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The effects of anthropogenic activities on the marine environment, along the coastline of Kwa-Zulu Natal: an ethical critique.

By
Kevin Mark Avery
STUDENT NUMBER: 216051250

SUPERVISOR: Professor Beatrice Okyere-Manu
University Of KwaZulu-Natal

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Student Name: **Kevin Mark Avery**

Student Number: **216051250**

Date: 25-**03 -2024**

Signature: 

Name of Supervisor: **Beatrice Okyere-Manu**

Date: 25-03-2024

Signature: 

Dedication

To my family, who are still with me today.

To my late grandmothers who taught me to love the environment.

To my close friends.

To my colleagues.

Aknowledgements

Firstly, I would like to express my appreciation to my supervisor and lecturer Professor Beatrice Okyere-Manu, for all the guidance and help that I have received throughout the past few years. I do not think I would have achieved nearly as much as I did if it were not for your guidance and constant support, and for that I am eternally grateful. Secondly, I would like to thank my peers and friends for the constant support when doing this project, as they have been there to ground me when experiencing difficult times over the past few years. I would also like to thank my family for the constant support and long hours of discussion, which gave me new insight into my approach towards my work. Finally, I would like to thank my language editor for making sure that that my language and work were constantly up to standard.

Abstract

South Africa, a nation shaped by diverse living conditions, bears the lasting imprint of historical racial segregation, which relegated a significant populace to impoverished regions lacking fundamental amenities (Adhikari, 2014: 78). The environmental rigors further compound these challenges, presenting an inherently unforgiving landscape. Despite these disparities, the country heavily depends on its natural resources, particularly the marine environment, as both a means of sustenance and a fundamental driver of economic progress (Branch et al., 2017: 215).

The sprawling coastline of KwaZulu-Natal, spanning over 600 kilometres along the Indian Ocean, stands as a repository of invaluable resources (Mann, 2014: 102). Within this expanse lie diverse habitats, indispensable for an array of wildlife. Rocky outcrops adorn the beaches, while estuaries harbour thriving biodiversity. Remote stretches reveal pristine beaches and extensive sand dunes, while reef systems enrich the area, contributing to a diverse and flourishing ecosystem (Götz et al., 2019: 45).

This coastline is not merely a sanctuary for marine life; it serves as a vital lifeline for nearby communities and an array of users who rely on its resources. However, this bounty faces a menacing threat from various human activities that relentlessly exploit the marine environment. Predominantly, issues such as overexploitation of resources, pollution, and overfishing loom large, precipitating a crisis that confronts the marine ecosystem daily (Kenchington et al., 2012: 309).

The ramifications of these activities are manifold and dire. The unbridled depletion of resources has far outstripped the ocean's capacity for replenishment, setting off a chain reaction of environmental degradation (McClanahan et al., 2019: 521). Pollution compounds these challenges, particularly the pervasive presence of plastic and chemical contaminants. Concurrently, persistent overfishing has perpetuated the depletion of marine life, intensifying the precarious equilibrium within these ecosystems (Pauly et al., 2002: 189).

The repercussions transcend the environmental sphere, casting a pall over communities reliant on the ocean for their sustenance (Cinner et al., 2012: 76). Despite a growing consciousness of these challenges, detrimental activities continue. The crux of the matter lies in the escalating

reliance of human populations on marine resources, posing a formidable challenge, especially in regions like South Africa, where the marine environment is pivotal for economic sustenance and livelihoods.

The marine and coastal ecosystems, renowned for their historical significance and high productivity in supporting human populations, are now confronted with the grim reality of severe degradation. The relentless dependence on these ecosystems has ushered in rapid resource depletion, resulting in approximately "seventy-five per cent of fisheries depleted and the remainder overexploited" (Clausen, 2005: 442), and thus upsetting the delicate equilibrium these environments once upheld. The metamorphosis of these once-balanced environments into ecosystems teetering on the brink of collapse underscores the enormity of the challenge at hand. The relentless pursuit of meeting human demands has exacted a profound toll, imperilling these invaluable ecosystems. Urgent and comprehensive action is imperative to chart a course towards sustainability, safeguarding these natural resources for the well-being of future generations.

This paper presents a comprehensive analysis of the multifaceted challenges posed by anthropogenic activities in coastal environments, with a particular focus on KwaZulu-Natal's coastline. It explores the diverse impacts of human actions on marine ecosystems, emphasising the urgency of addressing these issues through collaborative, community-driven solutions. Drawing upon a wide array of scholarly sources, this review examines the interconnectedness between environmental degradation and the potential pathways toward sustainable management.

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Chapter 1- Introduction

1.0- Introduction

In this chapter, the topic of the anthropogenic impacts on the marine environment will be introduced. This introduction includes the background of the South African marine environment, the motivation for this study, the research questions and objectives, the methodologies, and an outline of this paper's chapters.

1.1- South African Background

South Africa is a country in which there is a diverse array of living conditions in which the various sections of the population find themselves living. This is primarily a result of the racial segregation and injustices which occurred during the apartheid era. This injustice left the poorer sections of the population in a position where they found themselves living in areas that did not possess all the basic amenities and services that they required for survival; thus, these citizens often found themselves relying on the environment for survival. South Africa as a country is extremely dependent on its natural resources in order to sustain the needs of the population as well as the demands of a growing economy. For example, the marine environment is used for a variety of purposes. In this study, these environmental uses were examined, and the actions that occur within the environment were critically analysed in order to determine the potential impacts that may arise in the future.

The coastline of KwaZulu-Natal, South Africa, is an area which is rich in resources, stretching over 600 kilometres along the Indian Ocean. The beaches abound with rocky outcrops punctuating the shoreline, while estuaries provide vital habitats for diverse wildlife to thrive. Remote stretches reveal pristine beaches and extensive dunes, and reef systems ensure that the environment holds great potential. This coastline is not only a haven for marine life, but also an essential resource for the surrounding communities and others who make use of it. This chapter briefly introduces the topic of the effects of anthropogenic activity along the coastline of Kwa-Zulu Natal, which is discussed through the ethical lens of consequentialism, to determine the impacts which arise through the processes of pollution, both chemical and plastic, and the activities of the fishing industry.

1.2- Current Oceanic Crisis

Currently, "The world's oceans are experiencing a crisis of rapid biomass depletion" (Clausen, 2005: 442), and this is a result of the human population, who make use of the resources that the marine environment provides at an unprecedented rate, and through the introduction of pollutants into the said environment. It is estimated that at least "75% of the major fisheries are fully exploited" (Clausen, 2005: 442). This depletion of resources has disrupted the "metabolic relations within the oceanic ecosystem at multiple trophic and spatial scales" (Clausen, 2005: 442). In essence, this means that the marine environment and its resources have been harvested at such a rate, whereby the depletion of resources far exceeds the rate at which the marine environment can recover and regenerate. Resources have been removed from the environment, and the latter finds itself in a severely polluted state. This has resulted in the development of a degradational chain, which continues to grow more significant by the day. This process of environmental transformation, as a result of anthropogenic influence, has long been known. However, these relationships are not likely to change to a great extent due to the human population becoming more and more dependent on the marine environment. Many communities have developed a connection with the ocean as it has supported "livelihoods that include commercial fishing and aquaculture, coastal management, retail, industry, transport, tourism, and recreation" (Metcalf et al., 2015: 34).

South Africa is a region where the marine environment can be considered an extremely important asset to both the population and the organisations that rely on the ocean and coastal zones for economic success. In addition, the sustainability of the livelihoods of those who make use of the ocean for the collection of resources is essential, as "Many households in low- and middle-income countries rely directly or indirectly on common access lands and waters and the wild products that can be gathered or hunted from them" (Robinson, 2016: 282).

The context of this study was based on the current state of the marine environment and the socio-environmental pressures which are felt as a result of a "range of human activities which vary in their intensity, footprint" (Stelzenmüller, 2010: 19). One of the most prominent human activities is plastic pollution, as the "sheer extent of plastic pollution is astounding. Like the impacts of climate change, there is no ecosystem on Earth untouched by plastics. Plastics are found in the Mariana Trench, remote oceanic islands, and polar ice sheets" (Lavers, 2022: 2). Another prominent activity is that of chemical pollution, which generally occurs from "terrestrial runoff from rivers and streams contaminated by agricultural, industrial or urban

activities" (van Dam, 2011: 189), and runs directly into the oceans. Finally, the third activity that impacts this mini-environment is overfishing on a subsistence and commercial scale. Overfishing impacts the marine environment as "Fisheries have rarely been 'sustainable'. Rather, fishing has induced serial depletions, long masked by improved technology, geographic expansion and exploitation of previously spurned species lower in the food web" (Nevill, 2009: 30). These pressures include activities such as the addition of foreign matter like chemicals, human waste and plastics into the environment, and the removal of fish species at a rate that may hinder it in its process of replenishment. The collection of resources and marine dwelling organisms from the marine environment serves the purposes of providing for the consumer market. It also provides for local individuals who rely on subsistence fishing to ensure their survival, and for the immediate consumption of these resources by the individuals who partake in fishing activities for sport and recreation . The addition of pollutants into the environment as a result of product development and accidental or intentional chemical leaks, is a contributing factor which leads to the degradation of the marine environment. The impacts that these pressures have on the environment are significant as they "are a cause for concern both regionally, for the indigenous and local communities that rely on the resources provided by the marine ecosystems, as well as internationally due to the high biological, cultural and economic significance" (Townhill et al., 2021: 471).

When the environmental impacts of the collection of marine dwelling organisms were examined, it was clear that the threats that are present impacted the stability of the marine environment. This is due to the fact that the overcollection of organisms disrupts the “passive movements of nutrients, detritus, and prey between habitats”, which “can have major ‘bottom-up’ effects on food web productivity” (Valentine and Heck, 2005: 209); as such, the possible over-harvesting of these resources can potentially lead to a decline in the number of organisms present in the ecosystem. Along with this, the overcollection of organisms can potentially result in an overall decline in the population size of these said organisms, as the environment struggles to keep up with the current rate of harvesting; morevoer, overfishing “is causing rapid evolutionary changes in harvested populations” (Palkovacs, 2011: 616). The possibility of fish and other marine wildlife stock declining in quantity and quality poses a significant threat to humanity, as the marine environment provides society with multiple ecosystem services. Futhermore it is an ecosystem that is sensitive to change, meaning that any influence on it can affect the entire marine environment, and thus can negatively impact those who rely on this ecosystem's services.

The impacts which arise as a result of the abovementioned pollution and overcollection of resources, are unfortunately felt to a greater extent by individuals who reside in areas which are characterised by scarcity of food and poverty, commonly referred to as "rural" areas, and participate in the act of subsistence resource collection. For this study, the effects of the activities of the communities and conglomerates that rely on the marine environment for their survival and success, and how these individuals or entities impact the overall quality of the marine environment along the coastline of KwaZulu-Natal, were investigated. This study aimed to ethically critique the actions of those individuals and conglomerates who use the marine environment from a consequentialist perspective.

The marine and coastal environments are some of "the most productive and valued ecosystems of the world" (Crain, 2009: 39). Yet, they are some of the most heavily degraded ecosystems present on the planet. This is because the "coastal human populations have depended on the living resources of the sea for tens of thousands of years" (Crain, 2009: 41), and human beings still rely on these resources to provide for the global population and economy. As a result of this dependence on the marine environment, "the world's oceans are experiencing a crisis of rapid biomass depletion" (Clausen, 2005: 422), with an estimated seventy-five per cent of fisheries being wholly depleted, while the rest are overexploited to the extent where the environment is unable to sustain the rate of resource removal. This has taken an environment once in a state of equilibrium and placed it in a position of desolation, where it is struggling to keep up with the human population.

1.3- Background and Motivation

1.3.1- Personal Motivation for the Study

I decided to conduct my research in the field of environmental ethics and conservation because I have always taken an interest in the topic of environmental protection and the relationships that are found between humans and the environmental spaces that they occupy. Additionally, this field of study tied in well with my undergraduate qualification, as I completed my undergraduate degree in the fields of geography and environmental management, and my honours degree in the field of applied ethics. As a result of my attaining these qualifications, the topic that I chose to research tied in well with my knowledge of environmental relations and environmental ethics, and also with my passion for the overall protection of the marine

environment. The passion that I have for environmental protection stems from the experiences that I gained whilst doing my degree, as I witnessed the impact that humans have on the environment along the coastline of Kwa-Zulu Natal, where a large amount of terrestrial and marine pollution occurs, along with the removal of resources at a rate which is not sustainable. These encounters of environmental degradation drove me to search for a deeper understanding of the reality of the harmful activities that have taken place within the marine environment, and how they have negatively impacted it. This understanding allowed me to critique the justification for these activities, and through this, provide suitable suggestions for remediation that can enable the preservation of the marine environment along the coastline of Kwa-Zulu Natal.

1.3.2- Academic Motivation for the Study

South Africa is a region in which ecosystem services are essential to the population, but these ecosystems' degradation is significant. This environmental degradation occurs partially as a result of "industrial and human population growth" (Miller and Kirk, 1992: 238), and the fact that "approximately 38% of South Africa's population lives in ecologically degraded areas" (Sigwela et al., 2017:1). The degraded ecosystem that is being examined in this study is that of the marine environment. The analysis is based on how this environment is being degraded by those who remove resources from it. The KwaZulu-Natal coastline is a densely populated region because its ecosystem services make it a preferred place of settlement. This high population density has "led to increased pressure on the coastal zone through resource exploitation" (Palmer et al., 2011: 1390). For the purpose of this study, this strain is examined through the anthropogenic interactions between humans in their various communities, and the marine environment where the act of fishing occurs within the waters on and off the coastline. The collection of resources from the marine environment is often exploited; therefore, the environment is damaged past the point of recovery. This leads to a net loss in biodiversity within the environment as resources are being removed and damaged at a rate that the environment is unable to replenish. This research delved into whether or not it is ethical, from an environmental perspective, to allow various anthropogenic activities to continue with their exploitation and damage of the environment through overfishing and pollution, or if it is ethical, from a humanitarian perspective, to prohibit individuals from making use of the environment in order to preserve it. The act of preserving the environment can potentially place the well-being of those who rely on it at risk, as they lose the necessary resources that they may

require for survival. The majority of the current academic research in this field is based on areas that are not local or, indeed, South African. Therefore, this research has enabled me and the reader to understand these issues through a local lens, and to consider mitigation processes to help the individuals in these areas to protect the environment that they live in for the sake of the future generations.

1.4- Key Research Question

How does the presence of anthropogenic activities impact the marine environment on the coastline of KwaZulu-Natal?

1.5- Research Sub-Questions

- What is the nature of the anthropogenic activities in the marine environment?
- How can the ethical theory of consequentialism inform the activities in the marine environment?
- What interactive measures can be put in place to potentially improve how anthropogenic interactions are conducted?

1.6- Key Objective

To examine the various ethical issues which arise as a result of anthropogenic influences along the coastline of Kwa-Zulu Natal.

1.7- Sub-Objectives

- To highlight the anthropogenic activities which have an impact on the environment.
- To analyse the anthropogenic impacts through the ethical lens of consequentialism and to provide ethical backing for my argument.
- To highlight the measures that could be taken to improve the state of the environment through the implementation of more sustainable practices.

1.8- Methods and Methodology

The study which I conducted focused on the effects that anthropogenic activities have on the marine environment. The manner in which I conducted my research involved the use of pre-existing knowledge and data on my topic, in the form of a desktop study; as such, this is a study that was carried out purely by making use of data and information from secondary sources which were found on the internet. The resources that I used were collected by making use of the Google Scholar search engine, which enabled me to acquire journal articles, news reports, and books that have already been peer-reviewed to ensure their validity. The main research engines that used academic material included Science Direct, ELSEVIER, the African Journal of Marine Science, ResearchGate, and Science Advances, with my primary search engine being Google Scholar. With the information that I collected, I undertook an explanatory study which aided in the explanation of the relationships present between humans and the marine environment, and how these two entities relate to one another based on these relationships.

The information that I collected and made use of in my dissertation was arranged thematically. This allowed for the critical appraisal of relevant literature, ensuring that suitable information was provided when tackling the key questions I proposed. This thematic arrangement provided new perspectives on the current literature and identified the gaps in it.

Furthermore, I referred to local examples of environmental crises within the marine environment which resulted from anthropogenic influences. By making use of these local examples, I aimed to highlight the severity of these impacts on the said environment, and how by degrading it, those responsible are damaging their own standard of living too because they are bringing imbalance to this environment.

The applicability of this type of research to my study was based on the fact that I was able to analyse my topic from the multiple perspectives that each of the authors and sources provided, effectively allowing for a multidimensional analysis of my research topic. Doing so enabled me to apply the ethical frameworks I had chosen to the situations being discussed, which allowed for the development of a structured ethical analysis regarding the issues arising from the anthropogenic influences on the marine environment.

1.9- Outline of Chapters

Chapter 1: Introduction

This chapter introduced my topic, "The effects of anthropogenic activities on the various factions within the marine environment along the coastline of KwaZulu-Natal - an ethical critique", by highlighting the various environmental issues which arose as a result of an anthropogenic presence in the marine environment.

Chapter 2: Literature review

In the literature review of this paper, I substantiated my topic by making use of current and pre-existing literature to highlight the pressures felt by and the issues arising within the marine environment as a result of human activities. This chapter aimed to provide a comprehensive understanding of the environmental issues present as a result of anthropogenic influences, and how these affect the marine environment.

Chapter 3: Theoretical Framework

In this chapter, I gave an outline of the dominant theory that I planned to use in my analysis, namely consequentialism. I also referred to how this theory was the most applicable choice when conducting the research and analysis of my topic, namely “The effects of anthropogenic activities on the various groups within the marine environment along the coastline of KwaZulu-Natal - an ethical critique”.

Chapter 4: Case Studies/Examples

In this chapter, I highlighted multiple local examples where environmental issues arose as the result of an anthropogenic presence within the marine environment. These case studies were all based on various spheres of this environment, as mentioned above, and how the acts of human beings have impacted it in either a positive or a negative way. It was these case studies and examples that I referred to when identifying the environmental issues that were present, and the potential issues which might arise in the future as a result of these issues.

Chapter 5: Analysis

This chapter consisted of an ethical analysis of my research topic "The effects of anthropogenic activities on the various factions within the marine environment along the coastline of KwaZulu-Natal – an ethical critique". This analysis was conducted through the ethical lens of

consequentialism, which allowed me to analyse the environmental issues present within the cases provided, based on the impacts that they had on the marine environment and the communities that made use of them.

Chapter 6: Summary, Recommendations and Conclusion

This chapter summarised the entire research paper, highlighting all the ethical issues that arose in my analysis. Along with this, recommendations were made on how to achieve a sustainable relationship between human beings and the marine environment, to ensure that no further environmental degradation takes place and that this environment is allowed to recover to its original state.

1.10- Conclusion

In conclusion to this introductory chapter, it is evident that there are a large number of issues which the marine environment faces through the interaction of human beings with it. Along with this, this chapter outlined my personal and academic motivation for the study, the research questions and objectives, the methods and methodologies, and the outline of the chapters which showed how this project flowed. The following chapter, Chapter 2 - Literature Review, provides and discusses the existing literature on the topics of pollution and resource collection within the marine environment, and highlights the various issues which arise as a result of the anthropogenic influence within it.

Chapter 2 – Literature Review

2.0- Introduction

In the previous chapter, the topic of my study was introduced and briefly described to gain a general understanding of the anthropogenic impacts on the marine environment. In this chapter, some of the current literature on how anthropogenic activity impacts the marine environment is discussed and summarised. This summary is structured in thematic order and discusses the current state of the marine environment, and how pollution and the activities within the fishing sector have and are currently still negatively affecting the marine environment along the coastline of South Africa. This chapter aims to highlight how these impacts degrade the marine environment, along with what measures have been put in place to counterbalance these.

South Africa is a country which has a beautiful and diverse coastline, and attracts people to reside in these areas, meaning that “approximately 30% of South Africa’s population reside along the coastline” (Wepener, 2012: 1). Along with this, South Africa as a country is one in which the economy is largely based on the ports that are situated all along the coastline, with it being estimated that "at least 35% of South Africa’s gross domestic product is generated in the coastal regions” (O’Donoghue, 2003: 349). This places a large amount of pressure on the environment as pollution becomes a pressing issue that is leading to the degradation of the marine environment. The pollution of the marine environment, as a result of anthropogenic influences, can come in many forms, including “nutrients, including sewage, petroleum hydrocarbons (PAH), halogenated aromatic hydrocarbons (HAH), such as PCB and DDT, metals, radioactive substances, temperature, [and] litter, such as plastics and fishing equipment” (O’Donoghue, 2003: 350). These various pollutants find their way into the riverine and marine systems and pose a great risk to the stability of the ecosystems, as these foreign materials offset the balance within the environment. It is important to note that while the focus of this study is based on the marine environment, pollutants are not necessarily dumped straight into the ocean. This is because of South Africa's topography and the various catchment areas which all contain rivers leading to the ocean. Because of the interconnectedness of South Africa’s rivers and the marine environment, the "estuaries are major conduits for transporting plastics from catchments to the ocean, especially in urban areas, where they may serve as industrial outlets” (Naidoo and Glassom, 2019: 1).

2.1- Chemical Pollution

The pollution of the marine environment does not only come in the form of solid waste but also from particulate waste, which is comprised of toxic chemical substances that are leaked into the environment from multiple sources. These chemical pollutants travel through the riverine and groundwater systems which lead towards the ocean, and stem from issues such as: improper farming practices, where pesticides and fertilizers are washed into the ground and the rivers, pushing them downstream; poor water treatment at sewage plants; and from industrial activities which use various chemicals in their product development processes, and that pump their waste materials into the environment. A few examples of these pollutants include “pharmaceuticals, personal care products, pesticides, veterinary products, industrial waste, food additives and engineered nano-products” (Fayiga, 2018: 53), to name a few, and all of these pollutants are directly of anthropogenic origin. This has caused the quality of the surface water within South Africa to deteriorate as these effluents are discharged into the riverine systems at an uncontrolled rate. As a result of this improper disposal, the environment is being placed under immense strain as the equilibrium within the marine and riverine environments is thrown off balance.

2.1.1- Effects of Chemical Pollution on the Marine Environment

The pollution of South Africa's water sources, through the addition of chemicals into the environment, "has serious implications for human and environmental health" (Fayiga, 2018: 55), as these chemical pollutants are often toxic when consumed. As mentioned above, South Africa's riverine and marine systems are full of contaminants, which range from medical and personal care products to chemicals discharged through the processes of industrialised production. An example of this pollution is found within the Dzindi River, located in Limpopo province, South Africa, where this riverine system finds itself "contaminated with heavy metals due to high sediment inflow to the river during rainfall, poor agricultural practices, uncontrolled deforestation, poorly planned informal settlements and effluents from wastewater treatment plants" (Fayiga, 2018: 55). These various activities which are poorly maintained all contribute to the addition of heavy metals into the environment, and are therefore responsible for the degradation of both the riverine system that they make use of, as well as the marine system into which the river flows at the end of its course. Once chemicals are added to the riverine and marine systems, there are several side effects which will be felt by the environment.

