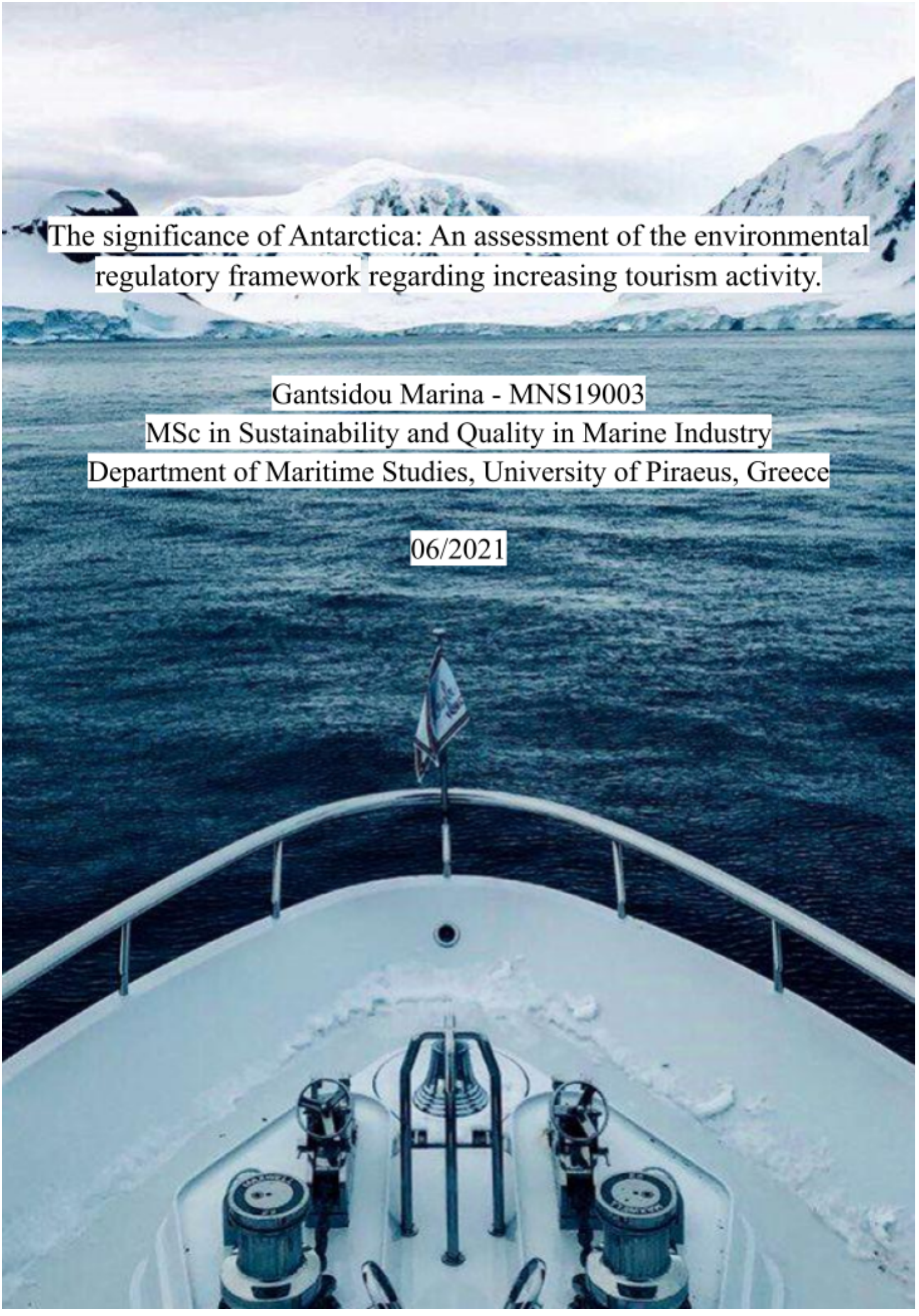

The significance of Antarctica: An assessment of the environmental regulatory framework regarding increasing tourism activity.

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ABSTRACT

It is a fact over the past years, the considerable increase of tourism activities has become a big issue of growing concern. While the majority of tourists in Antarctica travel on ships that carry large numbers of passengers, an increased number of travelers decide to visit Antarctica as individual tourists, in smaller groups. This non-stop growing demand for activity-based tourism and new activities such as kayaking, snowboarding, climbing, or scuba diving are starting to attract the attention of more and more travelers. This study analyzes the legal framework in places such as the Antarctic System (ATS) that was signed by several States and establishes this region as an international area dedicated to research and science. Tourism in Antarctica is a well-established and profitable industry, however, this increased activity in Antarctica could endanger the fragile environment in the case of a catastrophic maritime accident. This research examines the regulatory framework relating to the environmental protection of Antarctica by evaluating past accidents and at the same time factorizing the increasing presence of cruise ships in this pristine polar area. In order to succeed this, it is crucial to understand how this activity is regulated, what are the factors that jeopardize the environment, which are the instruments created by IMO and private parties to deal with this issue, and finally, assess if these regulations are enough to ensure safe operations. A thorough literature review regarding the extended regulatory framework (IAATO, Antarctic Treaty) was conducted. In addition, examining the level of conformity of the operators and the effectiveness of the inspection realized by member States of the ATS was included. The results indicate that the regulations have a positive impact on the operation ensuring best practices in order to protect the environment, although, certain incidents demonstrate the need to enhance safe operations in the continent. The issue of manning levels is clearly standing out as an issue of further investigation in order to safely and effectively conduct high manning levels operation in this hostile environment, with very adverse weather conditions.

Keywords: Antarctica. Sovereignty. Regional international society. Governance. ATCP. EIA. IAATO. Antarctic tourism. Tourism evolution. Antarctic Treaty. CoronaVirus..

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To my mother,

INTRODUCTION

Antarctica is the only continent on earth without an indigenous population, belongs to no one but is valuable to all. It has intrinsic importance for many unique species as a pristine wilderness that provides an environment. Due to its status as a large continent with marine water around the southern hemisphere, it has a profound impact on Earth's climate and ocean systems. It is therefore useful as a climate regulator, a tourist destination, a potential reserve of mineral resources, and a natural science laboratory. The continent has been a place of scientific exploration since the first explorers set foot on it a little over a century ago, with the benefits of Antarctic science extending well beyond the Southern Ocean's borders.

With extensive international research currently carried out on the Continent, researchers and tour operators in the Antarctic should understand how their values for the Antarctic differ. For effective communication strategies, such as setting out the message to inspire action, the identification of differences or strong congruence within these values is especially important. The creative aspect of this thesis is a practical piece of science communication that aims to communicate intrinsically valuable aspects of Antarctica.

In the present thesis the values are attributed by Antarctic scientists - from those who have conducted postgraduate or higher level research in the Antarctic to tour operators who have not conducted extensive research in the Antarctic.

Human impacts on the Antarctic have been measured for the first time with the advent of the first colonial expeditions Harvesting of seals, whales, and penguins lead to near extinction. The end of the 19th and early 20th centuries, also known as the “The Heroic Age of Exploration,”brought with it the establishment of the first Antarctic outposts and a trail of environmental wreckage (Blanchette et al. 2004). Over the course of the World Geophysical Year of 1957–58, and since then, human actions have intensified. Nowadays, users include industrial, science and private scholars, but adventurers as well. Regardless of the practice, life in Antarctica is dependent on fossil fuels and imported resources, but occurs in close contact with flora and fauna.

The research objective is to carry out and analyze answers for the perceived importance of Antarctica worldwide and how the assessment of the environmental framework can regulate the increasing tourism activity. Additionally, expands on this theme by highlighting the opportunities and challenges associated with effective science-policy communication in the context of Antarctic environmental protection.

