness of environmental issues (Thomas-Walters et al, 2020). One way is wildlife reporting and nature documentaries such as Blue Planet II series. According to some research, nature documentaries promote positive changes by raising viewers' awareness of environmental issues (Nolan, 2010), and improving conservation support (Lin, 2013).

Also, documentary films have traditionally served as a tool for social changes (Karlin & Johnson, 2011), particularly in the field of wildlife filmmaking, as they are often able to convey complex ideas about environmental issues to a wide demographic group (Janpol & Dilts, 2016). Despite the impact of documentary films, their ability to influence specific behavioural change has not been well researched.

A documentary, may change behaviour, but the relationship between information and behavioural change can be complex and uncertain, according to behavioural scientists (Braun et al, 2018; Kollmuss & Agyeman, 2002)

Nature-related documentaries are shown to inspire change in a number of ways. They have, for instance, shown to increase environmental awareness towards the species they depict, which relates to responsible environmental behaviour (Barbas et al, 2009). To examine the impact of documentaries on people's awareness and changing behaviour, researches have studied the viewers feedbacks, refer to as 'self-reports' of viewers behavioural change or intention to change (Beattie et al, 2011; Hofman & Hughes, 2018; Howell, 2011; Lin, 2013). Notwithstanding, the usefulness of 'self-reports', researches have questioned their reliability and validity (Steg & Vlek, 2009).

The BBC's Blue Planet II (BBC BPII), a nature documentary series about marine life produced by the BBC in 2017, has been widely credited with significantly influencing the environmental behaviour of the people in the UK, and also influencing government policy on marine plastic pollution (Partners, 2018; Schnurr et al, 2018); nevertheless, it is not clear as to the degree to which the BBC BPII documentary contributed to the public outcry at the time, and the extent to which it directly influenced policy.

1.5 BBC Blue Planet II

BBC BPII, a nature documentary series about marine life, received extensive public attention on marine plastic pollution in the UK and a number of other countries (Hunt, 2017). It is believed that the high level of conservation messaging within BBC BPII contributed to raising public awareness of plastic pollution, in contrast to previous nature documentary series produced

worldwide (Jones et al, 2019). The BBC BPII, principally produced by Sir David Attenborough, focuses on marine life, including the impact of plastics on marine ecological systems.

The series consisted of seven episodes. First episode, One Ocean, features a journey from the intense heat of the tropics to the frozen poles of our planet (Center, 2017a). It attracted 14.1 million viewers in the UK alone, and has become one of the most viewed TV programs in history (Hayns-Worthington, 2018). The second episode, the Deep, takes the viewer on an adventurous journey through the unknown corners of the ocean, where there is crushing pressure, freezing temperatures, and absolute darkness (Center, 2017b).

The third episode's main focus is on Coral Reefs, where a quarter of all marine species live. This episode shows the extent to which survival is a challenge in these underwater megacities (Center, 2017c). In episode four, special pressure-proof cameras capture Sperm whales hunting Squid a kilometre below the surface (Center, 2017d). The fifth episode shows an Octopus escaping a Pyjama Shark in Kelp forests. It also shows how Sea Otters defend the seaweed gardens (Center, 2017e).

The sixth episode, labelled as Coasts, explores how the wildlife covered in the Blue Planet is adapting to a constantly changing environment (Center, 2017f). The seventh episode, Our Planet, shows the areas of the ocean that have not been explored before. It also shows the impact of plastic pollution on marine life, in general (Center, 2017g). The episode was aired on 10 December 2017. Several studies subsequently claimed that it was most effective in communicating conservation messages, anthropogenic impacts, and specific messages relating to ocean plastic (Dunn et al, 2020; Hayns-Worthington, 2018).

Work on the BBC BPII series started in 2013, taking 4 years and involving 39 countries. It produced more than 6,000 hours of underwater footage from over 4,000 dives, giving rise to many unique shots (BBC, 2017). Sir David Attenborough once stated that:

> "I am truly thrilled to be joining this new exploration of the underwater worlds
> which cover most of our planet, yet are still its least known".

The series was initially called Oceans, but later Sir David Attenborough changed the title to BBC BPII on 29 February 2017 (BBC, 2017). Bristol hosted the premier of BBC BPII (Prideaux, 2017), which was broadcast on 29 October 2017 on BBC One and BBC One HD (Haubursin, 2017). BBC BPII has been sold to more than 30 countries, including Canada (Blue Ant Media's licensed channel for BBC Earth), Australia (Channel Nine), New Zealand (TVNZ), Denmark (DR), Netherlands (NPO), Sweden (SVT), Spain (Telefonica's BBC Earth block), Discovery Channel for

Latin America, Co-production partnerships with BBC America, Germany's WDR, France Televisions, China and CCTV-9 (Center, 2017).

Based on the BBC BPII producers' comments, one of the show's goals were to create a "platform for spreading the broader message about plastic pollution" (Honeyborne, 2018). This appears to have been achieved as some records show that the series has impacted global behavior, and political decision-making regarding plastic use. The Global Citizen Magazine stated in 2018 that the BBC BPIIfinal episode has been lauded as a catalyst for the war on plastics. Also, Waitrose and Partners supermarket, in its 2018 annual food and drink report, found that 88% of the viewers changed their behaviour afterwards (Calderwood, 2018; Partners, 2018).

Moreover, an analysis of consumer data by GlobalWebIndex concluded that the "Attenborough effect" from the BBC BPII series, in which marine life was highlighted as being at risk from plastic pollution, had had a significant impact on raising awareness and changing attitudes towards reducing plastic use (Gleeson, 2019). Additionally, according to the Twitter activity analysis, plastic waste reduction more than doubled in the first quarter of 2018 compared to the same period in the previous year (Joyce, 2018).

It is important to note that the majority of data regarding BBC BPII impact on viewers' plastic consumption is based on 'self-reporting'(Partners, 2018), which some experts believe is inaccurate and does not reflect actual behavioural change (Kormos & Gifford, 2014). Moreover, being a major environmental issue, marine plastics pollution may cause individuals to exaggerate their pro-environmental behaviour, in order to align with the societal norms (Pahl & Wyles, 2017).

There is little doubt that an increase in awareness of plastic pollution did correlate with the broadcast of BPII. However, whether there was a causal link is less clear. Some researchers have suggested that BBC BPII series should be assessed using valid methods of observing behavioural change, in order to develop evidence-based analysis, and fully and impartially understand the impact of the BBC BPII series on the public (Thomas-Walters et al, 2020; Veríssimo, 2013).

1.6   Study targets and structure of dissertation

The aim of this study was to evaluate whether the BBC BPII documentary series caused a change in public awareness of plastic pollution, following its broadcast in 2017.

In conducting this research study, three key questions were posed from the very outset:

1. Was there any change in awareness of and interest in plastic pollution in the Australia, Canada, the UK, the US - the four English-speaking countries chosen for this study – following the broadcasting of the BBC BPII series?

2. Was there an enhancement in public engagement in issues related to plastic pollution and plastic waste, following the broadcasting of the BBC BPII series?

To achieve the objectives of this research study a number of analytical tools were used to analyse the qualitative and quantitative data collated. In chapter two, internet search activity relating to plastics and BPII are analysed to determine whether there is a correlation between BPII broadcast and an increased interest in plastic pollution. If a correlation is seen in all four countries studied then we can be more confident of a causal link.

In addition, to assessing the magnitude of interest in plastic pollution we also studied whether public attitudes to plastic had changed by textual analysis of the comments on online newspaper articles. This work is described in chapter three.

Chapter 2 . Quantitative assessment of viewers' reaction to BBC BIP II on plastic pollution

2.1 Introduction

Traditionally, public opinion surveys have been used to assess public awareness of environmental issues (Inglehart, 1995). In recent years, however, the Internet has become a comprehensive data source for assessing public opinion (Butler, 2018). In 2009, Google was used for 76 billion searches per month of the entire 113 billion searches, and it is believed that is one of the world's popular global web search engines (Lipsman, 2009).

To find out more about a topic, internet users typically type it into Google (Baram et al, 2011). There is evidence that the volume of Google searches strongly correlated with public interest in politics and the environment (Proulx et al, 2014a; Reilly et al, 2012), indicating that the public pays close attention to the topic at a given moment. Thus, Google searches are strongly correlated with public engagement in common and especially political matters in societies (Reilly et al, 2012).

One new way of extracting information about a particular online subject through Google is by using an automated data gathering system, a web-spidering method, known as Google Trends (Raphael Proukx et al, 2013). This is an extremely accessible way to check how regularly a term is entered into Google. This proves useful in obtaining the extent of the public's interests in a specific issue, such as environmental matters (Ficetola, 2013).

Google Trends (GT) is a free tool that offers a regular Internet search volume for terms or topics that have been searched frequently enough via Google. Internet users may search any topics or queries in this website to extract a portion of relative volume searches (Choi et al., 2012).

GT allows comparisons of up to five Google queries on a selected area during a specified time window. Users can find a particular topic in GT, and display a relative number of searches during a defined time-span. For a given time span, GT analyses a proportion of all Google web searches and extracts the information to calculate the search volume. These data are displayed in an index graph which is updated on a regular basis (Carneiro & Mylonakis, 2009).

Google Trends (GT) has also been suggested as a method to monitor early indications of ecosystem deterioration, or to establish harvest calendars, monitor alterations in the scheduling of biological processes, the spatial allocation of native species and public awareness of the main conservation problems (Proulx et al, 2014a). For instance, the extent of interest in environmental issues such as "biodiversity", "wildlife" or "climate change" was examined by

using GT data in 2013. The result showed that the interests in environmental problems are reducing over the time and the reason for that is indefinite (Mccallum & and Bury, 2013). In this research study, GT search engine was used to collate date on the magnitude of interest of the internet users regarding plastic pollution.

This assessment survey covers a 5-year period, and includes four English-speaking countries: UK, US, Canada, Australia. A brief global survey is also included. In order to assess the trends of changes in interest in "Blue Plant II" and "Plastic Pollution" in Google, the information extracted from Google Trends is shown in linear graphs and box plots produced using R statistical software.

In addition, the Null Hypothesis was used to ascertain the difference between search activity in plastic pollution before and after BBC BPII series was broadcast. Wilcoxon-test was also used to extract the differences in data before and after broadcasting BBC BPII.

2.2   Methodology

Google search volume has been shown to directly relate to public participation and interest in environmental and political issues (Proulx et al, 2014b; Reilly et al, 2012).Therefore this study uses search volume to measure the interest in plastic pollution before and after the BBC Blue Planet II was aired. Search activities were analysed from 2014 to 2019 via the following link https://trends.google.com/trends/. An example of the data returned from Google Trends is shown in Figure 2-1.
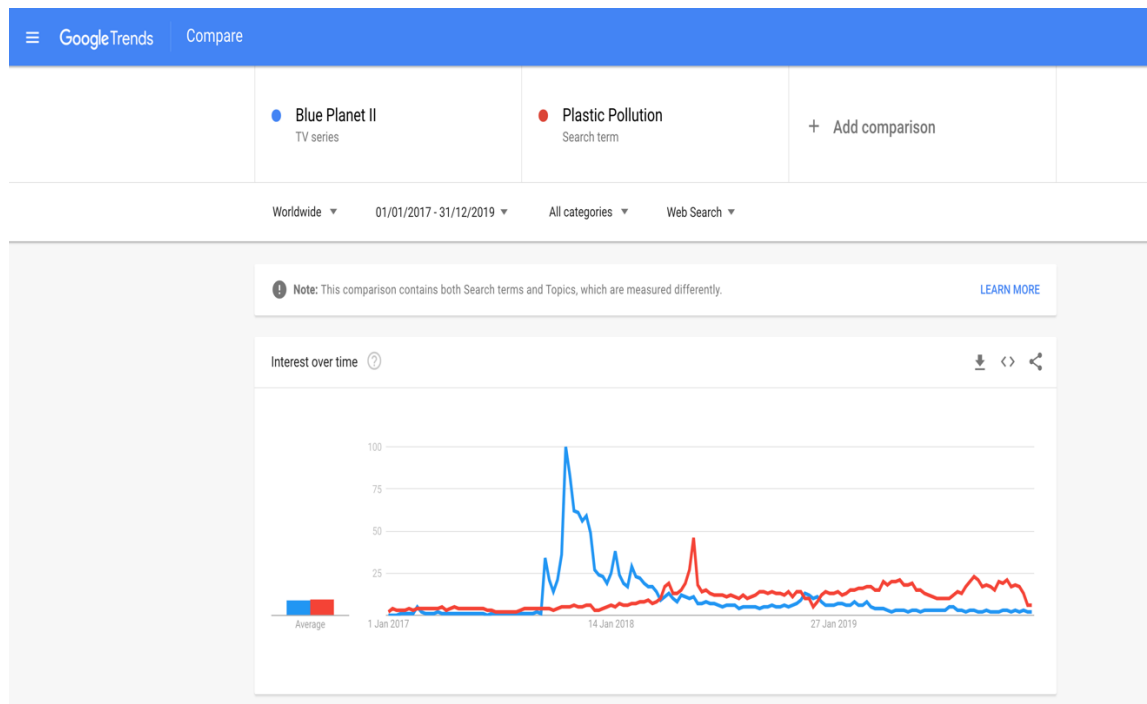

Figure 2-1 Image from Google Trends for the period 2014 to 2019

Data is outputted from GT as a normalized scale from 0-100 (y-axis of the graphs), where 100 shows a portion of the maximum search interest for the date and place selected (Avilez et al., 2017). Data can also be exported in CSV format for importing into spreadsheets and other data analysis software. If the number of searches interests for a term drops over time, it has been suggested that the public's interest in that term has decreased simultaneously (Lincoln, 2011).

GT data can be given for defined geographical regions and periods., enabling us to retrieve data for each of the locations used in our study. In this study queried GT data were obtained for two search terms that were submitted in English; 'Blue Planet II' (BBC BPII) and 'Plastic Pollution' (PP). These two terms were chosen to allow a direct comparison between interest in the documentary and the plastic pollution mentioned in a specific episode. Measure their popularity from 2014 to 2019, before and after the BBC BPII TV Show was broadcast.

R statistical software was used to create linear graphs and boxplots based on data downloaded from GT. R is a "language and environment for statistical computing and graphics"(Team, 2018). To export GT data into R software, two packages called "GtrendsR" and "Trendyy", were installed in the R software. "GtrendsR" is a package used to search the queries in GT (Philippe Massicotte & Eddelbuettel, 2019) and "Trendyy" package is organizing the data that were gathered by "GtrendsR" (Parry, 2019).

The GtrendsR package works with "Trendyy package", as a pattern finishing tool by extracting regional information from GT (Parry, 2019). The other reason that GtrendsR package was used is that using this package is a standard technique that refers to Google Trends database for all data analysis (Nick, 2018). Also, using GtrendsR and Trendyy packages as have been used previously in a number of studies, for instance by Hoare, in 2017, who examined the increase and decrease in "blue-ray" queries by extracting data from GT and analysed them with R software (Hoare, 2017).

To analyse data in the R, specific codes was needed, and the codes were developed internally in the Department of Biological and Marine Sciences for specific use for this research.

2.3 Statistical analysis and results

As data extracted in this study is not normally distributed, the Wilcoxon-test, a nonparametric statistical test, was used to examine the differences in queries of two paired groups. One group for searching the term "Blue Planet II" and the other for searching "Plastic Pollution", both before and after broadcasting the BBC BPII series.

The Wilcoxon-test makes the process of comparison possible and was chosen to obtain the p-value (McDonald, 2014). Conventionally, when p-value is less than 0.05 (typically < 0.05), it shows redoubtable confirmation against the null hypothesis. Therefore, the alternative hypothesis is acceptable. But, a p-value greater than 0.05 (typically > 0.05) is not statistically important and shows notable evidence for the null hypothesis (Agnes Ogee, 2015).

The data were extracted from the Google Trends and converted to linear graphs by the R statistic program. In order to see the level of people's interest in the two terms of 'Blue Planet II' and 'Plastic Pollution' in the four previous mentioned countries, in this section, each region is discussed separately, as noted below:

2.3.1 Worldwide

Figure 2-2 shows 'Blue Planet II' and 'Plastic Pollution' search interest volume between 2014 and 2019 around the world. As can be seen in figure 2.2, there was a sharp increase in search volume for the term 'Blue Planet II' in late 2017 followed by a steady decline. Meanwhile searches for "Plastic Pollution" shows a slow increase in mid-2017, a sharp spike in mid-2018 followed by a steady increase around the world.

Searches for 'Blue Planet II' increased suddenly one week before broadcasting the show, but it started to decrease immediately afterwards on 29th of October 2017. The blue highlighted vertical Panel shows the time period of broadcasting the BBC BPII in the UK from 29 October 2017 to 10 December 2017.