2.1.2- Environmental Impacts of Agricultural-based Chemical Pollution

Agricultural practices in South Africa form a large part of the economy that drives the country, and therefore large portions of the countryside are used for these. As a result of this large agricultural presence, there is an extremely large need for water, which is collected from the rivers and dams that all lead into the oceans. This means that agricultural land is generally situated close to or along a main water source, leading to several issues. The first issue is chemical runoff. This occurs when water collects chemicals and sediments, and runs back into the riverine systems which are situated along the edges of the farmland. It is in these areas where "poor farm management practices such as excessive use of agrochemicals, irrigation with contaminated water, the addition of untreated biosolids and farmyard manure contribute to the pollution of farmlands" (Fayiga, 2018: 56), and thus the pollution of the water sources surrounding them, which ultimately leads to the pollution of the marine environment. The high levels of nitrate-based chemicals from fertilisers and other industrial effluents result in eutrophication and algal blooms, which effectively remove oxygen from the water as they prevent any photosynthesis from occurring in the plants and organisms that diffuse the oxygen into the water.

2.1.3- Management and Monitoring of Marine Pollution

The monitoring of pollution in the marine environment internationally is undertaken by organisations such as the United Nations, which actively address the issues surrounding marine pollution. This has been done through the implementation of the "Global Plan of Action (GPA)", which aims to "actively address the issue of land-derived pollution sources in coastal regions" (Wepener, 2012: 4). This GPA requires national governments to identify pollutants of land-based origin and their impacts on the marine environment, and to implement management strategies to prevent the further damaging of the marine and riverine environments. In South Africa, the pollutant levels are relatively low as compared to some other countries in the world, but this does not mean that there is no negative impact on the marine environment as a result of pollution. As such, it is imperative that a legislative framework that applies to the country be developed to reduce the impacts that human beings have on the marine environment. Unfortunately, the management of the marine environment in South Africa is extremely fragmented, with little focus placed on the pollutants which are introduced into it, making it extremely difficult to manage the degradation of the said environment. The South African

government has taken steps towards the implementation of legal frameworks through the development of the “white paper for sustainable coastal development” (Wepener, 2012: 4), which entails that there is a national responsibility for the implementation of monitoring and regulation of the pollution generated through economic development and industrial processes. Along with the management of the marine environment being fragmented, South Africa as a country is still developing, and there is not a lot of capital for monitoring projects, despite the importance of the preservation of the marine environment. This means that monitoring is often done privately, without government aid, and therefore the monitoring that is done is on a small scale and focuses on smaller impacts. The marine monitoring undertaken by the government is heavily limited by the lack of funding that is given to marine organisations, as they attempt to save as much revenue as possible by reducing their available monitoring budgets. This reduction in funding subsequently reduces the number of locations which can be sampled, resulting in there being gaps in the information that is acquired, thus preventing a holistic perspective on the state of the marine environment from being developed. Ultimately, this means that organisations are responsible for maintaining the environments that they make use of through the precautionary principle, which states that "unless an activity can demonstrate that it is not having an impact then it should not be allowed" (Borja and Elliot, 2013:1). This allows organisations that pollute the environment to maintain their activities, and manage the environmental conditions themselves, as there is little external monitoring that takes place. There is a need for a more comprehensive monitoring method which will have a low cost for the government, and one where the monitoring processes can be easily and effectively done by those who do so.

2.2- Plastic Pollution

The main form of pollutant that is found within the marine environment off the coastline of KwaZulu-Natal is plastics. These are plastic particles or fibres which float freely within the water column. These plastic particles are a result of the processes of production which are associated with the industrial sector, and it is estimated that "from the onset of production, 8300 million metric tonnes of plastic has been produced with approximately 59% being discarded" (Naidoo and Glassom, 2019: 1). Plastic pollution in the marine environment is found in many different forms, whether it be large pieces of plastic which are visible to the naked eye, or microscopic ones which at first glance do not appear to be there, but upon closer examination millions of small particles are found suspended within the water column. These plastic

particles are classified into “microplastic, including debris such as fishing nets, large pieces of styrofoam, and parcels that have been lost or discarded from cargo ships; microplastic, particles under 5 mm in diameter, including plastic nurdles as well as fragments that remain when larger plastic objects enter marine ecosystems and phytodegrade, and nano plastics, either manufactured as such or the end state of microplastic degradation, invisible to the naked eye” (Vince and Stoett, 2018: 1). All the waste plastic which is discarded poses a large threat to the marine environment as it often resembles the prey items which marine organisms would consume, and therefore marine animals regularly consume this plastic which is detrimental to their health. Additionally, it easily passes from one organism to another. This damage is evident in numerous cases where animals are found washed up with their stomachs full of plastic-based debris. The issue of bio-magnification, which is the process of chemical accumulation within organisms, through transmission from one another through consumption, is another problem. This accumulation has an overall negative effect on the entire environment, as organisms are steadily becoming more and more toxic through trophic transfers, as plastic particles can hold onto various other chemical pollutants, which results in extremely high toxicity. The issues related to these trophic transfers are not solely environmental because humans are the primary consumers of organisms living in the oceans. This ultimately means that the pollution that humans are adding to the environment is coming back full circle, as the organisms which are consumed contain plastic themselves, and therefore we as a species within the trophic ladder are consuming the plastics that we are putting there.

The dispersion of plastic pollution within the marine environment of KwaZulu-Natal is generally connected to the rivers which flow into the ocean, and the currents therein which move these plastic particles up and down the coastline. The main area which is responsible for the pollution of the marine environment off KwaZulu-Natal is the Durban harbour, and this area is prone to pollution because of the high industrial presence and activities which take place there. Because this harbour is the main economic port for the region, there are many industrially driven businesses which trade in materials containing plastic powders, and that find their way into the environment as waste from the industrial processes which are taking place on a large scale. Along with the direct input of pollution into the environment, plastics also find their way down through the wastewater lines which flow into the harbour from treatment plants. This plastic originates from household uses such as the very clothing which we wear day to day. These plastic particles come from washing clothes, as in this process small fibres are removed and washed down the drain towards the treatment plants. Once at the treatment plants, the

larger particulate waste is removed from the wastewater, but small microplastics often pass through the filtering process and are therefore pumped into the environment as "clean" water, but in reality, it is full of pollutants.

2.2.1- Effects of Plastic Pollution on the Marine Environment

Unfortunately, although these issues are known, there is very little that is done to prevent the further addition of plastic-based pollutants to the environment, as the development of the economy, and the world as a whole, requires consumption. As a result of this, there are bound to be pollutants present and added to marine systems. Due to this constant development and the use of the marine environment, the latter is constantly being inundated with waste material which filters its way through the oceanic ecosystem. This infiltration of plastic particles into the waters off the coastline of KwaZulu-Natal poses serious threats to the well-being of the environment as a whole, and to the organisms that live in and make use of the oceans. Quantifying the amount of plastic pollutants which is currently present within the marine environment, is extremely important in trying to understand the complexity of the issue at hand. This is because pollution in the marine environment covers a vast array of different forms and each one impacts the environment differently. In the case of plastic presence in the marine environment, this often breaks down into microscopic particles known as microplastics, and these plastic particles resemble food items for organisms lower down on the trophic level. These organisms consume the plastic particles and the process of bioaccumulation begins. In essence, this means that if one small organism eats ten particles of plastic, then an organism higher up in the trophic scale which consumes ten of the smaller organisms, would ultimately be consuming a hundred parts of the pollutant, and so the process continues with the plastic consumed by each individual increasing exponentially. Naidoo highlights this when mentioning that these "trophic transfers may pose a threat to the rest of the food web, including humans" (Farrell and Nelson, 2013: 2). Along with trophic transfers, the presence of pollutants has a major effect on the smaller organisms which play an even more important role in the environment as compared to the larger ones. This is because they provide the world with most of its oxygen through photosynthesis. The pollutants which are present in the environment jeopardise the well-being of the organisms which are responsible for generating oxygen, as the coral reefs are being bleached by chemicals which have been added to the environment. This upsets the balance in the environment to a negative degree because if photosynthetic organisms are unable to conduct their primary function, the overall state of the environment will be in

decline. It is important to note that plastics and other pollutants do not need to be dumped straight into the oceans to cause damage. They are transported from riverine systems, meaning that the pollutants which enter the marine environment do not necessarily have to come from the area, but rather they travel in the river systems from all over the country before they finding themselves in the ocean. This leads to the realization that although the pollution of the marine environment occurs on the coastline, this is not necessarily the source, as pollutants could come downstream from large distances inland. It is this fact that I believe the general population is unaware of because their waste "magically" disappears, when in fact it is being disposed of in an environmentally unfriendly way, and this waste ends up in the oceans and degrades the marine environment and the ecosystems which are found therein.

2.3- Fishing

2.3.1- The Nature of the Fishing Sector

The fishing sectors present and active on the coastline of KwaZulu-Natal are subsistence, recreational, and commercial fisheries. Each type of fishery applies varying pressures on the environment. These pressures are far more present than one would think with fish populations often struggling for survival. Because of this, the sector has been placed under strict regulations which were set out at the third United Nations Conference on the Law of the Sea. It was at this conference that the world's oceans were split up and rights to waters were given to each country for the "management and use of fishery resources within their exclusive economic zones, establishing an international legal framework for the oceans and responsible fisheries management" (Lam and Pitcher, 2012: 365). In doing this, the resources within these economic zones were set to be used by the nations in charge of them and to sustain their future generations.

2.3.1.1- Subsistence Fisheries

A subsistence fishery is defined as one that is comprised of "those fishers who are poor, fish mainly for food and may exchange or sell the surplus harvest to meet other basic needs" (Sowman, 2006: 61). These fishermen collect marine organisms on a small scale as they do not possess the required technology to collect the resources at a larger level. The individuals who form part of the subsistence sector are primarily those who have fallen victim to colonisation, "and the introduction of discriminating apartheid legislation resulted in the systematic

exclusion of apartheid-defined Coloured and black subsistence fishers from direct legal access to fisheries resources" (Sowman, 2006: 61). The marginalisation of these racial groups, which led to their living in impoverished areas, has caused a relationship based on necessity, whereby individuals from these communities rely on the marine environment for their survival. As a result, they continue to remove organisms from the marine environment, either through illegal means or through the regulations that are put in place to manage recreational fisheries. In order to improve the livelihood conditions of these individuals, subsistence fisheries are being converted into small-scale commercial fisheries through infrastructural development.

Small-scale commercial fisheries are based on the premise of converting small-scale and subsistence fisheries into small commercial fisheries. These types of fisheries consist of "an important group of fishers who might previously have been considered as 'subsistence fishers' or 'artisanal fishers', but who would prefer to gain commercial rights" (Sowman, 2006: 66). The conversion of a subsistence fishery to one that is commercialised allows for those fishers to generate slightly higher yields whilst abiding by regulations, and they can therefore sell some of their product in ports or at markets, allowing them to generate a small income from their fishing efforts. This commercialisation has been noted as a step in the right direction towards the alleviation of poverty because of the newly generated cash flow within the albeit small economy. This newfound cash flow enables individuals within these communities to improve their way of living, through the development of their communal and personal living conditions.

2.3.1.2- Recreational Fisheries

Recreational angling is an extremely popular activity along the coastline of KwaZulu-Natal and it occurs regularly, even though it is primarily a seasonal activity, with the presence of recreational fishers peaking in the winter seasons when the sardine run occurs. Recreational fisheries are commonly defined as "fishing whereby the primary objective is not to produce food or generate income through the sale or trade of fishing products" (Arlinghaus et al., 2009: 39), meaning that these fishermen partake in fishing for enjoyment and often in the practice of catch and release, with only select fish being used for consumption. This method of fishing makes use of limited gear, which generally includes fishing rods, reels, and hooks, and these are used to catch one or a few fish at a time.

2.3.1.3- Commercial Fisheries

Commercial fishing is the process of harvesting marine organisms at a large scale, with the intent to market the catch to consumers. The collection of these organisms occurs by making use of equipment which is designed to collect large quantities of catch at a single time, such as large vessels, nets, or long lines, which catch thousands of creatures of all species in a single swoop. The introduction of worldwide commercial fishing to the world's oceans has had a large negative effect on the environment, as over time its "effort eventually outstripped the natural productivity of many fish stocks, driven by changes in fishing technology such as diesel engines, steel vessels and mechanised gear" (Anderson et,al. 2019: 268).

2.3.2- The Impacts that the Fishing Sector has on the Marine Environment

The depletion of stocks has developed a toxic relationship between the sectors because they are all in competition for the same finite resource, and its over-exploitation increases the necessity for each sector to augment their catch. This ultimately depletes the available resources. Along with this, South Africa's marine environment experiences large seasonal fluctuations. With the exploitation and fluctuations comes the necessity for the application of permits, which are said to govern how many fish each sector or individual is allowed to catch and keep. These permits apply more to the commercial and recreational line fishing sectors because they are the ones which have the largest impact on the fish stocks that the ocean holds.

2.3.2.1- Subsistence Fisheries

Due to the nature of subsistence fisheries, and the fact that they only collect species for consumption at a small scale, their impact is rarely looked into. This lack of monitoring is attributed to the poor governance of natural resources in areas that do not bring in any economic benefits, namely poorer areas where subsistence fishing occurs; this is because their impacts are considered to be small in relation to the recreational and commercial sectors. However, although these areas are not managed and their impacts are considered to be small, they still have an effect on the marine environment to a certain degree. Subsistence fishermen are relatively non-selective in terms of what resources they remove from the environment because they need food for the preservation of their well-being. This means that they will remove whatever they can catch, apart from a few select species which are undesirable to the communities. Along the coastline of KwaZulu-Natal the non-commercial Saccrosta cucullata, commonly referred to as a rock oyster, is the most frequently gathered species (Branch et al.

2002: 451). This is because these organisms are easy to harvest and are plentiful along the entire coastline. The subsistence fishers also catch and remove sizeable amounts of mullet, another fish species that is plentiful and found in a diverse range of habitats, meaning that the removal of these fish from the environment has a low impact on the species as a whole. These are but a few of the species which are collected, but they highlight the relatively low impact that subsistence fishing has on the marine environment. However, issues do arise when these fishermen harvest certain species which are protected, such as abalone, and acts of poaching occur. The removal of protected species from the environment is unlawful, but without regulation, it goes unnoticed by the authorities. This can potentially lead to issues of severe population decline, and these protected species could find themselves in a position where they are unable to recover from the pressures felt as a result of illegal fishing activities. It is important to note that while one subsistence fisher's impacts may be low, collectively, the impacts of all the individuals partaking in subsistence fishing are relatively high, and without proper management, these can be detrimental to the success of the marine environment.

2.3.2.2- Recreational Fishing

The activities in South Africa's fishing sectors fluctuate on a seasonal basis, with the overall peak being over the school holidays, as this is the time when vacationers visit the beach and practise recreational fishing as a source of entertainment. It is during these times when recreational fishing is at an all-time high (Dunlop, 2013: 83). On the other hand, commercial fishing has a reasonably consistent presence as it is not limited by the variable factors which are felt by the recreational fishing sector. However, this sector is limited by seasonal variations, as the fish stocks migrate to and from different regions throughout the year. This means that there are increases and decreases in pressure on the environment over certain periods, with "slight increases felt over winter and summer" (Dunlop, 2013 :83) because there are migrations which take place during those periods, so the fish are more abundant then. This pressure influences the growth and size of the fish stocks that are captured.

2.3.2.3- Commercial Fishing

The offshore line fishery off the coast of KwaZulu-Natal has been exploited, and "it is the largest of its kind in KZN in terms of capital investment, accounting for approximately 35% of the total capital value of all fisheries in the province" (Dunlop, 2013: 79). The offshore line fishing sector targets a vast array of species in both shallow and deep water, meaning that the

sector has a large impact on several different species, as these fishermen cannot control what organisms find themselves in the trawling nets. These organisms which are not targeted but are still caught in the nets are referred to as bycatch, and this varies between mammals and birds to various fish species which accidentally find themselves inside the nets of the trawlers. As per regulation, there are various species which must be put back once they are caught, but they are often injured or left weak as a result of being caught and sorted by the fishermen, meaning that mortality is unavoidable for a large portion of these protected species. When it comes to the targeted species and if the catch coming in is substantial, commercial fishing boats often aim to maximise their profits by bending the rules or not adhering to regulations at all. In these instances, these fishermen attempt to maximise their profits past the limits set in place for the total allowable catch, and this is done through overfishing activities and illegal offloading. These three issues, namely overfishing, bycatch, and illegal offloading are some of the main issues that lead to negative environmental impacts, and the issues relating to them will be highlighted below.

Overfishing

Fishing as a primary activity along the coastline of South Africa, and more so KwaZulu-Natal, has steadily increased as the country has experienced population growth and economic development. Overfishing has become a common practice in recent times, as fishermen strive to meet the needs of the industry along with their own, primarily revolving around money. Historically, the fishing sector was based on the collection of any marine organism, whether they be mammals such as seals, penguin eggs, whales, or fish. Fishermen were spoilt for choice due to the abundance of the marine environment at the time. However, they later moved on to harvesting and "exploiting species of fish, crustaceans and molluscs" (Moloney et.al, 2013: 2). This new direction gave rise to the development of a commercial fishing sector that revolved around trawling within a nationally declared 200-mile exclusive economic zone. This allowed the fishing sector of South Africa to have exclusive rights to fish in these waters, leading to the capture of marine creatures at an unsustainable rate. "Fishing reduces the abundance of selected species and truncates the age structures of their populations" (Moloney et.al, 2013: 4). In essence, this means that the process of overfishing in the waters of South Africa has placed immense pressure on the populations of marine animals. This is because these animals are unable to regulate their populations and sizes as they are not given the time to recover from this activity, leading to an overall decline in the condition of the marine environment along the

coastline of KwaZulu-Natal. Therefore, the population of native fish species is declining due to increased anthropogenic pressures. This results in lower populations which are unable to regulate themselves, and therefore the marine environment is becoming more barren.

Bycatch

In addition, overfishing poses another threat. This is related to accidental catch or bycatch, which refers to all the organisms which are caught by mistake. These animals include major predators such as sharks, bird life, and sea-dwelling mammals, namely whales, dolphins, and seals. This is an area of concern because "the taking of marine mammals, both as a target species and as incidental catch" ultimately leads to "the degradation of marine communities and ecologies" (Miller and Kirk, 1992: 238). Fortunately, trade in marine mammals has been outlawed by regulations, but it occurs nonetheless, albeit under the radar, in practices such as whaling, or accidentally through bycatch in trawler nets or long lines. However, bycatch is not only related to the collection of marine mammals, but rather to organisms that are not target species. For instance, if a prawn trawler were to pull up its nets, anything that is not a prawn is considered bycatch and is often thrown back into the ocean dead or alive. This is because trawlers do not have the necessary permits to legally keep any of these organisms. In a study based on the impact of commercial prawn trawlers on the population of line fish species along the coastline of KwaZulu-Natal, it was noted that there are various factors which affect how much bycatch is collected through the process of trawling. These factors include “gear size, day/night effects, season, depth, weather and fishing efficiency” (Fennessy, 1994: 264). The capture of bycatch and its return to the environment dead or alive places stress on the organisms that are caught. This often negatively impacts their health and that of the environment, as there is a large number of dead or dying organisms added to the environment. This upsets the balance of the food chains, as the predatory organisms which are often caught in the nets are removed from the system as they die during capture. This throws the various food chains off balance leading to the collapse of the ecosystem with the disturbance of trophic levels.

Illegal Offloading

Illegal offloading is the process of removing caught organisms from ships out at sea, to maximise profits as these organisms are not reported or recorded when the ship enter port. This allows these ships and their parent companies to profit on unrecorded organisms which have been removed from the marine environment.–Lee and Mann based their research on illegal

offloading on a fish species called S. Commerson, commonly known as Spanish mackerel. Their findings were that the average size of the fish caught was considerably smaller than their potential size. Their study showed that the size for "females averaged 95.87 cm FL (full length) and ranged from 49 to 161.5 cm FL. Male fish were on average smaller 84.40 cm FL, ranging from 52.1 to 141 cm FL" (Lee and Mann, 2017: 400). These results allow us to hypothesise that the population of Spanish mackerel is under pressure from overfishing because the majority of the fish are not reaching full size. This means that these fish are at the stage of population decline as they are not of mature breeding age. The question that needs to be asked is, why is this population of fish potentially being overharvested? U.R. Sumalia (2020) talks about the illicit fishing trade and how commercial fishing fleets bend the rules illegally. Sumalia talks about transhipments “which involves offloading catches from multiple fishing boats onto larger freezer and processing ships at sea” (Sumalia, 2020: 1). This process allows the fishing fleets to make more money without authorities catching them for illegally going over their regulation catches. More fish can be caught without punishment, leading to a decrease in fish populations. Along with the population decline for the fish, this also hinders the market and other fishing sectors, as there are fewer fish to be caught, and therefore those who are reliant on these resources for survival are impacted significantly.

2.3- Management of the Sectors

These sectors all pose different risks to the well-being of the marine environment and they all have different impacts when compared to one another. This calls for the need to tailor management plans specific to the various sectors.