This paper focuses on the relationships between Antarctic scientists and SCAR (Scientific Committee on Antarctic Research), as well as the development of policy by the ATCM and CEP (Committee for Environmental Protection) to advance the Protocol's objectives, although many of the principles discussed are likely to be applicable broadly. SCAR has also collaborated with the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR). CCAMLR is currently discussing additional ways for the Scientific Committee for the Conservation of Antarctic Marine Living Resources (SC-CAMLR) and CCAMLR to leverage policy-ready research outcomes made available through SCAR. SCAR input has previously been given primarily through submissions to SC-CAMLR. In recent years, increased cooperation between the CEP and SC-CAMLR, including two collaborative seminars (e.g., Grant and Penhale, 2016), has established many mutually advantageous topics and a suite of common scientific needs. The CEP and SC-CAMLR also agree that a closer partnership with SCAR would allow them to better understand and resolve the consequences of climate change for the security and survival of the Antarctic area (ATS, 2016; Constable, 2016; SCCAMLR, 2016).

Although not anticipated to grow to a large scale, and a policy area that first appeared on the agendas of Antarctic Treaty Consultative Meetings (ATCMs) seven years after the Antarctic Treaty was signed in 1959, Antarctic tourism has become a litmus test for the Antarctic Treaty Consultative Parties (ATCPs) in terms of their commitment to the Antarctic Treaty. The fundamental issues confronting ATCPs as they attempt to develop policy instruments for Antarctic tourism are structural and process-related, and include Antarctica's non-sovereign status, the consensus decision-making process at ATCMs, and tensions between the parties' national and common interests on the continent. These are significant issues to address, and the consultative parties have come under fire for putting tourism on hold in deference to the possibility that addressing these issues would put an undue strain on the Antarctic Treaty System's cooperative inter-governmental relationships (ATS). However, ATCPs must address these issues or risk jeopardizing the ATS's viability and legitimacy, as well as their own position within it. Antarctica appears to be an unlikely tourist destination. Its extreme conditions and status as the world's coldest, highest, windiest, driest, and most remote location precluded an indigenous population, making it one of the world's last unexplored areas (Smith 1994; Stonehouse and Snyder 2010). Even today, daily life in Antarctica is difficult and dangerous. Neither is the journey to the white

continent straightforward. This is exemplified by the high number of maritime accidents involving cruise ships in the Southern Ocean and Antarctic waters over the last decade (Klein 2010; Liggett and others 2010), with three serious accidents occurring in a single eighteen-month period. Nonetheless, tourism has developed into Antarctica's primary commercial activity (Liggett, and others 2011). Tourism has grown rapidly in recent years (IAATO 2011).

We used recent and academic literature, as well as the scientific papers presented at Antarctic tourism conferences over the last decade in this report. material was culled from such disciplines as ecology, geography, environmental science, and law as well as it related to longer term challenges for Antarctic tourism considerations (IAATO). The documentation can be found on the website of the Secretariat of the Antarctic Treaty (SAT 2011). Different methods of social and environmental sciences, including literature and paper analysis, interviews, analysis, and compilation of participatory scenarios and emission inventory. The research projects led to various publications which present an inclusive, future-oriented tourism development and regulation approach, including analysis of individual challenges, including the development of human risks and contingency planning (Lamers etc. 2007), the effects on the global environment and their implications (Lamers et al. 2007), and the analysis of human risks and contingency planning. The selected literature was evaluated for strategic content and subsequently divided into broad categories of strategic and improvement challenges.

As a citizen, our future generations will be significantly impacted by how all components of Antarctica – from ice to living things – respond to climate change, and thus we need to understand their fate in order to adapt and mitigate appropriately in time as a society. The Antarctic is still a largely pristine, humbling and fascinating environment, one of those places to prove what nature can accomplish.

LIST OF ABBREVIATIONS

ACIA: Arctic Climate Impact Assessment
ALE: Antarctic Logistics & Expeditions
AMSA: Arctic Marine Shipping Assessment
AMSP: Arctic Marine Strategic Plan
ANI: Adventure Network International
ASMA: Antarctic Specially Managed Area
ASOC: Antarctic and Southern Ocean Coalition
ATCM: Antarctic Treaty Consultative Meeting
ATECC: Antarctic tourism environmental carrying capacity
ATEF: Antarctic ecological footprint
ATME: Antarctic Treaty Meetings of Experts
ATS: Antarctic Treaty System
CCAMLR: Commission for the Conservation of Antarctic Marine Living Resources
CCE: Critical Environmental Assessment
CEP: Committee of Environmental Protection
COMNAP: Council of Managers of National Antarctic
EIA: Environmental Impact Assessment
ENSO: El Niño Southern Oscillation
GFC: Global Financial Crisis
GHG: Green houses Gases
IAATO: International Association of Antarctica Tour Operators
IEE: Initial Environmental Assessment
IGY: International Geophysical Year
IPCC: Intergovernmental Panel on Climate Change
MEPC: Marine Environment Protection Committee
MSC: Maritime Safety Committee
NAPS: National Antarctic Programmes
PAME: Protection of the Arctic Marine Environment
RF: Radiative Forcing
SCAR: Scientific Committee on Antarctic Research
SOLAS: Safety of Life at Sea
TEEC: Tourism Environmental Carrying capacity
TEF: Tourism Ecological Footprint
WAIS: West Antarctic ice sheet

CHAPTER 1

ANTARCTICA- INTRODUCTORY REMARKS

1.1 Background and context

Antarctica is the fifth-largest of the world's continents in size. Situated in the Antarctic region of the southern hemisphere almost entirely south of the Antarctic Circle, it is, therefore, the planet Earth's Southernmost continent. It reaches 14.2 million square km (5.5 million square miles) and it is covered nearly entirely by a vast ice sheet, approximately 98% of the land. Antarctica is entirely surrounded by the southern ocean and is home to the geographic South Pole (Watt, Lize-Marié van der. 2021).

The word Antarctica which originally means the opposite of the Arctic refers specifically to the continent of Antarctica. Whereas the term Antarctic is used to describe the polar region that includes both Antarctica as well as the various islands of the southern ocean that surrounds it (Watt, Lize-Marié van der. 2021). There are two embayments, the Ross Sea facing the Pacific Ocean and the Weddell Sea the Atlantic. Together they reach towards the southern tip of South America giving the continent a "pear- shape", dividing it into two unequal-size parts (Watt, Lize-Marié van der. 2021).

The Easter part of Antarctica is considerably larger in area than Western Antarctica. These two areas are divided by the Transantarctic Mountains that stretch across the continent for approximately 3,400km (Watt, Lize-Marié van der. 2021). Antarctica is located atop the tectonic plate of the same name, which extends out from the main landmass to underneath the surrounding oceans. Antarctica therefore has its tectonic plate all to itself. During the late Triassic period, 215-175 million years ago, the supercontinent Pangea started to fragment itself forming smaller continents, among them: Gondwana and Laurasia. The first includes today's Antarctica, South America, Madagascar, Africa, Australasia, and the Indian Peninsula which nowadays moved entirely into the northern hemisphere. The latter, referring to Laurasia, includes most of today's northern hemisphere such as Europe, Asia, and North America (Jordan, T. A., Riley, T. R., & Siddoway, C.S. 2020).

Around 140 million years ago, during the Cretaceous period, Africa and South America split from Australasia, India, and Antarctica. It was then when the first flowering plants made an appearance. The climate was warmer, the sea level was higher and dinosaurs were wandering the Earth. Some years after, around 90 to 100 million years ago, Australia and Antarctica had just separated, India was moving north and Africa and Madagascar had split. When the Tertiary period came, around 65 million years ago, dinosaurs became extinct. Mammals and widespread rainforest thrived on Earth 50 million years ago, and approximately 10 million years later, the continents were located at their present-day position (Tang, Carol Marie, 2019).