World-wide searches for 'Plastic Pollution' spiked several months after broadcasting the show in the UK, and reached a maximum in the middle of June 2018. Search volumes dropped sharply and the more gradually, before starting a much slower rise throughout 2019.

In late December of each year, there was a sudden drop in the level of search for 'Plastic Pollution'. This December drop is seen for most search terms and can be attributed to seasonal holidays. Overall, while the popularity of Blue Planet II term decreased after broadcasting the show, there was a general upward trend in Plastic Pollution popularity from 2014 to 2019 throughout the world. Of particular note is the lack of a sudden increase in Plastic Pollution popularity immediately after Blue Planet II was broadcast.

Figure 2-3 highlights the volume of worldwide searchers for 'Blue Planet II' and 'Plastic Pollution' in the week and month immediately prior and post broadcast of the documentary in the UK. The plots indicate a significant increase in interest in BPII but no significant increase in 'plastic pollution' in this time periods.
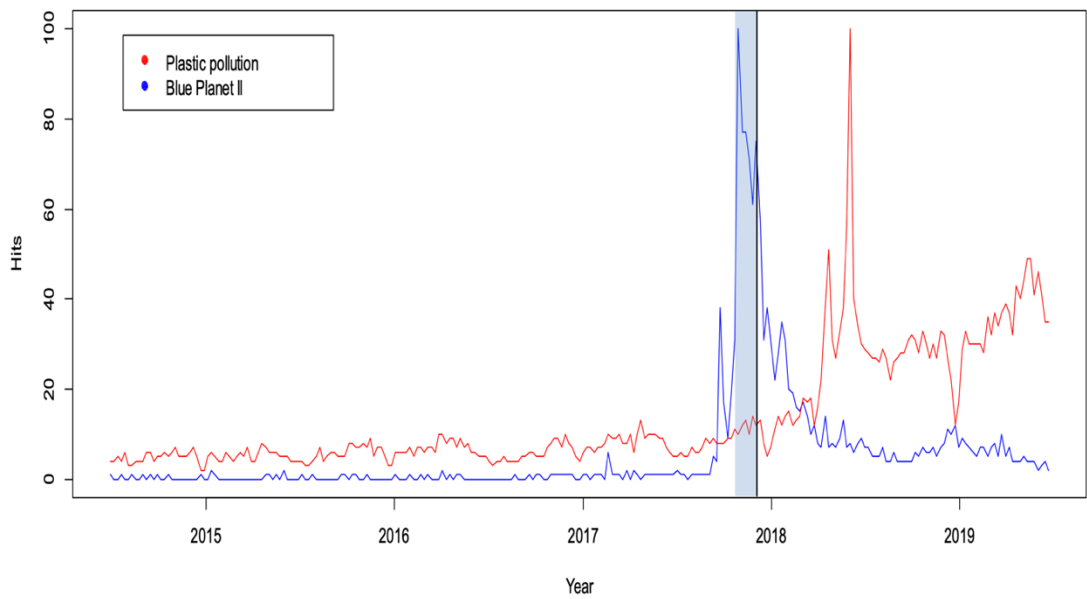
Figure 2-2 Linear trend model for public interest in Blue Planet II and Plastic Pollution from 2014 to 2019 worldwide

The x-axis covers a five-year time frame of internet searches for 'Blue Planet II' and 'Plastic Pollution'. The y-axis shows the relative number of searches. The numbers on y-axis are scaled to a range of 0 to 100 based on the number of subjects to all inquiries. The shaded box represents the duration of the BBC BPII series broadcast for the first time in the UK, with the first episode aired on 29 October 2017. Black vertical line indicate when the last episode was broadcast on 10 December 2017.
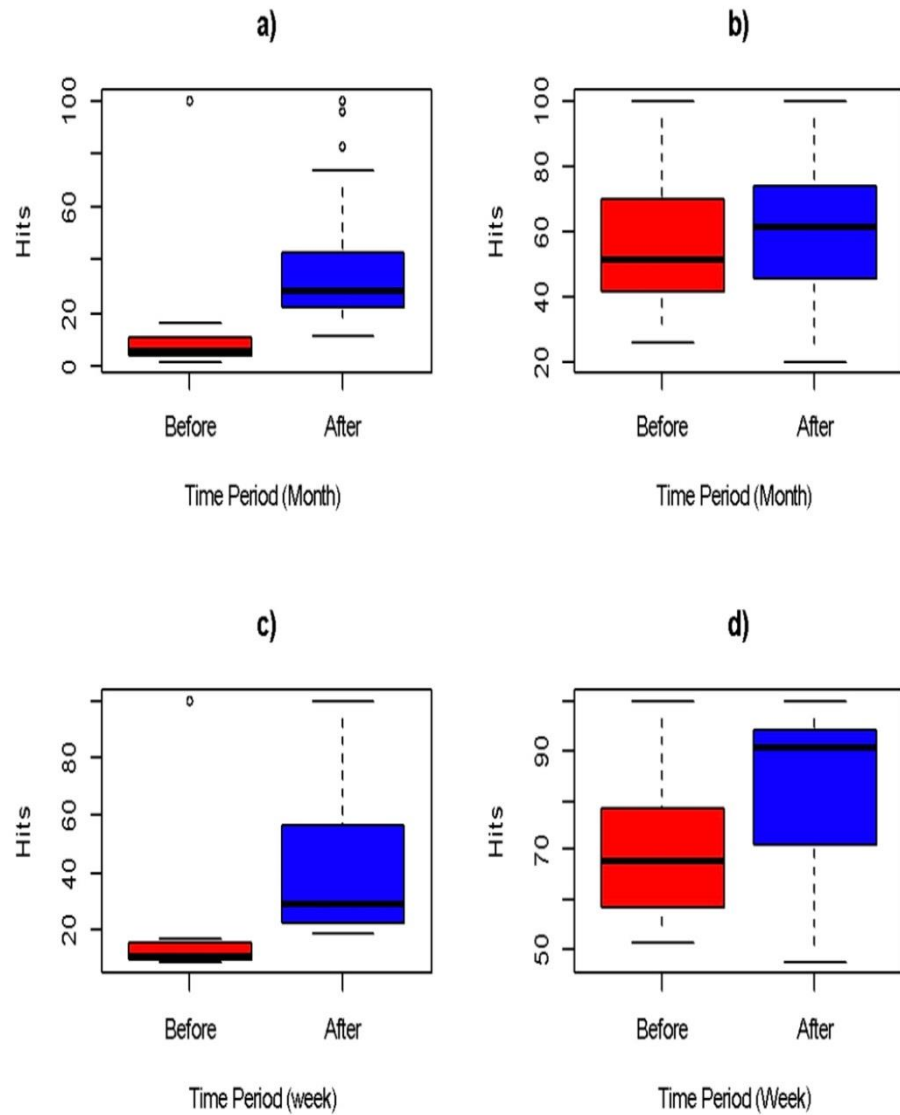
Figure 2-3 The worldwide searches for the Blue Planet II and Plastic Pollution in Google, a month to a week before and after the series was aired for the first time in the UK on 29 October 2017

The relative volume of world-wide Google searches for; (a) 'Blue Plant II' a month before and after the broadcasted of the first episode of BBC BPII in the UK. (b) 'plastic pollution' a month before and after the broadcasted of the first episode of BBC BPII in the UK, (c) 'Blue Plant II' a week before and after the broadcasted of the first episode of BBC BPII in the UK. (d) 'plastic pollution' a week before and after the broadcasted of the first episode of BBC BPII in the UK.

The thick lines in the middle of the boxes are median. The boxes represent 25-75 per cent of data. The two horizontal lines represent 95% of the data. Any circles outside these lines are outliers.

2.3.2 The UK

Figure 2-4, illustrates 'Blue Planet II' and 'Plastic Pollution' search interest volumes between 2014 and 2019. According to the figure 2.4, it is clear that interest in BBC BPII series on Google started was 38% of maximum a month before broadcasting the show and reached the maximum, on the date of broadcast (29th October 2017). Then it constantly stayed above 80% of maximum during seven weeks of broadcasting of the series.

Six days after broadcast interest dropped sharply, before rising again reaching a peak one day before the last episode was broadcast on 10th December 2017. After that, volume of searches for 'Blue Planet II' gradually decreased to virtually nothing by spring 2018. The extent of searching for the term 'Plastic Pollution' was very low prior to BBC BPII airing in the UK, the volume queries increased slowly to 13% of the maximum a month after the first BBC BPII's episode was broadcast.

The popularity of 'Plastic Pollution' continued to rise gradually between 2018 and 2019 and peaked in July 2019 in the UK. In summary, searching for 'Blue Planet II' reached a maximum that coincided with the last episode of the series, whilst searches from 'Plastic Pollution' term increased slowly whilst the series was being broadcast and then saw a dramatic rise several months after the series was aired.

Figure 2-5 shows that the minimum search volume for 'Blue Planet II' was 5% of maximum between four to 28 weeks before BBC BPII was broadcast, and then it increased to around 20% of maximum between four to 28 weeks after the last episode of BBC BPII was aired in the UK. The volume of searches for 'Plastic Pollution' was around 3% of maximum, between four to twenty- eight weeks before BBC BPII and 80%, between four to 28 weeks after the broadcast of the BBC BPII program in the UK.

In Figure 2-6, the number of searches for 'Blue Planet II' and 'Plastic Pollution' terms one week before and after and one month before and after the series airs in the UK can be seen. According to this figure, the average search for the 'Blue Planet II' increased a month and a week before and after the series aired, but search for 'Plastic Pollution' term was low a week before the series aired, then an increase one week after broadcast in the UK.

Moreover, results of Wilcoxon-test for 'Blue Planet II' and 'Plastic Pollution' search terms in the UK show the p-value is far less than> 0.05. Thus, there are significantly more hits after the program was released in the UK. Therefore, the result for the UK shows the null hypothesis is

acceptable and there is a difference between popularity of 'Plastic Pollution' before and after BBC BPII was released.
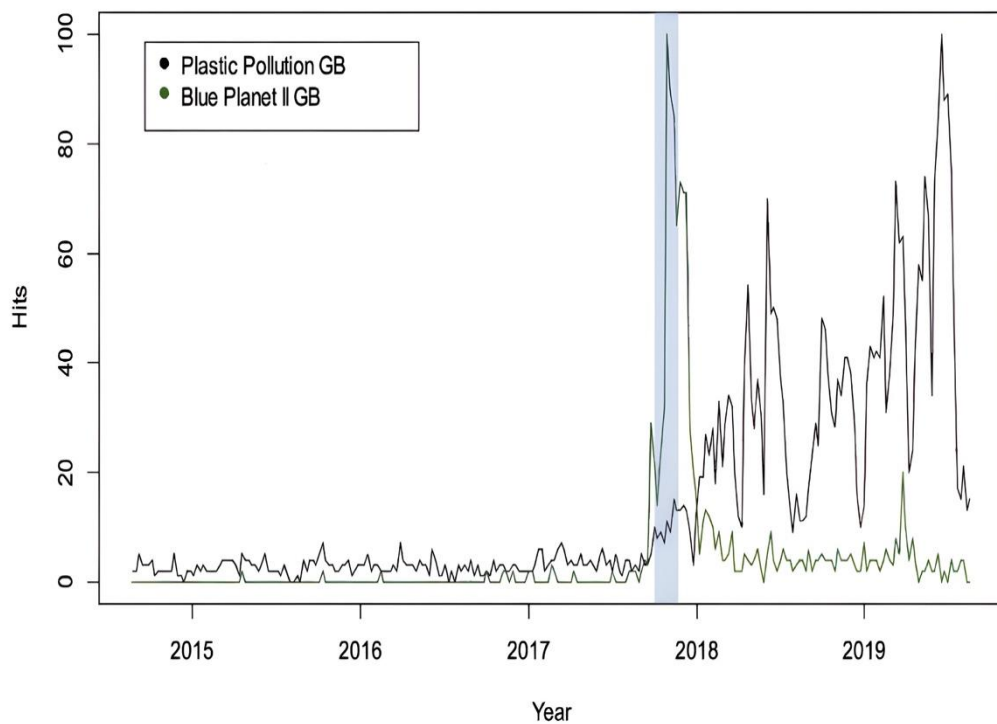
Figure 2-4 Linear trend model showing search volumes for Blue Planet II and Plastic Pollution from 2014 to 2019 in the UK

The x-axis covers a five-year time frame internet search for 'Blue Planet II' series and 'Plastic Pollution'. The y-axis shows the relative number of searches. The numbers on y-axis are scaled to a range of 0 to 100 based on the number of subjects to all inquiries. The blue coloured box shows the length of the first episode of the BBC BPII series broadcast in the UK (October 29, 2017 to 10, December 2017) (Google Trends known UK as GB).
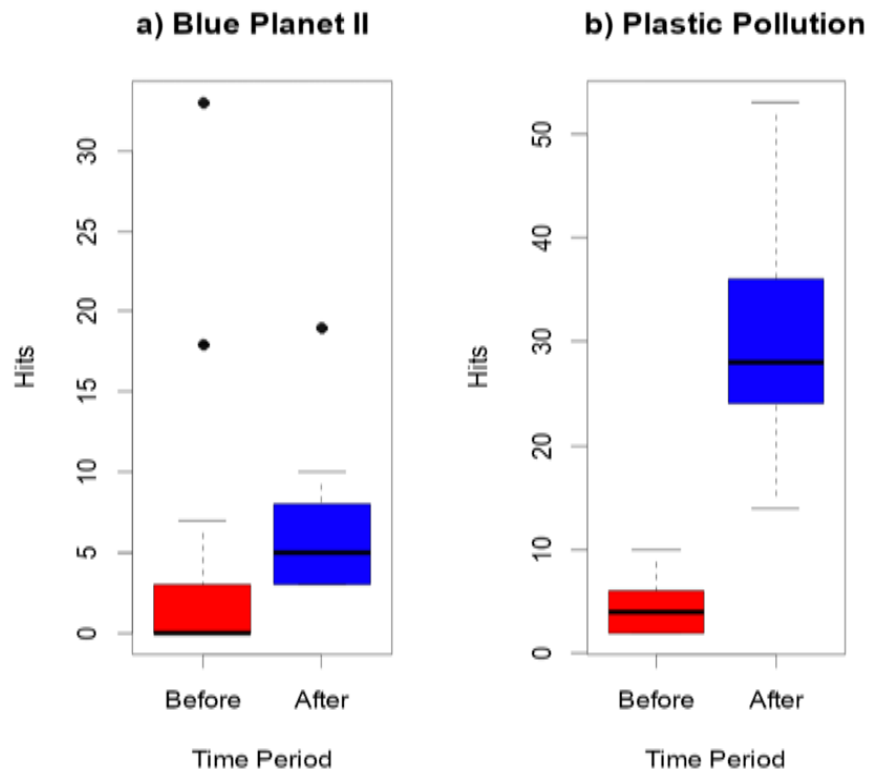
Figure 2-5 Search volumes for Blue Planet II, and Plastic Pollution in the UK