2.3.1-Management of Subsistence Fisheries

Due to the state of the economic situation of the country, a large section of the population finds itself living in rural areas, which are poorly governed and often do not feel many economic benefits. These rural coastal communities "rely on small-scale fisheries as a major source of food, income or as a contribution to their livelihoods” (Sowman, 2006: 60), and it is therefore important that this sector is managed carefully to preserve the well-being of the individuals who rely on it. Unfortunately, the common trend is that the overarching fishing sector pays more attention to the recreational and commercial sectors, as they bring revenue into the country. They, therefore, take priority over small-scale fisheries, meaning that subsistence

fisheries are often mismanaged by governing bodies. The issues that may arise are strongly based on the “equitable access to marine resources” (Sowman, 2006: 60). There is an imbalance in the fishing sector because each sub-sector is managed differently and has to adhere to different regulations. The different sub-sectors are monitored differently and this leaves gaps in which there is a lack of clarity. This allows certain resources to be collected, often without authorisation. The fishing sector has evolved into one where there is very little focus on the subsistence sector because the commercial and recreational sectors bring in "considerable social and economic benefits" (Veiga et al., 2013: 53); they are, therefore, considered more important. Managing the subsistence sector through the implementation of licenses seems irrational, as the communities who take part in subsistence fishing do not necessarily have the money to purchase these. This would slot the subsistence fishers into the recreational fishery sector and they would be legally required to abide by the recommended limits, which would potentially hinder them as they are “more dependent on fishing catches as an important extra source of food” (Veiga et al., 2013: 61). Additionally, the catch limits are less than what is required for survival. This means that either a new approach must be taken when managing the subsistence fisheries, or their impact needs to be ignored because of the relatively low effect that it has on the marine environment. An alternative management strategy could make use of co-management. This management strategy bases itself on communal involvement, whereby the communities and fishermen are also involved in the decision-making processes when setting out managerial regulations. This strategy has been well implemented in the subsistence communities in KwaZulu-Natal, as they are considered shareholders in the protection of the marine environment. They are involved with "the relevant local authority in the joint management of particular resources" (Harris et al., 2002: 511). This inclusivity allows local communities to provide their views on how and what needs to be managed from a grassroots level, leading to a more inclusive management strategy. This is in contrast to those who adopt a blanket approach which often neglects the needs of the local communities. By adopting a grassroots approach, management strategies can consider the socio-economic characteristics of the communities, meaning that their well-being is maintained or even improved. This community-based management strategy gives the community an identity within the environmental sphere. This often means that they will look after the environment to the best of their ability as it is theirs to protect and maintain.

2.3.2- Management of Recreational Fisheries

The recreational fishing sector has "substantial economic, socio-cultural, ecological and evolutionary importance" (Arlinghause, 2016: 178). It must be carefully managed through the implementation of various management strategies. This sector has a large presence within the marine environment with approximately eleven per cent of people taking part in recreational fishing activities. This percentage is relatively small when looking at the bigger picture, but the presence of these fishermen places much pressure on the marine environment. In developing countries which are attempting to achieve sustainability, such as South Africa, it is important to acknowledge the economic and social impacts that recreational fisheries have on both the environment and the people in this sector. This is centred around the poorly developed management strategies which are in place. However, it is seldom monitored due to a lack of governance within the sector. Poorly developed monitoring methods in developing countries are in dire need of re-evaluation. Initially, it is important to understand the complexity of the socio-environmental relationships present in this sector. This pertains to the attitudes of anglers towards the environment, as this is a driving factor in the decline of the marine environment. Because of these relationships, “there is much to gain from developing a systematic understanding of how recreational fisheries function” (Arlinghause, 2016: 181). This can be achieved through the collaborative involvement of those within the fishery sector and those who are there to govern it, allowing for the development of an “interdisciplinary knowledge base” (Arlinghause, 2016: 181) on which regulations can be based. When it comes to the implementation of regulations, there are different frameworks which can be applied to manage and monitor the impacts which are found within the recreational fishing sector.

One challenge is the issuing of fishing licences. These highlight which species these anglers are allowed to catch and the minimum sizes which are required for the organisms to be kept. In a study of anglers conducted by Beckley "94% supported minimum size limits, 88% bag limits, 90% closed areas and 90% closed season" (Beckley, 2008: 19). Adherence to the regulations allows for the populations of fish to adjust to fluctuations in size and quantity. This means that they can adjust to changes in population size, potentially allowing for a healthier population and a healthier overall environment. A positive attitude towards regulations ensures that there is some sustainability in this sector. Fishermen are not there with the intent of overfishing or removing endangered species from the environment. However, the management

of the recreational sector also has implications for abuse as there is poor monitoring of recreational fishers.

2.3.3- Management of Commercial Fisheries

Commercial fishing as a sector is regulated differently in each country, as individual nations are the ones who “own” the resources found in an area within their jurisdiction. The management regulations discussed serve as a general overview of how the sector could be managed. Anderson et al. (2018), provide three core approaches which can be seen as methods of managing and preserving the environment. Initially, the authors put forward a scenario which depicts unregulated access to the fishery, to use as a baseline. This is a fishery without any imposed constraints, "neither limiting the number of harvesters that enter the fishery nor limiting the quantity of harvested product" (Anderson et al., 2018: 269). Unregulated fisheries, such as those in this category, often find themselves overrun with individuals motivated by egotistical values. This is because revenue drives the economy and thus drives those who are within the unregulated commercial fishing sector. The potential to make a profit in this sector attracts many new individuals into it. This floods the fishery with harvesters and forces them to compete for resources, meaning that more organisms are harvested from the environment at a faster rate due to the influx of harvesters. This hinders the organisms and the environment in their replenishment and recovery, and stocks become severely depleted through overfishing. The dynamics of the fishery will then begin to change due to high competition and low product yield. Fishermen will be forced to refrain from fishing because they will no longer be able to sustain their livelihoods as they experience a “biological tragedy of the commons” (Anderson et al., 2018: 270). In Africa, this pattern occurs within the small-scale commercial fishing sectors as rural fishing communities become driven by the economic benefits of commercial fishing. The number of fishermen within West Africa increased from “953,000 in the 1950s to 1.74 million in 2010 and catch quadrupled, but, despite increases in landed value, fisher income is very low” (Belhabib, Sumalia, & Pauly, 2015: 76). The choices made by harvesters to flood the sector potentially leads to the sector being depleted beyond its ability to regenerate, and the environment is often severely degraded.

2.3.3.1- Limiting Catch

The first management approach put forward by Anderson is that of limiting catch. This approach makes use of mechanisms such as limited entry, total allowable catch, catch shares,

individual fishing quota, and individual transferable quota. Each of these mechanisms serves a different purpose, but all contribute to the same cause. The limitation of entry into the fishing sector controls the number of vessels involved within it. This serves the purpose of reducing the catch that is removed, even though the vessels which can operate within the sector are allowed to increase their catch limits leading to greater profitability. However, this increase often continues the trend of overfishing through mismanagement. This leads to the implementation of the next management mechanism which is total allowable catch. This is the "strict control over the total quantity harvested" (Anderson et al., 2018: 272). This ensures that environmental limits are not exceeded through the prevention of overfishing. Proper implementation of this mechanism often has a positive impact on the environment even though it has a negative one on the fishing sector, as the harvesting capacity of the vessels generally exceeds the limits set in place by the total allowable catch. This means that vessels operating within the sector are unable to maximise their profits and often end up losing revenue as a result of competition. The third management mechanism aims to reduce this competition amongst vessels within the sector, and this is done through the implementation of catch shares. This is the process of distributing portions of the total allowable catch amongst the communities and corporations that make use of the fishing sector. This distribution provides individuals with the right to portions of the total allowable catch, and in turn provides them with the power to define how the sector will be managed through the management of their individual and collective quotas. Individual fishing quotas are "non-transferable shares of the total allowable catch" (Anderson et al., 2018: 273), and they aim to reduce the economic impacts felt by the fishermen. This share within the fishery allows fishermen to operate in an environment without large amounts of competition as they own the rights to a specific portion of the total allowable catch. This means that those fishermen are not forced to spend capital on more efficient equipment as there is no pressure to catch as much as possible before the total allowable catch limits are reached. This places them in a more economically viable position. Furthermore, the fact that these individuals are given a solid share of the total allowable catch and the future of the fishery means that they are “driven to maintain or increase the value of their property via ensuring the productivity of the fishery” (Anderson et al., 2018: 273). This results in a reduction in the levels of overfishing, ultimately allowing for the environment to recover. Further adding to the economy comes the implementation of individual transferable quotas. This allows individuals to sell their rights to the total allowable catch to other fishermen or vessels in exchange for money. The sale or right to harvest allows for the less efficient fishermen to potentially make more money from the sale than they would generally make in a

fishing season. This provides a path for fishermen who do not possess the resources to conduct their fishing activities sustainably “to leave the fishery, with compensation from those who remain” (Anderson et al., 2018: 274), through the presence of a passive income. Unfortunately, this generally only provides an income for boat owners, but the staff who work on them find themselves without a form of income, thus leading to the possibility of social collapse as revenue is removed from the equation. Additionally, there are issues surrounding the loss of short-term jobs as they are replaced by long-term workers. Many individuals within these fishing communities find themselves without any source of income.

2.3.3.2- Limiting Effort

The second path towards managing commercial fishing revolves around the limitation of the methods used in the fishing industry. In this case, the fisheries choose to "limit fishing mortality by regulating technical inputs with restrictions on fishing effort by size of vessels, type and amount of fishing gear, or numbers of open fishing days" (Anderson et al., 2018: 274).
As fisheries realise that the levels of fish are beginning to decrease, they begin to implement limitations through guideline harvest levels, which are in place to prevent the act of overfishing. These harvest levels are often applied to areas which are difficult to monitor, and the enforcement of regulations is relatively poor. While the premise of guideline harvest levels is intended to reduce impacts on the environment, it is flawed by the fact that it is difficult to regulate it in poorly enforced environments. Guideline harvest levels fail to provide backing for fishermen to improve their fishing practices because it would effectively increase their profitability. A reduction in the number of organisms harvested means less profit. As a result of this lack of enforcement, fish populations are often overexploited and overfishing continues to occur. By ignoring the regulations that are put in place, fishermen find themselves “scaling up all unregulated inputs to increase their harvesting power in the face of regulations” (Anderson et al., 2018: 275). By ignoring harvest guidelines, fishermen can target the species which generate the most profit, increasing their earnings while damaging the populations of targeted species. In the case of species which are under less pressure and are abundant, the unregulated efforts, which go against the limitations, have less of an impact on the environment. It gives those species, which are under pressure, more time to recover. This proves to be better for the environment although overall the pressures are still damaging. In an attempt to further limit the effort of fishing, the parties of the NAURU agreement implemented a scheme by which vessels have to bid for the rights to access the fisheries with only a restricted

amount of vessels allowed to access the waters on a given day. This limits the pressures put on the environment as a result of overcrowded fishing grounds. This can be seen as an inter-transferable input control as inputs are transferred to those vessels that can use the time on the water most profitably. This does little to enforce the regulation, but it does reduce the pressure on the environment as fewer boats are fishing in the waters every day.

2.3.3.3- Spatial Access Controls

The third and final path that Anderson suggests as a management strategy for recreational fishing is that of spatial access control. This form of control within the fishing sector involves the implementation of fixed boundaries, which are there to prevent access to the areas that are protected. These boundaries contain areas such as "marine protected areas, marine reserves, marine parks and closed areas" (Anderson et al., 2018: 276). These are areas where no fishing is allowed, and they are generally prime fishing grounds with a high abundance of species. The regulated areas make use of community-involved programmes, which aim to preserve the environment through communal governing, giving communities an incentive to protect the environment. This communal governance allows for some limited fishing activity to occur on the periphery of the marine protected areas, but it prevents all forms of recreational and commercial fishing. Only subsistence fishing is allowed as communities rely on the environment for survival. With this limited access, it is important to note that the total allowable catch limits are still implemented, to ensure that communities do not overfish and disrupt the populations of the various species found within and around these protected areas. This encourages populations of fish species in these areas to regrow and flourish in conditions which are not under pressure, leading to an overall amelioration in environmental conditions. The limitation of areas which are allowed to be fished commercially is done by moving closed areas seasonally and opening up the fishery when populations are high and able to survive and recover. The fishery is fished to the level where guideline harvest levels have been reached. This path towards management has a large positive impact on the marine environment as it is allowed to recover from its degraded state into one that is plentiful. However, it does pose issues for the economies of fisheries in these areas. The closure of waters often results in a net loss in profits for fishermen, and when the fishermen find themselves under pressure, they often push the boundaries and fish in these areas illegally when able to do so.

2.4- Conclusion

In conclusion to this chapter on the literature review, it is evident that anthropogenic interactions with the marine environment have a diverse array of impacts on it. This is because the marine environment is regularly polluted, through the addition of chemical and plastic waste, and resources are continuously removed from it. This review of current literature highlights the environmental risks which are present due to the influence of human activities on the environment, allowing for my discussion to be based on the severity of these issues. Furthermore, it highlights how the sectors which are linked to pollution and overfishing, are currently being managed. In the next chapter, the theoretical frameworks of consequentialism and African environmental justice will be described and explained in preparation for the analysis that I undertook. These theories will be broken down and critiqued, allowing me to refer to their applicability to my study.

Chapter 3- Theoretical framework

3.0- Introduction

In the previous chapter, the current literature surrounding the ethical implications of humans on the marine environment was highlighted and discussed, showing the negative impacts that the former have on the latter. The current chapter highlights and explains the theoretical framework that will be used in the analysis of my topic. The theories that I will be using are consequentialism and environmental justice, and they will be applied to ethically analyse and critique the actions of humans which negatively affect the marine environment.

The theories take vastly different approaches when dealing with ethical dilemmas, but they nevertheless go hand in hand with one another, and thus can and will be used for an in-depth analysis of the issues resulting from anthropogenic interaction on the marine environment.

3.1- The Ethical Theory of Consequentialism

The theory of consequentialism is based on and derived from utilitarianism, and at its core, it is the belief that what is important is that consequences should be put in place to punish those who are ethically wrong, whilst also achieving an overall benefit for the majority. This entails that if the majority is negatively impacted by the results of an action performed by a party, then this action is deemed unethical as per the theory of consequentialism. Thus these kinds of actions should not be allowed to take place. The opposite also applies: if an action positively impacts the majority, then the action is seen to be ethical and conducting it is promoted to preserve the well-being of the group.

The key proponents of consequentialism are Jeremy Bentham (1748-1832) and John Stewart Mill (1806-1873), and the theory of utilitarianism that they put forward states that "an act is right if and only if it tends to maximize the net overbalancing sum total of pleasure over pain for all parties concerned" (Jeremy Bentham, 1748-1832). To put it simply, an ethical action is one that promotes the greatest good. Another key scholar and proponent of consequentialism is Phillip Pettit. Pettit sees consequentialism through a non-utilitarian lens. He states that "a consequentialist promotes whatever value he (or she) chooses, an agent (if he or she is a consequentialist) will honour the values only so far as honouring them is a part of their promotion, or is necessary in order to promote them" (Kalajtzidis, 2013: 160). This non-

utilitarian form of consequentialism is extremely egotistical in its nature, as the agent involved is only seeking to promote their own well-being without considering that of other agents. Along with this comes the utilitarian definition of consequentialism whereby "the action can be right only when there is no other action (of those actions that the agent could perform at the time) that would bring better consequences. Otherwise the action is immoral" (Kalajtzidis, 2013: 163).

3.1.1 - Types of Consequentialism

Consequentialism is a theory which has two forms, both of which have different perspectives on acting ethically. These two forms are act consequentialism and rule consequentialism.

Act consequentialism is applied during the decision-making process when there are no set rules to base a decision on. This forces the decision-maker to make use of their intuition as an aid to deciding which action taken will bring about the best benefit to the community (Shafer-Landau, 2012: 415). This approach places the community at the base of the pyramid and prioritises the community over the individual. This form of consequentialism relies on the morality of the agent to ensure its success, and when done properly, it is pure in its nature.

Rule consequentialism analyses things in more depth, as it bases decisions on the consequences that are known to occur, and will probably arise as an outcome of unethical actions. The rules which are set in place are used as an end in themselves when making decisions rather than as a means to an end, as it is these guidelines which govern the decision-making process. These set guidelines, which are situationally dependent, allow for a high degree of accuracy to be present when decisions are being analysed. This allows the agent in the decision-making process to weigh up the possible consequences and compare them to reach the best decision.

As these different forms of consequentialism possess different characteristics and approaches, the overall theory is valid in the sense that it can be used and applied to a variety of ethical dilemmas.

3.1.2- Critique of Consequentialism

Although consequentialism can be applied to many scenarios, it is vigorously critiqued by Kalajtzidis. Kalajtzidis interrogates the validity of consequentialism because it fails to

acknowledge the presence of other moral principles which overrule acts of consequentialism. An example of one such ethical principle is that of deontology. This theory bases ethical decisions on the duties that are owed to the agents involved. Deontology ensures that an agent abides by the rules of justice when making decisions, allowing the decision-maker to make decisions based on their duty to the other agents involved. Deontological views are not aligned with those of consequentialism. This is because there is a conflict between the theories. The core divide between them comes when any decision-maker is forced to set aside their compassion when making decisions from a deontological perspective. This entails that individuals making decisions might have to make unethical decisions from a consequentialist perspective, although these are ethical based on the individual's duties to the affected parties.

Along with this, the theory of consequentialism is seen through constantly emerging views which inevitably contradict themselves. This is a result of the development of society which is constantly evolving and changing its opinions, as many different cultures do not live by similar rules and customs. For example, in traditional Ubuntu-driven African communities that are communally based, the correct decision to make is the one which is done for the promotion of the greater good within the community.

However, in opposition to Ubuntu, modern-day Western societies are egotistical by nature as they ignore those who surround them and don't worry about the implications of their actions. In essence, this means that it is not possible to develop one solid theory for consequentialism because it is constantly changing based on societal change, and differs vastly when applied to different cultures, making it difficult to apply it to different situations.

3.1.3- How Consequentialism Aids my Research

Finally, this theory is useful to my topic because there is a large amount of uncertainty about the impacts of human activities on the marine environment. The impacts of these activities are hard to identify and track because of their vastness and variety. Using this theory, therefore, allows me to analyse the consequences on both the environment and the communities surrounding conservation areas. Therefore by making use of this theory, I am able to compare and contrast the effects that each agent, namely the communities and the environment, faces and how these agents affect one another. This allows me to come to a solid conclusion as to what the most morally acceptable course of action is, concerning whether or not communities

and companies should be allowed to access the marine environment through sustainable measures, or if they should be cut off completely to ensure that it is "preserved" in its entirety for both its well-being and that of future generations.

3.3- Conclusion

In conclusion, it is evident that the consequentialist theory is the most applicable theory to the analysis of the relationships and impacts that humans have on the marine environment. This theory, when applied effectively, allows me to understand the impacts that arise as a result of the interactions that take place between humans and the marine environment. This ultimately allows me to deduce whether or not it is ethical to protect areas which are being degraded by preventing any human contact, or if it is ethical to allow limited access to the environment in order to sustain the livelihoods of those individuals reliant on environmental resources.

The next chapter, provides several local examples of instances of various anthropogenic impacts on the marine environment and where disturbances cause environmental damage. These case studies will highlight the impacts which result from anthropogenic environmental use, and describe how the environment has been impacted in a variety of negative ways.

Chapter 4 - Local Case Studies

4.0- Introduction

In the previous chapter on the theoretical framework, the theory of consequentialism was explained and discussed in order to understand the applicability of this ethical theory to my study. The current chapter provides local examples of environmental use which lead to the degradation of the marine environment on the coast of KwaZulu-Natal.

South Africa is a region which is blessed with pristine natural environments that possess a surreal natural beauty and a vast array of resources. The spatial dispersion of people across the country is one where there are many rich and developed areas. However, it is unfortunate that a large portion of the country's population finds itself living in areas which are severely underdeveloped, and are often without access to the necessities of survival. The inaccessibility to resources is largely a result of the past injustices and inequalities of Apartheid, and results in extreme poverty for many in underdeveloped areas. This poverty, therefore, forces a relationship of dependency between people and the natural environment. Their well-being often depends on resources from the environment, as without these, they would not be able to sustain themselves or their families. This means that there is a large number of individuals and communities who use the resources that the environment has to offer. Unfortunately, these resources are often misused and abused by those who do not otherwise possess the necessities for survival. This chapter aims to highlight local examples of where the natural environment has been negatively impacted by human interaction, through direct environmental interaction and the pollution and overuse of the environment.

4.1- Pollution

The pollution of the marine environment is an issue that is complex in nature, and does not only occur from the obvious, direct introduction of pollutants into the ocean. Marine pollution is also caused by ancillary influences, which include the addition of pollutants to the land environment. These pollutants enter the riverine systems at a distance inland and flow downriver through the river "highways" and into the ocean. This results in the development of various environmental issues which impact the marine environment as a whole. This section in the chapter focuses on events which have occurred recently in South Africa, and how the

pollution that has ensued has negatively impacted and damaged the marine environment along the East Coast of South Africa.

4.1.1- Chemical Pollution

South Africa is a country whose economy is largely based on the industrial sector, meaning that many resources are used for the attainment of economic gain. As a result of the nature of the industrial sector, the infrastructure that is associated with these industries is generally located along riverine systems and main water sources. This is because these industries require water from these water sources for their various processes to function properly. More often than not, the water is returned to these rivers once it has been used. The water returned may be both treated and untreated in certain cases, and this addition changes the chemical properties of the water sources when it is added back into the main riverine or marine system. The close proximity of industrial sites to these riverine systems and the dependency that these industries have on the water poses a significant threat to the environment. If the resources are not used carefully, and if industrial processes are not closely monitored, any error can result in the development of catastrophic impacts.

4.1.1.1- Ohlanga Chemical Spill

In the year 2021, South Africa was in a state of unrest in response to the former president of the country being found guilty of crimes of corruption and being imprisoned. A significant number of the country's population protested, and this developed into a situation where there was looting and damage to infrastructure all around the country, particularly in KwaZulu-Natal. This resulted in significant economic stress as items were stolen from stores and warehouses and multiple buildings were set on fire during demonstrations. While this had a significant impact on the economy of the country, I will not focus on these economic pressures in this chapter. What is of note here is that the riots and the subsequent actions of protesters imposed significant pressure on the natural environment. On the 12th of July 2021, rioters set fire to a UPL warehouse in Cornubia, just inland from Umhlanga. This warehouse was situated on the Ohlanga River which flows into the Umhlanga Lagoon and then into the ocean. The warehouse served as a storage facility for millions of litres of herbicides, insecticides, fungicides, and a blue dye, and during efforts to put out the inferno, the firefighters washed all of these chemicals, in a toxic soup, down into the river to flow into the nearby lagoon and the ocean. Some of the chemicals that were present in the warehouse and which washed into the river were "30 000

litres of monosodium methyl arsonate which contains a carcinogenic compound called arsenic, 150 000 litres and 30 tonnes of Altrazine, 26 tonnes of Bromoxynil and 17 000 litres of bromoxynil based products, 34.8 tonnes of picloram and more than 110 000 litres of products containing this chemical which is chlorine derived, 60 tonnes of Diuron and 45 000 litres of products containing it, more than 600 tonnes of Tebuthiuron which remains in the soil for up to 8 years, more than 280 tonnes of amicarbazone, and the chemicals Napthalene, 1,2,4-trimethyl benzene and Benzo(a)anthracene" (van Rensberg & Comrie, 2021: 1). The addition of these chemicals to the riverine system had a devastating effect on the environment, as these chemicals poisoned anything and everything that came into contact with them, resulting in millions of fish, crustaceans, and other small organisms washing up dead from overexposure to these contaminants. Furthermore, the river had turned a turquoise blue colour due to the addition of dyes, and the water now possessed a strong chemical smell which filled the air close to the water source (van Rensberg & Comrie, 2021: 1). These chemicals eventually leaked into the ocean, as a result of flooding that had also recently occurred, and led to it manifesting the same symptoms present in the riverine system. Many animals washed up dead, the seawater had an off-colour, and a chemical smell which spread for kilometres was noted. This led to the closure of beaches and residents were urged to avoid the water and not consume any of the organisms that came from the ocean after the chemical spill had occurred (Earth, 2021). These chemicals did not just pose direct immediate impacts, but also those that will remain within the environment for a significant period, even after the immediate effects of the spill have dissipated. This is because these chemicals disrupted photosynthesis, which is vital to the environment's survival, and therefore the system found itself starved of oxygen, leading to a mass die-off of organisms. This has left the marine environment in this area barren and in a state that is difficult to recover from as key components for survival are missing. Along with this, the chemicals and toxins which were added to the river possess long half-lives, meaning that it takes a relatively long time for the effects of these chemicals to wear off. The issue here is that toxins have been absorbed into the sediments found within the river, lagoon, and mangrove swamps, meaning that they are not able to be flushed out and dealt with easily, thus prolonging the effects of this chemical pollution.