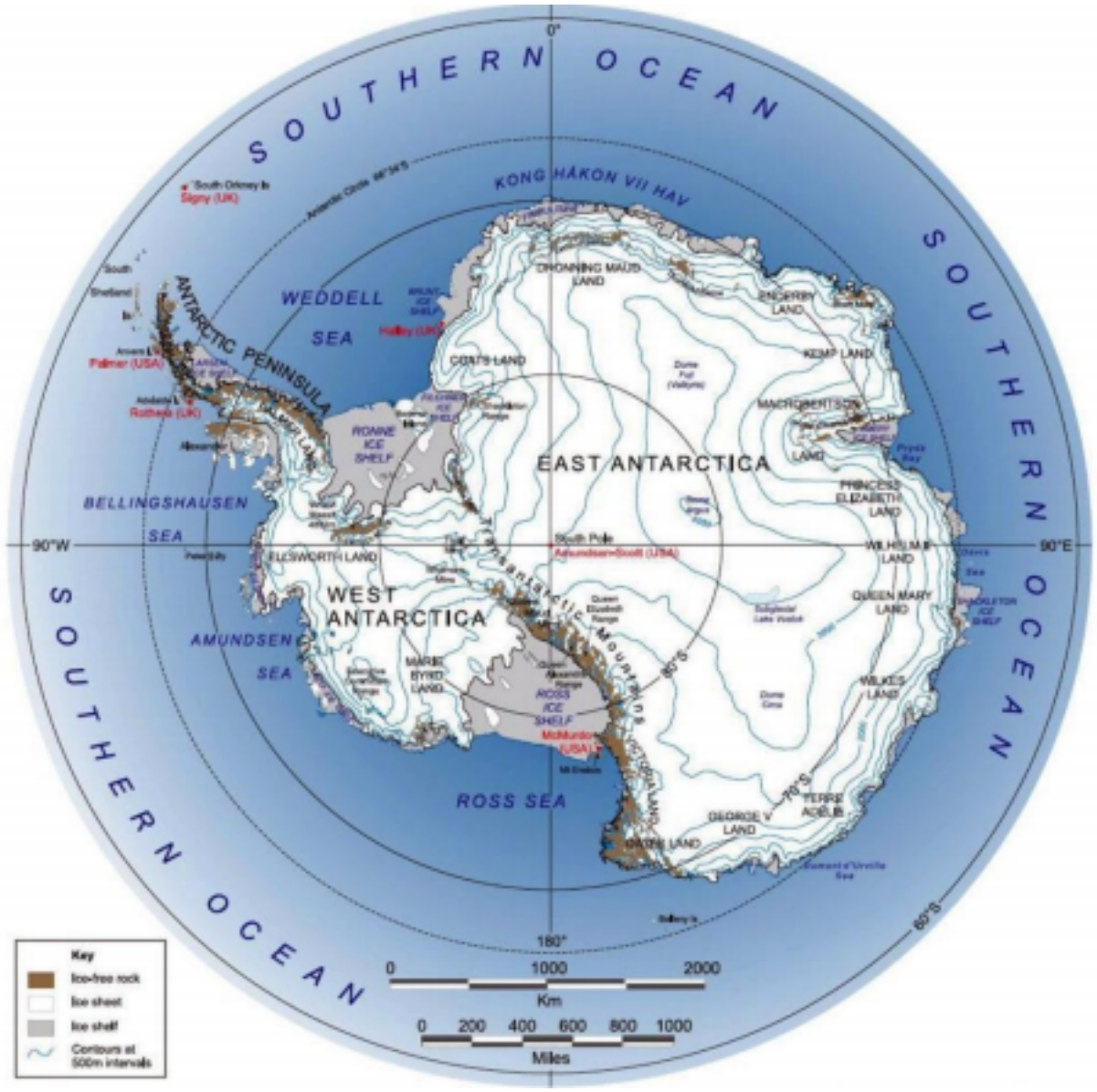

Fig. 1 Antarctic Region

This map shows the major geographical features on the Antarctic continent and the USA and UK research stations, to accompany the Landsat Image Mosaic of Antarctica (LIMA). For information about LIMA and to access the imagery, go to http://lima.usgs.gov (U.S. Geological Survey, Antarctic Overview Map).

In terms of human history, the continent of Antarctica was in relative geographical obscurity. There have been a variety of myths and speculations, dating back to antiquity, about this Southern land, the possible Terra Australis (Bastias, J., et al. 2019). Due to the fact that many explorers wrongly assumed the non-existence of more Southern landmass, the name Australia was given to Australia, rather than to the actual Southernmost continent on Earth, Antarctica. As a result of its remoteness when compared to other continents, Antarctica was the last major region on earth to be discovered by humans. The first sighting of the continent goes back to the year 1820, when a Russian expedition led by Mikhail Lazarev and Fabian Lee von Bellingshausen, spotted the frozen landmass (Bland, R. L. 2015). Antarctica remained largely neglected for the rest of the 19th century. The very first substantiated and entirely undisputed landing on Antarctica occured 75 years later in 1895. Norwegian explorers Henrik Bull and Carsten Griffin landed at the cape on dare, having traveled to the frozen continent aboard a ship named the “Antarctic”. The first person to reach the South Pole was an elite explorer named Roald Amundsen, arriving on the 14th of December 1911 beating the English explorer Robert Falcon by over a month (John P. Rafferty, et al. 2015). Antarctica has since become as originally established by the Antarctic Treaty in 1959, a political territory over which currently 54 states agreed to share dominion (Shah, R. M., Hashim, R., & Hanifah, N.A. 2012).

1.2 Biodiversity of the Antarctic continent

The absolute prevalence of ice and the low temperatures that prevail, are prohibitive factors for the growth and survival of fauna but especially difficult for flora. For the above reasons, the human establishment is not easily accessible thus making Antarctica the only continent that does not host indigenous people or residents on a permanent basis (Convey P, Peck LS., 2019). There are 800 plant species present in Antarctica, 350 of which are lichens. Despite its slow growth, it is well suited to the Antarctic climate. Besides, there are only a few species such as mosses and field algae on the globe since ice cover of the interior of the continent inhibits the presence of it (Diane Boudreau, et al. 1993). Additionally, various species of yeasts, molds, fungi, and bacteria occur in highly widespread forms throughout the region. The Antarctic sea is rich in plankton plant life, especially near the coast, where nutrient-rich upwelling zones exist (Watt, Lize-Marié van der., 2021). Antarctica's fauna is very diverse in terms of marine life, especially at the bottom of the Antarctic oceans, which are the most diverse on the globe. Due to the thick waters' proclivity to brush towards the ocean surface, phytoplankton and algae flourish. The indigenous land fauna is entirely invertebrates. Heliozoans, rotifers, tardigrades, nematodes, and ciliated protozoans constitute the Antarctic microfauna. Protozoans are the dominant organisms in soil and freshwater ecosystems. The terrestrial macrofauna is entirely composed of arthropods, with some animals feeding on birds and seals (Watt, Lize-Marié van der., 2021).
Numerous animals, such as krills that feed on plankton, as well as a wide diversity of marine mammals in the cold Antarctic oceans, such as humpback, minke, sperm whales, penguins, and Weddell seals, are threatened with extinction as a consequence of climate change. The penguin is perhaps the most well-known species that once existed on this continent. They have also adapted to the frigid temperatures and saline waters of the coast. Their body construction allows them to "jump" across the water in pursuit of food, and the feathers on their wings hold a coating of air, aiding them in preserving their body temperature when swimming in Antarctica's freezing waters. The leopard seal is one of the most vicious hunters of all aquatic animals in Antarctica (Diane Boudreau, et al. 1993). Whales and their cetacean associates, porpoises and dolphins, are present in the world's oceans and seas, from the Arctic to the Antarctic. Numerous species occur near, but not across, the Antarctic Convergence, and are therefore classified as peripheral Antarctic species. Among the toothed whales, or odontocetes, that feed on fish and squid are a few peripheral Antarctic porpoises and dolphins, as well as the pilot whale. The killer whale, sperm whale, and the unusual bottle-nosed, or beaked, whale are more abundant in Antarctic waters. Seven types of baleen, or whalebone, whales even occupy Antarctic seas, subsisting on the abundant krill: the southern right whale, the humpback whale, and four species of rorqual—the blue whale, the fin whale, the sei whale, and the lesser rorqual, or minke. Antarctic and subantarctic seas are home to the pygmy right whale. The killer whale, one of the most intelligent marine mammals, kills in groups and consumes greater prey such as tuna, penguins and other underwater birds, seals, dolphins, and other whales. Behind its name, there have been no confirmed reports of human assaults in the vicinity of Antarctica. Excessive slaughter in the past has wiped out large whale populations, especially the giant blue whale. Blue whales, which were on the verge of extinction, have been covered by international agreement. Sheep, rabbits, sheep, cats, rodents, mice, and humans are mostly foreign mammals that still exist semipermanently in Antarctic and subantarctic areas. The impacts on local habitats are profound, ranging from contamination of station areas by human wastes to deforestation triggered by livestock overgrazing and decimation of bird species by dogs and cats, as well as human-caused loss of whale and fur seal stocks. Despite this, Antarctica is by far the least polluted continent on the planet. It is classified as a special protected area under the Antarctic Convention, and several former human actions have been banned in an effort to conserve the unusual environment's existing ecological structure (Watt, Lize-Marié van der., 2021).
There are about 45 species of birds south of the Antarctic Convergence, but just three—the emperor penguin, the Antarctic petrel, and the South Polar (McCormick's) skua—breed primarily on the continent or surrounding islands. Antarctic coasts are a refuge for massive seabird rookeries due to the lack of mammalian ground predators and the abundant offshore food supplies. Penguins, of the order Sphenisciformes, are symbolic of this polar area, despite their widespread distribution along the Southern Hemisphere's coasts. Just the Adélie and emperor live along the Antarctic coast, out of the 18 living animals. Five other polar animals have ranges that range just as far south as the northern Antarctic Peninsula and subantarctic islands: king, chinstrap, gentoo, rockhopper, and macaroni. The evolution of these flightless birds has been tracked all the way back to the Eocene Period, about 40 million years ago, using fossils uncovered on Seymour Island, near the northern tip of