A) Shows relative search volumes for the 'Blue Planet II' term in Google, during a period from 28 weeks to 4 weeks before the broadcasting of the first episode of BBC BPII TV Show in the UK. Boxplot B) shows the numbers of searches for 'Plastic Pollution' term during a period from 4 weeks to 28 weeks after the release of last episode of BBC BPII in the UK. The boxes are representing 25-75 per cent of data. The two horizontal lines in the middle of the boxes represent 95% of the data. The thick lines in the middle of the boxes show the median. Circles outside the lines are outliers.
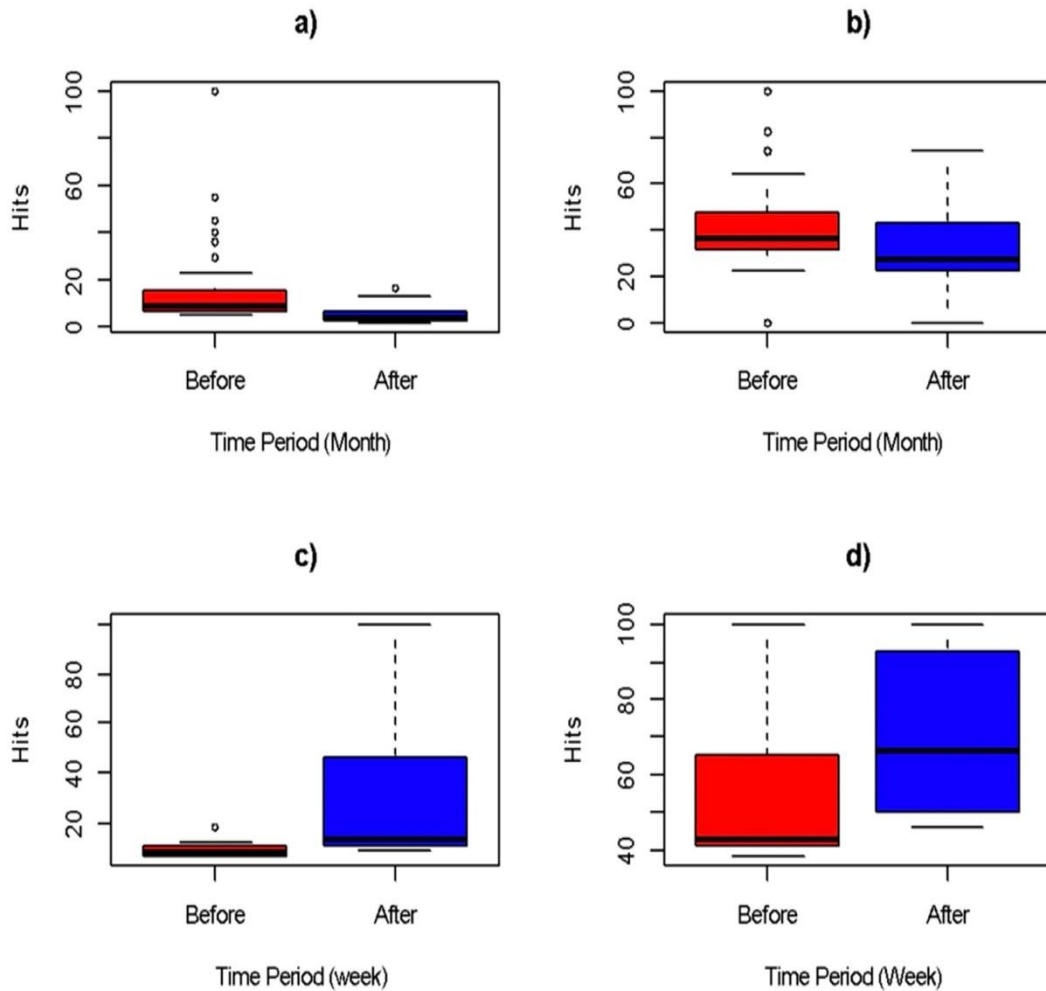
Figure 2-6 Searches for the Blue Planet II and Plastic Pollution in Google, a month to a week before and after the series was aired in the UK (October 2017)

The relative volume of Google searches for; (a) 'Blue Plant II' a month before and after the broadcasted of the first episode of BBC BPII in the UK. (b) 'plastic pollution' a month before and after the broadcasted of the first episode of BBC BPII in the UK, (c) 'Blue Plant II' a week before and after the broadcasted of the first episode of BBC BPII in the UK. (d) 'plastic pollution' a week before and after the broadcasted of the first episode of BBC BPII in the UK,

The thick lines in the middle of the boxes are median. The boxes represent 25-75 per cent of data. The two horizontal lines represent 95% of the data. Any circles outside these lines are outliers.

2.3.3 The US

Figure 2-7 displays 'Blue Planet II' and 'Plastic Pollution' search interest volume between 2014 and 2019 in United States. Based on the figure, there was a sudden rise in the queries volume of 'Blue Planet II' from about 50% of maximum to 100% one day after the show was broadcast 21 January 2018. The volume of searching for 'Blue Planet II' remained high in the seven weeks following weeks during the time of the show was broadcast.

The search volume of the term 'Plastic Pollution' climbed moderately from 11% of maximum to around 30% between November and January 2018. Subsequently, the trends fluctuated with 59% at the highest level and 12% at the lowest level from 2018 to 2019. Overall, the volume of queries of 'Plastic Pollution' increased substantially and peaked at 100% on 12th May 2019 in the US. In figure 2-7 the red vertical bar showing the duration of the BBC BPII series in the United States.

Figure 2-8 illustrates searches for 'Blue Planet II' was 60% of maximum, 4 to 28 weeks before the show was aired in the US, but it decreased to around 26% out of a maximum 4 to 28 weeks after the show was broadcast. In contrast, according to Google Trends the popularity of 'Plastic Pollution' was 10%, four to twenty weeks before the BBC BPII broadcast, reaching 60%, 4 to 28 weeks after the show was broadcast in the US.

Moreover, in this research data was collected between 4 and 28 weeks before and after the BBC BPII series to assess whether internet searches for 'Blue Planet II' and 'Plastic Pollution' had changed 4 weeks before the first episode, and 14 weeks after the broadcast of the last episode of the show.

Figure 2-9 shows the highest volume of searches for the 'Blue Plane II' was nearly 80% of the maximum a month before the first episode of the BBC BPII aired, and decreased to about 30% of the maximum a month after the show was released in the US. Also, searching for 'Blue Planet II' was 50% of the maximum a week before the first episode of the show, and declined to 30% a week after.

On the other hand, searching for 'Plastic Pollution' was 80% a month before and decreased to 60% of the maximum a month after the show. However, internet searches were at their peak a week before the show and fall to 30% of the maximum a week after.

The result of Wilcoxon test for US shows that p-value for 'Blue Planet II' and 'Plastic Pollution' are both less than> 0.05. This means there is a significant difference in the search interest hits after the show was broadcast in the country. Thus, results for the US show the null hypothesis

is acceptable, and there is a significant difference between interest in 'Plastic Pollution' before and after BBC BPII series was released.

Figure 2-7 Linear trend model for public interest in Blue Planet II and Plastic Pollution from 2014 to 2019 in the US

The x-axis covers a five-year time frame for Google searches for 'Blue Planet II' and 'Plastic Pollution'. The y-axis shows the relative number of searches. The numbers on y-axis are scaled to a range of 0 to 100. The blue coloured panel shows the length of the first episode of the BBC BPII series broadcast in the UK (October 29, 2017 to 10, December 2017), while the red bar shows the period of airing the series in the US (20 January 2018 to 10 March, 2018).
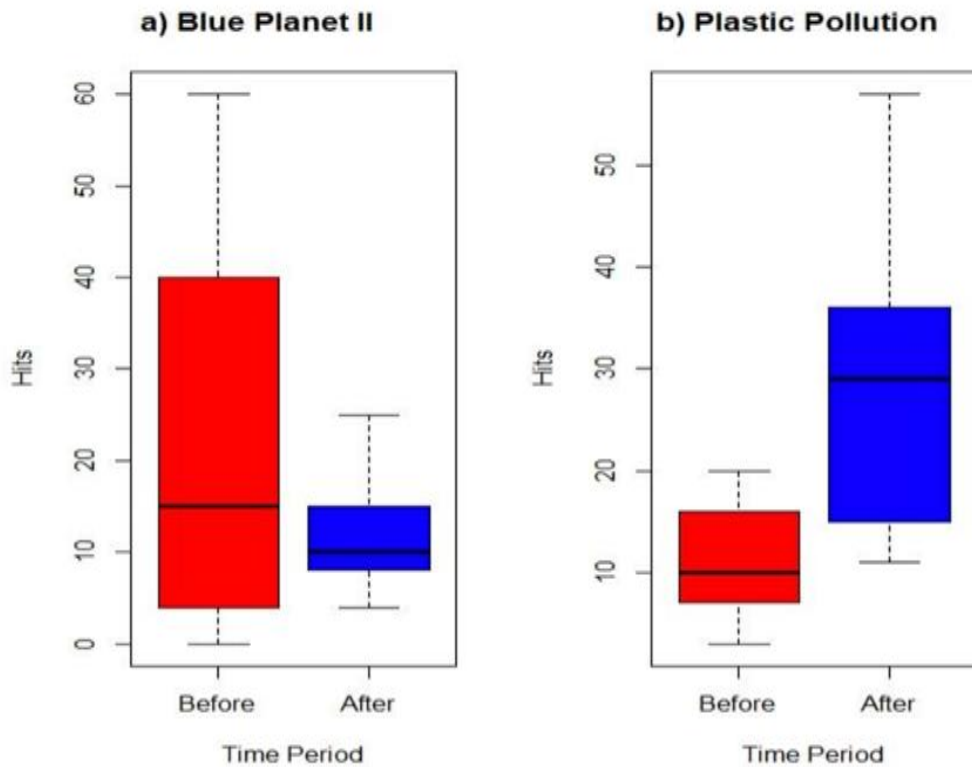
Figure 2-8 Search Volumes for Blue Planet II, and Plastic Pollution in the US

A) Shows relative search volumes for the 'Blue Planet II' term in Google, during a period from 28 weeks to 4 weeks before the broadcasting of the first episode of BBC BPII TV program in the US. Boxplot B) shows the numbers of searches for 'Plastic Pollution' term during a period from 4 weeks to 28 weeks after the release of last episode of BBC BPII in the US. The boxes are representing 25-75 per cent of data. The two horizontal lines in the middle of the boxes represent 95% of the data. The thick lines in the middle of the boxes show the median. Circles outside the lines are outliers.
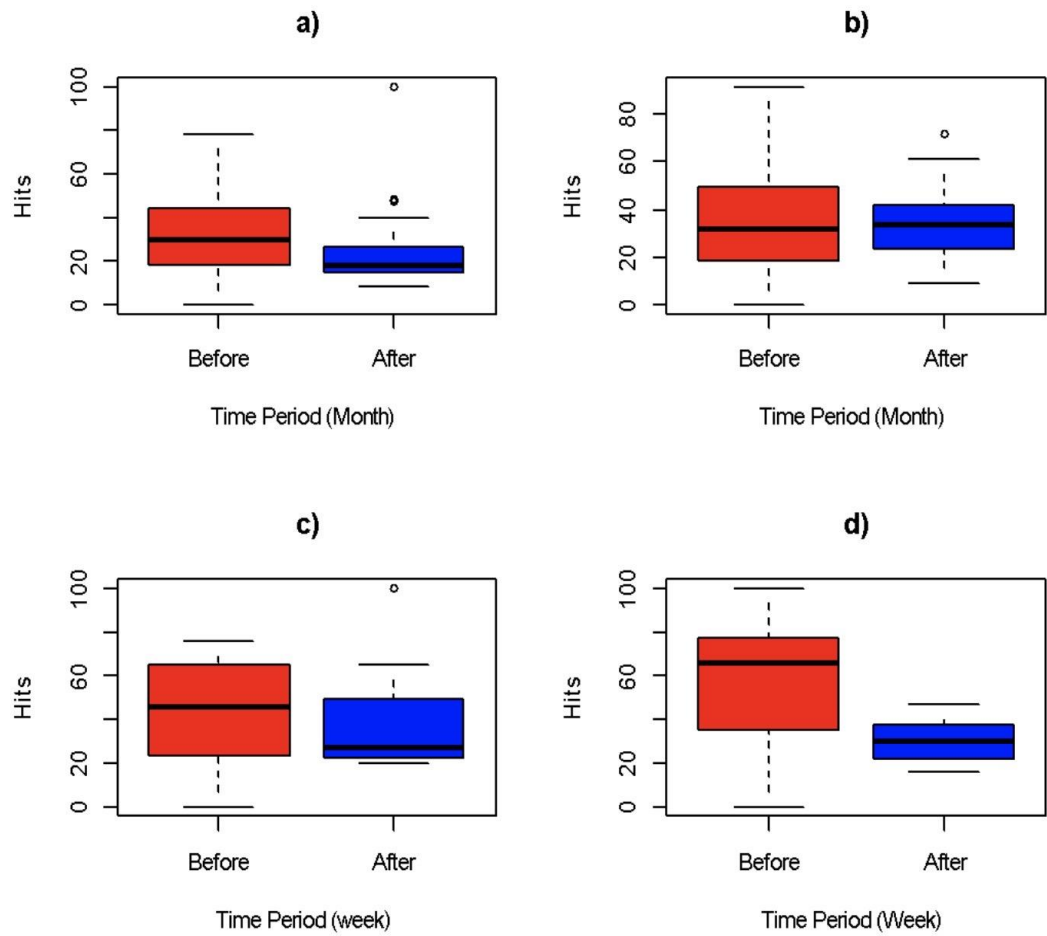
Figure 2-9 Searches for the Blue Planet II and Plastic Pollution in Google, a month to a week before and after the series was aired in the US (October 2017)

The relative volume of searches for; (a) 'Blue Plant II' a month before and after the broadcasted of the first episode of BBC BPII in the US. (b) 'plastic pollution' a month before and after the broadcasted of the first episode of BBC BPII in the US, (c) 'Blue Plant II' a week before and after the broadcasted of the first episode of BBC BPII in the US. (d) 'plastic pollution' a week before and after the broadcasted of the first episode of BBC BPII in the US,

The thick lines in the middle of the boxes are median. The boxes represent 25-75 per cent of data. The two horizontal lines represent 95% of the data. Any circles outside these lines are outliers.

2.3.4   Canada

Figure 2-10 depicts internet searches for 'Blue Planet II' and 'Plastic Pollution' terms between 2014 and 2019. According to the figure, there was a sudden rise in 'Blue Planet II' queries by 79% from the maximum at the end of September 2017, but it hits the lowest point of 0% of the maximum in October 2017. In addition, there were two spikes in 'Blue Planet II' internet searches during the seven weeks of broadcasts of the series from October to December 2017.

In January 2018, the BBC BPII series was aired in Canada. Search volume for the 'Blue Planet II' term showed an upward trend in the following month and reached nearly 60% of the maximum during the airing of the last episode of the show in March 2018. Furthermore, internet searches for the 'Plastic Pollution' term fluctuated from 0% to 100% of the maximum between 2017 and 2019, with the most changes happening in months following the last episode of the show aired in this country.

Based on the figure 2-10, 'Plastic Pollution' internet searches were not significant before the BBC BPII series aired, but fluctuated wildly and reached to 100% of the maximum in June 2019. In figure 2-10, the red vertical bar represents the duration of the BBC BPII series broadcast in Canada.

Figure 2-11 indicates the Internet searches for the 'Blue Planet II' term was at the peak, 4 to 28 weeks before the show was released, but it decreased to about 60%, 4 to 28 weeks after the series was broadcast. While searching for 'Plastic Pollution' was about 30%, 4 to 28 weeks before the show aired and climbed to nearly 60%, 4 to 28 weeks in 20 January 2018.

Furthermore, Figure 2-12 shows search for 'Plastic Pollution' and 'Blue Planet II' a month, and a week before and after the series premiered. According to the figure, searches for 'Blue Planet II' were about 70% of the maximum a month before, and remained the same a month after the first episode of the show aired in Canada. In addition, according to the figure 2-12, searching for 'Plastic Pollution' was nearly 40% of the maximum a week before and spiked to 100% a week after the first episode of the show in Canada.

Wilcoxon-test result for Canada shows p-value for 'Blue Planet II' and 'Plastic Pollution' terms are far less than> 0.05. Consequently, searches before and after the series aired in Canada differ significantly. As a result, the null hypothesis is acceptable, and 'Plastic Pollution' popularity differed before and after the BBC BPII series in Canada.
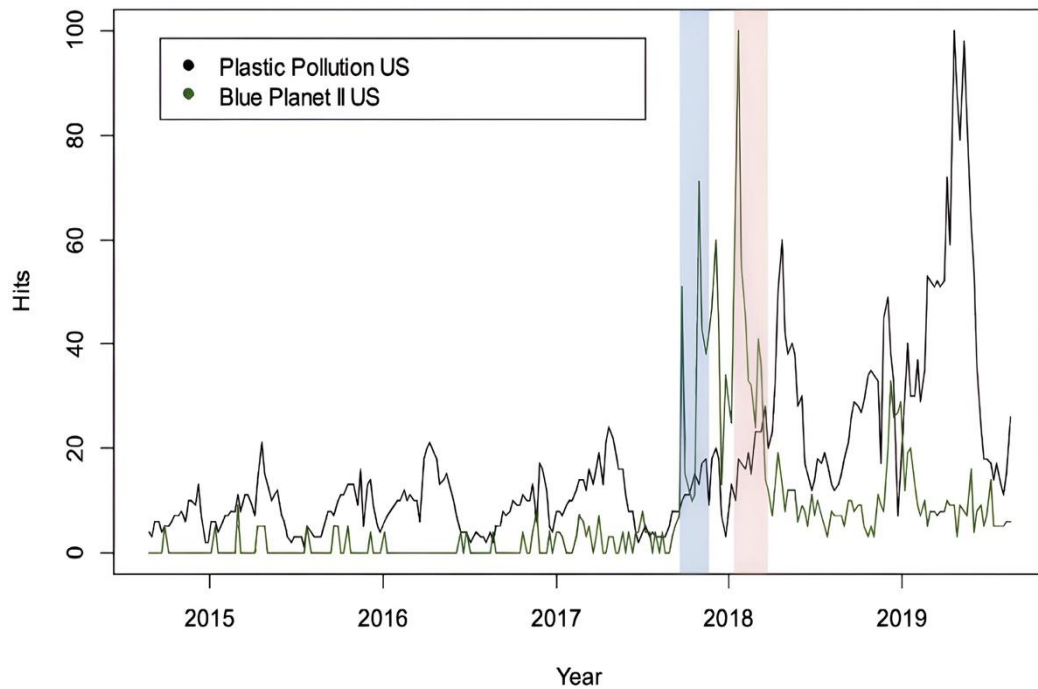
Figure 2-10 Linear trend model for public interest in Blue Planet II and Plastic Pollution from 2014 to 2019 in Canada