4.1.1.2- Durban Harbour

As mentioned above, the contamination of the marine environment often stems from the pollution that is added to the environment far inland and away from the ocean. The pollution

levels that are present within river systems are difficult to measure because of the vast network of rivers that flow throughout South Africa, and therefore the monitoring of these is conducted in specific locations which are thought to have the largest environmental impact. One such location is Durban Harbour, which is one of South Africa's largest and most important industrial ports. This port generates large amounts of income which directly contributes to the gross domestic product of the country. Durban Harbour is therefore an important location for the country's economy. In addition, it also possesses ecological importance as this harbour is considered to be an estuarine environment. The ecosystems which are present within the harbour's walls serve as a breeding ground and nursery for many of the fish species which are found along this stretch of the coastline (Coetzee, 2015: 2). The issue around the pollution of this environment is that the harbour's ecological importance is constantly at risk, due to the nature of the industries which operate within the harbour. In addition, the rivers which flow into the harbour also bring a large amount of accidental and intentional pollution. Many organic and inorganic pollutants are added into the marine environment within the harbour's walls or flow into the harbour. Some of these organic pollutants include: polychlorinated biphenyls, which are derived from oil-based products and electronics; organochlorinated pesticides, which come from the treatment of agricultural products or for use as an insecticide; polychlorinated dibenzo-p-furans, which are by-products of chemical processes that use chlorine; and polychlorinated dibenzo-p-dioxins, which are by-products from the process of manufacturing chemicals (Coetzee, 2015: 4). These are all examples of chemicals which are present within the marine environment in the Durban harbour, and their impact on the marine environment is potentially life-threatening for both the organisms within the environment, and for the individuals who consume these to live. This danger is present because many of these pollutants possess certain traits which make organisms susceptible to their toxicity, as a result of these contaminants' long half-lives. They can remain within the environment for years and potentially travel throughout it with the currents. Along with this, these chemicals are all lipophilic, meaning that they are easily absorbed into the fatty tissues of any organism that comes into contact with these chemicals (Coetzee, 2015: 3). The easy chemical binding to the fatty tissues in the organisms which come into contact with these chemicals, allows for the process of bioaccumulation of these chemicals on a large scale. It is estimated that most of the organisms within the environment are carrying these chemicals, and that these same chemicals will be transferred to the humans who consume these organisms.

4.1.2- Agricultural Pollution

While many of the pollutants mentioned above stem from a variety of sectors, the agricultural sector in South Africa has particular significance when it comes to the pollution of the environment. This is because the South African agricultural industry is vitally important to the country economically. It is one of the main economic sectors, and contributes both to the gross domestic product of the country and to combating food insecurity for sections of the South African population who are unable to sustain themselves. However, there are some negative aspects to agricultural production. The agricultural sector in South Africa makes use of chemicals such as insecticides and herbicides to protect crops from being eaten or damaged, and to ensure that the crop yield is as high as possible. Given the climatic conditions in South Africa, most of the country experiences annual rainfall in the summer months. It is during the high rainfall season that crops are planted and sprayed with the various chemicals that protect them. It is quite clear that this becomes a significant environmental issue, as the rain and the runoff which comes as a result of it, washes the chemicals either down into the soil or into the nearest water source, which is normally a river. The river may flow for many kilometres through the countryside and towards the ocean. Chemicals and their traces are rarely found floating freely in the water column, but are traceable in the sediments within the river and ocean environments. A study was conducted in the early 2000s by Sereda and Meinhardt, to monitor the levels of pesticide and herbicide pollution in the aquatic environment within KwaZulu-Natal. They conducted sediment sampling at numerous different sites around KZN, and their results showed that there was a significant presence of insecticide and herbicide residue within the sediments that they tested. Out of the twenty-four samples that were collected, 75% of them contained traces of pyrethroids, 100% of them contained organochlorines, and 50% of them contained organophosphates (Sereda and Meinhardt, 2003: 48). The presence of these chemicals in the sediment shows the ability of the environment to absorb and store toxins. This harms the overall system, along with the possibility that improper treatment methods of these chemicals are occurring throughout the country, with little regard for the well-being and stability of the aquatic environment.

A local example of agricultural pollution was highlighted in a study undertaken by Agboola, where the water quality along major catchment rivers in KwaZulu-Natal was assessed based on its composition. This study collected data from 15 core rivers which are spread throughout the province, and include the Lovu, Matikulu, Mdloti, iMfolozi, Mhlathuze, Mkamazi, Mkuze,

Mtamvuna, Mzimkhulu, Pongolo, Thukela, Tongati, uMlazi, uMgeni, and the uMvoti rivers (Agboola, 2019:3). The main use of these rivers is to provide the agricultural land that surrounds them with water to irrigate crops, with the primary agricultural activity in the area being the production of sugar cane. During the sampling, which occurred from March 2015 to April 2016, the “psycho-chemical parameters indicated the loss of ecological quality or integrity in downstream sites" (Agboola, 2019: 5), with the highest impacts occurring downstream in areas located within agricultural land-use zones. These results pointed to "elevated levels of total inorganic nitrogen at the sites near agricultural lands (Agboola, 2019:6), indicating that during the process of adding fertiliser, large amounts of the nutrients that were added to the crops were washed off the land and into the riverine systems surrounding the agricultural area. The addition of nutrients into the river systems leads to the process of eutrophication, whereby the water is plagued by algae which thus reduces the amount of dissolved oxygen therein. This makes the environment unsuitable for life to flourish and ultimately results in a loss of biodiversity within the said environment.

4.1.3- Bilge Dumping

The pollution of the marine environment through the addition of chemicals is an occurrence that is primarily land-based, as chemicals are washed down the highway of river networks into the ocean. However, this is not the only source of chemical pollution within the marine environment. Another key contributor towards marine chemical pollution occurs at the hands of seafaring vessels; this happens as a result of by-products which are produced by operations out at sea. A prime example of this chemical pollution is the process of bilge dumping, where wastewater containing many different contaminants collects in a ship’s lower hull, and is then pumped into the ocean in order to get rid of the toxic waste. This process is a worldwide phenomenon and is often conducted just before the vessels enter the ports to which they are travelling. The cleaning process is costly to shipping companies and dumping is seen as a cheaper alternative as it drastically reduces the costs of having the bilge properly removed. The bilge waste which is pumped out comprises of contaminants such as “lubricants, grease, and cleaning fluids, as well as harmful or toxic metals such as arsenic, cadmium, chromium, lead, and selenium as well as organic chemicals such as benzene, chloroform, hexachlorocyclohexane isomers, and naphthalene” (Evanisko, 2020: 5). Upon entry into the marine environment, these chemicals pose immediate threats to its overall well-being. This is because it is virtually impossible for organisms within the contaminated environment to avoid

the impacts of these chemicals, as “this dense oily slick lingers in the water until it’s broken apart by wind and wave action, dispersing toxins and globs of oil that can harm coastal communities and marine ecosystems.” (Evanisko, 2020: 2). The effects of this dumping are widespread and are felt by communities and the environment in areas which can be far-away from the initial dump site, as this oily chemical mix is transported by currents which move this substance around the entire marine environment. This has vast negative social and environmental impacts as the presence of this bilge contaminates the entire system. Organisms within the environment find themselves contaminated by the toxins and thus the quality of well-being within this system is drastically reduced. With this reduction in the quality of the environment, organisms within the system are often poisoned or covered by chemicals, which subsequently leads to disease and potentially death. This leaves the environment in a state where it is not healthy enough to sustain life, and apart from the direct environmental impact, the area’s economy is also left uncertain. The uncertainty is a result of the surrounding community’s and the economy’s reliance on the marine environment to sustain livelihoods and generate revenue through tourism, which is an extremely important aspect of a developing country's economy. Unfortunately, the occurrence of bilge dumping is relatively difficult to monitor and manage, as it is difficult to regulate the actions of vessels when they are in the open ocean. This means that it is up to the captains of vessels to adhere to the laws in place to protect the environment. However, not all companies and vessels are environmentally conscious, resulting in the occurrence of bilge dumping to save extra costs for the vessel. Furthermore, the available monitoring methods require the use of satellite imagery and remote sensing, and the process of obtaining these images is expensive and difficult.

4.1.4- E. coli Pollution

Another key component of riverine and marine pollution is the addition and presence of organic pollutants which are found within the water systems. These organic components mainly consist of bacteria which can be, and often are, harmful to any organism which consumes contaminated water sources In many, if not most cases, it leads to sickness and potentially even death. For the purpose of this study, I will be focussing on E. coli as the main form of organic pollutant, as the presence of this bacteria poses a serious threat to the health of the riverine and marine environments within the interior and along the coastline of KwaZulu-Natal. As mentioned earlier, in 2022 KwaZulu-Natal experienced some of the worst floods ever recorded. Many people found their lives in jeopardy as the natural disaster destroyed homes and vital

infrastructure necessary for the survival of the population. The damage to infrastructure included the destruction of clean water lines and treatment plants, meaning that clean water was no longer being transported to homes, while untreated wastewater was finding its way into the environment and mixing with clean river water, thus creating an extremely harmful water source if consumed. The severity of this contamination is highlighted in an article published by a news company called Citizen, where their journalist states that "in the interests of public health, communities are advised to avoid all contact (swimming, fishing, recreational and sporting activities as well as traditional activities) with water in rivers or streams as this may result in gastroenteritis, diarrhoea, typhoid, cholera, and other water born related diseases" (Patel, 2022). The presence of E. coli in river systems is a strong indicator of the presence of sewage, and these high toxicity levels were largely a result of poor governance and service delivery, related to the Department of Water and Sanitation (Khanyi, 2022). The addition of this contaminant into the water systems was also a result of vandalism which occurred on one of Durban's largest wastewater pumps; this resulted in spillages into the riverine and marine environments occurring, and led to the closure of six prominent beaches along the eastern coastline of South Africa (eNCA, 2022). Through poor maintenance and the occurrence of floods, Durban lost the ability to effectively treat and transport water both in treated and untreated forms, as out of the twenty-seven wastewater treatment plants within the region, nine were “totally non-functioning”, which resulted in untreated water being introduced into the environment (Carnie, 2022). When looking at the levels of E. coli within the riverine systems, it is evident that sewage pump stations and treatment plants are routinely failing to contain the contaminants, as levels are well above the recommended safety limit of between two hundred to four hundred parts per hundred millilitres of water. In a press statement released by the Democratic Alliance in 2022, they published the levels of E. coli at four key points within the Durban catchment area. The results of these tests were staggeringly high, with the recordings showing levels at “Blue Lagoon being 68 670 parts per 100ml, at Johanna Road pump station being 16 160 parts per 100ml, at the northern wastewater treatment plant being 920 800 parts per 100ml, and at Mount Moreland bridge being 4 611 parts per 100ml" (DA, 2022). It is evident that the levels of E.coli within the water pose a serious threat to the health and safety of the marine environment, as even the lowest reading is ten times the recommended safety limit, with the highest one being many factors higher still.

4.1.5- Plastic and Solid Waste Pollution

Plastic poses threats to both the riverine and marine environments. However, these threats are different but have a similarly negative effect on the two environments. Plastics do not degrade quickly and remain in the environment, whether riverine or marine, for a very long time. This means that as more plastic is produced and added to the marine environment, it is accumulating in amounts that are insurmountable as seen by the sheer mass of plastic pollution that is evident in the oceans. This plastic either simply lies in the water or is consumed by many marine organisms. The process of bio-accumulation takes place, where the rate of intake exceeds the rate of excretion or elimination, and this eventually results in humans consuming microplastics in the very food that they eat. Along with this, organisms that consume larger pieces of plastic often fall ill or die because of its presence in their bodies; indeed, animals such as whales and dolphins wash up dead on the beach, with their stomachs full of plastic waste that has been added to the environment by humans. One example of plastic pollution within the marine environment occurred in 2017 when a shipping container containing raw plastic spilt in the Durban harbour. This raw plastic was in the form of plastic nurdles, which are little plastic pellets used to produce most plastic end-products. These plastic nurdles are small in size and carry no direct toxicity, but once added to the environment, they act as a nucleus onto which toxins attach themselves, posing a significant threat to the environment. This threat, apart from adding tonnes of plastic into the environment, carries a serious weight because these nuclei attract toxins such as land-derived pesticides and herbicides, along with heavy metals, and because of the size of these plastic nurdles, they are easily consumed by marine-based organisms.

In the context of local plastic pollution, it is important to note that the majority of plastic items that end up in the ocean are derived from inland sources and flow down rivers into the ocean. This is based on a statement that the United Nations Environmental Program released declaring that "80% of marine litter is land-based" and that "it is mediated through flash floods and river inputs" (Patnode, 2021). Recently, the Southern Hemisphere experienced a climatological oscillation known as La Nina, which brings in large amounts of rain, relieving the area from drought. This oscillation brought large amounts of rain to South Africa in 2022, and as a result of this, the country experienced disastrous impacts from the floods that occurred. Times Live reported that because of these floods, approximately three years of litter had been washed

downstream and into the ocean via the major rivers in KwaZulu-Natal (Govender, 2022). This left the environment with massive amounts of pollution to deal with in a very short time, as the amounts added to it were significantly higher than what is usually added. It is estimated that about one hundred tonnes of plastic are floating in the waves off the coastline of Durban, with countless more tonnes being washed up onto beaches along the same coastline (Caboz, 2019).

4.2- Fishing

4.2.1- Illegal Fishing Practices

Illegal fishing practices regularly occur along the coastline of KwaZulu-Natal, as a large section of the rural population relies on the marine environment for their survival. These illegal fishing practices occur in the forms of unlicensed fishing, overfishing, collecting protected and undersized organisms, fishing in protected areas, or using equipment which is prohibited by law. These illegal practices are often resorted to due to the fact that past inequalities and cultural segregation, left these sections of the population unable to enjoy a high standard of living, as segregation prevented them from developing economically and subsequently they live in poverty. These practices all pose a serious threat to the survival of the marine environment, as the constant pressure that they place on it leads to an overall decline in the quality of the populations of organisms within the affected marine ecosystem. A local news site, North Coast Courier, published an article on illegal fishing and overfishing, where they highlighted the increase in these activities over the past few years. They interviewed over a thousand fishermen, and their findings showed that there is a current and ever-present decline in the quality and quantity of organisms which are found within the marine environment. The findings showed that since the time when Ezemvelo Wildlife reduced its policing presence along the coastal areas, there has been a dramatic increase in the presence of illegal fishing activities, resulting in the current decline of the marine environment. The presence of illegal fishermen is evident as seen by the fact that only two of the fishermen interviewed possessed legal fishing licences, while thousands of others continued to make use of the marine environment and its resources despite being unlicensed users. Troskie (2018) discovered that a staggering “46% of these fishermen admitted to taking undersized fish, and a further 9% of them stated that they had been and still were fishing within marine protected areas, which are supposed to be off-limits to fishermen. This increase in illegal fishing has seen 87% of the questioned fishermen

observing a decline in size and quantity of catch, with the main contributors to this decline being overfishing, trawling, pollution, and climate change” ~~(Troskie, 2018)~~

4.2.1.1- Fish Aggregating Devices

The first of my local examples of illegal fishing practices, apart from unlicensed fishing, comes in the form of fish aggregating devices which have been found within a marine protected area in Sodwana Bay. These are man-made devices which float on top of or just under the surface of the water, and are made up of various materials giving them unique shapes and structures. These devices are placed in the marine environment to serve the purpose of attracting fish through the shelter that it provides to them, as "they serve as a temporary habitat for surface-dwelling fish" (Biggar, 2021). The attraction of small fish to the structure leads to the further attraction of predatory organisms which prey on them. This process of attraction cycles through the food chain and complex ecosystems are developed, as larger and larger predatory fish collect near these devices to prey on the smaller organisms which are seeking shelter near them. These artificial environments serve as traps for those organisms that congregate around them, as the devices are strategically placed to attract as many organisms as possible. This method of fishing ensures that there are always organisms which can be removed from the environment, as the devices are effective in attracting life towards them regardless of where they are in the marine environment. This method of fishing, through the use of fish-aggregating devices, is non-selective by nature, as when the organisms are collected, the entire device is removed by a trawler with a large net. This means that any organisms which are in close proximity to the device are removed when the net comes past, and this results in extremely large amounts of by-catch being collected. This threatens species whose concentrations and populations are relatively low within the environment, as their populations continue to decline at the hands of these fishermen. These threatened species include sharks and turtles, which are already endangered and are facing extinction, and tuna which have been and continue to be fished at a rate which their populations cannot sustain. The organisms which are removed during the device collection are rarely returned to the environment alive, as the collection process is brutal, with many of them dying before they reach the sorting stations on the boats. Along with this, organisms that are collected are harvested regardless of their size, as throwing them back into the ocean alive would drastically decrease the size of the catch. The fact that this collection process is illegal and happens under the radar means that the fishermen feel justified to further break the rules on minimum sizes and the total allowable catch which they remove. This

method of fishing has a severely negative impact on the marine environment along the coastline of KwaZulu-Natal as it is largely unregulated by the authorities and occurs within the shadows. The sustainability of the environment is thus threatened as the organisms are being removed at an unsustainable rate, and populations are declining faster than they can recover and reproduce.

4.2.2- Commercial Fishing

The second local example that I make use of is based on the impacts of commercial fishing on the fish and other marine organism populations through their overcollection. Apart from African vessels that fish within our waters, some larger players are increasingly invading local waters in search of organisms to catch and take back to sell in order to make a profit. The largest contributor to the destruction of the marine ecosystem along the African coastline is the Chinese commercial fishing fleet. This fleet has severely desecrated their own waters as they have fished them to the point where "50% of fish are fully exploited, 25% of fish are overexploited and 25% of fish are completely exploited" (Fishing, 2022). This over-exploitation has forced the Chinese fishing fleet to move into foreign waters to provide its population with enough consumable resources. This illegal collection of resources often occurs along the coastline of Africa, as the continent's underdevelopment leaves it prone to this sort of exploitation, due to little to no regulation of the African national waters. Even in cases where there is regulation, there is no surefire way of policing and prosecuting the vessels that make use of the resources found within these waters. Additionally, the Chinese fishing fleet is so large that any effort to prevent individual vessels from fishing in African waters illegally is overshadowed by the vast presence of vessels in the area. This is made evident by the number of trawlers that are situated within foreign waters. It is estimated that recently "Senegal lost 300 million US dollars as a result of illegal, unregulated and unreported fishing as only one out of one hundred and thirty ships within their waters was of African origin, while the remaining 129 were Chinese" (Fishing, 2022). Because of the Chinese presence in African waters, countries in Western Africa expressed that they "only have a short window of time to bring our fish populations back from the edge of collapse" (Godfrey, 2022), as the Chinese fleet is ravaging the African waters that they fish, not only damaging the ocean and fish populations, but also the livelihoods of those who rely on resources collected from the ocean for their survival. This is a prime example of how human interaction and over-exploitation within the marine environment, are damaging to both the environment and the livelihoods and economy of those who rely on it. The presence of Chinese fishing vessels within international waters and

the damage that they are capable of causing to the environment is extremely threatening to the stability and sustainability of the marine ecosystem as a whole, as they have the power to desecrate it in a relatively short period.

4.3- Conclusion

In conclusion to this chapter, the numerous examples of anthropogenic actions which occur within and impact the marine environment suggest that humans have a significant impact therein. Whether this is through direct or indirect influence, the presence of human activity can be felt in this environment. The impacts on the marine environment are generally negative as the anthropogenic influence tends to take away from it, as opposed to aiding and preserving it. As a result of the economic and social imbalances within South Africa, the negative impacts are felt by both the marine environment and those individuals who rely on it for their survival. Additionally, the negative impacts do not only occur and are felt in localised areas where they occur directly within the marine environment, but also far inland, as pollution often washes downriver and into the ocean. This means that the environmental impacts of humans on the environment all around the country directly impact the health and quality of the marine environment on which we are so dependent. The environment is a holistic system, and by impacting one part of it, the entire system is affected.

The following chapter, will outline and analyse some of the ethical issues which arise as a result of the environmental issues mentioned in the case studies in Chapter 4. This analysis will be conducted by looking at these environmental issues through the ethical lens of consequentialism. The application of this theory to these case studies will allow for these instances of environmental use to be critically and ethically evaluated, in order to see whether or not anthropogenic influence is ethical or not, through looking at its impacts.

Chapter 5 - Ethical Analysis

5.0- Introduction

In the previous chapter on local case studies, the instances of chemical and plastic pollution as well as illegal acts of fishing which occur along the coastline of KwaZulu-Natal, were outlined and discussed. The current chapter, which is an ethical analysis, will look at the effects of pollution and fishing practices, both in terms of the environmental and social issues arising from anthropogenic influences in the marine environment. Once these impacts have been highlighted, I will make use of the ethical lens of consequentialism to focus on issues related to environmental damage. In addition, I will focus on social issues arise as a result of human interaction within the marine environment. This analysis will be utilised to analyse the morality or otherwise of human interaction therein.

The pollution and overcollection of resources from the marine environment have a significant impact on both its well-being and that of societies that rely on it for their survival. These negative impacts are a direct consequence of anthropogenic influence, whether it be through the addition of chemicals and plastics, or the removal of sea-dwelling creatures for human consumption. This chapter highlights the consequences arising from the pollution and overcollection of resources, by dividing these into environmental and social consequences felt by the different sectors mentioned, allowing for an ethical analysis to be conducted using the theory of consequentialism.