the Antarctic Peninsula, and a few other locations. According to certain authorities, penguins may share an ancestor with other flightless birds of Antarctica belonging to the order Procellariiformes. Birds of that class, mostly petrels but even a few albatrosses, account for more than half of the breeding species in Antarctica and subantarctic. Cormorants, pintails, gulls, terns, sheathbills, and pipits are also found in the area (Watt, Lize-Marié van der., 2021). Though metabolic adaptability is strong, species diversity can be poor to support the necessary functions. While the Southern Ocean seems to have a tremendous number of microbial biomass and freshwater cyanobacterial mats, they are more restricted than they are in tepid areas. Certain microbial populations may be used as measures of how microbes react to climatic change. The environmental patterns and ancient ecosystems of this continent's dry valleys act as vital analogs for tracking diversity on Mars. Diversitas, the multinational microbial biodiversity project, and BIOTAS (Biological Studies of Terrestrial Antarctic Systems), the Antarctic networks, have regained ecophysiological knowledge in order to better recognize and recognize these unique polar habitats (Watt, Lize-Marié van der., 2021). Humans also had a major impact on the natural ecosystems of a number of Antarctic and subantarctic areas. Alien vascular plant species have been introduced around whaling stations, and many alien microorganisms are undoubtedly present near all Antarctic stations. Increased visitor numbers would have a negative effect on Antarctica's delicate environment (Watt, Lize-Marié van der., 2021).

1.3 Environmental & Climate conditions

Antarctica is the world's driest, coldest, and iciest continent and contains approximately 29 million cubic km of ice which represents almost 90% of the world's ice and 80% of its freshwater. The dispersal of the snow precipitation is highly noted in Antarctica, with several meters of snow falling every year near the coast. The interior part of the continent is only getting an annual snowfall of a few centimeters (John Turner et al. 2009). Due to very low temperatures, the Antarctic environment is the one that drives the atmospheric circulation in the Southern Hemisphere, and hence across the globe. During the long winter, the South Pole reaches almost -58 Celsius but even during the summer, the temperature fluctuates around -26 Celsius. On the coasts, during the long winter, the temperature ranges from -10 Celsius to -30 Celsius, and during the summer hovers around 0 Celsius but it can reach as high as 9 Celsius. In mountainous regions, the temperature is much lower, dropping below -60 Celius during the winter season, and -20 Celsius during the summer season (T.A. Scambos, et al. 2018).

The role of the Antarctic region to the Earth is of crucial importance in its climate processes, since it is an indispensable part in maintaining its energy balance. Namely the relationship between the quantity of the absorbed solar heat by Earth's atmosphere and the quantity of the reflected heat back into space. Ice is a more effective surface than the others such as land or water. The Antarctic ice sheet reflects a huge quantity of solar radiation away from Earth's surface, by maintaining a balance of the heat in the planet's atmosphere. In case the ice sheet reduces considerably in area, there is less radiation reflected to space and the temperatures in the planet inevitably will rise proving the Antarctic ice sheets importance (Noble, T. L., et al. 2020). The cold water surrounding the continent is a key part of the "ocean conveyor belt", a universal system in which water circulates around the Earth. Due to the Antarctic bottom Water (cold water that surrounds Antarctica) more specifically its density, they have the tendency to push against the ocean floor and therefore they are causing warmer waters to rise. The combination of the strength of the upwelling water and the winds of Antarctica is the main cause of the circular motivation of the waters around the entire planet, and without this system, the planets' water of the planet would not circulate in an efficient and balanced manner (Diane Boudreau, et al. 1993).

The Antarctic continent's climate and environment is not only important to describe in order to explain the dynamics of the region, but also due to its much broader implication on a planetary scale. The continent attracts today's team of scientists with various fields and backgrounds who offer answers to many of nowadays' unanswered questions (Noble, T. L., et al. 2020). Meteorologists who study climate patterns, including the ozone hole that hovers over the region, geographers who map the surface of the world's most isolated continent, climatologists who track the history of Earth's climate using ice cores from continents's pristine ice sheet, astronomers who make observations from the interior because it offers an explicit view of space from Earth, marine biologists who study the behavior of seals, whales, and squid, even astrologists who study the possible life outside Earth's atmosphere (Diane Boudreau, et al. 1993).

1.4 Impacts of Climate Change

The polar regions are explicitly sensitive to the effects of climate change, this ecosystem is commonly known as "the canary in the coalmine" in that they show changes long before they can be seen elsewhere in the world (Doney, S. C., 2012). Antarctica is known for some of the last physically undisturbed marine spaces on earth. Early in the 21st century, the Polar region has been undergoing uncommon environmental and developmental alteration.The growing worldwide demand and a high commodity in current years have poised the Antarctic as a considerable contributor to the global economy. Coupled with the increasing presence of the global marine tourism industry, as well as the exploration and extraction of oil, gas, and hard minerals combined with the climate change, have created a complex scenario on the maritime usage of the Antarctic region (Diane Boudreau, et al. 1993).

The possible impacts of these new marine users are unknown but will be surely significant for the Antarctic Indigenous population and the marine environment that is already undergoing outstanding changes (Convey, P., & Peck, L. S. 2019). At the same time, with the globalization of the Arctic, marine access in the Arctic Ocean has been changing in unprecedented ways driven by global climate change such as sea ice historic transformation extent reduction in all seasons and essential reductions in the extent of multi-year ice in the center of Arctic Ocean (Meredith, M., et al. 2019). In Antarctica, a group of NASA scientists has found that due to current climate change, more ice sheets have been formed in some parts of the continent. These patterns create strong winds which are called the “polar vortex”. This causes the temperature in some parts of Antarctica to lower, and although this phenomenon has been building in strength through the last decade, there are many other parts that, due to the current situation, are experiencing ice melting (Holger Schmithüsen, 2015). Antarctica holds the temperature record of the coldest continent on Earth with an annual average -50 °C below, especially in East Antarctica. The continental character of the Antarctic climate, and the advancement of the enormous areas are the two main reasons, besides its location, why the temperature in this continent is extremely low (Lesley Mackintosh, 2001). The IPCC submits the most extensive reports on international climate change. Some reports corroborate the anthropogenic impact on the Earth’s climate and state that anthropogenic emissions of carbon dioxide are the main causes for the climatic change in our planet’s climate since 1750. (Meredith, M., et al. 2019). In the annual average temperature, the polar regions are very sensitive to small rises and the annual air temperature of the Antarctic Peninsula has increased by nearly 3°C in the region over the last 50 years. This is approximately 10 times faster than the average in the rest of the world. The temperature of Western Antarctica, the region attached to the Peninsula that stretches to the Transantarctic Mountains, has also risen by a comparable amount. On the other hand, the temperature of Eastern Antarctica, the region on the other side of the Transantarctic Mountains, has risen by a much smaller amount or it has remained stable as of 2009 (Wannamaker, P., 2017).