The x-axis covers a five-year time frame internet search for Blue Planet II series and Plastic Pollution. The y-axis shows the relative number of searches. The numbers on y-axis are scaled to a range of 0 to 100 based on the number of subjects to all inquiries. The blue coloured bar shows the length of the first episode of the BBC BPII series broadcast in the UK (October 29, 2017 to 10, December 2017), while the red one shows the period of airing the series in Canada (20 January 2018 to 10 March, 2018).
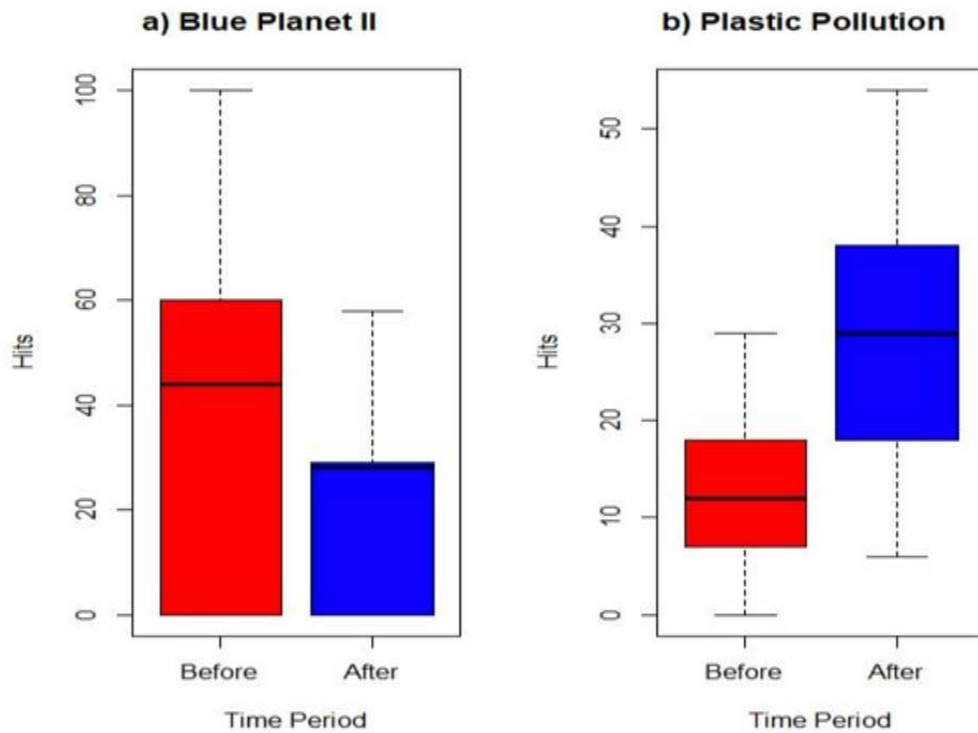
Figure 2-11 Search Volumes for Blue Planet II, and Plastic Pollution in Canada

A) Shows relative search volumes for the 'Blue Planet II' term in Google, during a period from 28 weeks to 4 weeks before the broadcasting of the first episode of BBC BPII TV program in Canada. Boxplot B) shows the numbers of searches for 'Plastic Pollution' term during a period from 4 weeks to 28 weeks after the release of last episode of BBC BPII in Canada. The boxes are representing 25-75 per cent of data. The two horizontal lines in the middle of the boxes represent 95% of the data. The thick lines in the middle of the boxes show the median. Circles outside the lines are outliers.
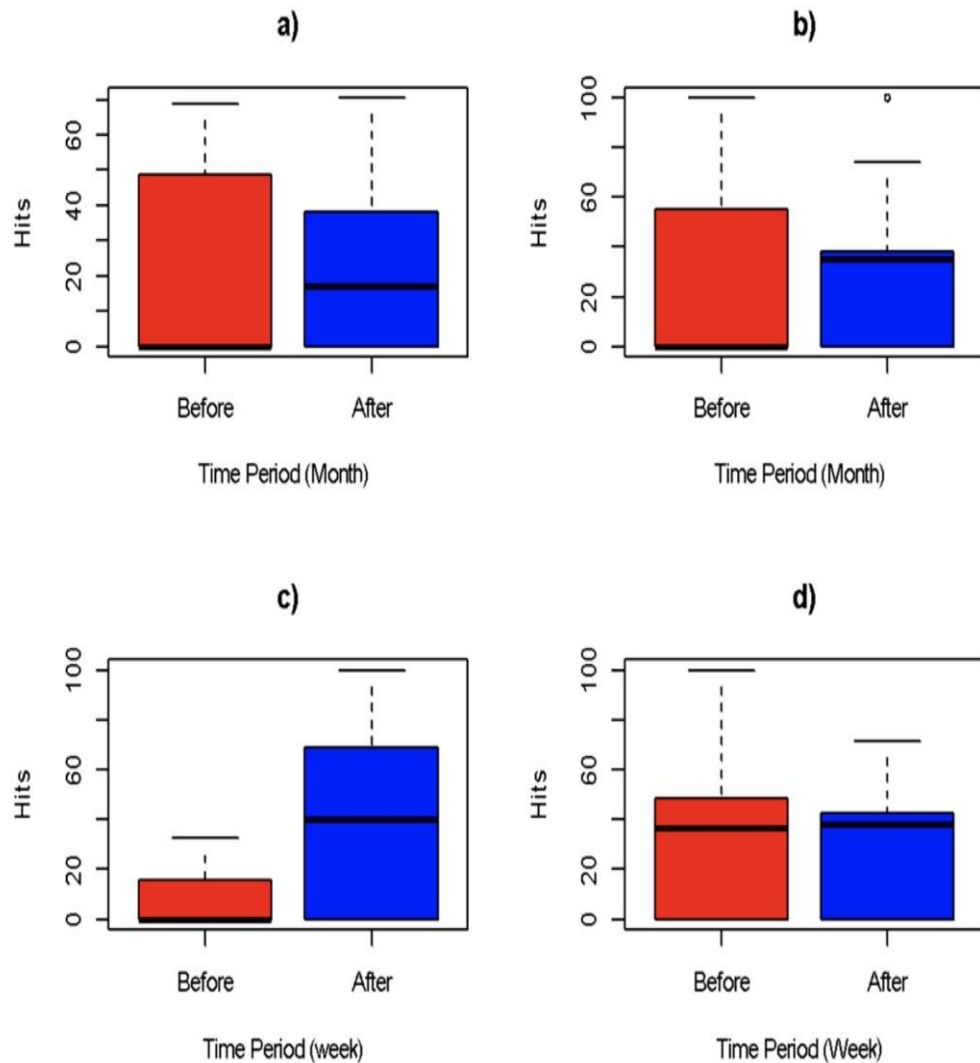
Figure 2-12 Searches for the Blue Planet II and Plastic Pollution in Google, a month to a week before and after the series was aired in Canada (October 2017)

The relative volume of searches for; (a) 'Blue Plant II' a month before and after the broadcasted of the first episode of BBC BPII in Canada. (b) 'plastic pollution' a month before and after the broadcasted of the first episode of BBC BPII in Canada, (c) 'Blue Plant II' a week before and after the broadcasted of the first episode of BBC BPII in Canada. (d) 'plastic pollution' a week before and after the broadcasted of the first episode of BBC BPII in Canada.

The thick lines in the middle of the boxes are median. The boxes represent 25-75 per cent of data. The two horizontal lines represent 95% of the data. Any circles outside these lines are outliers.

2.3.5 Australia

BBC BPII series aired in Australia on 20 February 2018. Figure 2-13 shows the search interest volume for 'Blue Planet II' and 'Plastic Pollution' in this country between 2017 and 2019. According to the figure, after the show premiered in October 2017, the number of internet searches for 'Blue Planet II' peaked at 100% of the maximum, and increased to 62% of the maximum in February 2018, but decreased again and remained below 50% of the maximum by July 2019.

Figure 2-13, show an upward trend in searching 'Plastic Pollution' to 60% of the maximum on April, June and July 2018 after the BBC BPII broadcast in Australia. However, the 'Blue Planet' internet searches peaked at 100% of the maximum by the end of 2019. In figure 2-13 the red vertical bar showing the duration of the BBC BPII series in Australia.

In addition, Figure 2-14 illustrate there was zero% of the maximum searches in the Google for the 'Blue Planet II' 4 to 28 weeks before the show was released in Australia, however, it increased to about 70% of the maximum, 4 to 28 weeks after the show was broadcast. Nevertheless, the volume of searches for 'Plastic Pollution' was about 30%, 4 to 28 weeks before, and rose to more than 90%, 4 to 28 weeks after the show was aired in Australia.

Furthermore, Figure 2-15 indicates google searches for the 'Blue Planet II' and 'Plastic Pollution' a month and a week before and after the series was aired in Australia. As it can be seen in Figure 2-15 , a month prior to and following the BBC BPII, searching for the 'Blue Planet II' and 'Plastic Pollution' terms were nearly the same, and more than 90% of the maximum. However, while searching for the 'Blue Planet II' increased to 100% of the maximum a week after the show was released, search for 'Plastic Pollution' decreased to 50% of the maximum a week after the broadcast of the show in Australia.

As determined by the Wilcoxon-test, 'Blue Planet II' has a p-value greater than 0.05, meaning there was no significant difference in its popularity before and after the show. A Wilcoxon-test shows, however, that the p-value of 'Plastic Pollution' is far less than >0.05, and there are remarkable differences in hits after the BBC BPII series was released in Australia.

Therefore, the result for Australia shows that the null hypothesis is accepted, and 'Plastic Pollution' popularity has changed since BBC BPII was released.
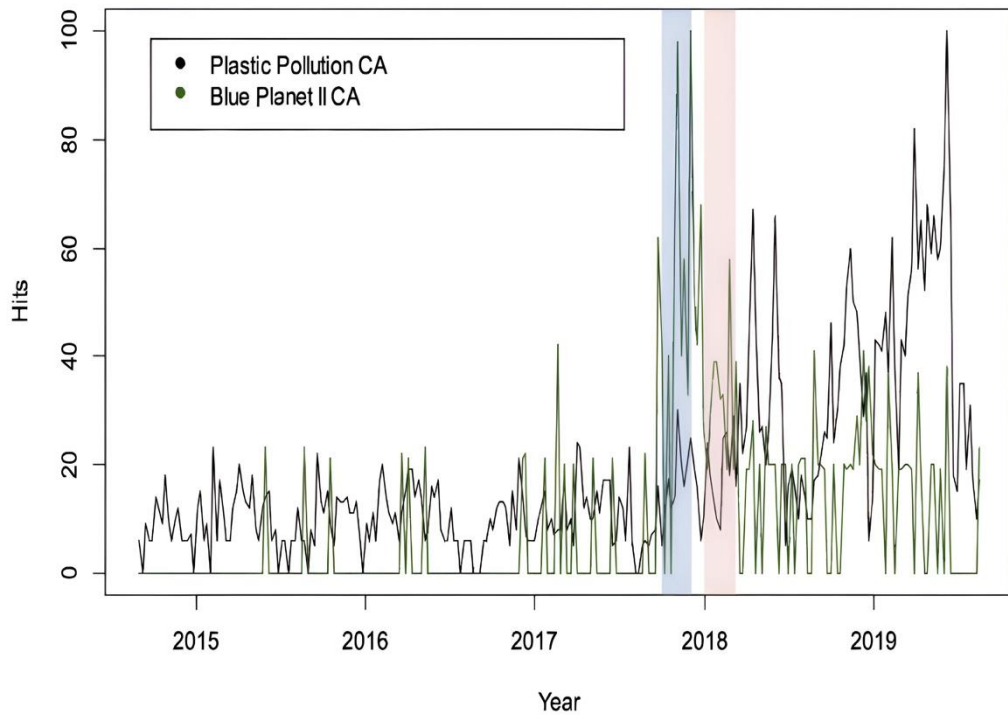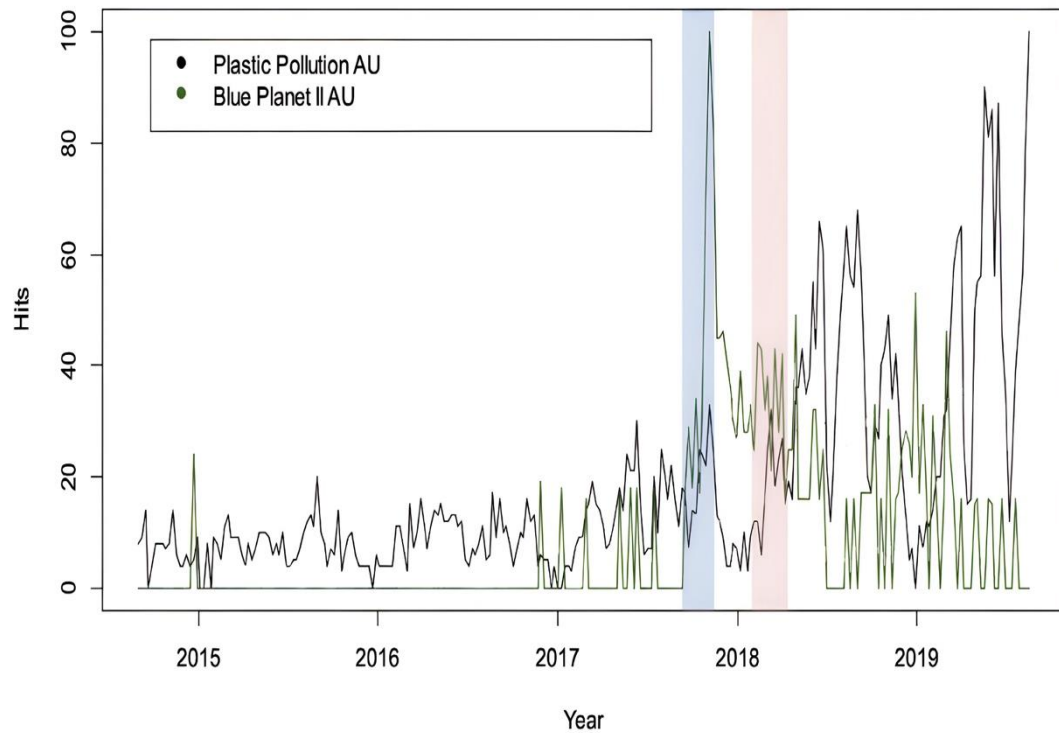
Figure 2-13 Linear trend model for public interest in Blue Planet II and Plastic Pollution from 2014 to 2019 in Australia

The x-axis covers a five-year time frame internet search for 'Blue Planet II' series and 'Plastic Pollution'. The y-axis shows the relative number of searches. The numbers on y-axis are scaled to a range of 0 to 100 based on the number of subjects to all inquiries. The blue coloured panel shows the length of the first episode of the BBC BPII series broadcast in the UK (October 29, 2017 to 10, December 2017), while the red one shows the period of airing the series in Australia (20 February 2018 to 10 April, 2018).
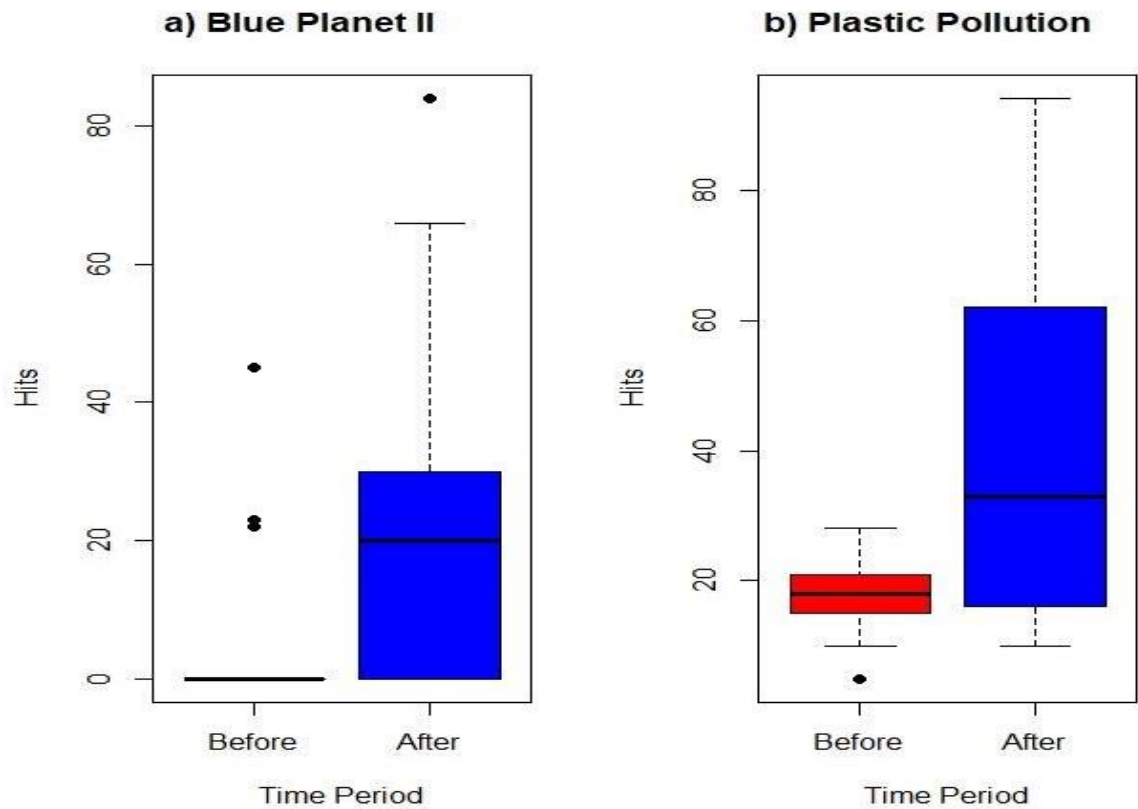
Figure 2-14 Search volumes for Blue Planet II, and Plastic Pollution in Australia