5.1- Consequences Felt by the Marine Environment

For the first part of my analysis, I will look at the environmental issues arising from human intervention within the marine environment. I will then use the theory of consequentialism to ethically analyse the environmental impacts arising from pollution, both chemical and plastic, and from fishing practices. These practices include overfishing and other impacts of the fishing sector on the marine environment. As mentioned in my theoretical framework in Chapter 3, the theory of consequentialism bases "the rightness or wrongness of the action as being determined by the value of a moral code that permits everyone to act this way" (Hiller and Kahn, 2013: 6). The actions of overcollection of organisms from the marine environment go directly against the theory of rule consequentialism, as the rules and guidelines, which are designed to prevent the environment from deteriorating, are bent or broken to achieve economic success.

Consequentialism, from an environmental perspective, is governed by laws and regulations which are put in place to manage the environment most effectively, as these "acts are morally correct insofar as they promote the integrity, stability, and the beauty of the biotic community" (Hiller and Kahn, 2013: 12). This ensures that the use of the environment should strictly adhere to rules which are put in place to minimise the negative consequences which may arise from its use. However, this is not always the case in modern-day societies, as they are driven by individual gain and economic development.

5.1.1- Organism Population Decline

The first of the consequences that I will look at are the effects which result in a decline in organism populations within the marine environment. This occurs in most of the local examples that I referred to in Chapter 4. These all directly impact the stability of the trophic systems present within the environment, through the killing of various organisms in a variety of ways. This includes the addition of chemicals and plastics, as well as the direct removal of organisms through overfishing and bycatch.

5.1.1.1 Population Decline as a Consequence of Chemical Pollution

As mentioned in Chapter 4, the occurrence of chemical pollution along the coastline of KwaZulu-Natal is a prominent factor contributing to the degradation of the marine environment. Along KZN's coastline, there have been many local instances where chemical pollution has been released into the riverine and marine environments through the addition of pesticides. This has been documented on the Ohlanga River, in the Durban harbour, and in agricultural zones. The addition of chemicals into the marine environment poses a serious threat to the overall well-being of the environment and societies that rely on it for their survival. This is because the addition of chemicals into the marine environment alters its chemistry by poisoning organisms and contaminating the entire water column.

In the instance of chemical pollution of the marine environment, the first category is the addition of pesticides and insecticides. A prime example of this is the Ohlanga chemical spill, mentioned in Chapter 4. The chemical spill occurred as a result of human-related environmental harm, namely the destruction of infrastructure and the human reaction in extinguishing the flames. This allowed chemicals to flow down and eventually infiltrate KwaZulu-Natal's riverine and marine environments. The chemicals added to the environment

were herbicides, insecticides, fungicides, and dye, and the mixture that was created was one that the environment could not sustain. These chemicals are all created to harm one or another aspect of the environment, as they are designed and used to control different pests to minimise damage to crops. Although it is safe to make use of these chemicals when added in the correct quantities in the agricultural sector, the mass addition of these chemicals into the riverine and marine environment pose a serious threat to the entire environmental system, as these chemicals are, by nature, designed to do damage. The environmental damage resulting from this chemical spill was drastic, as the majority of the organisms within the river system died off immediately, due to the toxicity of the chemicals. In addition, because of the close proximity of the chemical spill to the ocean, organisms within the marine environment experienced similar symptoms from this pollution event. Organic creatures which were exposed to the toxic chemicals washed up dead on the banks of the river and along the coastline, with high levels of toxins being found within their bodies. However, the damage to these organisms is only the tip of the iceberg, as these chemicals can remain within the system for an extremely long time due to their relatively long half-lives, with many of these chemicals having half-lives varying from "1 year to several decades" (Ritter et al., 2011: 225). This means that the negative environmental impact is predicted to extend over many years, as their lasting presence in the environment allows these chemicals to come into contact with multiple species. This will lead to the contamination of large numbers of organisms. When examining the Ohlanga chemical spill through the ethical lens of consequentialism, it is clear that the environmental impacts which were felt as a result of the presence of pesticides and other chemicals within the marine environment, came as a direct consequence of anthropogenic actions. These included the act of setting fire to the warehouse storing these chemicals. This action was deliberate arson and led directly to the degradation of the riverine and marine environments. Consequentialism, when viewed from the perspective of environmental ethics, is governed by laws and regulations which are put in place to manage the environment most effectively, as the "acts are morally correct insofar as they promote the integrity, stability, and the beauty of the biotic community" (Hiller and Kahn, 2013: 12). This means that there are set rules and regulations which have to be adhered to in order to prevent any environmental disturbances. When considering the Ohlanga scenario described above, the disturbances to the marine environment follow the premise of consequentialism, as the deliberate actions which were taken had a direct negative impact on the area as a whole, with little to no regard for the environment. Because of this spill event, the riverine and marine environments experienced a drastic loss in biodiversity, as organisms within the system were poisoned by pesticides, resulting in a net loss in the number

of organisms living in the newly polluted environment. This leaves the environment in a position where the active organism populations are low, as they have been killed off by the addition and presence of chemicals.

Secondly, I refer to an example in which the consequences of the organism population decline felt by the environment arose from the industrial processes and subsequent chemical pollution of the marine environment within the Durban harbour. The pollution within the harbour was more localised than the chemical spill which was mentioned above, as the environment in Durban Harbour does not experience a lot of current flow. This means that chemical pollutants remain in a more localised area and have a larger impact on their environment, due to an increase in concentration levels. The brackish and sheltered conditions found within the harbour provide a vitally important environment in which fish and other organisms breed, and their young use this region to live a sheltered life during their larval and adolescent stages. The importance of this estuarine bay is emphasised by Naidoo, as he mentions that it is estimated that up to 160 species of fish in South Africa are dependent on estuaries at some point in their life cycle (Naidoo, 2015: 2). Due to the importance of the harbour, the pollution of the estuarine environment within its boundaries poses a significant environmental risk, as this environment is important for the succession of marine species. The addition of chemical pollutants into the harbour places the well-being and lives of young organisms at risk because they are particularly susceptible to the effects of these chemicals. Owing to the high concentrations of chemicals and the relatively small size of these organisms, they become contaminated with high levels of chemical pollutants. This leads to the development of an unhealthy ecosystem, whereby the organisms within the environment either die off or are permanently damaged at the hands of human beings. This places the future of marine organism populations at risk because the newer generations are unable to adapt to the change, and the overall quality of these populations declines rapidly. As a result, the environment will eventually experience an overall decline in the quality and quantity of the organisms which reach maturity, entailing that future populations will be lower than current levels. The pollution of the Durban harbour holds a similar position as the abovementioned example through the lens of consequentialism. This is because the addition of chemicals into the harbour, which acts as an enclosed environment that many fish use for breeding purposes, directly disrupted the fragile ecosystem. This results in generational population decline, as fewer healthy organisms reach adulthood, thus entailing that their population levels are currently in decline.

My third example, where chemical pollution has led to a decline in organism populations, is the pollution of the riverine and marine environments through the use of chemicals for agriculture. This includes the use of chemicals such as fertilisers, insecticides, and herbicides. These chemicals are added to the terrestrial environment to manage the impacts of pests on the agricultural sector. The addition of these chemicals to agricultural land poses a threat to the populations of marine welling organisms, due to the close proximity of agricultural land to water sources, entailing that the chemicals that are added to the environment are easily able to enter the riverine and marine ecosystems. Poor agricultural practices are the main cause of pollution caused by this sector (Fayiga, 2016: 55); the chemicals which are added to the system are toxic by nature. In many cases, when organisms, which form part of the riverine and subsequent marine environments encounter these chemicals and their trace elements, they end up dying. Whilst insecticides and herbicides kill off the plants and insects which form a vital part of the ecosystem, the addition of fertilisers into the area leads to a high nutrient load being present in the water column. The excess of nutrients in the system leads to there being high levels of nitrogen and phosphorous within the water column. These elements promote plant growth and are consumed by the algae which are naturally found within the river. This results in the development of "eutrophication and harmful algal blooms" (Fayiga, 2016: 55). Algal blooms plague the water with algae, consuming oxygen and thus removing it from the environment. This makes the environment a hostile place as few organisms can survive in these low oxygen conditions, leading to a collapse in its structural integrity and leading to an overall decline in environmental conditions. This effect penetrates further than simply the riverine environment, as many of the agricultural practices in KwaZulu-Natal are situated along the coastline, due to the readily available sources of water and the subtropical climate, which best promote the growth of the primary crops grown in KwaZulu-Natal. This entails that any chemicals which are added to the riverine environment as a result of agriculture, often find themselves entering the ocean through estuaries, before they settle into the sediments of the rivers to which they were originally added. This degrades the overall water quality within rivers as organisms die during the process of eutrophication. The occurrence of "estuarine and coastal agricultural nutrient pollution is also an issue in some regions causing algal blooms damaging marine life" (Parris, 2011: 39), as organisms die as a result of algal bloom that removes dissolved oxygen from the water, directly leading to the loss of biodiversity in the area. The consequences of this environmental degradation are a loss of biodiversity and a reduction in water quality in the nearby rivers, leaving this resource unusable due to its poor quality. This results from actions that are perceived as unethical through the lens of consequentialism, as the

impacts on the environment hinder its ability to survive. This means that the net effects which are felt by the environment are negative, entailing that the actions conducted are unethical, as there are little to no positive aspects arising from this environmental pollution.

The fourth example, where the addition of chemicals into the marine environment has led to a decline in the population of marine-dwelling organisms, is the addition of oil into the marine environment. Oil is added into the environment in a variety of ways, but for the purpose of this study, bilge dumping will be focused on. Bilge dumping is the process whereby ships pump their excess waste out into the marine environment, and this waste is generally comprised of the oil that is required to run the ship, as well as any other residue or chemicals which collect in the bilge of the ships. The addition of this oily substance into the marine environment poses serious threats to all the organisms within the environmental system. This toxic oily substance tends to cling to organic matter and is extremely difficult to break up and decompose. The result is that the oil that is released into the ocean moves throughout the system, and negatively affects all the organisms with which it comes into contact. Because the oil tends to remain on the surface of the ocean, its primary impacts are on those organisms which reside there or just below the surface. These are the organisms that are primarily contaminated with oils and toxins. A prime example of an environmental impact as a result of oil is the contamination of sea birds as "there were more seabird oiling events in the 2000s than in earlier decades" (Moloney, 2013: 6). The impact that the presence of oil has on the organisms within the marine environment, falls into two categories – acute and chronic impacts. The general impacts of oil spills are usually acute as they are short term, in the sense that the oil directly impacts the immediate life of the organism that it comes into contact with. For example, contaminated sea birds often drown because the oil on their feathers impedes them from flying and renders them unable to move. Essentially, these birds are "sitting ducks" as they are unable to do anything about the oily situation that they find themselves in. Apart from this immediate mortality, the chronic impacts of bilge dumping extend far past the death of these organisms. Even though it is possible to remove the oil from organisms, primarily birds, the effects of oil contamination last long into the future of these birds' lives. These chronic effects include "reduced breeding productivity and life expectancy" (Moloney, 2013: 8). Furthermore, the presence of oil in the marine environment impacts the coastal zones, through the tides and the waves which break up and spread the oily residue along the beaches and rocks. These coastal zones have significant importance as many organisms reside in these areas. The contamination of the beaches and the nearby water often leads to a mass die-off of organisms that are exposed to and negatively

affected by toxins within the oil. Through the ethical lens of consequentialism, the addition of oil-based products into the marine environment also imposes a significant impact on its well-being. As mentioned above, oil residues are added directly into the marine environment through anthropogenic activity, and its presence directly affects the lives of those organisms who come into contact with these oily residues. This negative impact comes as a result of organisms being covered in sticky residue, thus impairing their ability to survive as the oil hinders their respiratory processes along with restraining their movements. Apart from the death of the contaminated organisms, the chronic effects of oil contamination hinders their ability to reproduce effectively, resulting in a current and future decline in the number of organisms in the environment. Only the few uncontaminated organisms can effectively reproduce, leading to a decline in marine biodiversity. This entails that, as a consequence of oil pollution within the marine environment, there is a direct decline in its well-being. The decline in the number of healthy organisms which are present in the environment is due to the presence of oil residue, which hinders the organism population's ability to survive.

5.1.1.2- Organism Population Decline as a Consequence of Plastic Pollution

The pollution of the marine and riverine environments by the addition of plastic is a serious threat that has the potential to damage the well-being and stability of the natural environment. This is because the consumption of single-use plastics has become widespread with the majority of the population using and disposing of plastic products. Particles of plastic enter the marine environment from various sources and pollution of the environment often starts far inland. This is backed up by the fact that "Estuaries are major conduits for transporting plastic from catchments to the ocean, especially in urban areas where they may serve as industrial outlets" (Naidoo, 2015: 1). Plastic has varying impacts on the marine environment as it remains in the system almost indefinitely, collecting and distributing itself around the globe, as "All categories of plastic litter have been found in even the most remote parts of the world's oceans and along the majority of coastlines" (Vince, 2018: 1). These larger pieces of plastic are easier to manage and some can be removed from the environment through clean-up projects, but the current rate of use means that there will always be single-use plastics present in the ocean environment. These plastic items threaten the environment as they are often consumed by larger organisms such as larger fish or marine mammals. This plastic is consumed as it often resembles prey items and therefore it remains within the organisms which consume it, as they are unable to digest it. In some cases, marine mammals wash up dead on the shoreline with

their stomachs full of plastic debris. The large amount of plastic consumed may also have an impact on an animal's buoyancy, either through the low density of the material consumed, or, more plausibly, by impairing digestive function leading to gas build-up. This inhibits the ability of the organisms to be neutrally buoyant making them more susceptible to being preyed upon.

Another direct impact of the consumption of plastic by marine organisms is that when plastic debris is consumed in large enough quantities, it provides the organism with the sensation that it is full of food, leading to a loss in appetite. Over time, organisms that experience this unfortunate side effect will die from starvation due to the lack of nutrients. This is a direct environmental issue as plastic "ingestion has the potential to have far-reaching implications at the population level, posing a threat to the conservation of individual species" (Ryan, 2016: 2). Furthermore, the presence of larger plastic objects in the environment, such as fishing equipment and large plastic bags, can lead to organisms being entangled in the plastic material. This often causes the death of the animals which are caught, as they are either unable to breathe air from the surface, or they are suffocated through water being unable to pass over their gills. The debris plays a direct role in the damage caused to biodiversity, as countless organisms are killed off as a result of the presence of plastic within the marine environment.

When looking at the issues related to plastic pollution through the lens of consequentialism, it is evident that the addition of plastic into the environment by humans poses a serious threat to the overall stability of the marine environment. Plastic that is added into the marine environment is often consumed by marine organisms, impairing their digestive tracts and processes, and frequently leads to illness and their potential death. Furthermore, the consumption of microplastics leads to the process of bioaccumulation, as the chemicals that bond to the microplastics are passed on from one organism to another through consumption. This increases the load of chemical pollutants in the bodies of these organisms which leads to illness and death. The death of organisms related to plastic consumption directly impacts their populations within the marine environment and the biodiversity of the overall environment drops through the decline of organism populations. The addition of plastics into the marine environment through human agency it can be considered unethical when viewed through the lens of consequentialism, as it directly impacts the ecosystems in the marine environment and causes the decline of organism populations.

5.1.1.3- Organism Population Decline as a Consequence of Overfishing and Bycatch

The global fishing sector is probably one of the largest industries in the world, and organisms are regularly removed from the marine environment in large quantities by fishermen. The fishing sector is comprised of artisanal, recreational, and commercial fisheries and each of these different sectors have "a variety of direct and indirect effects on food webs in marine ecosystems" (Crowder, 2008: 260). The removal of organisms from the marine environment, through overfishing poses serious threats to the overall sustainability of the environment, with commercial fishing playing the largest part in this environmental degradation. The presence of commercial fisheries and their operations within the marine environment has "led to dramatic changes in marine food webs by direct removal of key food web components" (Crowder, 2008: 263). The pressure that commercial fishing places on the environment leads to a shift toward the collection of organisms in the lower trophic levels, as these organisms are generally in high supply, entailing that the fishery can generate a large amount of revenue from the collection and selling of these on the market. This affects the environment negatively as the targeting of specific species in different trophic levels can affect the balance naturally found within these systems. Removing organisms from lower trophic levels further threatens the environment as these "organisms play an important role in trophic transfers" (Smith, 2011: 1147). As nutrients are passed through the system, these organisms are consumed by predators higher up the trophic ladder. The removal of low-level organisms offsets the transfer of nutrients, as there is far less prey for the predators to consume. This overfishing of "small pelagic 'forage' fish accounts for about 30% of fish landed" by the commercial sector (Smith, 2011: 1147). This negatively affects the populations of those organisms which rely on this trophic transfer, as they are unable to consume enough of the low-level organisms to sustain their population. This results in a net decline in predators in the environmental system. When it comes to harvesting fish from the middle of the food web, the removal of these organisms "decrease(s) prey availability to top predators, as evidenced with several marine mammal populations" (Crowder, 2008: 263), whilst increasing the populations of the organisms which reside lower down in the system. This entails that there will be a large number of small prey items, but no means of biocontrol as the population of predators has declined. This leads to a net imbalance, as both predators and mid-tier trophic organisms are removed, leaving the populations of smaller organisms in a position where they can flourish. When looking at the removal of organisms high up in the food web, the removal of "apex predators can result in a direct increase in the abundance of their prey, potentially altering the remaining food web" (Crowder, 2008: 263).

This occurs as the organisms lower down on the trophic ladder are no longer being preyed upon, as their natural predators are either no longer in the environment or their populations are extremely small, allowing for the other populations of organisms in the food web to multiply and thrive as nothing is keeping them in check. Furthermore, overfishing can lead to a significant reduction in biomass when the larger organisms in their respective trophic classes are removed.

However, overfishing the right species may not necessarily be a bad thing in the long run. This is because the current rate at which overfishing practices occur causes an imbalance in the population levels of different species, with there being less of some and excesses of others within the environmental system. Therefore, the removal of species that are far more abundant allows the environment to slowly return to a state of equilibrium, by allowing dwindling populations to recover, whilst the overpopulated portions of the environment are removed to reduce the pressure on the system. From the perspective of consequentialism, the current rate at which organisms are being removed from the marine environment is unsustainable, but with the guidelines of rule consequentialism and proper implementation, the populations of organisms within the marine environment could slowly begin to increase through selective catching. However, if the current fishing pressures are exacerbated and there is no direct change to the operations of the fishery, all populations will continue to decrease.

Another issue within the fishing sector that negatively impacts the ecosystems which are being fished is the occurrence of bycatch. This is because "In the process of fishing, target and nontarget species can be inadvertently killed, injured, or otherwise incapacitated, but not retained" (Crowder, 2008: 265), as these organisms are often caught in the trawlers' nets even though they are not the intended targets. It is estimated that "more than 650,000 marine mammals are taken in fisheries each year" (Crowder, 2008: 265), with large portions of this catch including organisms such as seabirds, turtles, sharks, and mammals such as dolphins and seals. The removal of these higher-order predators allows for an influx of prey items, placing the environment in a state of unbalance, which inadvertedly results in a net loss of biodiversity as many organisms are unintentionally removed from the environment without being put back alive. This places strain on the environment as “species with low reproduction rates suffer the greatest population-level consequences of bycatch mortality” (Dayton, 2002: 16). These populations are no longer able to reproduce at the same rate due to the lack of key reproductive individuals.

This inability to reproduce effectively leads to an overall decline in organism populations, entailing that they are unable to sustain themselves and certain endangered species find themselves on the brink of extinction. The fluctuation in populations causes a strain in the environment as "ecologists are well aware that, if a species' population booms, it will have serious consequences for other species that share its ecosystems" (Clydesdale, 2018: 5). The overpopulation of the marine environment will disrupt the trophic systems therein, and the populations of the lesser species will decline through the competition that is now present within the environment. The overcollection of resources and the trophic disruption, which takes place as a result of fishing practices that directly removes predatory species from the environment and allowing for other organisms to flourish, brings further imbalance to the marine ecosystem. These consequences can be attributed to human beings, as the organisms are being removed from the environment regardless of whether they are the intended species being targeted.

Rule consequentialism is most applicable to this scenario, as there are regulations as to what can and cannot be kept by commercial fishermen, and these regulations are generally neglected as anything and everything is caught in the nets, with the unwanted organisms often being thrown back into the ocean either dead or injured. This leads to the assertion that the practices of commercial fishing related to bycatch are unethical by nature, as there are a lot of organism casualties that arise from this fishing process. Overfishing is an issue that carries an ethical weight from the lens of consequentialism, as the removal of organisms from different trophic spheres puts direct pressure on the populations which are found within the system. This removal reduces the overall population of certain species within the environment, as there is a disturbance in the trophic transfers which take place, meaning that certain organisms are unable to attain food, whilst others are in direct competition over food sources. This leads to fluctuations in population levels.

The argument for the sustainable use of resources is put forward by Gifford Pinchot, as he argues from a utilitarian perspective "for not overusing natural resources since doing so would not be in the best long-term interest of humans." In the scenario of overfishing, through the lens of consequentialism, this theory bases "the rightness or wrongness of the action as being determined by the value of a moral code that permits everyone to act this way" (Hiller and Kahn, 2013: 6), and the actions which take place through the overcollection of organisms from the marine environment directly go against the theory of rule consequentialism, as the rules

and guidelines, which prevent the environment from deteriorating, are bent or broken to achieve economic success. This entails that the actions which are being conducted by humans within the marine environment are unethical by nature, as they go against the recommended plan for environmental protection.

5.1.1.4 - Organism Population Decline as a Consequence of Subsistence and Recreational Fisheries

When looking at the environmental impacts of the fishing sector, one must also consider the recreational and subsistence sectors which are present within South African society. The recreational and subsistence sectors may appear to have less of an environmental impact as compared to commercial fishing, and whilst that is true, it is important to note that they still have a relatively large impact on the environment. This is due to the fact that, on a global scale, "approximately 11.5% of the population participates in recreational fisheries" (Crowder, 2008: 268). This means that recreational fishers can remove a large number of organisms from the environment without appearing to do so due to the relatively low visual impact that a single fisherman has on the environment. Whilst this impact may seem relatively insignificant in comparison to those of commercial fishing, the cumulative impacts from all recreational fishermen are astonishingly high, and the reduction of species and number of organisms in the environment can occur on a large scale. Artisanal, or subsistence fishermen, are more difficult to regulate, as there is a largely unknown number of these fishermen operating within the environment, attempting to sustain their livelihoods and those of their communities. It is estimated that "Artisanal fisheries outnumber industrial fisheries by a wide margin" with "an estimated 99% of the 51 million fishers worldwide" being artisanal by nature (Crowder, 2008: 269). The large presence of unregulated fishing within the marine environment poses a serious threat to the populations of the fish species caught, as these fishermen are relatively non-selective. This means that undersized and protected species are often removed and consumed, leaving their populations unbalanced due to diminishing size of specimens and population numbers. It has been noted that "reef-associated demersal fishes are highly vulnerable to fishing and can decline even at the early stages of the fisheries", due to their high demand and the needs of the individuals collecting these organisms (Crowder, 2008: 270). The physical damage that is caused to the marine environment through recreational and subsistence fishing does not compare to that caused by the commercial sector, but its impact is still felt. This is because these fishermen implement techniques such as netting, spearing, and long-line fishing to collect

the organisms, and these practices often directly damage reefs within the area, killing off corals and the organisms which rely on them for their survival. From a consequentialist perspective, the damage that is caused to the marine environment through the process of subsistence fishing, places this environment at risk through the impacts of human interaction. This can lead to a potential population decline, especially for vulnerable species, as the organisms which are removed from the environment have often not yet reached maturity; this puts the population under pressure as it is not able to thoroughly replenish itself. Amongst subsistence fishermen in South Africa, anecdotal narrative shows that, in general, marine resources are managed better than by commercial fisheries. This is because they usually take only what they need from the environment and not more than what is required.