Rising temperatures as an effect of Global Warming, cause ice shelves to break up and as they are floating it may cause the glaciers behind them to speed up their flow-rate considerably and they will sum up to the sea level rise in case they will melt. Moreover, the temperature of Antarctica as a whole is predicted to rise by a small amount over the next 50 years.That means that any increase in the rate of ice melting is expected to be at least partly offset by increased snowfall as a result of Global warming which is happening more quickly in some parts of the world than others.

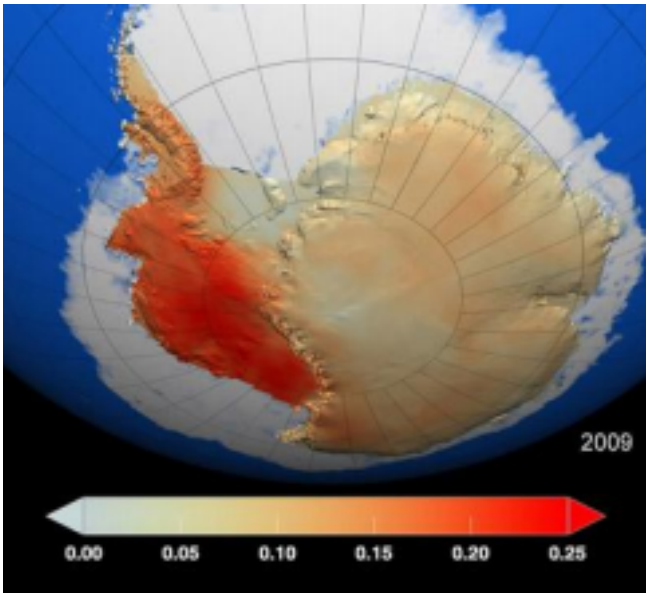

Fig.2 This map shows the temperature change in Antarctica per decade from 1957-2008, NASA,2009.

It is very important to mention that the seasonal sea-ice that forms in the winter and disappears in the summer, in the region of Antarctica and the Arctic are both changing in different directions. For example, in the Antarctic sea ice trend, between the years 1979-2015, the average increase was approximately 4.1% per decade while in the Arctic sea ice trend, between the years 1981-2015 the average decrease was approximately 2.4% per decade (Yamanouchi, T., & Takata, K. 2020).

Sea ice can concentrate and dissolve much more rapidly than much thicker glaciers and ice sheets since the average thickness in Antarctica is approximately 1m, whereas the average thickness in the Arctic is approximately 2m. Which is why Arctic sea ice is more likely to survive longer than a year and therefore thicken, while Antarctic sea ice is more likely to melt within a year (Lemke, P., et al. 2007).

The area of Antarctica doubles about two times each winter due to the formation of sea ice. While the area of Arctic sea ice in April 2015 was the second-lowest ever measured, the area of Antarctic sea ice in the same period was the highest ever measured by satellite. The explanation behind this complex behavior is based on the different ways to change the climate. It may seem intuitive that warmer temperatures mean less ice in Antarctica and not more, in part by the effect of the ozone hole that forms annually over Antarctica. The depletion of the ozone hole has brought out an overall cooling trend on the Antarctic continent which has masked the effects of warming temperatures at a local level, especially on the larger part of East Antarctica and areas away from the peninsula region. Furthermore, it has also led to increased winds and storms, both frequency and strength, estimated to have increased by 15-20% (Bandoro, J., et al. 2014).

This particular low pressure takes cold air from the interior of Antarctica and across the Ross Sea leading to a great rise in the amount of sea-ice forming in this area in recent years. It has resulted in the re-formation of a low pressure environment in the Amundsen Sea, this time with greater frequency and intensity. This low pressure system draws cold air from the interior of Antarctica and from the Ross Sea, resulting in a significant rise in the amount of sea ice forming in this region in recent years. This has been compounded by cool fresh melt water from the Pine Island glacier, which is less thick than the surrounding seawater and therefore freezes more quickly than seawater owing to its lower salt content. As a consequence of the increased frequency of cold storms and the increased ability of surface seawater to freeze, more sea ice forms. Additionally to these causes, the El Nino Southern Oscillation complicates matters by resulting in significant annual variations in sea ice formation.

Although the negative effects due to climate change are discussed often, the Antarctic region is comparatively neglected or misleadingly reported. Science has made it clear for us. Climate change is already negatively impacting Antarctica. The part of the West Antarctic Peninsula is one the fastest warming areas on Earth, and since Antarctica is a big continent, climate change is not impacting it in a uniform way. For instance, some areas

are experiencing increases in sea ice extent. But for the most part the sea ice is decreasing, and measurable impacts on the wildlife have been observed. The Antarctic and Southern Ocean Coalition (ASOC) underlines the importance of understanding the climate change impacts in Antarctica as a matter of urgency for the world and the continent itself. The greatest threat to the inhabited world comes from the West Antarctic ice sheet (WAIS), and so may have the potential for rapid shrinkage (Convey, P., & Peck, L. S. 2019).

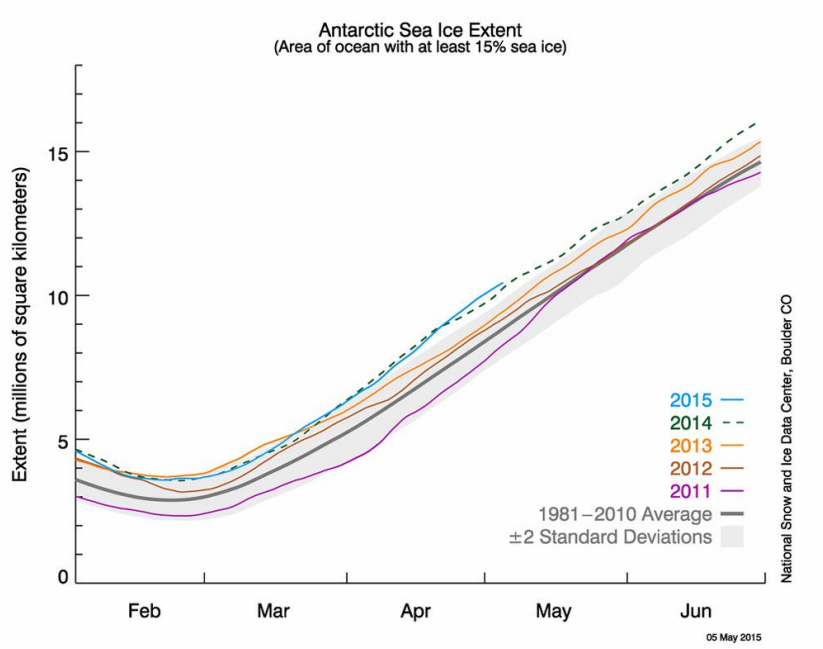

Fig. 3 Antarctic Ice sea Extent
Antarctica's total sea ice depth during the past five years in comparison to the 30-year average.

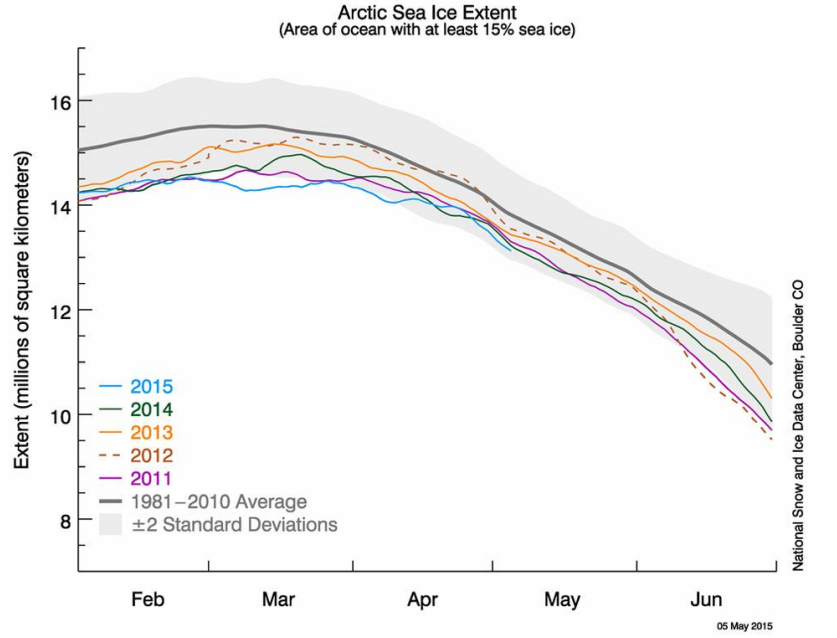

Fig. 4 Arctic Sea Ice Extent
The Arctic's total sea ice depth during the last five years in comparison to the 30-year average