A) Shows relative search volumes for the 'Blue Planet II' term in Google, during a period from 28 weeks to 4 weeks before the broadcasting of the first episode of BBC BPII TV program in Australia. Boxplot B) shows the numbers of searches for 'Plastic Pollution' term during a period from 4 weeks to 28 weeks after the release of last episode of BBC BPII in Australia. The boxes are representing 25-75 per cent of data. The two horizontal lines in the middle of the boxes represent 95% of the data. The thick lines in the middle of the boxes show the median. Circles outside the lines are outliers.
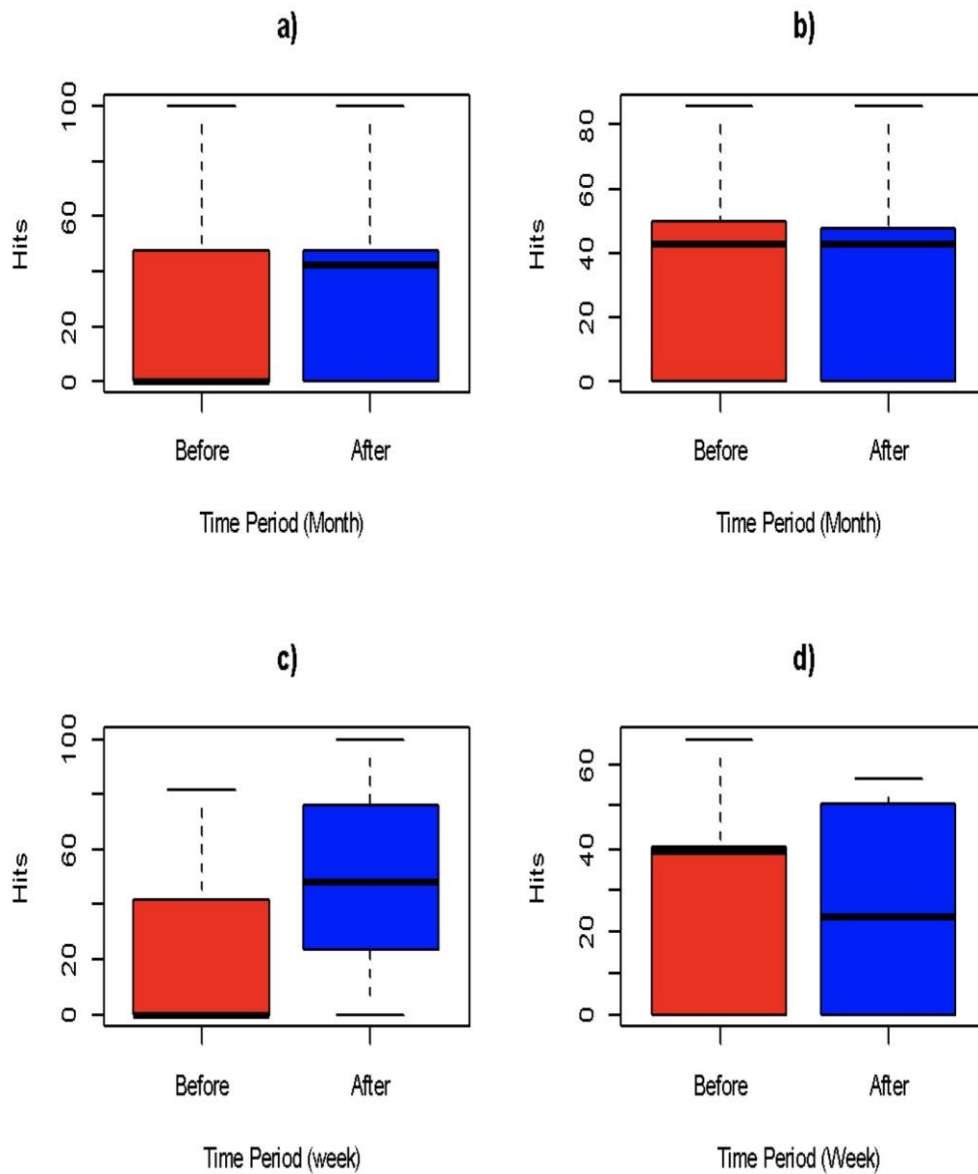
Figure 2-15 Searches for the Blue Planet II and Plastic Pollution in Google, a month to a week before and after the series was aired in Australia (October 2017)

The relative volume of searches for; (a) 'Blue Plant II' a month before and after the broadcasted of the first episode of BBC BPII in Australia. (b) 'plastic pollution' a month before and after the broadcasted of the first episode of BBC BPII in Australia, (c) 'Blue Plant II' a week before and after the broadcasted of the first episode of BBC BPII in Australia. (d) 'plastic pollution' a week before and after the broadcasted of the first episode of BBC BPII in Australia.

The thick lines in the middle of the boxes are median. The boxes represent 25-75 per cent of data. The two horizontal lines represent 95% of the data. Any circles outside these lines are outliers.

2.4 Discussion of results using Google Trends

Blue Planet II series was produced by BBC One in 2017, and various experts and organizations argue that it had a huge impact on people reducing plastic uses (Calderwood, 2018; Hayns-Worthington, 2018; Murray, 2018; Partners, 2018).

This study aims to gauge whether internet search results for 'plastic pollution' correlate with broadcasting of Blue Planet II in four English speaking countries. In order to investigate this hypothesis, a Google Trends analysis was conducted between 2014 and 2019, before and after Blue Planet II was broadcast, on searches related to the two main terms (Blue Planet II and Plastic Pollution).

In order to investigate this hypothesis, a Google Trends analysis was conducted between 2014 and 2019, before and after BBC BPII was broadcast, on searches related to the two main terms (Blue Planet II and Plastic Pollution).

GT normalizes interest over time from 0-100, with 100 showing the maximum interest at the selected date and place (Avilez et al, 2017). A decline in search interests' frequency for a given term is indicative of a decrease in public interest for that term (Lincoln, 2011). GT results can be provide for specific geographical regions and period, allowing for a comparison. Some experts argue that Google Trends demonstrates the pattern of "popularity" (Nick, 2018).

Google Trends (the number of searches for the two mentioned terms in a 5-year period) used to plot two types of graphs within R software: linear graphs and box plots was converted to two types of graphs by R software. Analyses of the popularity of the two mentioned terms before and after the series was broadcast, showed different trends for each search term. For instance, when the topic was 'Blue Planet II', there appeared to be an upward trend before broadcasting and downward trend afterward. This trend was observed in all four regions studied (see figures 2.2, 2.4, 2.7, 2.10, 2.13).

During the time when BBC BPII series was being broadcast (late 2017 to mid 2018), the volume of queries for 'Plastic Pollution' began to increase gradually and reaching a worldwide peak in the middle of 2018. However, in none of the regions studied did the increase in searches for Plastic Pollution correlate with searches for Blue Planet II or the broadcast of the series. Closer analysis of search terms within defined time windows (one week and one month before and after broadcast) also failed to find a correlation. In other words, the short- term impact of the BBC BPII on public interest in Plastic Pollution could not substantiated by our analysis of internet search activity.

It is noteworthy that the data used in this study were derived from English-speaking internet users, in four different regions of the globe, who searched the Internet in English. Therefore, these data do not represent the global communities which do not use the internet or search engines to investigate a specific subject.

Bahjat, et al 2016, argue that four billion of the world's population do not have access to the internet, simply because connecting to the internet is not cheap, there is not enough relevant content, or that the internet is not familiar to them (Bahjat et al, 2016). Moreover, we do not know beyond the threshold that Google sets what the actual number of people looking for an issue or topic is, and it may be that the searches are not representative of the general population (Reilly et al, 2012).

Nonetheless, the findings still include the highest and most widely available public interest data set (Choi et al, 2012; Lipsman, 2009), and reliably reveals public interest and opinion patterns (Breyer et al, 2010; Christine, 2009; Vosen et al, 2011).

In short, this study suggests that internet searches alone would not be sufficient to evaluate this type of research. For future research, and in order to achieve more accurate analyses of data, other tools including Google Insight could be used, in addition to Google Trends.

Also, it is worth pointing out, that the linear graphs presented in this work show that searching for the Plastic Pollution keyword on the internet declined at the end of each year in the four mentioned countries, around Christmas. Christmas-related searches by the public may have contributed to this trend.

For instance, in an article in BBC NEWS, it was reported that a single study carried out by Hubbub, an environmental charity, found that most Christmas sweaters contain plastics, and this result shows people pay less attention to plastic or polymers pollution during this holiday season (NEWS, 2019).

Despite this, the frequency of internet searches relating attention to plastic pollution rose again in the months following Christmas. A clear example of this is the news about families contributed photos to the plastic war (Nazca, 2018) .

To enhance public awareness of plastic pollution, Ben Lecompte, started a six-months swimming through the 'Great Pacific Garbage Patch' (Zhou, 2018), and in September 2018 scientist announced that they are getting ready to cleaned up the area (Summers, 2018).

Also, single-use plastic bottles were prohibited from the London semi-marathon (Rebecca, 2018b). The Plastic Pollution issue was extensively studied in 2018. For instance, a new study detected microplastics in tap water across the US (Foxnews, 2018), and the US government announced that full-service restaurants in California would no longer be able to serve plastic straws, as a result of this study (Moon, 2018).

2.5 Closing remarks

Some studies claim that awareness of plastic pollution has increased around the world (Crisp, 2018; Gabbatiss, 2017; Press, 2018) and a number of experts believe that the BBC BPII series has had a major impact on initiating plastic war (Calderwood, 2018; Hayns-Worthington, 2018).

Based on the findings of this study, there was no immediate increase in interest in plastic pollution following the BBC BPII series in the UK, the US, Canada, and Australia. However, an upward trend in the popularity of plastic pollution was found months after the show was aired.

Also, the study of some news related to 'Plastic Pollution' shows after the BBC BPII series broadcast, a number of laws were passed and a number of voluntary actions were initiated in different countries to reduce the use of plastic products. For instance, in 2018 The Guardian newspaper announced that families are joining plastic war globally (Nazca, 2018), and in 2019 the British government banned the use of some plastic products such as plastic straws and cotton buds, and invested £60m to address the problem of plastic waste (Harvey, 2019; Press, 2018).

Chapter 3 Qualitative assessment of internet comments on plastic pollution

3.1 Introduction

Plastic pollution is regarded as a major global environmental problem (Freinkel, 2011), and a number of experts believe it is a catastrophe for the environment (Barnes et al, 2009). Therefore, raising public awareness about it is vital (Lohr et al, 2017), and could have a significant impact on the policy decisions of the governments (Press, 2018).

According to Shapiro & page, awareness of public concerns is also important for biologists and environmental scientists, and can motivate them to take conservation steps (Shapiro & Page, 1983). In regards to raising awareness, exploring the potential of online media, like television and newspapers has been increasingly examined by scientists and journalists (Schultz, 1999).

One of the features of the online platforms is the "comment" section that can cultivate reader engagements in social forums. According to Richardson, online platforms provide the opportunity for readers to post comments on articles, and express their believes and opinions (Richardson, 2007). Hermida & Neil, also believe that the online newspaper comments section, commonly known as an online feature, allows individuals and commentators to share their voice, views, and experiences about an online article (Hermida & Neil, 2007).

Therefore, several studies investigated the impact of online comments section on reader participate in debates, or the effect of their opinion on journalists' jobs, or other subjects. For instance, in 2012, Nielsen examined how online comments section in newspapers has an impact on journalist's job. She studied data collected from 582 journalists working for 36 daily print newspapers to see whether journalists appreciate using anonymous online comments as an interaction way with readers or it is an insult to a journalistic standard. The result of Nielsen study showed that journalists are believe readers, must have the opportunity to comment their opinion online (Nielsen, 2012).

Another example is a study done by Kyung and his colleagues, who explored the relationship between citizen engagement and online comments in South Korea. According to the result of Kyung and his colleges, the age of commenters and the content of the news had crucial impact on public online engagement (Kyung et al, 2014).

Moreover, researchers have been trying to find the particular reason that shows using readers' comments in discussion forums indicate the interest of people in participating and discussing their opinion about a specific subject (Manosevitch & Walker, 2009).

In this chapter we aim to determine whether attitudes to plastic pollution have changed after airing of Blue Planet II by performing textual analysis of comments left on articles about plastic pollution published before and after BPII was aired.

3.2   Methodology

Manosevitch and Walker method was used to examine as to whether the public perception and reaction to plastic pollution had change following BBC BPII broadcast. The method suggests analysing online comments section of newspapers, to ascertain public's reactions.

They examined the impact of online newspapers' comments section on encouraging users to participate or not participate in democratic discussions (Manosevitch & Walker, 2009). It is worth mentioning that the Manosevitch and Walker method was inspired by Gastil's method, but Gastil had only considered how online comments affected political decisions (Gastil, 2008).

In addition, the Manosevitch and Walker method was chosen for this study, as it emphasises analysis of comments made by readers of online newspaper articles, in assessing the level of public awareness regarding a critical issue such as plastic pollution. In addition, according to Manosevitch and Walker, reader comments can cultivate public deliberation, and this dissertation analyses whether the online commentary regarding plastic pollution changed after the BBC BPII was broadcast.

Furthermore, in light of the fact that Plastic Pollution has now become a public debate, the Manosevitch and Walker method was chosen to determine if the public debate on plastic pollution has changed after BBC BPII aired.

Based on the mentioned method, comments on four articles published by The Guardian and The Times online newspapers were analysed in this chapter to determine the point of view of readers and how public discourse changed before and after the broadcast of the BBC BPII series in October 2017.

Based on the mentioned method, 613 comments were analysed are separated into two categories: "Analytic Process of Deliberation" and "Social Process of Deliberation". Also, the quality of the debate was examined using the 'posing question' element which is useful to indicate whether a reader is willing to engage in debate. All comments were studied and categorized as explained below:

3.2.1 The analytic process of deliberation

In this group, comments were analysed and coded based on whether they included personal narratives, facts, sources, personal positions on a topic, personal values and/or reasons for an opinion (Gastil, 2008; Manosevitch & Walker, 2009).

3.2.1.1 Narrator

These comments are referring to a unique experience which is related to the subject. Comments fall into this category when readers share first-hand knowledge or experiences of the subject. For instance, the underlined sections in the following comments have been classified as a narrative from two separate articles:

An article from The Guardian online newspaper titled "A million bottles a minute: world's plastic binge 'as dangerous as climate change"(Sandra & Matthew, 2017).

> "I go into Boots and think to myself that it is just full to the rafters of stuff that will be in landfill 3 weeks after purchase. There has to be a better way but trying to buy shampoo or washing up liquid in anything other than plastic is nigh on impossible"

Article from Times newspaper titled "Prince Charles: Anyone eating seafood will be consuming plastic too"(Webster, 2017).

> "Interestingly my wife and I have just arrived in Malta for a holiday and immediately having come through customs we were presented with a plastic water bottle courtesy of the Malta tourist office I suspect. On arrival at the hotel, we paid our government "conservation tax" and when subsequently visiting the supermarket for "supplies" each type of fruit purchased was put in a separate plastic bag and then all put in another plastic bag"

3.2.1.2 Fact

Comments that included factual information related to the topic, such as statistical data, laws, a particular activity, decisions made, or descriptions of events related to the subject were categorized as "facts." The underlined section of the following examples showing were coded as 'facts'

> "The plastic industry must be charged for all this waste. They produce this crap and have absolutely no responsibility for the effects on the environment. Tax them and with the money, you can pay people to clean it up. Create jobs and clean the environment"(Sandra & Matthew, 2017).