5.1.2- Ecosystem Damage

5.1.2.1- Ecosystem Damage as a Consequence of Chemical Pollution

The presence of chemicals in the system presents further health risks to the marine environment, apart from poisoning, as the equilibrium that is naturally found within the system is disrupted, leaving the marine enviroenmtn in a vulnerable position. This environmental imbalance takes place when the chemicals that are added to the environment alter the nature of the processes which occur naturally, by altering their environmental processes or bringing these to a complete halt. The addition of chemicals into the marine environment leads to the occurrence of coral reef bleaching and a change in biodiversity, and even one small change to the environment will impact a large portion of the ecosystem (Wepener, 2012: 1). The damage that is caused to coral reefs places the entire environment under strain, as the ecosystem services that these reefs provide are hindered, leading to low levels of dissolved oxygen with high levels of dissolved carbon dioxide. This occurs because these coral reefs and the organisms that they thrive there are damaged, while their ability to consume carbon dioxide and produce oxygen are reduced. This means that the condition of the environment is one in which it will be difficult for life to be sustained.

The presence of chemicals in the marine environment also disrupts ecosystem services, which are extremely important to the environment's survival, leading to a deterioration in environmental conditions. As mentioned previously, the effects of chemicals in the environment can be felt for long periods, as they often possess long half-lives, meaning that

they can remain active within the environment and in the organisms which find themselves unfortunate enough to have consumed or been exposed to them.

The pollution of the environment, through the addition of E. coli bacteria to the system, is a regular occurrence in South Africa. This pollution occurs in two main ways, namely from the vast number of informal settlements which are situated within South Africa's various catchment areas, and from accidental spills from wastewater treatment plants. As mentioned in Chapter 4, there is a large amount of pollution that has recently occurred within KwaZulu-Natal, as a result of the floods which damaged many of the wastewater plants in the Durban metropolitan area. This addition of wastewater into the environment occured as a result of poor infrastructure, which was unable to handle the load on the system during the flood events in April and May 2022 Wastewater treatment plants malfunctioned and allowed contaminated water to leak into nearby water sources. The presence of E. coli in the marine and riverine environments poses an even more serious threat to their health. This is because the consumption of E. coli by any aquatic organism can be potentially lethal, as there is a high chance that illness may occur.

Another issue that results from of E. coli pollution is the mass introduction of organic nutrients into the environmental system. It must be noted that the eutrophication of the marine and riverine environments occurs differently for each one. In riverine environments, this high nutrient load leads to algal bloom. The development and presence of this algae within the environment hampers the water's ability to hold and store dissolved oxygen, because it disturbs the ability of aquatic plants to perform photosynthesis, meaning that little to no oxygen is added to the system. Eutrophication in the marine environment is vastly different from that in the freshwater one. Due to the vast size of the oceans, nutrient loads are easier to absorb. This promotes the reproduction and growth of phytoplankton, which is a common prey item for many organisms. However, as nutrients are added to the system and the "water column becomes increasingly eutrophied, the photosynthetic biomass will tend to be concentrated towards the surface, diffusive loss of oxygen will be greater and there will be an increased oxygen deficiency in the system" (Laurence, 1988: 160). Laurence describes this process as critical eutrophication and it "occurs when the net flux of limiting nutrients incorporated into the plants' biomass is such that the rate of production of new organic matter exceeds the net rate of oxygen supply required to oxidize it" (Laurence, 1988: 160). This process leaves the water starved of oxygen and barren of organisms.

Through the ethical lens of consequentialism, the addition of human waste into the marine and riverine environments poses a serious threat to their health, leading to the development of illnesses in and death of those organisms that consume the bacteria in a high enough volume. Furthermore, the mass addition of nutrients into the marine environment leads to eutrophication, a phenomenon whereby there is a bloom of algae in the system which reduces the dissolved oxygen that is present in the water column. This makes the environment uninhabitable for many marine and river-based organisms, as there is no oxygen for them to consume, while there is a large amount of bacteria in the system which renders them contaminated and unhealthy.

5.1.2.2- Ecosystem Damage as a Consequence of Microplastic Pollution

The pollution of the environment through the addition of microplastics poses another serious threat to the marine environment. Although one can see large amounts of plastic material in the marine environment, there is a lot more of it that is not always visible to the naked eye. Microplastics come about as a result of partial plastic degeneration, and the direct addition of these tiny plastic particles into the environment originates from their use in various industrial processes and the production of consumable products. Microplastics are defined as plastic particles which have an upper size limit of 5 mm and a lower one that stretches to the microscopic level (Nel, 2015: 1). Because of the small size of these particles, they are often ingested by small organisms in the environment, as they strongly resemble the prey items of these small ocean-dwelling creatures. Due to the fact that plastics are indigestible, the microplastics remain in the bodies of these organisms. This presence of plastic in microscopic prey organisms kickstarts the process of biomagnification, in which organisms higher up on the trophic scale consume plastic-ridden prey items, which leads to a build-up of plastic in the organisms high up on the trophic scale.

The main issue related to the process of plastic bioaccumulation, is that the microplastics within the environment are present in such large quantities that the surface area of these plastics is very large, allowing chemical pollutants to bond onto the plastic particles with "persistent organic pollutants absorbed onto microplastics accumulating at concentrations several orders of magnitude higher than in ambient seawater" (Andrady, 2011: 1597). This entails that the plastics which are consumed enable the consumption of other potentially life-threatening chemicals which bioaccumulate within the organisms consuming this plastic. The side effects

of this chemical ingestion are a decline in environmental well-being, as the organisms within the environment are now contaminated with unnatural toxins, which can potentially change chemical structures therein. This allows for the biomagnification of various chemicals, as organisms higher up on the trophic scale can consume these along with their prey, leaving them with elevated levels of pollutants in their systems.

Apart from the ingestion by animals of these microplastics, they also settle within the sediments along coastlines, beaches, and rivers. The sedimental load of microplastics poses a similar threat to the environment, as the environmental load of pollutants increases due to the adherence of chemicals onto these plastic particles. This leaves sediments in the environment contaminated with various toxins, which remain within the system for years, due to their long half-lives and their inability to be broken down. This places strain on the environment, as these toxins have the potential to cause damage to ecosystems, which can result in a net loss of biodiversity.

5.1.2.3- Ecosystem Damage as a Consequence of Physical Environmental Damage

The damage caused to the marine environment as a result of fishing reaches beyond just the mass collection of intended and unintended organisms. It includes direct physical damage which comes as a result of some fishing methods that are implemented. The destruction of the ocean floor environment, which is brought about by the impacts of fishing gear and methods, impacts countless ecosystems, as the nets flatten land, removing vital ecosystems from the environment. This is backed by the assertion that "The strongest ecosystem impacts of commercial fisheries are from mobile fishing gears that contact the bottom, taking target and non-target species and damaging benthic habitat" (Crowder, 2008: 267). The gear that is used in commercial fishing is often designed to reach the sea floor, and collect any organisms which find themselves unlucky enough to be swept up by the large nets. Therefore, the use of these nets leads to "habitat destruction, loss of refuge, and subsequent reductions in survival" (Crowder, 2008: 267). While the nets are being dragged along the ocean floor, the surface is altered as "bedforms which are dominated by mounds and depressions that are produced by burrowing infauna, are reduced to graded flatlands", along with coral structures being destroyed (Dayton, 2002: 27). The change to the architecture of the environment, particularly in sedimented areas, places a large strain on the ecosystem as "these habitats support high biodiversity and cover more than 70% of the seafloor" (Crowder, 2008: 267), meaning that their contribution towards marine biodiversity is extremely high, and the degradation of these

flats contributes towards population and biodiversity loss throughout the entire ecosystem. The process of damaging the sea floor comes as a direct consequence of the activities in which fishermen participate. While fishermen and fishing companies may well be aware of the damage they are causing to the environment, the practice of lowering nets to the sea floor continues, as this is their methos of generating income. This reduction of biodiversity places the environment in a state of imbalance, caused by human intervention.

5.2- Consequences Felt by Social Systems

5.2.1- Lack of Access to Resources

South Africa as a region is one in which natural resources are important, and are directly used by many communities in order to sustain their well-being, by providing them with sufficient food and water. These resources are less important for more affluent individuals, as they can purchase the goods that they require for survival, but those who find themselves living in conditions of poverty and food scarcity, are extremely reliant on these resources for their survival. The inability to sufficiently access these resources risks degrading their well-being, as they do not possess sufficient resources to survive. The pollution of the marine environment also results in disease and illness for those who consume the polluted resources, and this directly degrades the well-being of those communities who are unable to prevent these illnesses from affecting their lives. Along with this, the pollution and overcollection of resources also affect the tourism industry in South Africa, which generates a large amount of revenue for the country, as foreigners are attracted there due to its natural beauty. The damage caused to the country's landscapes reduces its attractiveness, thus resulting in fewer tourists visiting the nation, meaning that less revenue is brought in.

The next section of this chapter will highlight the social consequences which arise as a result of chemical and plastic pollution and the overcollection of resources, and how these factors contribute to a decline in the well-being of many individuals who reside along the coastline of KwaZulu-Natal.

5.2.1.1- Lack of Access to Resources as a Consequence of Chemical Pollution

The addition of chemicals into the marine environment is an issue that drastically impacts the lives of those individuals and societies who make use of it for their survival, as these chemicals

contaminate the food and water resources, making them unusable and potentially dangerous when consumed. When looking at chemical pollution in the local examples which I provided in Chapter 4, the chemical spill which occurred in the Ohlanga area is one which negatively affected the social systems of those human beings who live near to or rely on this river for their survival. The pollution of South Africa's groundwater sources, through the addition of chemical pesticides into the system, poses various health risks for those individuals who make use of these polluted resources, as the consumption of contaminated water is potentially life-threatening. The chemical spill which occurred added a vast number of different chemicals into the environment, making the social impacts of this spill difficult to assess. This is because "each kind of potential pollutant has different characteristics, which have to be taken into account to correctly estimate the travel time, the concentration of the pollutant or the duration of contamination" (Orellana-Macías, 2022: 2). In turn, this means that pollutants which are added into the environment can affect multiple organisms in different ways and for varying time periods, with the potential of "having subtle long-term effects on wildlife, ecosystem structure, stability, and function, as well as on human health" (Backhaus, 2012: 2). When looking at the social implications of the chemical spill that occurred, one needs to consider both the affluent and poor rural populations, as their well-beings were affected in different ways. The poorer section of the population in South Africa is dependent on the environment for its survival through the collection of resources such as food and water. The chemical spill and the subsequent pollution as a result of this spill, contaminated the water source, meaning that the consumption of any organism from the system could lead to illness. The pollution of the riverine and ocean systems in Durban negatively affected the well-being of those individuals who rely on them for their survival, as these individuals were no longer able to access the resources that they require to sustain their livelihoods.

The second example of chemical pollution that has an impact on the social systems present in KwaZulu-Natal, is the pesticide-related pollution in South Africa's riverine and marine environments, which regularly occurs through the mismanagement of agricultural practices. The agricultural sector in South Africa contributes vast amounts of revenue to the GDP, entailing that this sector is extremely important to the country, not only for the provision of food, but also for the addition of money into the economy. The agricultural sector, therefore, needs to make use of chemicals to provide the soils with as many nutrients as possible to attain the necessary growth of crops, and to prevent their damage by pests. As a result of chemical additions to the environment, nearby waterways often are polluted with chemicals resulting "in

an increase in the nutrient concentration in the lagoon, finally leading to eutrophication and the generation of algal blooms" (Alcon et al., 2022: 4). The presence of chemicals in the environment and the algal bloom that occurs therefrom, places the environment under immense strain. This is as a result of the drop in water quality caused by eutrophication, as this process leads to an absence of new life within the natural system, as oxygen levels are depleted. The pollution of the riverine and marine environments through agricultural practices places societies that make use of this environment at risk of a decline in well-being. This is because many local individuals use this water for daily consumption along with the resources which they collect from the environment for survival. The consumption of polluted resources may lead to illness, while the loss of vital resources affects these individuals' well-being, as they are no longer able to use them and the resources which are aveiable are degraded which could lead to possible health implications if consumed. Pollution prevents the use of this water, as it is contaminated, and therefore forces local individuals to seek this resource elsewhere, as the source that they once relied on has theoretically run dry. Along with this, the poor water quality entails that it is unusable for many agricultural processes, as clean water is required for irrigation to ensure the sustainability of the crops which are being cultivated.

The third example I refer to is the pollution of the marine environment through the intentional addition of oil and other residues which come as a result of ships' operating processes. This places immense strain on the environment. As mentioned previously in this chapter, there is a diverse array of physical environmental issues which arise because of this pollution, but there is also a large number of social impacts associated with the presence of oil in the marine environment. Due to the fluid nature of oil, it is easily able to be moved around the marine environment by wind and ocean currents. This means that the presence and effects of this pollutant in the environment are widespread and felt by multiple social groups along the coastline. Impacts include "ecosystem destruction, chemical contamination of land and water, long-term harm to animal populations (particularly migrating birds and marine mammals), and human health and safety risks for neighbouring communities" (O'Rourke, 2003: 594). The bilge that is released into the system poses various health risks to those who are exposed to the chemicals as the oil contains "heavy metals such as barium, arsenic, cadmium, chromium, and mercury" (O'Rourke, 2003: 594). These chemicals are all carcinogenic by nature leading to human health impacts such as "cancer, central nervous system toxicity, and poisoning" (O'Rourke, 2003: 607). This directly impacts the lives of individuals who have been exposed to these chemicals. Furthermore, these chemicals have an impact on the ecosystem services

which the environment provides as "Aggregates and tar residues will contribute to the prolonged release of toxic low-middle weight hydrocarbons, yielding prolonged ecological impacts" (Zhang, 2019: 399). This hinders the functioning of these ecological services and subsequently harms the societies that rely on them for their survival. This, in turn, jeopardises the well-being of these individuals, as the human populations who reside on the KwaZulu-Natal coastline include groups of people who live rural lifestyles and depend on the environment for their survival, meaning that they will not be able to access the necessary resources that they require due to this pollution.

The fourth example of chemical additives that impact the social systems in KwaZulu-Natal is the addition of and presence of E. coli bacteria in the marine environment. These bacteria pose a serious threat to the well-being of those societies that make use of the marine and riverine environments. The presence of the bacteria contaminates food sources which are vital to the population's survival, and the consumption of contaminated foods will often lead to illness and, potentially, death. It is safe to say that the pollution of the riverine and marine environments through their contamination with E. coli has extremely negative effects, as the contaminated water is unusable. Local individuals who rely on this water source for their survival are without the necessary resources that they require for their day-to-day living, thus negatively impacting the well-being of the community. Although the addition of E. coli to the environment does not occur directly at the hands of human beings, it still comes as a result of human-driven actions. In this case, pollution occurs due to the poor infrastructure which is used by the Durban municipality to treat water. This infrastructure is not properly maintained, which leads to wastewater leaking directly into the environment. When looking at the pollution of the environment with E. coli through the lens of consequentialism, it is evident that the addition of this bacteria to the marine environment has vastly negative impacts on the environment and on the lives of those who rely on it for their survival. This is because the consumption of these bacteria often leads to disease and, potentially, death. This means that because the consumption of polluted water is dangerous and affects the well-being of all those who interact with the environment, this vital resource is no longer usable by the population.

5.2.1.2- Lack of Access to Resources as a Consequence of Plastic Pollution

The plastic pollution of the marine environment also results in damage to the ecosystem services which the environment provides, as "Diverse impacts caused by ingestion of

microplastic due to particle and chemical-related toxicity have been reported, including physical injury, changes in physiology, and impaired feeding, growth, reproduction, and oxygen consumption rates" (MacLeod, 2021: 9). These environmental changes impact the populations of organisms which are viable for consumption, leading to a reduced supply of food for local individuals, while the organisms that they are able to collect are ridden with toxins and chemicals, which make them dangerous to consume. This risk related to the consumption of these organisms places the lives of consumers at risk, through the potential health implications which may occur as a result of this chemical ingestion. In South Africa these effects are more widely felt, as the "Arid areas of the world, where surface water is in short supply, may find their remaining freshwater ecosystem resources further compromised by plastic pollution (specifically through toxic plastic additives) and small plastic particles that may penetrate through drinking water production systems" (MacLeod, 2021: 9), entailing that marginalised communities that lack direct access to a reliable food and water supply are forced to consume these polluted resources, potentially degrading their collective well-being.

5.2.1.3- Lack of Access to Resources as a Consequence of Fishing Practices

The fishing sectors which are present within South Africa's waters all have varying impacts on one another, and the social impacts which arise have a large effect on the population of the country. Because of South Africa's rich biodiversity, fishing is a common practice for individuals in commercial, recreational, and subsistence sectors, with each sector feeling the social implications of the processes related to these sectors.

The commercial fishing sector operating in South African and African waters undoubtedly has the largest social implications, and they are often felt on individuals in the recreational and subsistence sectors. As mentioned previously, a large number of the commercial fishing vessels which operate in South Africa's waters are not of local origin, and they compete with local vessels for the resources which are available in local waters. This places immense strain on the local economy as foreign vessels often outnumber local ones. In addition, they remove organisms from the environment in quantities vastly higher than local collection, leading to the development of further economic pressures, as the country is unable to supply enough resources to successfully contribute to its gross domestic product. Due to the large number of foreign ships operating in local waters, local companies and individuals are pressed for jobs as they are few and far between, with many locals losing their jobs due to "a decrease in crew

size" and increased pressure on the system (Pollnac, 2006: 6). This places local individuals in a position whereby they are forced to look for work elsewhere to maintain their livelihood. The commercial fishing sector affects more than just locals' ability to find work. It also affects the lives of recreational and subsistence fishermen. This is because the commercial fishing sector removes large amounts of organisms from the environment, potentially decimating populations, while leaving the remaining organisms that are of a relatively small size or with reduced populations. The overcollection of marine organisms leaves the subsistence and recreational fisheries with fewer large organisms to collect, meaning that they are forced to collect specimens that are undersized and/or part of dwindling populations. The issue here is that the organisms collected by subsistence fishermen are either too small or in too small quantities to sustain themselves. Herein lies the issue, as "the simplest cases of subsistence fishing involve the production of fish for human food, thus reducing the costs of feeding a family" (Pollnac, 2006: 6), and without the marine organisms to feed themselves and their families, these individuals are forced to look elsewhere for food-related resources. This can potentially lead to famine and a direct decrease in the standard of communal well-being, as these individuals are no longer able to sustain themselves through the use of the marine environment. The decrease in well-being in communities, which is felt as a result of unregulated fishing practices, places their lives in jeopardy, as a large portion of South Africa's coastal population is reliant on subsistence fishing for their survival. The overcollection of resources from and the damage caused to the marine environment, hinders these communities in their collection of resources, as the populations of organisms are declining as commercialised fishing practices continue to grow. Rawls, quoted by Ssebunya, makes use of the principle of equal liberty which states that "each person has an equal right to the most extensive liberties compatible with similar liberties for all" (Ssebunya et al., 2019: 1790), arguing that the inequalities which arise as a result of low organism populations are unethical by nature. Subsistence, coastal communities have had their right to the use of nature removed from them by the commercial fishing sector, and the environment is no longer able to sustain the rate at which organisms are being removed. Essentially, this means that subsistence communities are unable to sustain their well-being, leading to a degradation in their livelihoods. Furthermore, Rawls makes use of the difference principle which "demands that social and economic inequalities should be arranged such that they are both to the greatest benefit of the least advantaged persons" (Rawls, 2001: 122-24), meaning that the overuse of the marine environment by the fishing sector lacks ethical basis, as the overconsumption of

resources negatively impacts the lives of those individuals who find themselves dependent on these resources for their communal survival.

5.2.2- Negative Health Implications

5.2.2.1- Illness as a Consequence of Chemical Pollution

The pollution of the Durban harbour was an occurrence that brought a variety of social issues, impacting the lives of all those individuals who reside and interact with the polluted environment. As mentioned earlier, the Durban harbour contains vitally important ecosystems which support the growth of organism populations and the lives of many individuals who make use of this ecosystem. The addition of various chemicals into the marine environment within the harbour has posed a serious threat to the lives of local individuals, as many of their daily procedures include interactions with the waters within this polluted zone, through resource collection and fishing. The collection of resources and organisms exposes these individuals to the contaminants which are in the waters. This potentially places them at risk of illness through both indirect and direct consumption. The chemical contaminants bio-magnify through the food web and collect in high concentrations in organisms which are higher up the predatory scale. Unfortunately for the local people who fish in the harbour, it is these organisms that are targeted and consumed, meaning that the chemicals which are pumped into the environment find their way into the human beings who consume organisms from the said polluted environment. This places the well-being and lives of the local individuals at risk, as they now also feel the effects of toxic chemicals through illness or even death, as many of the chemicals are carcinogenic by nature.

E. coli is a bacterium that is commonly present in the guts of all warm-blooded organisms and in natural localised doses, it is relatively harmless to other organisms. However, when it is consumed in volumes that are higher than those which naturally occur within the organism's body, the latter can suffer very negative effects. The addition of these bacteria into the marine environment comes as a result of poor wastewater management, and is added into the system either through the improper treatment of wastewater, or the direct addition of untreated water into the environment. These bacteria have the ability to bio-magnify throughout the food web, and organisms within the environment act as direct carriers for bacteria that find their way into the bodies of other organisms in riverine and ocean environments. The social implications of

the presence of E. coli in the water systems are vast, and they directly influence the lives of individuals who are exposed to and make use of the polluted environment. The contamination of water and food with "faecal bacteria is, and remains, a common and persistent problem, impacting public health and local and national economies" (Ishii, 2008: 101), and its social impacts are widespread throughout the population. Due to South Africa's demographic and past injustices, large portions of the population find themselves living in rural and peri-urban areas without the necessary means to sustain life. This entails that they must make use of the riverine and marine environments for water and food resources, meaning that they are directly exposed to the E. coli pollution which is present within the environment. The consumption of this bacteria in high volumes can cause human diseases, such as haemolytic uremic syndrome and diarrheal diseases which are "estimated to cause 1.8 million deaths each year, mostly in developing countries" (Ishii, 2008: 103). This places the lives of local residents at serious risk of contamination and the disease directly contributes to a decline in communal well-being.