CHAPTER 2

LITERATURE REVIEW

2.1 History of the Antarctic Treaty

There are few areas on Earth where war has never occurred, where the ecosystem is fully secure, and where scientific exploration is prioritized. But there is a continent like that – the territory that the Parties to the Antarctic Treaty name *"[...] a natural reserve, devoted to peace and science"* (The Antarctic Treaty).
This global interest in Antarctica has encountered a number of roadblocks, including extreme weather conditions, altitude, and remoteness. Taking these difficulties into consideration, and in the context of international political and scientific collaboration, a 1959 consensus, the Antarctic Treaty, was established (Diane Boudreau, et al., 2012).
Prior to the Antarctic Treaty's signing, and as developments in technology and intelligence provided for increased access to the globe over the last century, the IGY was the region's first major multinational research program in 1957-1958. By the mid-century, territorial demands had been raised in the area, resulting in conflicts that jeopardized future scientific cooperation. Twelve nations in Antarctica agreed that their legal and political differences would not jeopardize the science program, and as a result of the IGGY's remarkable accomplishment, these nations extended their scientific cooperation in Antarctica indefinitely. Negotiations for such an arrangement quickly began following the IGY (Shusterich, K. M. 1984).
All of the above led the twelve nations to convene in Washington D.C. on December 1st, 1959, to sign the agreement outlining the laws and regulations to be enforced in the Antarctic region. Argentina, Australia, Norway, Belgium, the Union of Soviet Socialist Republics, Chile, the United States of America, France, Japan, and New Zealand were among these countries. This Treaty was a watershed moment in diplomacy, addressing several issues in a novel way, including territorial claims and nuclear weapons. The Treaty is composed of fourteen distinct Articles, each of which will be outlined and addressed in detail on the subsequent sections (Datan, M., & Scheffran, J. 2019).

Article I — Peaceful purposes.
This Article establishes the peaceful use of Antarctica. In other words, the activities engaged in the Antarctic region shall be for peaceful purposes only. It prohibits any measure of military nature (establishment of military bases and fortifications, the carrying out of military maneuvers) as well as the testing of any type of weapon (SAT 2011)

Article II & III — International scientific investigation, freedom and cooperation
These two Articles underline one of the bedrocks of the spirit of this Treaty which is international cooperation for scientific investigation purposes. The freedom of scientific research and collaboration is of the utmost importance, it was initially established during the IGY years. In implementing these Articles, every encouragement shall be given to the establishment of cooperating working relations with those Specialized Agencies of the United Nations and other international organizations having scientific or technical interest in Antarctica (SAT 2011).

Article IV — Territorial sovereignty
The Article establishes that pre-existing rights of Antarctica's territorial integrity will not be renounced. This way, in the event of a possible Treaty termination, certain states retain the rights they had on Antarctic territories previous to the treaty's signature. Additionally, the Article establishes that no new right to territorial jurisdiction in Antarctica, or expansion of an established claim, shall be claimed while the present Treaty remains in effect (SAT 2011).

Article V — Nuclear activity
Any type of nuclear related activities are prohibited in Antarctic territory according to this Article, whether maybe nuclear explosion or radioactive waste disposal. Also states that in the event of the conclusion of international agreements concerning the use of nuclear energy, the regulation established under such agreement shall apply in Antarctica to all of the Contracting Parties (SAT 2011).

Article VI — Geographical coverage
All areas south of latitude 60°S, are within the reach of the Treaty thus establishing Antarctica's territory. This excludes the high seas which come under international law (SAT 2011).

Article VII — Inspections
This Article empowers each Contracting Party to appoint observers to conduct inspections. This would further the Treaty's goals and maintain compliance with its terms. During the inspection, each appointed observer has full access to all or most areas of Antarctica, including all stations, facilities, and equipment within those regions. Additionally, it is allowed access to both boats and aircraft at locations where freight or staff are discharged or embarked. At some point during each of these checks, aerial surveillance can be conducted. All expeditions to and inside Antarctica conducted by a Contracting Party must be reported to the other Contracting Parties. This includes expeditions conducted by its ships or nationals, as well as any military forces or equipment planned to be brought into the area. A notice in advance must be given to approve any project(SAT 2011).

Article VIII — Jurisdiction
This Article concerns the legal jurisdiction regarding the actions of a country’s nationals while in Antarctica. In essence it states that any observers, scientific personnel and members of the staff shall be subject only to the jurisdiction of their Contracting Party if they are nationals. Any accidents that occur while they are in Antarctica, exercising their functions, will fall under the jurisdiction of the Contracting Party (SAT 2011).

Article IX — Treaty meetings.
Refers to the clause requiring annual meetings and reports on scientific, legal, and resource management issues, as well as foreign affairs. Representatives of the Contracting Parties named in the preamble to this Treaty shall convene in the City of Canberra within two months of the Treaty's entry into effect, and at reasonable intervals and locations thereafter, for the purpose of sharing knowledge and advising on issues of mutual concern relating to Antarctica, as well as formulating and enforcing the Treaty. The proposals become effective when all Contracting Parties represented at the meeting are called to consider them and approve them. The findings of the observers referred to in Article VII of this Treaty shall be sent to the representatives of the Contracting Parties holding the relevant meetings. Some or all of the privileges enshrined in this Treaty that are automatically exercisable upon its entry into effect, regardless of whether any measures allowing such exercise have been proposed, considered, or agreed (SAT 2011).

Article X — Activities contrary to Treaty
Observes the commitment to undertake appropriate efforts by Contracting Parties to prevent possible activities that might run contrary to the regulations of the present Treaty (SAT 2011).

Article XI — Disputes between Parties
In case that Contracting Parties cannot find a common ground in a dispute by peaceful negotiation or arbitration, the dispute will go to the International Court of Justice. In case of failure to reach agreement, even through the ICJ, the Parties are not absolved from having the responsibility of continuing to seek to resolve the dispute by any of the various peaceful means (SAT 2011).

Article XII— Modification and duration
This Article states that the Treaty is open to possible modifications and amendments by unanimous agreement of all the Contracting Parties. A notice of ratification of each Contracting Party is required, and in case that ratification is not received within the period of two years from the date of entry into force of the modification to the depositary Government, the Contracting Party that fails to do so, shall be deemed to have withdrawn from the present Treaty on the date of the expiration of such period (SAT 2011).

Article XIII — Ratification and entry into force.
This Article states that the Treatymust be ratified by the signatory states and is available for accession to any State that is a member of the United Nations or to any other State that may be invited to join the Treaty with the agreement of both Contracting Parties. If the Treaty is amended, each state's legal procedures will be changed. The United States of America's Government, as depositary Government, is liable for notifying all signatory states (SAT 2011).

Article XIV — Deposition
The Treaty has been written in several languages “French, English, Russian and Spanish”. Each version is equally authentic and it has been deposited in the documents of the Government of the United States of America which transmits certified copies to the Government of the signatory State (SAT 2011).