> "China 1.3 billion people 1.5-3.5 million tons. India 1.3 billion people less than .5 million tons on any estimate USA 300 million even less"(Webster, 2017).

3.2.1.3 Sources

Comments listed for "sources" deliver further information on the topic as references to internet materials on the subject, citations from public issues, or providing source information and descriptions of associated problems related to the topic. For example, the underlined sections in the following comments were coded as 'sources':

> "That's not quite right. Many plastics are toxic to the environment, even if they aren't, they can still cause considerable damage to wildlife. <u>Here's an interesting link: https://serc.carleton.edu/NAGTWorkshops/health/case_studies/plastics.html</u>"(Sandra & Matthew, 2017).

> "I think you missed the bit about plastic in fish used as food. From what I understand, there is a lot of it that is broken up into tiny bits that gets into the fish we eat. <u>https://www.theguardian.com/lifeandstyle/2017/feb/14/sea-to- plate-plastic-got-into-fished fish waste could well end up being used to feed other food animals</u>"(Sandra & Matthew, 2017).

3.2.1.4 Position and values

Where commentators created a specific declaration about their stance these were coded as 'position'. In this type of comment, the commenter talks about their own opinion. For example, underlined sections of the following two comments were coded as 'position':

> "<u>The plastic industry must be charged for all this waste</u>. They produce this crap and have absolutely no responsibility for the effects on the environment. <u>Tax them and with the money, you can pay people to clean it up</u>. Create jobs and clean the environment"(Sandra & Matthew, 2017).

> "<u>Of course, it's about making sustainable products in the first place, displacing the companies creating plastic products which pollute</u>. Plastic is forever" (Sparrow, 2018).

3.2.1.5 Reason

Comments which would include particular claims of purpose for or against an issue were coded as 'reason'. For instance:

> "Plastic bottles can be returned just as easily as glass ones. <u>They save fuel used in transport because they are light, they don't break and stay years in the ground hurting people and animals.</u> Plastic is not the problem, the waste is"(Sandra & Matthew, 2017).

> "Without wishing to labour the point, <u>I still reckon it makes me the polluter because it doesn't become pollution until it's been used and discarded</u>"(Sparrow, 2018).

3.2.2 The social process of deliberation

Comments were also coded based on Manosevitch and Walker's description of whether commentors were engaging socially with other contributors to the article (including the authors) This social method was evaluated by three elements:

3.2.2.1 Addressing other comments and commenters

Replying directly too or citing other comments or commenters, whether to declare acceptance or opposition, based on reasoning or query clarification are all classified as 'addressing'. For example:

> "This comment highlights the problem for me - people are prepared to blame everyone else yet when it comes to taking responsibility for their own rubbish, they blame others"(Sandra & Matthew, 2017).

3.2.2.2 Posing questions

Ask for an explanation or additional information from other commentators, indictes awareness of the presence of others in the online space and shows that one considers oneself a member of the debate with others. This method further shows that other respondents are respected and valued.

Asking for transparency can also indicate a serious effort to understand what other people are saying in the discussion. Posing question defines commentator's respects for the purpose of the conversation, and not comment or criticize opinions. Manosevitch and Walker, believe that using this strategy by commenters is very important for discourse, because it is one of the main goals of public conversation. For instance:

> "Forgive me if I'm wrong, but isn't this more of an aesthetic concern, than any real issue of toxicity?" (Sandra & Matthew, 2017).

3.2.2.3 Addressing the content of article

When debate responds directly to the content of the article, such as by questioning the data or view provided by the author, or merely by expressing gratitude or absence of the published material, this was coded as 'addressing'/ For example:

> "Some media outlets do try, this article for one, then we have others who only care about profit for the large corporations who are destroying the planet, I too as an old bigger am pessimistic, what a dumb species we are" (Sparrow, 2018).

3.2.2.4 Article selection

Data used for analysis in this chapter have been chosen from two well-known online newspapers: The Guardian and The Times. Two articles were chosen from each paper to enable a comparison of two more left-wing (The Guardian) and right-wing (The Times) groups of reader comments with a different perspective before and after BBC BPII series was aired for the first time on 29 October 2017. Articles were selected based on their topic (plastic pollution), reader engagement (over 75 comments), and proximity to broadcasting of BPII in the UK.

The first article is "A million bottles a minute: world's plastic binge 'as dangerous as climate change'" from The Guardian (Sandra & Matthew, 2017). This article was chosen because it was published two months before the BBC BPII series aired, and also it is about plastic pollution and comparing it to climate change as a significant problem.

The report has 200 online comments written by readers beneath the content. The title of the second article is "Recycling: how corporate Australia played us for mugs July 2018 " from The Guardian, released in July 2018 that was ten months after the BBC BPII series aired (Sparrow, 2018). The subject of this report is recycling in Australia and the conduct of large companies. The article contains 133 online comments.

"Prince Charles: Anyone eating seafood will be consuming plastic too" is the title of the third article surveyed in this chapter. It was published on 6 October 2017 in The Times (Webster, 2017). The article is related to plastic pollution and it was published 23 days before BBC BPII was broadcast. The article was followed by 78 online comments.

"Thousands of tons of plastic recycling are secretly burnt for fuel" is the fourth article that I chosen. It was published in The Times newspaper (Webster, 2019) in May 2019, and is about burning plastic waste instead of recycling it. It is discussing plastic and it contains 102 comments written by readers.

In the case of the articles published before BPII the comments made after airing were discounted. For the post-BPII articles comments were included in the analysis for up to 12 months after BPII was broadcast. Comments that were not related to plastic pollution, were not used in this study. For instance, during the time frame of the research, there were some comments discussing the British Royal family and commenters were only criticizing others' spelling.

The remaining 613 comments from the four mentioned articles of The Guardian and The Times were saved in a separate file in the data section of NVivo Software. QSR NVivo is a platform for qualitative and mixed-method research (Kent, 2019). As Kent suggested, NVivo is useful for analysing unstructured documents, sound, video, and picture information, such as interviews,

market research, studies, online forums, and journal articles. All comments from The Guardian and The Times were saved in a word file and transferred into the NVivo. Afterwards, two groups were created in NVivo files section.

The first group called "the analytic process of deliberation" with five deliberation elements: facts; narrative; position and value; reason; source. The second group is "the social process of deliberation" with three deliberation elements: addressing other comments and commenters; addressing the article content; posing questions that have been created in code section of NVivo (Manosevitch & Walker, 2009).

Moreover, position and value, the two deliberation elements that were analysed separately in the Manosevitch and Walker method, were merged in this chapter. Because in analysing comments process, it was decided that position and value have a very close definition. In addition, in the process of coding comments extracted from The Guardian and The Times (Table 3-1 Coding comment for each online newspaper article in Nvivo) all the comments imported were studied, and then based on the method, they were coded by being assigned to the eight deliberation elements of the analytic and social deliberation.

Since it was important to show the proportion of each of the eight deliberation elements for the process of analytic and social deliberation, the row percentage was used in NVivo as it shows the percentage of codes used for each element, e.g., Facts, posing question and etc., versus the total number of words used across all the other elements, which in table are listed in rows (Table 3-1 Coding comment for each online newspaper article in Nvivo).

Lastly, after reading the online comments from four mentioned articles one by one in NVivo software, based on Manosevitch and Walker method, and coding them in the two mentioned groups, related graphs were created.

Table 3-1 Coding comment for each online newspaper article in Nvivo software

Files		
Name	codes	References
The Guardian comments before BBC BPII	202	421
The Guardian comments after BBC BPII	141	334
The Times Comments before BBC BPII	85	169
The Times Comments after BBC BPII	104	245

3.3 Result of the qualitative assessment of online comments

A total of 613 published reader comments to the four articles that were coded, comprising the following eight elements noted above. Results are summaries in table 3.2.

Out of the five elements in the analytical processes of deliberation, the 'Position and Value's' element were used more often than the other elements by the commenters.

Before broadcast of BPII 36% and 51% of comments, form The Guardian and Times articles respectively included a 'position and value' statement. After broadcast 'position and value' statements appeared in 54% and 38% of The Guardian and Times articles respectively.

The second most common element that was used by the commenters is the 'narrative' mainly seen in the comments left for The Guardian's articles. There is evidence of a narrative element in 32% of comments left before and 12% after the broadcast. In The Times 4% and 13% of comments left before and after the show showed a narrative element.

6% of comments from the article published after the series in The Times contained the 'Source' element, none quoted sources in the article published before BPII. The use of 'Source' element was slightly more common in The Guardian comments. 9% including sources in the earlier article, decreasing to 1.6% after the BBC BPII was broadcast.

The Guardian's comments coded as containing 'Fact' elements were 6% for both the early and later articles. In The Times 11% quoted facts in the early article and 4% in the post-BPII article.

'Reason' comments increased from 2.4% to 5% in the Guardian, and from 1.6% to 5% in The Times.

When assessing comments in the 'Social process of deliberation' category, 17% of comments before and 18% of comments left after the show was released in The Times articles included some of these elements. For The Guardian 8% before and 9% after broadcast of The Guardian comments included these elements.

More specifically 6% vs 9% of the comments left in The Guardian, before and after the BBC BPII, respectively, consist of elements that 'addressed other comments and commenters', whereas 8% of the comments left before and 14% after BPII The Times online newspaper, respectively, are in this category. In The Guardian 0.5% of comments were coded as 'posing questions' before BPII vs 4% of the after broadcast. This compared to 1% before and 7% after in The Times comments after the BBC BPII.

Table 3-2 Percentages of comments used for each deliberation criterion in The Guardian and The Times online newspapers

Values highlighted in green represent elements that have increased after BPII, amber values are largely unchanged and red values have decreased.

Online Newspapers	The Analytical Process of Deliberation					The Social Process of Deliberation		
	Facts	Narratives	Position and value	Reasons	Sources	Addressing other comments and commenters	Posing questions	Addressing the article content
The Guardian before BBC BPII	5.7%	32%	36%	2.4%	9.4%	6.1%	0.46%	8.2%
The Guardian after BBC BPII	5.7%	11%	54%	5.0%	1.6%	9.1%	4.3%	9.3%
The Times before BBC BPII	11%	4.1%	38%	1.7%	6.2%	14%	7.1%	18%
The Times after BBC BPII	4.4%	13%	51%	4.8%	0%	8.3%	1.2%	17%

3.4 Discussion of the qualitative assessment of internet comment on plastic pollution

As noted previously, 'the analytical process of deliberation' and 'the social process of deliberation' were utilised to assess the 613 comments from two online newspapers. As regards the 8 elements of deliberation, the most frequent element commented on was 'Position and Value'. This indicates that the internet users were primarily interested in expressing their views and opinion on the subject of plastic waste.

The element 'Source,' was used less frequently after the BBC BPII program was aired. The observation indicates that compared to the period prior to the airing of the series, the internet users were not utilizing as many different sources. These sources included environmentally related web links, newspaper articles, and podcasts.

The 'Narrative' element was more frequently used in The Times online newspaper comments section, and less frequently in The Guardian online comments section, after the BBC BPII was broadcast. However, the opposing patterns in The Times and The Guardian cannot be attributed to a specific factor. In relation to the 'Narrative' element, the commenters were interested in sharing their first-hand experience of how plastic pollution is addressed and managed in their own countries and beyond. In general, The Guardian commenters were more interested in the topics of plastic waste and plastic pollution.

Regarding the 'Facts' element, the assessment showed no change in The Guardian readers comments. However, there was a corresponding decrease in relation to the comments made by The Times readers. As regards to the element 'Reason', in both online newspapers an increase was observed after the BBC BPII broadcast.

The assessment also indicated that there was a minor increase in interest in relation to the 'Addressing the article content' element in the Guardian, whereas there was a decrease in relation to The Times readers comments. There was a contradiction in the patterns observed for element 'Addressing other comments and commenters' where there was an increase in relation to The Guardian and a decrease for The Times.

The same opposing pattern was observed from the assessment for the element 'Posing questions', where there was a 10-fold increase for The Guardian readers and a 6-fold decrease for The Times readers comments. Some of the results discussed in this work reflect the political and economic status of the readership of these two online newspapers.

Prior to the commandment of this research study, it was expected to find an enhance level of public understanding of the impact of plastic pollution on the marine ecology. However, based on the research conducted in this study, and the online data collated regarding comments made by readers, it is found that public awareness of environmental issues relating to plastic pollution has not been as extensive as expected.

In this research study four online articles were used, two of which were The Guardians and The Times prior to the airing of the BBC BPII program, and two from the same online newspapers after the program was aired. These four articles contained 613 online comments, as listed in table 3-1. Further research studies using a larger sample of data might show a more definite pattern, as regards the extent to which the BBC BPII program has informed the public of the adverse impact of plastic pollution on the marine environment.

Indeed, these two online newspapers were specifically chosen for this study, as they represent different political stance towards the importance of economic, social, and environmental issues which inform policy development at National, Europeans, and international levels.

Chapter 4 . General discussion and concluding remarks

To investigate the impact of the Blue Planet II (BBC BPII) series on people's awareness of plastic pollution, the popularity and correlation between Blue Planet II and Plastic Pollution terms were analysed in the second chapter of this study. Google search volume data for the two previously mentioned terms were obtained from Google Trends (GT) for the four major English-speaking countries of Canada, Australia, the United States, the United Kingdom, and the rest of the world.

GT data were tested as described in the second chapter of this thesis. Based on the result, the volume of Blue Planet II searches on the internet, which indicate its popularity, have increased before the show aired on October 29, 2017, but decreased immediately afterwards in all mentioned regions. However, the same result shows that the popularity of Plastic Pollution was not significant before and BBC BPII. Interest in this search term did increase after BPII, however there is no correlation between the searches for 'Blue Planet II' and 'Plastic Pollution' in any of the regions studied. Nor is there a clear correlation between the dates that the series was aired and an immediate change in searches for 'plastic pollution'.

In summary, according to the result of the chapter two, the popularity of plastic pollution searches did not increase suddenly after the airing of the BBC BPII and reached its peak by the end of 2018, after one year of the series airing. Thus, we were unable to support a causal link between the BBC BPII series and plastic pollution awareness.

Meanwhile a qualitative analysis of BBC BPII regarding people's awareness of plastic pollution was conducted in chapter three of this study, using the method described by Manosevitch and Walker. The reason for using this method is various studies claim that analysing comments can reveal people's opinions about a particular social or economic issues (Friemel & Dötsch, 2015; Gastil, 2008; Kyung et al, 2014; Manosevitch & Walker, 2009; Richardson, 2007).

613 comments were analysed concerning plastic pollution before and after BBC BPII was aired using the nine deliberations elements suggested by Manosevitch and Walker method (Manosevitch & Walker, 2009). Comments were selected from four articles published in two well-known online newspapers, The Guardian and The Times.

Based on the analysis of the comments at two stages, before and after broadcasting the BBC BPII series, it was clear that there was significant differences in the nature of the comments.

It is evident in the result of the chapter three that the percentage of commenting 'sources' elements, which is indicative of the quality of deliberation, has decreased after the show was aired. in despite, the percentage of comments containing 'position and value', which only shows

people's opinions, increased after the show broadcast. As a result, since BBC BPII aired, the quality of comments shared by commenters on the mentioned articles was not changed noticeably.

Additionally, an analysis of comments in the social process of deliberation category indicates that commenters' use of the 'addressing the content of article' element increased in The Guardian comments, while it decreased in Times comments after the show was released. The result also shows that The Guardian commenters used 'addressing other comments and commenters' element more and The Times commenters used it less after the BBC BPII aired.

Moreover, a comprehensive analysis of all the comments indicates that the use of 'posing question' element, which indicates a higher level of participation in a debate, increased in The Guardian comments but significantly decreased in The Times comments following the broadcast of the BBC BPII series.

Furthermore, analysis of the comments shows that some commentators posted multiple comments during the debate, which shows that they participated more than others, and they may be more concerned with plastic pollution. This also means that, as the debate progressed over time, commenters participated in the discussion several times and they were more involved in discussion each time with more information.

Also, it seems that commenters, especially in The Times newspaper comments section, preferred to discuss the subject with each other, and left a direct opinion under the content to criticize other commenters, editorial or even the Royal Family. This attitude was seen mostly among the comments related to the article called "Prince Charles: Anyone eating seafood will be consuming plastic too" (Webster, 2017) which was published before the BBC BPII series was broadcast.

Despite these notable differences in the comment left before and after BPII was aired, we were unable to identify a pattern in the changes that we could ascribe to BPII. It is worth noting that where a particular coding element increased after BPII in one newspaper it tended to decrease in the other. We do not have enough data to determine whether this was a meaningful change in attitude of the readers of the particularly paper or merely random fluctuations.

We would suggest that the cause of this issue be considered in future researches by interviewing commenters directly, to find why and how this attitude has an impact on public awareness of plastic pollution. Research should also be done on the severity of plastic pollution in other countries, including third world countries such as Iran, where the water crisis is more important

than plastic pollution, so that the real importance of plastic pollution around the world can be realized and effective action be taken.