As mentioned, the pollution of the marine environment through the addition of plastic is a regular occurrence, with large amounts of plastic being added into the environment every day. This plastic enters the environment in the form of large pieces or microplastics, and they have different effects on the social environment due to their varying characteristics. Due to the ability of plastics to bio-magnify throughout the trophic system, humans indirectly consume large amounts of plastics in the resources that we get from the marine environment. This is backed up by MacLeod who states that "Ingestion of plastic particles by diverse biota and humans has been demonstrated in numerous studies. Recently, there have been reports that small plastic particles can be taken up from the gastrointestinal tract into tissues, and small plastic particles have been shown to penetrate biological membranes" with "internal tissues and organs of humans and other biota" being a location of plastic and chemical accumulation (MacLeod, 2021: 4). This poses serious issues for those societies that consume these marine-derived products, as plastics and microplastics have an innate ability to carry toxins which have bonded onto their surfaces. This means that through consuming water and organisms from the ocean, humans are exposed to the various effects of the numerous chemicals which are unknowingly being ingested, potentially leading to serious illness or even death, depending on the chemicals which are consumed.

5.2.3- The Negative Effects of Pollution on the Tourism Sector in KwaZulu-Natal

The tourism sector in South Africa brings in a lot of revenue, with close to 3.8 million people having visited the country in the year 2020, according to Statista, and this sector generally contributes around 6.9% to the country's gross domestic product. This entails that the tourism sector in South Africa is important not only for the country's economy, but also for the livelihoods of those who operate and trade crafts and other tourism-related goods. The pollution of the marine environment along the coastline of KwaZulu-Natal severely degrades the environment and drastically reduces the natural aesthetic beauty of the region, making it unappealing to many of the individuals who visit the region for its natural beauty. The next portion of the chapter discusses the impacts that pollution has on the tourism sector, and how this impact affects the lives of those who are dependent on it for their survival.

5.2.3.1-The Effect of Chemical Pollution on Tourism

Social impacts are also felt by the more affluent portions of the population involved in the tourism industry. As a result of unrest in 2022, discussed in chapter 4, the tourist area around the Ohlanga River in KwaZuluNatal was negatively affected. UMhlanga is a popular tourist and residential destination, due to the natural beauty of the area. The nature of this sector generally brings large amounts of revenue into the region, but the pollution of the environment which occurred in 2022 has damaged the tourism industry there. This once pristine environment is no longer attractive to the population and other visitors, as it is in an extremely poor state, due to the presence of life-threatening chemicals. This places a strain on the area's economy as the local government has spent more money than the area brings in to mitigate and rectify the effects of the chemical spill. Furthermore, one must consider the "impacts on biological diversity" (Backhaus, 2012: 2), as a loss in organism diversity and population entails that subsistence fishermen in the area are under pressure. This is a result of diminishing populations of targeted organisms, meaning that the available food sources are reduced day by day. The social impact of this pollution extends beyond its repercussions on local subsistence communities, as this pollution also has a large impact on tourism in the area. The pollution of Durban Harbour often flows into the ocean through the process of tidal variation, allowing this pollution to move up and down the coastline. The effect of this movement is felt by the tourism sector on the beaches of the Durban coastline, as many of the beaches which attract people into the area have lost their blue flag status. This status is highly prized by the tourism industry, as

a clean beach and coastal environment are a large pull factor for tourists, and the lack of these clean environments entails that the amount of tourism within the area will decline. This results in a loss of revenue within the area due to the lack of tourists. This means that the lives of some poorer sections of the population are compromised, as a large portion of their economy is driven through sales by street vendors situated along the beachfront, and the lack of tourists to buy products entails that their livelihoods and well-being are at risk through the pollution of the marine environment.

Along with this, "Oil spills and their effects can have disastrous implications economically for fishing and other marine industries such as tourism" (Zhang, 2019: 399). The loss of environmental integrity in the marine environment leads to a decrease in the overall amount of money that is brought into the area as fewer organisms are caught; similarly, there is far less revenue coming in from tourist attractions. This entails that the well-being of all those involved in these sectors declines drastically at the hands of pollution. The addition of oil-based products into the marine environment poses similar issues regarding environmental degradation, which impacts the social spheres that are present in the polluted areas.

5.2.3.2- The Effects of Plastic Pollution on Tourism in KwaZulu Natal as a Consequence of Plastic Pollution

"According to the United Nations World Tourism Organisation, rural tourism plays a key role in promoting the sustainable development of the local community and will be vital to meet the Sustainable Development Goals" (Mihai et al., 2022: 14). The development goals are beneficial to the development of communities and their economies. However, the pollution of the marine environment has serious implications on the tourism sector, as well as on the livelihoods of those individuals who reside near it and rely on this environment for their survival. The addition of plastic into the marine environment poses a threat to tourism along KwaZulu-Natal's coastline. These larger plastic pieces are transported up and down the coastline through the ocean currents, and are deposited along the beaches with the tidal variations which occur in the area. The plastic litters the beaches and rocks all along the coastline and provides a picture that is unpleasing to the eye. This loss in aesthetic value acts as a push factor, reducing the number of tourists and locals who make use of the coastline for leisure activities. This results in a net loss of revenue coming into the area, which places local businesses at risk, as their livelihoods are dependent on people visiting the area. When looking at the issues related to plastic

pollution, humans are directly impacting the marine and riverine environments, through the addition of plastics into the system, and the environment has become plagued with plastic which remains within the system for years if not centuries.

As mentioned above, plastic ingestion affects the lives of organisms, by altering their populations, and also affects the lives of human beings, as the plastics which are ingested pass on chemical pollutants to those individuals who consume the plastic particles. This results in the potential development of illness and disease, which negatively affect the lives of communities that are unable to avoid this contamination. Furthermore, the plastic within the environment leads to a decrease in revenue brought into KZN through ecotourism, as "In South Africa, 85% of both out of town tourists and local tourists would avoid visiting beaches with more than 2 items of litter per square meter, and 97% of visitors would avoid visiting if the beach had more than 10 large items per square meter" (Dyson, 2010: 10). The lack of tourists visiting the KZN province has direct implications on the success of local economies. If no tourists visit the area then the economic activities, which are dependent on the tourism sector, suffer as a result of the pollution of the marine environment.

It is evident that the development of human-environmental relationships is important for the succession of both the environment and the societies within it, as they are co-dependent on one another for their survival. This entails that pollution of the environment leads to a direct decline in the well-being of the individuals within it, as a decline in the condition of the environmental spheres will result in a decline in the well-being of the social spheres which interact with the polluted environment. As a result of this interdependence, the pollution of the marine environment through the addition of plastics can be considered unethical because it directly impacts both the environmental and social spheres, leading to an overall decline in communal well-being as the entire system is placed under pressure.

5.3- Conclusion

In conclusion, by making use of the ethical lens of consequentialism, it is evident that many negative consequences arise as a result of human interactions with the marine environment. As such, it is vital to ensure that the actions which occur within this environment do not degrade both it and the well-being of those who rely on it. The agents in the environmental decision-making process need to adopt the principles of consequentialism when making decisions about

environmental use, to ensure that the marine environment is used sustainably and is not degraded past the point of no return.

The following chapter will provide an overall summary of the paper, along with recommendations for the mitigation of the issues that were brought up above.

Chapter 6 - Summary, Conclusions, and Recommendations

6.0- Introduction

In the previous chapter, which was the analysis, the effects felt by the marine environment along the coastline of KwaZulu-Natal as a result of anthropogenic influences, were analysed and ethically critiqued through the lens of consequentialism. The issues of pollution, environmental damage, and the overcollection of resources that are present within the marine environment and the rivers that lead into the ocean, were highlighted. The current chapter provides a summary of this paper along with recommendations for the mitigation of the issues that are present within the relationship between humans and the marine environment.

6.1- Summary of the Dissertation

In summary of this dissertation project, titled “The effects of anthropogenic activities on the marine environment, along the coastline of KwaZulu-Natal, an ethical critique”, it is evident that there are a large number of issues which arise as a result of anthropogenic influences within the marine environment along the coastline of KZN. These issues stem from overfishing and direct environmental pollution through the addition of plastics and chemical pollutants to the environment.

The environmental issues that arose were organism depletion and ecosystem damage, while the social issues that arose were the lack of access to resources, health implications, and the financial impacts on the tourism sector.

6.1.1- Summary of Chapters

In Chapter 1, the introduction, I introduced the topic of this dissertation and provided my personal and academic background for this research, an outline of the research questions and objectives, the methods that were used, and the layout of the chapters that were to follow. This chapter forms the basis of this dissertation, as it provides the format for the project along with the topic which was discussed.

In Chapter 2, the literature review, some of the current literature on environmental pollution and overfishing was covered to provide a basis for analysing humans' impacts on the marine

environment. This review looked at various local and international sources to provide a comprehensive overview of the issues that are present within the marine environment. In this chapter, the concepts of chemical pollution, plastic pollution, and fishing were discussed, while their negative impacts on the environment were outlined. Environmental degradation occurs through the addition of chemicals and plastics, which poison the environment and the organisms that consume them. In addition, it occurs through overfishing, which reduces the number of organisms within the environment and impacts their populations, as their rate of reproduction is unable to match the rate of their removal, resulting in a net loss of biodiversity.

In Chapter 3, the theoretical framework, the theory of consequentialism was explained. In this chapter, the theory of consequentialism was discussed to prove its applicability to the topic of this dissertation. Along with this, the proponents of this theory were presented, and their work in their respective fields was explained by identifying the two types of consequentialism: act and rule consequentialism. These two types differ from one another, with act consequentialism being based on decision-making without a definitive set of rules being in place, while in rule consequentialism decisions are made based on rules that are set in place and are required to be met by the decision-maker. These two forms of consequentialism take the agents and the rule makers' perspectives into consideration, to allow decisions to be made based on the negative consequences arising from the anthropogenic influence within the marine environment.

In Chapter 4, the local case studies and examples, I provided several examples of where humans are damaging the marine environment as a result of pollution, whether it be plastic or chemical, and through overfishing, the removal of resources, and physical damage caused to the marine environment through various fishing practices. These examples included chemical pollution spills on the Ohlanga River and in the Durban harbour, chemical pollution due to agricultural practices, bilge dumping, chemical pollution through improper waste management, and the subsequent addition of E.coli bacteria into the environment. The last form of pollution that this chapter discussed was the addition of plastic waste into the marine environment. It is either added directly into the marine environment, or is added into the environment and transported to the ocean through the rivers which lead into it. The next environmental issue that this chapter discussed was overfishing and illegal fishing practices, which either attract fish to the area, such as fish aggregating devices, or damage the environment through the use of nets and long lines.

In Chapter 5, the analysis, the issues that are present as a result of pollution and overfishing were ethically analysed through the lens of consequentialism. This allowed me to highlight these issues based on the consequences which arose and were felt by the environment and the populations who live close by or rely on it for their survival. In this chapter, the environmental issues which arose as a result of the anthropogenic influence within the marine environment were: a decline in organism populations, as a result of damage caused by the addition of chemicals and plastics, which impacted the health of the organisms; and the overcollection of organisms through the process of unregulated overfishing in the commercial, recreational, and subsistence sectors. The first environmental issue was the direct damage caused to the marine environment. This damage comes about as a result of chemical and plastic pollution. This results in coral bleaching, which leads to environmental conditions which are not suitable for the organisms therein, as the dissolved oxygen levels are reduced because photosynthetic organisms are killed off. This means that there is less oxygen added to the environmental system. In addition, the physical damage caused to the system, as a result of the fishing practices that occur within the commercial fishing sector, was examined. These fishing practices involve the use of nets which are dragged along the sea floor, disrupting the sensitive ecosystems found there. The use of these nets also causes damage to coral reefs, which are present within the areas being fished, damaging ecosystems as the structures they require to thrive are removed.

The social issues arising from the anthropogenic influence within the marine environment were a lack of access to resources, the development of health issues, and the impacts felt by the tourism sector. The lack of access to resources places the well-being of communities who live in the area at risk, through chemical and plastic pollution of water sources which are used by them. This pollutes not only drinking water sources, but also food sources that are found in the polluted environment. This leads to the next issue: the negative implications on the community's health when they consume the resources they rely on for survival. The consumption of chemicals and plastics that contain chemicals leads to the development of illness amongst individuals within the communities, as these chemicals are toxic when consumed in large doses. The last social issue that arose as a result of pollution and overfishing was the impact on the tourism sector. This sector brings in a large amount of revenue into the country and contributes significantly towards its GDP. With the current rate of pollution being added, through the direct introduction of pollutants into the marine environment or through the addition of pollutants through transport via river systems, beaches and oceans are increasingly

becoming more polluted. This leads to an environment that is not aesthetically pleasing and is in a deplorable condition. This drives tourists away from the coastline as the environment no longer appeals to them. As a result of the lack of tourists visiting the area, businesses and individuals who rely on this sector for their survival are feeling the adverse effects of this. Their livelihoods are being negatively affected as less money is coming into the area, meaning that businesses are struggling.

6.2- Recommendations

When making recommendations, it is essential to note that not all of these are universally applicable, and must be tailored to the regions where they are being implemented. However, there are several that can be applied to the South African context. These include a number of options that range from legally protecting environments and species, to the implementation of water use policies and community management programmes, which are the main drivers of environmental education. Society is constantly evolving, and the issues that are present through pollution and overfishing are evolving along with it, as there is a growing demand for waste removal and food for the population. However, there is a finite amount of space to dispose of this waste, as well as a finite supply of resources which are available for consumption. One of the main issues in modern-day society is awareness of environmental degradation and the impacts that result from human beings and their actions. This awareness alone could potentially combat the regression in environmental stability. Within this portion of the chapter, education pertaining to the environment plays a dominant role when looking at ways to prevent or mitigate the issues which arise around marine pollution and fishing, as "environmental educators are required to come up with new knowledge and techniques which would address the demands of a constantly evolving social and technological landscape" (Hudson, 2001: 283). Moreover, it is essential to combine and make use of several techniques along, with both Western and indigenous knowledge, to combat the degradation of the marine environment effectively. Additionally, it is crucial to consider the social impacts, such as reduced access to resources, health risks, or economic repercussions, while efforts should focus on equitable solutions that prioritise the well-being of marginalised communities, including initiatives for alternative livelihoods, resource management, and healthcare provision.

When dealing with the complexities of overfishing, solutions might include implementing sustainable fishing quotas, supporting small-scale and artisanal fishing practices, and creating marine protected areas to allow ecosystems to recover.

6.2.1- Environmental Education

Environmental education in South Africa is required to improve how the environment is used in the future. This should aim to minimise the current impacts on the marine environment and at the same time improve the current conditions, while protecting the natural environment going forward. This is applicable to South Africa's situation and should be a global imperative. Since the 1970s, world governments have met on a number of occasions regarding environmental education. Many goals have been set in place, such as "to foster a clear awareness of, and concern about, economic, social, political and ecological interdependence in urban and rural areas; to provide every person with opportunities to acquire knowledge, values, attitudes, commitment and skills needed to protect and improve the environment; to create new patterns of behaviour of individuals, groups and society as a whole towards the environment" (Gough, 2017: 1). Through these summits and resolutions, it is evident that the need for environmental education is vitally important to maintain the natural environment. All individuals who both live in and make use of the natural environment must be made aware of their actions and roles as its protectors. Due to the demographics within South Africa, it is essential to acknowledge the need for tailored environmental solutions which embody the ideology of Africanism. This approach towards environmental education would entail that the majority of the population would need to adopt a holistic outlook of the environment. It will need to be an approach that takes into account all the aspects of the natural environment, the built environment along with its technology, and the social environment (Gough, 2017: 2), as these aspects are all interrelated through their direct influence on one another.

The South African economy, and often its policies, is dominated by minority populations and economic groups. Previously, a top-down Eurocentric approach towards environmental education had been promoted. However, taking into account the demographics of the country, it is clear that this type of approach to environmental education is unlikely to work effectively, and instead, an African approach to environmental education should be implemented, as "It involves much more than mere linguistic translation, although language is important. It requires the involvement of the potential audiences in program design. Moreover, programmes must be

designed to be sustainable within the communities they seek to involve" (Hudson, 2001: 285). Involving communities and empowering them with knowledge around the topic of environmental education allows individuals therein to govern the environment that they interact with more sustainably. This will lead towards the preservation of the natural environment.

Along with educating communities about the environment and the issues it faces, environmental education must adopt indigenous knowledge systems into their curricula. Indigenous knowledge systems are defined "as the knowledge that is characterised by its embeddedness in the cultural web and history of a people including their civilisation and forms the backbone of the social, economic, scientific and technological identity of such a people" (ODora-Hoppers, 2001: 4); the use of these knowledge systems moves away from a Eurocentric approach to education, and towards one which is Afrocentric by nature. An Afrocentric approach towards environmental protection “leads to inclusivity amongst communities when making decisions about the protection of the environment and allows this to occur in a manner that benefits both the environment and the communities who rely on it for their survival” (Sakurai and Uehara, 2019: 1). Furthermore, the aim of education about the environment should be that it is passed down through generations as a form of modern-day 'indigenous knowledge', to envisage a future which is positively sustainable by nature.

It is important to note that the more affluent sectors of the population already have access to high-quality education, and students in these sectors have the highest exposure to an education which promotes environmental protection. However, it is not always this sector of the population that is most involved in the causes and feels the effects of the damage to the environment, owing to the relatively small numbers in this group. People in this sector are also rarely impacted by the negative consequences arising from environmental degradation. It is, on the whole, peri-urban and rural communities and populations who both contribute more towards the degradation of the marine environment and feel the negative effects of this. Environmental degradation affects the everyday lives of impoverished, rural, and peri-urban people, as they often require the polluted and degraded resources to ensure their survival. Managing plastic pollution could involve educational campaigns, improving waste management systems, and advocating for reduced plastic usage at both individual and industrial levels.

6.2.1.1- School Curriculum Changes

When it comes to environmental education, the most influential people in the education system are the teachers themselves. This statement is backed by Sukma, where the author states that “Teachers play an important role in raising ecological citizens who advocate for a new social order” (Sukma, 2020: 2), and that these teachers' approaches towards environmental education should be student-centred through the use of collaborative methods with real-world examples. It is critical to allow learners to develop their critical thinking skills when applying their environmental knowledge to these real-world examples. It is also worth noting that the teachers providing the environmental education must "adapt to various socio-economic structures, cultures and living conditions in different age groups and consider regional differences" (Sukma, 2020: 2), as the demographics in South Africa include a vast spread of cultures and traditional practices. This entails that environmental education needs to be structured around key focus points. There should, however, be room for flexibility in the minor details to allow for the accommodation of these cultures and their worldviews.

Teacher education is critical in this regard. Teachers who are not specialists in environmentally based subjects, like natural and social sciences, seldom receive any environmental education during their pre-service training. Thus, they are unaware of the importance of teaching learners about preserving their natural environment. Training courses in environmental issues could be offered to teachers already in service, whether their undergraduate degrees are in environmentally based subjects or not. Another aspect of teacher education is simply raising awareness through departmental initiatives and campaigns, not only from the Department of Education, but also from other departments like the Department of Health, the Department of Water and Sanitation, and the Department of Environmental Affairs.

While completing my teaching degree and teaching at several high schools in Pietermaritzburg, I noticed that when it comes to basic education in South Africa, the natural sciences and geography curricula focus more on environmental processes and not on the preservation of the environment. This results in a large number of learners not being aware of the direct and indirect impacts which they themselves impose on the environment and the marine environment in particular. In this regard, the curricula of these environmentally based subjects should pay more attention to managing and protecting the marine environment and the greater environment as a whole. This could be achieved in a number of ways. Firstly, the curriculum

that the learners cover during the school year could be altered to include a more significant emphasis on environmental management rather than simply focusing on environmental processes. However, this would be extremely challenging, considering that the curriculum is dictated by the Department of Basic Education or other curriculum bodies, such as the Independent Education Board. The curriculum in South Africa tends to be inflexible and relatively static and is thus difficult to change. Another way to increase awareness of environmental management is to add small sections based on environmental protection to classroom activities. For example, projects focusing on environmental management, which serve the purpose of developing environmental awareness, can be incorporated into related topics. Another way to increase environmental awareness is through the provision of environmental posters to schools by organisations like Working for Water Programme administered by the Department of Environmental Affairs. The Department of Health also provides information and posters about water and health, and the Department of Water Affairs runs campaigns in schools to emphasise the importance of clean water. Another strategy is to start environmental education at a younger age. The younger learners are still at a stage where they can be moulded into who they will become. Targeted environmental education could develop them into a generation whose habits are changed due to their knowledge of environmental processes and the negative impacts that come as a result of human beings. It is essential to empower learners in schools through the provision of the necessary knowledge and skills, so that they will be able to address the environmental processes and issues that negatively affect their own environment. Through providing environmental education to a more significant degree in schools, the learners will become custodians of the environment that they live in, thus promoting a sustainably oriented society in the near future.

6.2.1.2- Excursions

Another recommendation within the education system could be to include a variety of environmentally based excursions, in which the learners enter the natural environment to observe its processes and the impacts that are imposed on it. When planning and conducting field trips, the teacher must prepare their students with adequate coursework and knowledge pertaining to what they will be experiencing. Along with this, the teacher must engage the students during their excursions by asking open-ended questions which promote critical thinking, enabling them to analyse and explore the environment that they are studying. Failure to do so can result in the learners not achieving the goals set out for the excursion. It is noted

by Behrendt and Franklin that "Students who directly participate during a field experience generate a more positive attitude about the subject" (Behrendt and Franklin, 2014: 235), highlighting the importance of fieldwork in schooling. This importance can be linked to the fact that the learners experiencing the environment during their excursions will develop a "personally relevant meaning" (Behrendt and Franklin, 2014: 235) and connection to the environment, allowing them to learn from and apply their knowledge from the experience that they have undergone. This connection allows the learners to reflect on what they have seen and make informed decisions to guide their future actions within the environment, through their understanding of its importance and vulnerability. When it comes to planning field trips around the marine environment, schools could make use of excursions such as beach clean-ups and 'mini-SASS' studies. This low-tech activity looks at the health of rivers based on the organisms found within the river system, allowing the learners to analyse its overall health and educating them about the findings of their work on rivers. These excursions could play a pivotal role in the development of environmental awareness amongst the younger section of the population, which could lead to an "increasing passion for the subject matter, no matter whether it concerns the environment, animals, or a social situation" (Behrendt and Franklin, 2014: 238). Through the development of this passion for the environment through field trips, the learners become active participants who engage in the protection of the marine environment through direct intervention, or by influencing those individuals who interact with them in their home lives.