2.2 Madrid Protocol of Antarctica

The Treaty Parties introduced a legally binding resolution known as the Protocol on Environmental Protection to the Antarctic Treaty, or the Madrid Protocol, in October 1991, after a conference in Madrid. Additionally, the Antarctic Treaty Secretariat was created in Buenos Aires 2004 in response to the increasing difficulty of Antarctic Treaty meetings and the number of parties. Just seven years after the 1998 Madrid Meeting, the Madrid Protocol on Environmental Protection to the Antarctic Treaty came into effect, designating Antarctica as a natural reserve devoted to peace and research (Shah, R. M., Hashim, R., & Hanifah, N. A. 2012).
The Madrid Protocol is a legal instrument that controls all practices on the continent that could have an environmental effect on its signatories, such as the introduction of non-native animals, the development and maintenance of scientific facilities, and the limitation of human entry to certain regions. It regulates human contact with the flora and fauna of the natural environment. For example, it has directed that all dogs be eradicated from the globe. The Protocol sets strict guidelines for the Antarctic climate and habitats, which are seen as a natural resource devoted to peace and research. The Environmental Protocol sets basic rules for human activities on Antarctica and bans all activities concerning Antarctic mineral resources, with the exception of science study. The Protocol could not be changed until 2048 without the unanimous consent of all Antarctic Treaty Consultative Parties. Additionally, once a legally binding status quo is established, the ban on mineral resource operations cannot be removed (Shah, R. M., Hashim, R., & Hanifah, N. A. 2012).
The fourth International Polar Year (2007–2008) reinvigorated interest in the Earth's polar regions and their position in the global system. It culminated in expanded spending on Antarctic science, facilities, and services, as well as a broadening of the reach of Antarctic experimental programs with the aim of better understanding global environmental change. Unlike previous years, it featured social arts, mathematics, and pharmacy programmes, as well as disciplines such as literature studies, political science, anthropology, heritage studies, archaeology, and ethnology. When the Madrid Protocol was extended to terrestrial and coastal areas within the Antarctic Treaty Area, it was under the auspices of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) that 24 nations and the European Union negotiated another landmark in Antarctic environmental protection - the declaration of the Ross Sea region marine protected area. Although significantly narrower in scope than the agreement's original proposal, the agreement, which was signed in October 2016 and entered into force in December 2017, (covers 600,000 square miles of the ocean including the Ross Ice Shelf, the Balleny Islands, and the ocean surrounding two seamounts) (Shah, R. M., Hashim, R., & Hanifah, N. A. 2012).

2.3 MARPOL & POLAR CODE

The Polar Code, IMO's International Code for Ships Operating in Polar Waters is obligatory under both the International Convention for the Prevention of Pollution from Ships (MARPOL) and the International Convention for the Safety of Life at Sea (SOLAS). The Polar Code entered into force on 1st January 2017 and covers a great range of construction, design, ship design, construction and equipment, operational training, search and rescue, and environmental protection matters relevant to ship operating and navigating in waters surrounding the two poles. The amendments of the Polar Code and SOLAS were adopted during the 94th session of IMO's Maritime Safety Committee (MSC), in November 2014. Then, the environmental provisions and MARPOL modifications were approved during the 68th session of the Marine Environment Protection Committee (MEPC) in May 2015 (MEPC 68/21/Add.1 Annex 10, page 3).
The Polar Code contains matters that are linked to the protection of the unique environment and the associated ecosystems of the polar region. Includes measures that cover safety, pollution, and prevention and recommendatory provisions for both. This Code requires ships to operate in the defined water of the Antarctic continent that will be obligated to apply for a Polar Ship Certificate, which classifies the vessel as a category A ship - Ship designed for operation in polar waters which will include old ice inclusions. Then, there will be a Category B ship - those vessels that are not included in the first category, and that is designed for operation in polar waters with a minimum thin first-year ice, which may contain old ice inclusions. The third Category refers to Category C - a ship that is designed to operate in open water or in ice conditions less severe than those included in the first two categories A and B (MEPC 68/21/Add.1 Annex 10, page 3).
This Certificate will be followed with an assessment which will include data on identified operational limitations, and procedures or additional safety equipment obligatory to mitigate incidents with possible safety or environmental consequences. It is necessary for all categories of a vessel to carry a Polar Water Operational Manual, in order to provide for the Owner, Operator, Master, and crew sufficient information relevant to the ship's operational capabilities and limitations with the purpose to support their decision-making process. Each chapter of the Polar Code sets out goals to include those covering ship structure (MEPC 68/21/Add.1 Annex 10, page 3).
In 2009, PAME (Protection of the Arctic Marine Environment) announced the Arctic Marine Shipping Assessment (AMSA) which advised that the Arctic states cooperatively support efforts at the IMO to augment global ship safety and pollution prevention conventions with specified Arctic requirements. Additionally, more recent Arctic Council Declarations, including the Iqaluit Declaration in 2015 and the Fairbanks Declaration in 2017 which include similar calls for closer collaboration between the Arctic Council and the IMO on matters of Arctic Shipping remains. PAME has consistently supported the implementation of the Code since 2012 but now that the Code is in force, PAME encourages, even more, the Arctic and the Observers States to continue to work towards a harmonized and effective implementation. Moreover, it is developing a Polar Code information brochure and has created the Arctic Best Practices Information Forum to accommodate the implementation of the Polar Code (A 31/Res.1137 16 January 2020, IMO).
In 2002, at the Council's third Ministerial meeting in Inari, Finland, the ministers acknowledged that the already existing activities that are held in the Antarctic continent, have to be more coordinated and approached with an integrated strategy to confront all the challenges of the Arctic coastal marine environment and that was the reason that they decided to develop a strategic plan for the protection of the Arctic marine environment under leadership by the Protection of the Arctic Marine Environment (PAME) working group. This Arctic Marine Strategic Plan (AMSP) was approved by the Council in 2004. In the plan (AMSP) were outlined four fundamental strategic goals. The reduction and prevention of pollution in the Arctic marine environment was one of the four goals as well as the conservation of the Arctic marine diversity and ecosystem functions. Moreover, the plan had set objectives such as to promote the health and prosperity of all Arctic inhabitants and to advance sustainable Arctic marine resource use. The AMSP addressed the demand for future implementation of an ecosystem approach and called for a comprehensive assessment of Arctic Marine shipping.
In November 2004, the Council gave in public, an important paper named the Arctic Climate Impact Assessment (ACIA). The ACIA found that Antarctica is extremely vulnerable to climate change and due to that phenomenon, the Antarctic continent is experiencing the most rapid and severe change on Earth during the 21st century in many aspects.

The MARPOL Convention was adopted on 2nd November 1973 at IMO. The Protocol of 1978 entered into force as a response to a spate of tanker accidents in 1976-1977. As the MARPOL Convention had not yet been active, the Protocol engaged with the parent Convention. This combined instrument entered into force on the 2nd of October, 1983. The Convention contains regulations that are aiming to prevent and minimize pollution from any type of vessel, such as routine operations and the possible scenario of accidental pollution. There are six Annexes that are currently included in the Protocol.

Annex I: Regulation for the Prevention of Pollution by Oil, which entered into force on 2nd October 1983. This Annex covers the subject of pollution by oil from potential accidents and from operation measures. In 1992, it became obligatory for oil tankers to have double hulls and brought in a new era for existing tankers to be able to fit double hulls, which was later on revised in 2001 and 2003.

Annex II: Regulation for the Control of Pollution by Noxious Liquid Substances in Bulk, which entered into force on 2nd October 1983. This Annex provides a detailed description of the measures and discharge criteria for the control of pollution by harmful liquid substances carried in bulk. The procedure of discharge of the residues is allowed only to reception facilities until certain conditions and concentrations are complied with and are permitted within 12 miles of the nearest land.

Annex III: Prevention of Pollution by Harmful Substances carried by sea in Packaged form, which entered into force on 1st July 1992. Includes general requirements for the issue of detailed standards on marking, packing, labeling, stowage, quantity limitations, exceptions, and notification.

Annex IV: Prevention of Pollution by Sewage from Ships, which entered into force on 27th September 2003. This Annex includes requirements with the purpose to control the pollution of the sea by sewage. It is very important that the discharge of sewage is not allowed into the sea, with the exception when the vessel is discharging comminuted and disinfected sewage using an approved system at a distance of more than three nautical miles from the nearest land. Also, sewage that is not comminuted has to be discharged at a distance of more than 12 nautical miles from the nearest land.

Annex V: Prevention of Pollution by Garbage from Ships, which entered into force on 31st December 1988. This Annex is linked with various types of garbage and specifies the distances from land on which the discharge of sewage should be operated. The most important feature of this Annex is the complete ban that was imposed on the disposal of all forms of plastics into the sea.