In addition, further research is needed to determine why The Guardian online newspaper commentators were more engaged in the debate over plastic pollution than The Times online newspaper commentators after the airing of the BBC BPII series.

Furthermore, the study gathered news related to public and governmental decisions after the BBC BPII aired to assess the level of awareness raised about plastic pollution. Based on the results, most significant government decisions about plastic pollution or public environmental behaviour related to single-use plastics occurred between 2018 and 2019, not immediately or even one week or a month after the BBC BPII was broadcast in all four mentioned country we cannot find evidence of a link between BPII and a change in attitudes to plastics, it is undeniable that changes did follow the series and BPII has been credited with altered environmental attitudes and behaviours.

BPII was aired in the UK in October 2017, just over a year later in November 2018, Waitrose and Partners supermarket reported 60% of its customers used more reusable water bottles than they did in 2017. According to the Waitrose and Partners report, one in eight British citizens have become vegetarian or vegan after the show was broadcast in the UK. The report also shows that of those who made changes in their diet, 55% was for animal welfare purposes, 45% is for health reasons, and 38% for environmental reasons (Partners, 2018).

A few months after BPII, in February 2018, there was a wave of banning plastic straws in British supermarkets (Rebecca, 2018a), and following that UK government allocated 60 million pounds to combat plastic waste, on April 2018 (Press, 2018).

In September 2018, single-use plastic bottles was prohibited from the London semi-marathon (Rebecca, 2018b). In January 2019, a study found microplastic in all marine mammals in the UK (Turns, 2019), and the UK government announced that plastic straws, cotton buds and stirrers were to prohibited in England, from April 2020 (Harvey, 2019).

Elsewhere in the world changes also followed airing of BPII being broadcast. In January 2018 in the US, the California governor signed a law prohibiting full-service restaurants from giving out disposable straws eight months after the series aired (Moon, 2018).

In the April of 2018, The Guardian newspaper announced that according to ' Tangaroa Blue Foundation' data for 2016 and 2017, plastic was found in 75% of Australia beaches by volunteers (Graham & Andy, 2018), and families joined the way on plastics by highlighting the problem

with photos from around the world (Nazca, 2018). Also, Ben LeCompte started a six-month swimming through 'Great Pacific garbage patch' to make people aware of plastic pollution (Zhou, 2018).

After BPII aired in Canada in January 2018 a zero-plastic-waste strategy was developed by the federal government, provinces, and territories (Goverment, 2018). Although there have been some reports of important decisions being made to reduce the use of plastic products by public or governments after the broadcast of BBC BPII, but the series has not been proven to have had a direct impact on making these decisions or raising public awareness of plastic pollution.

Several studies claim that as a high-profile documentary, BBC BPII has been effective in raising public awareness about plastic pollution (Hayns-Worthington, 2018; Thompson, 2017). However, several experts, including Jones and her colleagues, believe that it would be impossible to quantify the real impact of nature documentaries such as BBC BPII on people's awareness of plastic pollution, but perhaps they have the greatest potential to do so and encourage people to change their behaviours towards environment (Jones et al, 2019).

  Another example is the study done by Pahl et al. They argue that plastic pollution has become more prevalent in coastal areas in recent years. It has been shown in movies or television series such as BPII that plastic pollution is a major cause of the deaths of charismatic megafauna and seabirds. For this reason, more attention is being paid to this issue (Pahl et al, 2017). Hence, this study is suggested that more research is needed about the real impact of plastic pollution on the ocean creatures, human health and environment in general.

In addition, research should be done to see if plastic pollution actually threatens all parts of the globe and is more serious than other environmental issues such as water crisis, air pollution or climate change in future. This argument of Jones et al, is illustrated in the article "He has been my lifetime inspiration: How David Attenborough influenced our lives" published in The Guardian newspaper and explains how Sir David Attenborough and his series inspired people to choose their profession (Fishwick, 2016).

Nature documentaries also can be a good source for the education of next generation that do not have a chance to see all parts of the earth and it's specious and understand the importance of protecting biodiversity (Jones et al, 2019).

Although this study did not find statistical evidence for a direct link between the impacts of the BBC BPII series on people's awareness of plastic pollution, the available reports and news, which were previously, mentioned show that the series has not been completely ineffective. In fact,

by using documentaries such as BBC BPII, people can be introduced to what is threatening biodiversity, such as plastic pollution.

It is impossible to ignore the impact of millions of people watching a series which emphasizes the danger of plastic pollution. It should also be noted that not everyone who watched the series had access to the Internet, and since the data studied in this study were taken from the Internet, it is not possible to say with certainty how many people have been informed about plastic pollution by the BBC BPII series.

Furthermore, although it is difficult to determine whether BBC BPII directly affected consumer behaviour regarding plastic use, the series emphasized the importance of taking care of our blue planet, and highlighted how human activities adversely affect marine life. Therefore, the program appeared to be inspiring viewers to act in a pro-environmental manner.

Finally, like all research, this study had limitations. The data for this study was obtained from Google Trends, as mentioned in the second chapter. According to Reilly et al., the problem with Google Trends data is that it's hard to know what the actual number of people searching for a given issue is beyond Google's limits, so the searches may not represent the overall population (Reilly et al, 2012).

Nonetheless, the findings still include the highest and most widely available public interest data set (Choi et al, 2012; Lipsman, 2009), and reliably reveals public interest and opinion patterns (Breyer et al, 2010; Christine, 2009; Vosen et al, 2011).

In addition, the Google Trends data are based on the number of English-speaking internet users who search the Internet in the English language in four mentioned countries. Therefore, these data do not reflect the global community that does not use the internet or search engines.

According to Behjat et al., 4 billion people worldwide do not have internet access. The reasons for this are numerous. Some politicians, for example, are concerned about foreign competitors, who they feel unfairly compete with local telecom and internet firms (Bahjat et al, 2016). Or simply because access to the internet is expensive for some people.

In addition, there have been some limitations in analysing online comments. For instance, the comments were chosen from two online newspapers comments section; The Guardian and Times. During the study, it was found that registration and payment of a monthly fee were required to leave comments on these sites. The first consequence of this could be that some readers who do not wish to pay for the article will not be able to post a comment. Second, researchers with limited budgets may not be able to access and assess these comments.

4.1   Recommendations for further studies

In short, this study suggests that other tools including Google Insight could be used in addition to Google Trends in order to achieve more accurate analyses of data for future researches.

In addition, an expansion of our study on readers comments is required to determine whether this method can detect any meaningful change in attitudes to a given subject.

Research should also be done on the severity of plastic pollution in other countries, including Iran, where the water crisis is more important than plastic pollution, so that the real importance of plastic pollution around the world can be realized and effective action will be taken.

More research is also needed to determine if plastic pollution threatens all parts of the globe or is a matter of importance only in some countries, and if it is more serious than other environmental issues such as the water crisis or climate change.

References

Agnes Ogee, M. E., Bruno Scibilia,Cheryl Pammer. (2015) *What Can You Say When Your P-Value is Greater Than 0.05?*4/7/2019)The Minitab Blog. Available online: https://blog.minitab.com/blog/understanding-statistics/what-can-you-say-when-your-p-value-is-greater-than-005.

Ahamed, S., Foster, J. S., Bukovsky, A. & Wimalasena, J. (2001) Signal transduction through the ras/Erk pathway is essential for the mycoestrogen zearalenone‐induced cell‐cycle progression in MCF‐7 cells. *Molecular Carcinogenesis: Published in cooperation with the University of Texas MD Anderson Cancer Center*, 30(2), 88-98.

Arnaud, F. (2019) Plastics: from apogee to controversy, *The journal of field actions*, (Special Issue 19) Field Actions Science Reports2019, 4-5.

Avilez, J. L., Zevallos-Morales, A. & Taype-Rondan, A. (2017) Use of enhancement drugs amongst athletes and television celebrities and public interest in androgenic anabolic steroids. Exploring two Peruvian cases with Google Trends. *Public Health*, 146, 29-31.

Bahjat, E.-D., Mathias, H. & Rawia, A. S. (2016) *Why are 4 Billion People without the Internet?*strategy+business. Available online: https://www.strategy-business.com/article/Why-Are-4-Billion-People-without-the-Internet?gko=1ed7b.

Baram, T., Ayelet, S. & Elad. (2011) Exploring new web-based tools to identify public interest in science. *Public understanding of science*, 20, 130-143.

Barbas, T. A., Paraskevopoulos, S. & Stamou, A. G. (2009) The effect of nature documentaries on students' environmental sensitivity: A case study. *Learning, Media and Technology*, 34(1), 61-69.

Barnes, D. K., Galgani, F., Thompson, R. C. & Barlaz, M. (2009) Accumulation and fragmentation of plastic debris in global environments. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 364(1526), 1985-1998.

BBC (2017) *Blue Planet II: Preview Screening*, 2017. Available online: https://web.archive.org/web/20170930021600/http://www.bbc.co.uk/showsandtours/shows/blue_planet_11oct17# [Accessed 16/04/2019].

Beattie, G., Sale, L. & McGuire, L. (2011) An inconvenient truth? Can a film really affect psychological mood and our explicit attitudes towards climate change?

Braun, T., Cottrell, R. & Dierkes, P. (2018) Fostering changes in attitude, knowledge and behavior: Demographic variation in environmental education effects. *Environmental Education Research*, 24(6), 899-920.

Breyer, N, B., Eisenberg & L, M. (2010) Use of Google in study of noninfectious medical conditions. *Epidemiology*, 21, 584.

Butler, S. (2018) Ikea commits to phase out single-use plastic products by 2020, *The Guardian.*2018 [Online]. Available online: https://www.theguardian.com/business/2018/jun/07/ikea-commits-to-phase-out-single-use-plastic-products-by-2020, [Accessed 28/3/2019].

Calderwood, E. B. v. I. (2018) 88% of People Who Saw 'Blue Planet II' Changed Their Lifestyle, *Global Citizen*2018.

Center, B. M. (2017a) *Blue Planet II episod 1*

, 2017a. Available online: https://www.bbc.co.uk/mediacentre/proginfo/2017/44/blue-planet-2 [Accessed 30/05/2019].

Center, B. M. (2017b) *Blue Planet II episode 2*

The Deep, 2017b. Available online: https://www.bbc.co.uk/mediacentre/proginfo/2017/45/blue-planet-2 [Accessed 16/04/2019].

Center, B. M. (2017c) *Blue Planet II episode 3*

Coral Reefs, 2017c. Available online: https://www.bbc.co.uk/mediacentre/proginfo/2017/46/blue-planet-2 [Accessed 30/05/2019].

Center, B. M. (2017d) *Blue Planet II Episode 4*

Big Blue, 2017d. Available online:
https://www.bbc.co.uk/mediacentre/proginfo/2017/47/blue-planet-2 [Accessed 30/05/2019].
Center, B. M. (2017e) *Blue Planet II Episode 5*

Green Seas, 2017e. Available online:
https://www.bbc.co.uk/mediacentre/proginfo/2017/48/blue-planet-ii [Accessed 30/05/2019].
Center, B. M. (2017f) *Blue Planet II episode 6*

Coasts, 2017f. Available online: https://www.bbc.co.uk/mediacentre/proginfo/2017/49/blue-planet-ii [Accessed 16/04/2019].
Center, B. M. (2017g) *Blue Planet II episode 7*

Our Blue Planet, 2017g. Available online:
https://www.bbc.co.uk/mediacentre/proginfo/2017/44/blue-planet-2 [Accessed 30/05/2019].
Choi, Hyunyoung, Varian & Hal (2012) Predicting the present with Google Trends. *Economic Record*, 88, 2-9.
Chong, D. & Druckman, J. N. (2007) Framing theory. *Annual review of political science*, 10(1), 103-126.
Christine, M. (2009) What social media offers to health professionals and citizens. Scielo Public Health.
Commission, E. & Environment, D.-G. f. (2014) *Attitudes of Europeans towards waste management and resource efficiency*European Commission.
Crisp, J. (2018) Global 24-hour boycott on plastic packaging to fight ocean pollution begins in wake of 'Blue Planet effect'. *The Telegraph*.
Davison, S. M. C., White, M. P., Pahl, S., Taylor, T., Fielding, K., Roberts, B. R., Economou, T., McMeel, O., Kellett, P. & Fleming, L. E. (2021) Public concern about, and desire for research into, the human health effects of marine plastic pollution: Results from a 15-country survey across Europe and Australia. *Global Environmental Change*, 69, 102309.
Dunn, M. E., Mills, M. & Veríssimo, D. (2020) Evaluating the impact of the documentary series Blue Planet II on viewers' plastic consumption behaviors. *Conservation Science and Practice*, 2(10), e280.
Ficetola, G. F. (2013) Is interest toward the environment really declining? The complexity of analysing trends using internet search data. *Biodiversity and conservation 22* (12), 2983-2988.
Fishwick, C. (2016) 'He has been my lifetime inspiration': how David Attenborough influenced our lives(7/03/2019).
Fletcher, S., Jefferson, R. & Mckinley, E. (2012) Exploring the shallows: a response to 'Saving the shallows: focusing marine conservation where people might care'. Wiley Online Library.
Foster, P., Mylchreest, E., Gaido, K. & Sar, M. (2001) Effects of phthalate esters on the developing reproductive tract of male rats. *Apmis*, 109(S103), S272-S277.
Foxnews (2018) *There's plastic in the tap water: Study says 94 percent of U.S. tap water could be contaminated*, 2018. Available online: https://www.foxnews.com/food-drink/theres-plastic-in-the-tap-water-study-says-94-percent-of-u-s-tap-water-could-be-contaminated [Accessed 3/5/2019].
Freinkel, S. (2011) *Plastic: a toxic love story*HMH.
Friemel, T. N. & Dötsch, M. (2015) Online reader comments as indicator for perceived public opinion. DEU.
Gabbatiss, J. (2017) Plastic-eating enzyme accidentally created by scientists could help solve pollution crisis. *INDEPENDENT*.
Galloway, T. & Galloway, T. (2015) Micro-and Nano-plastics and Human Health, 343-366.
Gastil, J. (2008) *political communication and deliberation*.
Gelcich, S., Buckley, P., Pinnegar, J. K., Chilvers, J., Lorenzoni, I., Terry, G., Guerrero, M., Castilla, J. C., Valdebenito, A. & Duarte, C. M. (2014) Public awareness, concerns, and priorities

about anthropogenic impacts on marine environments. *Proceedings of the National Academy of Sciences*, 111(42), 15042-15047.

GESAMP (2015) *fate and effects of microplastics in the marine*

*environment: a global assessment*Joint Group of Experts on the Scientific Aspects of Marine Environmental

Protection. Available online: https://pubs.acs.org/doi/pdf/10.1021/acs.est.6b02569.

GESAMP (2016) Sources, fate and effects of microplastics in the marine environment: part two of a global assessment. IMO London.

Gleeson, C. (2019) Attenborough effect' praised for reduced use of plastic, *The Irish Times.*2019 [Online]. Available online: https://www.irishtimes.com/news/environment/attenborough-effect-praised-for-reduced-use-of-plastic-1.3945951, [Accessed 2/2/2019].

Gore, M. L. & Knuth, B. A. (2009) Mass Media Effect on the Operating Environment of a Wildlife-Related Risk-Communication Campaign. *The Journal of Wildlife Management*, 73(8), 1407-1413.

Goverment, C. o. (2018) *Federal government, provinces, and territories push forward on a Canada-wide zero-plastic-waste strategy*5/8/2020). Available online: https://www.canada.ca/en/environment-climate-change/news/2018/11/federal-government-provinces-and-territories-push-forward-on-a-canada-wide-zero-plastic-waste-strategy.html.

Graham, R. & Andy, B. (2018) The great Australian garbage map: 75% of beach rubbish made of plastic, 2018 [Online]. Available online: https://www.theguardian.com/environment/ng-interactive/2018/apr/18/the-great-australian-garbage-map-75-of-beach-rubbish-made-of-plastic, [Accessed 8/1/2019].

Gregory, M. (2002) Environmental implications of plastic debris in marine settings—entanglement, ingestion, smothering, hangers-on, hitch-hiking and alien invasions. *R J Philosophical Transactions of the Royal Society B: Biological Sciences*, 364, 2013-2025.

Happer, C. & Philo, G. (2013) The role of the media in the construction of public belief and social change. *Journal of social and political psychology*, 1(1), 321-336.

Hartley, B. L., Pahl, S., Veiga, J., Vlachogianni, T., Vasconcelos, L., Maes, T., Doyle, T., d'Arcy Metcalfe, R., Öztürk, A. A., Di Berardo, M. & Thompson, R. C. (2018) Exploring public views on marine litter in Europe: Perceived causes, consequences and pathways to change. *Marine Pollution Bulletin*, 133, 945-955.