6.2.1.3- Development of Educational Centres

Apart from the schooling system, environmental education still needs to be provided to the communities at large, for it is here where the majority of the individuals who negatively impact the environment are found. It is noted by Gough that "education is critical for promoting sustainable development and improving the capacity of the people to address and development issues (Gough, 2017: 2). Whilst it is known that agencies such as the Sharks Board, Wildlife and Environmental Society of Southern Africa (WESSA), Sanparks, and the Oceanographic Research Institute (ORI) all provide educational training in the metropolitan and protected areas for both schools and communities, the less privileged sections of the population, many of whom live in remote rural areas and settlements located along the less densely portion of the coastline, receive little to no service relating to environmental education. Here lies an issue, as it is these communities that often contribute significantly to the pollution of rivers and, consequently, the addition of these pollutants into the marine environment. My

recommendation for this is the development of public-private partnerships (PPP), with the aim of developing education centres to provide environmental education to the communities that are more remote, and do not have access to adequate environmental education. PPPs are partnerships between private organisations and the municipal or national government, in which the government provides funds for a private organisation to develop and run its project for a set period of time. The facilities which are constructed through these partnerships are then transferred over to the government for their use, once the project has run its course. In the context of environmental protection, public-private partnerships refer to the coming together of public, business, and governmental interests based on a long-term strategy aimed at reducing adverse environmental effects, or making up for these in accordance with the social and ecological needs of the entities involved, as well as the requirements of a shared objective to maintain ecological security and sustainable development.

It is through these partnerships that I recommend developing environmental education centres along the KwaZulu-Natal coast, which could serve the purpose of providing education on the marine environment to those communities who are more remote, and do not have access to the current facilities within the metropolitan areas. Through the education of these communities, the possibility of addressing social, economic, and environmental issues can become a reality, as they learn of the importance of the marine environment. They can be made aware of the negative impacts they are imposing on the marine environment, potentially creating an awareness of this fragile environment and kickstarting mechanisms that could drive its protection within their communities. The target of these PPP interventions and provision of marine environmental education would not only be the sections of the population who are generating the most significant negative impact, namely the adult consumers, , they would also cater to the future generations through the education of children and students. The aim of the educational intervention would be for these young people, not only so that they are able to change their ways of living fundamentally, but also so that they can make use of the environment sustainably, as it develops "environmental and ethical awareness, values and attitudes, skills and behaviour consistent with sustainable development, and for public participation in decision making" (Gough, 2017: 2). The aim of these projects should be environmental education that serves the masses, especially those who do not live in developed areas, as it is often these individuals who are unaware of the current issues within the marine environment. They are also often unaware of the impacts that they are causing on the environment through their daily actions. To add to this, it is vital that these PPPs include the

communities in the development of their educational programmes. A top-down approach to educational programmes is often counter-productive. By including communities in the design, the educational programmes that are developed could be moulded to different regions' traditional views through the use of traditional and indigenous knowledge pertaining to environmental education. Furthermore, by involving the local communities, the PPPs will develop a sense of empowerment within the communities, as they are the ones who are partly responsible for the protection and preservation of the environments in which they live.

6.2.2- Water Use and Pollution Policies

In South Africa, water is a resource which is scarce for a large section of the population, as they do not have access to clean water sources for consumption. This is because the services providing this clean water are non-existent in some areas or have been damaged, leaving the water contaminated with bacteria and chemicals that are potentially life-threatening. As mentioned earlier in this paper, South Africa's rivers are widely used by the population. They are polluted to a severe extent whereby chemicals, plastics, and human waste are regularly added into the environment, as a result of poor management processes in the industrial sector and inadequate waste management by local government. This is of particular concern for South Africa as "groundwater provides a major share of drinking water supplies for both human and livestock populations, and also as natural recovery rates from pollution can take many decades" (Parris, 2011: 38), meaning that the effects of water pollution can impact the lives of the population and the state of the environment for a considerable time period, leaving water in a state in which it is not useable.

To prevent the further pollution of water in South Africa, a possible recommendation for the prevention of water pollution is the implementation of water use and pollution policies. The misuse of pesticides in the agricultural sector places immense strain on the environment, as "Estuarine and coastal agricultural nutrient pollution is also an issue in some regions causing algal blooms damaging marine life, including commercial fisheries in coastal waters adjacent" (Parris, 2011: 39). This also disrupts the lives of people who have to make use of polluted resources, as they are unable to make use of the things on which they rely for their survival. This results in the need for water management practices which aim to prevent further pollution of the riverine and marine environments. Worldwide "There is a growing recognition that water policies should be coherent across different scales of decision-making, including from the farm

to water catchment, national and international levels, and also between the different users and uses of water" (Parris, 2011: 43).

Addressing chemical pollution might necessitate more vigorous enforcement of regulations, investment in cleaner production methods, and the promotion of eco-friendly alternatives. When introducing policies and regulations which are set to prevent the pollution of water sources, there is a variety of factors to consider. These factors include the type and amount of pesticides or fertilisers being used, as well as their proximity of use to water sources. There are several such policies which are the following: 'overall input regulations', which pertain to the number of chemicals used, and aim to reduce the chemical load added into the environment; 'Pesticide regulations', which govern the storage of these chemicals and their use in proximity to water sources; and 'Regulations with regard to buffer strips and catch crops', which install a set zone around water sources in which chemicals and farming practices are prohibited, in order to ensure that there is no chemical leaching which occurs, to reduce the likelihood of the water sources becoming contaminated (Parris, 2011: 46). Along with these regulations comes the implementation of taxes and fines which are imposed on farmers to ensure that they adhere to the regulations which are put in place. These are known as environmental taxes and they "are more often applied on the sale of inputs identified as having a potentially adverse impact on the environment" (Parris, 2011: 49). These taxes and fines are used as a deterrent, as farmers are negatively affected by having to pay them to the government, thus forcing them to adhere to the regulations which are in place, preventing the further deterioration of the riverine and marine environments.

6.2.3- Legal Action

The anthropogenic influence within the marine environment that leads to environmental degradation is a worldwide occurrence, and it has been addressed through the implementation of many laws and policies. Some of these maritime laws are found within the South African Constitution, in which the convention of the "prevention of marine pollution from land-based sources" (Bapela, 2016: 13) is found. This convention states that “the contracting parties pledge themselves to take all possible steps to prevent pollution of the sea, by which is meant the introduction by man, directly or indirectly, of substances or energy into the marine environment (including estuaries) resulting in such a deleterious effects as hazards to human health, harm to living resources and to the marine ecosystem” (Bapela, 2016: 13). Along with this is found the

National Environmental Waste Act 58 of 2009, whereby reasonable measures pertaining to ecological degradation are provided in line with sustainable development, through the implementation of "national norms and standards for regulating the management of waste by all spheres of government" (Bapela, 2016: 14), thus managing waste disposal and land use to reduce the amount of pollution and natural resource exploitation by regulating human consumption. These laws and policies set “punishments for non-compliance” (Bapela, 2016: 5). However, it is extremely challenging to regulate the adherence to these laws and regulations. Legal action is a method of preventing the degradation of the marine environment through the implementation of strict rules and regulations, along with permits and licences which enable certain acts of pollution and resource collection to take place. These recommendations do not seek to stop pollution and resource collection, but rather aim to distribute the impacts of these actions through the use of tradable permits and licences. The use of tradable permits in pollution regulation within the environment "can often achieve environmental targets at lower social cost than traditional design and performance standards and environmental taxes" (Parris, 2011: 49). As mentioned here, this is a feasible way to combat the pollution of the marine environment, whether it be that of chemical or plastic addition. The implementation of laws can also contribute directly to reducing illegal fishing practices, as there are strict regulations that must be adhered to, and if they are contravened, there are penalties that the fishermen are required to pay.

It is important to note that legal action does not entail that the pollution of the marine and riverine environments will not still occur. However, it will probably occur on a smaller scale due to the negative implications imposed on those who degrade the environment. For example, farmers are required to buy pollution permits in order to carry on with their agricultural practices. The use of licencing in pollution and resource collection in the fishing sector allows polluters and resource collectors to conduct their various activities within the environment. However, these activities are heavily regulated by the guidelines that these licences put in place. The issue with the use of licences and permits, is the fact that due to the large number of licences and permits which are issued, "authorities often simply lack the ability to closely monitor each industry for their discharge limits, and offenders get away unpunished" (Kraemer, 2001: 9). One recommendation to mitigate this issue is to implement community-driven monitoring programmes, whereby the public regulates the negative impacts on the environment. This is because regulation will benefit them in the long run, as they will be able to make use of the water sources and resources that are found therein. These community

monitoring programmes can include patrol groups that actively engage with individuals who are making use of the environment, and report back to their local authorities. For example, the checking of fishermen's fishing licenses along the coastline could be done by these community monitoring programmes, along with checking pollution levels within streams and rivers at different points, in order to determine whether or not communities are polluting the riverine environment. Furthermore, when developing environmental legislation and policies, it is advisable for authorities to involve communities in the formulation of new laws and policies. This could promote the well-being of the communities and the marine environment, as these laws can be tailored to protect specific aspects of the marine environment, such as rivers and the ocean itself, whilst ensuring that the local communities are still able to access and sustainably make use of the resources found within this environment.

6.2.4- Community Management Programmes

South Africa's largely rural society and its communities display irregular behavioural patterns, and have created and continue to create a vast array of complex ecological issues, according to Milfont, Schultz and Schumak. As a result of the revolution brought about by ideas arising from the principles of sustainable development and survival issues, attempts to transition to a sustainable future currently face a number of social challenges (Milfont, Schultz, and Schumak, 2018: 1). In order to counteract this instability, community management programmes are effective ways of managing the state of the environment when it comes to the issues of pollution, the overcollection of resources, and environmental damage. This is because "community participation is a consultative empowerment process designed to establish communities as effective decision-making entities" (Harvey and Reed, 2007: 367), and allows community members to "strengthen their involvement in, and understanding of, conservation issues and processes" (Dowsley, 2009: 44), through managing their resources for their own benefit. This is best implemented through a decision-making process based on the collective group's decision rather than an individual's. This is backed by Dowsley, who states that community management programmes "can increase the information available to the co-management decision-making process" (Dowsley, 2009: 44), and this can only be achieved through collaboration between the communities and researchers. Through this communal management of the marine environment, a recommendation for the improvement of environmental conditions is to involve the community in local management issues. This social inclusion allows the entire community to collaborate on the development of solutions for the

environmental issues that arise as a result of anthropogenic influence, through the improvement of environmental policies.

6.2.4.1- Citizen Science

Citizen science is a division of community-based management programmes in which the population is involved in collecting data as 'researchers'. These individuals are responsible for reporting environmental damage to their local authorities, and this research "informs when the system is departing from the desired state, measures the success of management actions, and detects effects of perturbations and disturbances" (Legg and Nagy, 2006: 194). This practice is called upon as there is “concern about the effectiveness of government monitoring” (Conrad and Hilchey, 2011: 274), as there has been a reduction in funding for governmental ecological monitoring. The application of citizen science benefits the social and ecological systems in a number of ways, as it increases “environmental democracy, scientific literacy, social capital, citizens inclusion in local issues, benefits to government, and benefits to ecosystems being monitored” (Conrad and Hilchey, 2011: 280).

As an environmental management strategy, citizen science can be broken up into three main categories. The first is '[1]consultative governance’, in which the governing agency within a region “is asking for information from the public or making decisions and then involving local people” (Conrad and Hilchey, 2011: 274). The second is ‘[2]collaborative governance’, which is a form of governance constructed around the development of a “board or group representing as many facets of the community as possible” (Conrad and Hilchey, 2011: 277). The third and final form is ‘[3]transformative governance' and it is based on the application of the grassroots approach to environmental protection. Through the implementation of community-based government, which gives the community a role in the development of regulations and the management of the marine environment, there is a significant possibility that the trajectory of environmental conditions will improve along the coastline of KwaZulu-Natal.

These methods of managing the environment and its resources are relevant to my findings as they directly help to combat the pollution of the environment at its source. Whether it be the addition of chemicals to rivers as a result of poor agricultural practices, or the removal of fish and other marine organisms from the environment through unsustainable practices, community management programmes address these issues by empowering the communities to become

custodians of their environment. This is because the community are given the power and ability to implement set guidelines to restrict the improper use of the environment, whilst sustainably maximising its use to maintain the supply of goods which are needed for the community's survival. This method of African environmental management is a bottom-up approach that is more applicable to African communities, as it allows them to make use of their traditional knowledge in the decision-making process. Furthermore, it does not impose on their identity. In contrast, a top-down approach would undermine them in decision-making processes, as they would be told how to manage the environment instead of allowing them to adopt practices and make decisions which they believe to be most applicable to the situations in which they find themselves; this, thus, allows them to take control of their development and tailor the environment to their needs.

6.3- Conclusion

In conclusion to this paper, the theory of consequentialism informs the activities that occur within the marine environment as it highlights the negative impacts which are imposed on it. There is a sizeable anthropogenic impact which is imposed on the marine environment as a result of the various processes of pollution, whether it be from: the introduction of plastic; the addition of chemicals directly into the oceans or rivers which lead into them; or the overcollection of marine life and the damage caused to the environment through various fishing practices which dramatically alter the state of the ecosystems that are found within the marine environment. The nature of these activities is harmful as they alter the environment in a manner that seriously threatens the lives of individuals who rely on it for their survival. Firstly, these individuals are unable to attain the necessary resources they require to sustain their livelihoods. Secondly, they are faced with illnesses which stem from the consumption of polluted resources. Thirdly, they are obstructed economically as the revenue that they once attained through the sale of resources and the 'sale' of the environment through tourism, is no longer enough to sustain their livelihoods due to the poor condition of the marine environment.

This study sought to ethically evaluate the anthropogenic activities which impact the marine environment, through the ethical lens of consequentialism. In doing so I posed three main sub-questions and one overarching main question, which were all analysed.

The first of these questions was, 'What is the nature of the anthropogenic activities in the marine environment?', and I aimed to answer this by looking at the human activities which take place in and around the marine environment, and whether they negatively impact it or not. Through these findings, it was evident that many human activities in current society are often destructive and immoral by nature, as this societal model is driven by the consumption and destruction of the marine environment. These damaging drivers are a result of a high demand for resources and services, which are needed to manage the rate at which the population is growing within the country.

The second of these questions was, 'How can the ethical theory of consequentialism inform the activities in the marine environment?' I answered this question by looking at the consequences of these anthropogenic activities in Chapter 5, making references to the environmental impacts that arose as a result of the actions that I presented in my case studies. This allowed me to look at the various environmental issues which are divided into: chemical pollution, stemming from industrial and agricultural processes; plastic pollution, which arises as a result of poor waste management; and fishing on a commercial, local, and subsistence level. Through isolating these issues, I was able to ethically analyse them from both an environmental and social perspective, based on the consequences that arise as a direct result of these actions that cause degradation. In relation to these, the theory of consequentialism promotes a proactive viewpoint on marine environmental management, by the results of anthropogenic activities. It emphasises how crucial it is to take into account the wide-ranging and long-term effects of human activity on the marine environment, in order to preserve its resilience, productivity, and health for coming generations.

The third question was, 'What interactive measures can be put in place to improve how anthropogenic interactions are conducted potentially?' In answering this question, I provided a number of recommendations that can be implemented to deter the degradation of the marine environment. These recommendations include:

6.3.1 - Education and Awareness:

- Tailored Environmental Education: By customising education programmes to incorporate African ideologies and indigenous knowledge systems, these initiatives can ensure that communities are engaged and empowered to become stewards of their

environment. This approach fosters a deeper understanding and appreciation for nature, encouraging sustainable practices.

- Curriculum Changes: Integrating environmental education into school curricula and teacher training enhances awareness from a young age, shaping responsible attitudes and behaviours towards the environment.
- Excursions and Educational Centres: Direct experiences in nature through excursions and the establishment of educational centres in underprivileged areas could help create personal connections with the environment. These initiatives can instil a sense of responsibility and encourage proactive involvement in environmental preservation.

6.3.2 - Policy Implementation:

- Water Use and Pollution Policies: Regulating agricultural chemical usage through policies and tradable permits helps prevent water contamination. Implementing fines and taxes for non-compliance can act as deterrents, encouraging adherence to regulations.
- Legal Action: Enforcing laws and regulations against overfishing, illegal fishing, and pollution can significantly reduce harmful practices. Community involvement in policy formulation ensures that regulations align with local needs and realities.

6.3.3 - Community Engagement and Management:

- Public-Private Partnerships: Establishing educational centres in remote areas through partnerships promotes environmental education where it is most needed. This empowers communities to understand and address their impact on the environment.
- Community Management Programmes: Engaging communities through citizen science and participatory governance fosters a sense of ownership and responsibility. Community-driven monitoring and management initiatives ensure that decisions align with local needs while addressing environmental concerns.

Finally, the fourth and main question that I posed was, 'How does the presence of anthropogenic activities impact the marine environment on the coastline of KwaZulu-Natal?' In answering this, the sub-questions were used to guide the study, as there are a large number of impacts which arose as a result of anthropogenic influence within the marine environment. Anthropogenic activities have a significant impact on the marine environment along the

coastline of KwaZulu-Natal, and these impacts are a direct result of pollution, overfishing and illegal fishing practices, and habitat destruction.

6.3.4 - Pollution:

- Industrial Waste: This kind of waste is discharged from industries along the coastline and often contains chemicals, heavy metals, and pollutants that enter the marine ecosystem, affecting water quality and harming marine life.
- Agricultural Runoff: Pesticides, fertilisers, and sediments from agricultural lands can wash into rivers and ultimately reach the ocean, causing nutrient imbalances and harmful algal blooms.
- Marine Debris: Plastic pollution from improper waste disposal, littering, and inadequate waste management practices leads to the accumulation of debris in coastal waters, endangering marine life through ingestion and entanglement.

6.3.5 - Overfishing and Illegal Fishing:

- Overexploitation: Overfishing depletes fish populations, disrupting the balance of marine ecosystems and impacting the food chain. Illegal and unsustainable fishing practices exacerbate this problem, leading to a decline in biodiversity.

6.3.6 - Habitat Destruction:

- Coastal Development: Urbanisation and coastal infrastructure development can result in habitat loss for marine species, disrupting ecosystems such as mangroves, estuaries, and coral reefs.

These anthropogenic activities collectively contribute to the degradation of the marine environment in KwaZulu-Natal, impacting biodiversity, water quality, ecosystem balance, and overall ecological health along the coastline. The recommended efforts to mitigate these impacts involve stricter regulations, sustainable practices, community involvement, and educational initiatives aimed at preserving marine ecosystems and biodiversity.

The implementation of these recommended strategies towards the improvement of the marine environment allows the communities and individuals within them to assess the consequences of their actions based on their outcomes. Here, it is crucial to evaluate the severity of each environmental issue's consequences. For instance, the long-term impact of chemical pollution

on biodiversity, the persistent nature of plastics affecting food webs, or the ecological disruptions caused by overfishing need comprehensive scrutiny. A consequentialist approach towards environmental management prompts the consideration of the long-term implications of our actions. Strategies to combat these issues might involve implementing policies that not only address immediate problems, but also aim for sustained environmental restoration and preservation. For instance, investing in eco-friendly alternatives to chemicals or establishing protected marine areas to restore ecosystems would make a significant impact. Consequentialism emphasises maximising overall well-being for all people as well as the environment. Solutions should aim to protect the health of marine ecosystems, ensure the livelihoods of communities relying on these environments, and safeguard resources. This might entail promoting sustainable fishing practices, reducing plastic use, and implementing clean-up initiatives. Finally, consequentialism calls for responsible decision-making by considering broader impacts. This means adopting policies and practices that not only mitigate current issues but also prevent future harm. For instance, stringent regulations on chemical use, awareness campaigns to reduce plastic consumption, or supporting alternative livelihoods for communities reliant on fishing should all be considered.

Through this analysis, it is evident that at the current rate of pollution and consumption, the environment is steadily approaching a point where it will be unable to provide for those individuals who rely on it. This is because its condition will be degraded to a point where it is unable to naturally recover from this human influence. This will require human intervention to prevent further damage and maintain the little integrity that it still possesses. Fortunately, there are interactive measures that can be implemented to improve the current state of the environment and how it is used by humans. These interactive measures include aspects such as environmental education, the implementation of policies and legal frameworks, and communal management strategies, which can all positively contribute towards the prevention of further degradation and the sustainable use of the resources which are still present within the system. These methods, if used correctly, will allow the marine environment to recover slowly and transition back into one which is flourishing with organisms that are healthy to consume. Ultimately, the end goal in the use of the environment is to achieve sustainability within the interactions that take place between humans and the marine environment, as it is an environment which provides a large number of resources and ecosystem services that contribute towards the well-being of the entire human population. Through achieving sustainability, both entities, namely human beings and the marine environment, will be able to

co-exist, whilst ensuring that both prosper by ensuring that life is preserved on both fronts. In essence, a consequentialist ethical approach demands a comprehensive and inclusive strategy that takes into account the diverse consequences of human activities on marine environments. It necessitates a proactive, multifaceted, and collaborative approach to ensure a sustainable future for both ecosystems and communities reliant on these vital natural resources.

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UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

Mr Kevin Mark Avery (216051250)
School Of Rel Phil & Classics
Pietermaritzburg

Dear Mr Kevin Mark Avery,

Original application number: 00022667
Project title: The effects of anthropogenic activities on the marine environment, along the coastline of Kwa-Zulu Natal, an ethical critique.

Exemption from Ethics Review

In response to your application received on , your school has indicated that the protocol has been granted **EXEMPTION FROM ETHICS REVIEW.**

Any alteration/s to the exempted research protocol, e.g., Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through an amendment/modification prior to its implementation. The original exemption number must be cited.

For any changes that could result in potential risk, an ethics application including the proposed amendments must be submitted to the relevant UKZN Research Ethics Committee. The original exemption number must be cited.

In case you have further queries, please quote the above reference number.

PLEASE NOTE:
Research data should be securely stored in the discipline/department for a period of 5 years.

I take this opportunity of wishing you everything of the best with your study.

Yours sincerely

[redacted]

Prof Herbert Moyo
Academic Leader Research
School Of Rel Phil & Classics