Hartley, B. L., Thompson, R. C. & Pahl, S. (2015) Marine litter education boosts children's understanding and self-reported actions. *Marine pollution bulletin*, 90(1-2), 209-217.

Harvey, F. (2019) Plastic straws, cotton buds and drink stirrers to be banned in England, *The Guardian.*2019 [Online]. Available online: https://www.theguardian.com/environment/2019/may/22/england-plastic-straws-ban, [Accessed 6/1/2019].

Hayns-Worthington, S. (2018) *The Attenborough Effect: Searches For Plastic Recycling Rocket After Blue Planet II*, 2018. Available online: https://resource.co/article/attenborough-effect-searches-plastic-recycling-rocket-after-blue-planet-ii-12334 [Accessed 8/9/2019].

Heidbreder, L. M., Bablok, I., Drews, S. & Menzel, C. (2019) Tackling the plastic problem: A review on perceptions, behaviors, and interventions. *Science of The Total Environment*, 668, 1077-1093.

Hermida, A. & Neil, T. (2007) *How the British news media are struggling with user-generated content.* (12/8/2019. Available online: https://www.researchgate.net/profile/Alfred_Hermida/publication/228863261_Comments_please_How_the_British_news_media_are_struggling_with_user-generated_content/links/09e4150758996741ca000000/Comments-please-How-the-British-news-media-are-struggling-with-user-generated-content.pdf.

Hoare, J. (2017) *Analyzing Google Trends Data in R*03/06/2019). Available online: https://datascienceplus.com/analyzing-google-trends-data-in-r/.

Hofman, K. & Hughes, K. (2018) Protecting the Great Barrier Reef: analysing the impact of a conservation documentary and post-viewing strategies on long-term conservation behaviour. *Environmental Education Research*, 24(4), 521-536.

Howell, R. A. (2011) Lights, camera… action? Altered attitudes and behaviour in response to the climate change film The Age of Stupid. *Global Environmental Change*, 21(1), 177-187.

Inglehart, R. (1995) Public Support for Environmental Protection: Objective Problems and Subjective Values in 43 Societies. *Political Science & Politics,*, 57-72.

Jambeck, J. R., Geyer, R., Wilcox, C., Siegler, T. R., Perryman, M., Andrady, A., Narayan, R. & Law, K. L. (2015) Plastic waste inputs from land into the ocean. *Science*, 347(6223), 768-771.

Janpol, H. L. & Dilts, R. (2016) Does viewing documentary films affect environmental perceptions and behaviors? *Applied Environmental Education & Communication*, 15(1), 90-98.

Jefferson, R., McKinley, E., Capstick, S., Fletcher, S., Griffin, H. & Milanese, M. (2015) Understanding audiences: making public perceptions research matter to marine conservation. *Ocean & Coastal Management*, 115, 61-70.

John, V. (2020) Waste Managment, Available online: https://theoceancleanup.com/waste-management-and-recycling/ [Accessed 8/2/2019].

Jones, J. P., Thomas‐Walters, L., Rust, N. A. & Veríssimo, D. (2019) Nature documentaries and saving nature: Reflections on the new Netflix series Our Planet. *People and Nature*, 1(4), 420-425.

Karlin, B. & Johnson, J. (2011) Measuring impact: The importance of evaluation for documentary film campaigns. *M/C Journal*, 14(6).

Kaza, S., Yao, L., Bhada-Tata, P. & Van Woerden, F. (2018) *What a waste 2.0: a global snapshot of solid waste management to 2050*World Bank Publications.

Kent, U. o. (2019) Statistical & Qualitative Data Analysis Software: About NVIVO

. *Kent University Libraries*.

Koelmans, B., Pahl, S., Backhaus, T., Bessa, F., van Calster, G., Contzen, N., Cronin, R., Galloway, T., Hart, A. & Henderson, L. (2019) *A scientific perspective on microplastics in nature and society*SAPEA.

Kollmuss, A. & Agyeman, J. (2002) Mind the gap: why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental education research*, 8(3), 239-260.

Kormos, C. & Gifford, R. (2014) The validity of self-report measures of proenvironmental behavior: A meta-analytic review. *Journal of Environmental Psychology*, 40, 359-371.

Kyung, H., Lee, M. & Oh, S. (2014) Exploring the Relationship Between Online Comments Usage and Civic Engagement in South Korea. *Asia-Pacific Social Science Review*, 14(1).

Leiserowitz, A. A. (2005) American risk perceptions: Is climate change dangerous? *Risk Analysis: An International Journal*, 25(6), 1433-1442.

Lin, S.-J. (2013) Perceived impact of a documentary film: An investigation of the first-person effect and its implications for environmental issues. *Science Communication*, 35(6), 708-733.

Lincoln, N. (2011) *The relationship between internet marketing, search volume, and product sales.*The Ohio State University. Available online: https://kb.osu.edu/bitstream/handle/1811/48845/Lincoln_HonorsThesis_2011.pdf?sequence=1 [Accessed 30/02/2019].

Lipsman, A. (2009) *Google Gets 76 Billion Searches Per Month of 113 Billion Total*18/01/2019). Reston,

Virginia. Available online: https://website101.com/press/google-76-billion-searches/#.XiL-c8j7RPY.

Lohr, A., Savelli, H., Beunen, R., Kalz, M., Ragas, A. & Van Belleghem, F. (2017) Solutions for global marine litter pollution. *Current Opinion in Environmental Sustainability*, 28, 90-99.

Lotze, H. K., Guest, H., O'Leary, J., Tuda, A. & Wallace, D. (2018) Public perceptions of marine threats and protection from around the world. *Ocean & Coastal Management*, 152, 14-22.

Manosevitch, E. & Walker, D. (2009) Reader comments to online opinion journalism: A space of public deliberation, *International Symposium on Online Journalism*. Citeseer.

Mccallum, M. L. & and Bury, G. W. (2013) Google search patterns suggest declining interest in the environment, 22 (*6*-7), 1355-1367.

McDonald, J. H. (2014) *Kruskal–Wallis test*. (8/5/2019. Handbook of Biological Statistics (3rd ed.): Sparky House Publishing, Baltimore, Maryland. Available online: http://www.biostathandbook.com/kruskalwallis.html.

McKinley, E. & Fletcher, S. (2012) Improving marine environmental health through marine citizenship: a call for debate. *Marine Policy*, 36(3), 839-843.

Moon, R. E. a. S. (2018) *California bans plastic straws in full-service restaurants -- unless customers request one*, 2018. Available online: https://edition.cnn.com/2018/09/20/us/plastic-straws-banned-in-california/index.html [Accessed 17/2/2019].

Murray, J. (2018) The Blue Planet Effect: BBC to ban single use plastics from 2020. *businessgreen*.

Nazca, J. (2018) *Families around the world join war on plastic* Reuters[Video]. Available online: https://www.theguardian.com/environment/2018/jun/05/families-around-the-world-join-war-on-plastic-in-pictures [Accessed 3/3/2019].

NEWS, B. (2019) *Most Christmas jumpers contain plastic, environmental charity warns*, 2019. Available online: https://www.bbc.co.uk/news/uk-50682657 [Accessed 25/12/2019].

Nick, C. (2018) *How to Use Google Trends for Keyword Research: 7 Effective Ways*14/7/2018). Available online: https://ahrefs.com/blog/how-to-use-google-trends-for-keyword-research/.

Nielsen, C. (2012) Newspaper Journalists Support Online Comments. *Newspaper Research Journal*, 33(1), 86-100.

Nolan, J. M. (2010) "An inconvenient truth" increases knowledge, concern, and willingness to reduce greenhouse gases. *Environment and Behavior*, 42(5), 643-658.

Pahl, S. & Wyles, K. J. (2017) The human dimension: how social and behavioural research methods can help address microplastics in the environment. *Analytical Methods*, 9(9), 1404-1411.

Pahl, S., Wyles, K. J. & Thompson, R. C. (2017) Channelling passion for the ocean towards plastic pollution. *Nature human behaviour*, 1(10), 697-699.

Parry, J. (2019) *trendyy: A Tidy Wrapper Around 'gtrendsR'*. Available online: {https://CRAN.R-project.org/package=trendyy.

Partners, W. (2018) Waitrose & Partners Food and Drink Report 2019, 25/5/20192018.

Philippe Massicotte & Eddelbuettel, D. (2019) *Package 'gtrendsR'*1/7/2019). Available online: https://cran.r-project.org/web/packages/gtrendsR/gtrendsR.pdf.

Potts, T., Pita, C., O'Higgins, T. & Mee, L. (2016) Who cares? European attitudes towards marine and coastal environments. *Marine Policy*, 72, 59-66.

Press, A. (2018) Government sets aside £60m to fight scourge of plastic waste, *The Guardian.*2018 [Online]. Available online: https://www.theguardian.com/environment/2018/apr/14/government-sets-aside-fund-to-fight-plastic-waste-oceans, [Accessed 4/3/2019].

Proulx, R., Massicotte, P. and Pépino & M. (2014a) Internet search for trends in conservation biology. . *Conservation Biology*, *28* (1)   44-51.

Proulx, R., Massicotte, P. & Pepino, M. (2014b) Internet search for trends in conservation biology. *Conservation Biology*, 28(1), 44-51.

Raphael Proukx, Philippe Massicotte & Epino, M. P. (2013) *Internet search for Trends in Conservation Biology*. Available online: https://www.researchgate.net/profile/Raphael_Proulx/publication/256608458_Internet search for_Trends_in_Conservation_Biology/links/59f3e4d6458515547c206abb/Internet search for-Trends-in-Conservation-Biology.pdf [Accessed 6/7/2019].

Rebecca, S. (2018a) Asda joins wave of supermarkets pledging to cut plastic waste, *The Guardian.*2018a [Online]. Available online: https://www.theguardian.com/environment/2018/feb/05/asda-joins-wave-of-supermarkets-pledging-to-cut-plastic-waste, [Accessed 7/2/2019].

Rebecca, S. (2018b) Single use plastic bottles banned from half marathon in London, *The Guardian.*2018b [Online]. Available online: https://www.theguardian.com/environment/2018/sep/12/single-use-plastic-bottles-banned-from-half-marathon-in-london, [Accessed 1/2/2019].

Reilly, Shauna Richey, Sean Taylor & Benjamin, J. (2012) Using Google search data for state politics research: an empirical validity test using roll-off data. *State Politics Policy Quarterly*, 12, 146-159.

Richardson, J. E. (2007) *Analysing newspapers: an approach from critical discourse analysis*. Basingstoke: Palgrave Macmillan.

Rochman, C. M., Browne, M. A., Halpern, B. S., Hentschel, B. T., Hoh, E., Karapanagioti, H. K., Rios-Mendoza, L. M., Takada, H., Teh, S. & Thompson, R. C. J. N. (2013) Policy: Classify plastic waste as hazardous. *COMMENT*, 169.

Sandra, L. & Matthew, T. (2017) A million bottles a minute: world's plastic binge 'as dangerous as climate change, *The Guardian.*2017 [Online]. Available online: https://www.theguardian.com/environment/2017/jun/28/a-million-a-minute-worlds-plastic-bottle-binge-as-dangerous-as-climate-change, [Accessed 3/3/2019].

Schnurr, R. E., Alboiu, V., Chaudhary, M., Corbett, R. A., Quanz, M. E., Sankar, K., Srain, H. S., Thavarajah, V., Xanthos, D. & Walker, T. R. (2018) Reducing marine pollution from single-use plastics (SUPs): A review. *Marine pollution bulletin*, 137, 157-171.

Schultz, T. (1999) Interactive Options in Online Journalism: a Content Analysis of 100 U.S. Newspapers. *Journal of Computer-Mediated Communication*, 5(1).

Shapiro, R. & Page, B. (1983) Effects of public opinion on policy. *The American Political Science Review*, 175-90.

Skakkebaek, N. E., De Meyts, E. R. & Main, K. M. (2001) Testicular dysgenesis syndrome: an increasingly common developmental disorder with environmental aspects. *Apmis*, 109(S103), S22-S30.

Sparrow, J. (2018) Recycling:how corporate Australia played us for mugs, *the Guardian.*2018 [Online]. Available online: https://www.theguardian.com/environment/commentisfree/2018/jul/19/its-not-recycling-its-collecting-how-australians-were-sucked-into-the-crisis, [Accessed 7/3/2019].

Stafford, R. & Jones, P. J. (2019) *Viewpoint–Ocean plastic pollution: A convenient but distracting truth?*, 2019. Available online: https://www.sciencedirect.com/science/article/pii/S0308597X1830681X [Accessed 12/15/2020].

Steel, B. S., Smith, C., Opsommer, L., Curiel, S. & Warner-Steel, R. (2005) Public ocean literacy in the United States. *Ocean & Coastal Management*, 48(2), 97-114.

Steg, L. & Vlek, C. (2009) Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology*, 29(3), 309-317.

Summers, H. (2018) Scientists get ready to begin Great Pacific Garbage Patch cleanup, *The Guardian.*2018 [Online]. Available online: https://www.theguardian.com/environment/2018/sep/08/scientists-get-ready-to-begin-great-pacific-garbage-patch-cleanup, [Accessed 27/3/2019].

Swain, K. A. (2012) Mass media roles in climate change mitigation, *Handbook of climate change mitigation*Springer, 161-195.

Team, R. C. (2018) *R: A language and environment for statistical computing*28/12/2018)R Foundation for Statistical Computing,Vienna, Austria. Available online: https://www.R-project.org/.

Thomas-Walters, L., McNulty, C. & Veríssimo, D. (2020) A scoping review into the impact of animal imagery on pro-environmental outcomes. *Ambio*, 49(6), 1135-1145.

Thompson, R. (2017) Environment: A journey on plastic seas, *Nature*. 547, 76632017, 278.

Turns, A. (2019) Microplastics found in every marine mammal surveyed in UK study, *The Guardian.*2019 [Online]. Available online: https://www.theguardian.com/environment/2019/jan/31/microplastics-found-every-marine-mammal-uk-study, [Accessed 3/5/2019].

UNEP (2005) Selection, design and implementation of economic instruments in the solid waste management sector in Kenya the case of plastic bags.

UNEP (2016) *Marine plastic debris and microplastics–Global lessons and research to inspire action and guide policy change*United Nations Environment Programme.

Vegter, A. C., Barletta, M., Beck, C., Borrero, J., Burton, H., Campbell, M. L., Costa, M. F., Eriksen, M., Eriksson, C. & Estrades, A. (2014) Global research priorities to mitigate plastic pollution impacts on marine wildlife. *Endangered Species Research*, 25(3), 225-247.

Veríssimo, D. (2013) Influencing human behaviour: an underutilised tool for biodiversity management. *Conservation Evidence*, 10(1), 29-31.

Vethaak, A. D. & Leslie, H. A. (2016) Plastic Debris Is a Human Health Issue. *Environ Sci Technol*, 50(13), 6825-6.

Vosen, Simeon, Schmidt & Torsten (2011) Forecasting private consumption: survey‐based indicators vs. Google trends. *ournal of Forecasting*, 30, 565-578.

Warren, C. (2012) Risk and the sacred: environment, media and public opinion in Bali, 82(Oceania), 294-307.

Webster, B. (2017) Prince Charles:Anyone eating seafood will be consuming plastic too, *The Times.*2017 [Online]. Available online: https://www.thetimes.co.uk/article/anyone-eating-seafood-will-be-consuming-plastic-too-says-prince-charles-zldr8trqf, [Accessed 3/2/2019].

Webster, B. (2019) Thousands of tons of plastic recycling are

secretly burnt for fuel, *Th Times.*2019 [Online]. Available online: https://www.thetimes.co.uk/article/thousands-of-tonnes-of-plastic-recycling-are-secretly-burnt-for-fuel-t6qsfdvj5, [Accessed 5/10/2019].

Werner, S., Budziak, A., Van Franeker, J., Galgani, F., Hanke, G., Maes, T., Matiddi, M., Nilsson, P., Oosterbaan, L. & Priestland, E. (2016) Harm caused by marine litter. *Publication office of the European Union*.

Wijesekara, H., Bolan, N. S., Bradney, L., Obadamudalige, N., Seshadri, B., Kunhikrishnan, A., Dharmarajan, R., Ok, Y. S., Rinklebe, J., Kirkham, M. B. & Vithanage, M. (2018) Trace element dynamics of biosolids-derived microbeads. *Chemosphere*, 199, 331-339.

Wright, S. L. & Kelly, F. J. (2017) Plastic and Human Health: A Micro Issue? *Environmental Science & Technology*, 15.

Zhou, N. (2018) Man begins six-month swim through 'Great Pacific garbage patch', *The Guardian.*2018 [Online]. Available online: https://www.theguardian.com/environment/2018/jun/05/man-begins-six-month-swim-through-great-pacific-garbage-patch, [Accessed 29/2/2019].