Annex VI: Prevention of Air Pollution from Ships, which entered into force on 19th May 2005. This Annex sets restrictions and limits on sulfur oxide and nitrogen oxide emission from vessel exhausts and does not allow deliberate emissions of ozone-depleting substances. The Annex is very strict towards designated emission control areas and sets more stringent standards for SOx, NOx, and particulate matter. This Chapter was adopted in 2011 and covers mandatory operational and technical feature energy efficiency measures aimed at minimizing greenhouse gas emissions from ships (International Convention for the Prevention of Pollution from Ships - MARPOL).

2.4 Regulatory framework of IAATO

On December 1st, 1959, in Washington, scientists who had become acquainted with the Antarctic plateau during the 1957-1958 International Geophysical Year (IGY) took the initiative and formed the Antarctic Treaty. Started on June 23, 1961, by the initial 12 consultative nations: Argentina, Australia, Belgium, France, Chile, Japan, New Zealand, Norway, the Union of South Africa, the Union of Soviet Socialist Republics, the United Kingdom of Great Britain and Northern Ireland, and the United States of America. The Antarctic Treaty already has more than 50 members, since it has been ratified by a large number of other countries. Argentina, Australia, Brazil, Belgium, Bulgaria, Chile, China, Czech Republic, Ecuador, Finland, France, Germany, Italy, India, Japan, Korea (ROK), Netherlands, New Zealand, Peru, Norway, Poland, Russian Federation, Spain, South Africa, Sweden, Ukraine, and Uruguay were among the countries that successfully offered consultative power. Just Russia maintained the former Soviet Union's signatory benefits and authorities. Austria, Belarus, Canada, Colombia, Cuba, Denmark, Estonia, Greece, Guatemala, Hungary, Iceland, Kazakhstan, Korea (DPRK), Malaysia, Monaco, Mongolia, Pakistan, Papua New Guinea, Portugal, Romania, Slovakia, Slovenia, Switzerland, Turkey, and Venezuela succeeded in offering a non-consultative ability. These countries decided to watch and participate in meetings in an observer capacity.
Nowadays Antarctic Treaty nations correspond to the two-thirds worldwide human population. The meetings are taking place almost every year since the treaty entered into force.Each meeting of the ATCM (Antarctic Treaty Consultative Meeting) produces suggestions on the treaty's operational viability. Once the participating governments certify such proposals, they become binding on all treaty parties. Supplementary treaty meetings resulted in an agreement on seal restoration, living resource management, and comprehensive environmental preservation. Additionally, the ATCM's job is to provide expert guidance not just on environmental concerns, but also on tourism-related issues, including a more thorough discussion of how human activity can be managed on this continent. In 2011, the ATCM acquired General Guidelines for Travelers to ensure that no adverse effects on the Antarctic climate occurs. Then, domestic legislation implements the Antarctic Treaty's General Guidelines, and finally, national measures provide authorizing governance for activities in Antarctica for tourists who must obtain prior permission from the applicable qualified authority of each Antarctic Treaty Party. The real objective behind the designation of the Antarctic Treaty is for the Parties to commit themselves to the inclusive protection and conservation of the Antarctic environment and hereby to determine this continent as a natural reserve that will be committed to peace and science.

2.4.1 Mission of IAATO

The main mission of the IAATO is to promote safe and environmentally responsible private-sector travel to Antarctica by operating along with the parameters of the Antarctic Treaty System within the IMO Conventions and relevant international as well as national laws and agreements. Providing a forum for the international travel industry to share their opinion and best practices and creating a crew of ambassadors for the protection of the Antarctic continent, offers the opportunity to experience the continent first-hand. Moreover, the organization patronizes scientific research in Antarctica through cooperation with National Antarctic Programs, together with the scientific support between the private-sector travel and international scientific community in the Antarctic. To ensure the quality of the scientific research the Membership employs the most qualified staff and field personnel through continued training. Also, the organization in order to strive for the mission develops international acceptance of evaluation, certification, and accreditation programs for the personnel.

2.4.2 Environmental Principles of IAATO

It is critical and necessary for the Treaty to establish guidelines for all activities within the Antarctic Treaty area in order to comprehend the global environment. All activities on the continent are aimed at mitigating adverse effects on the Antarctic environment and the rest of the continent's dependent and associated ecosystems. Additionally, activities must avoid adverse effects on weather patterns, water quality, atmospheric equilibrium, marine environments, species abundance (fauna or flora), endangered species or populations, and degradation of areas of scientific, historic, or aesthetic significance. Additionally, the activities that take place on the continent shall be documented in order to allow for prior evaluations and informed perceptions of their potential effects on the environment, associated ecosystems, and the value of Antarctica for scientific research. Decisions must take the scope of each activity into account, including its area, duration, and intensity. Additionally, it is critical to consider the cumulative impacts of each activity occurring within the Antarctic Treaty area, compare them to other activities, and determine whether they will have an effect on other activities. Additionally, the Antarctic Treaty must investigate whether updated technology exists to enable environmentally friendly operations and whether the possibility exists to control these critical environmental parameters in anticipation of any potential adverse effects of this activity. The same holds true for the area outside the Antarctic Treaty, its environment, and the ecosystems that comprise it. All assessments of the effects of ongoing activities, including predicted effects, shall be monitored. All Antarctic Treaty Parties shall work cooperatively to advance educational, technical, and scientific programs with the common goal of protecting the Antarctic continent's environment and associated ecosystems, as well as providing appropriate assistance with environmental impact assessments. Additionally, they are obligated to provide any pertinent information regarding any potential environmental risk and to assist in minimizing any adverse effects on the Antarctic continent's environment or associated ecosystems. Consult with other Antarctic Treaty members regarding the location of future facilities on the continent, in order to avoid possible cumulative impacts in any location and, if necessary, to take necessary actions unanimously agreed upon by the Antarctic Treaty. As a result, all activities relating to mineral resources, in general, are strictly prohibited except for scientific research. Each Party is required to share information that may be beneficial to other Parties in order to plan their activities in the Antarctic Treaty area. Sharing a common vision is the most fundamental principle of the Antarctic Treaty, and as such, the members of the Party shall cooperate to ensure that no activities have a detrimental effect on the Antarctic environment or associated ecosystems within the Antarctic Treaty area.

2.4.3 Committee for Environmental Protection of IAATO

Each part of the IAATO organization is eligible to be a part of the Committee and to assign a representative to be accompanied by advisers and experts. Besides that, the Committee should be open to observer status or any Contracting Party who may not be a member of this Protocol. Furthermore, the President of the Scientific Committee should be invited by the Committee as well as the Chairman of the Scientific Committee to participate as observers at its sessions regarding the conservation and protection of Antarctic Marine Living Resources. With the approval of the Antarctic Treaty Consultative Meeting, any other relevant scientific, technical, and environmental organizations can be involved as observed at its sessions. After each session to the Antarctic Treaty Consultative, the Committee presents a report that covers all matters considered including the views expressed during the session. This report should be circulated to the Parties and to observers that were attending the session and thereupon be made publicly available. Finally, the Committee should adopt its rules of procedure which will be subject to approval by the Antarctic Treaty Consultative Meeting.

The Committee's role should be to make recommendations and advocate for the Parties regarding the Protocol's implementation, as well as to perform other functions. To begin, the Committee should ensure the effectiveness of the measures agreed to in this Protocol, as well as keep abreast of new or improved measures. Keep an eye out for instances where additional measures or Annexes, such as the implementation of environmental impact assessment procedures, are required. Additionally, the Committee's role is to mitigate the environmental impacts of Antarctic activities and to review the procedure for situations requiring immediate action. When it comes to environmental protection, the Committee places a premium on inspection procedures. By collecting, archiving, exchanging, and evaluating inspection reports, the Committee consults with the Scientific Committee on Antarctic Research and other relevant scientific, environmental, and technical organizations to achieve the best possible outcomes for the Antarctic environment and associated ecosystems.

To ensure compliance with the Protocol, each member of the Committee should take appropriate measures within its adequacy. Additionally, should make consistent efforts in accordance with the United Nations Charter to ensure that no one violates the Protocol. Each member of the Committee should bring to the attention of the other members any activity that jeopardizes the Protocol's objectives and principles, as well as any activity undertaken by the State, its agencies, natural or juridical persons, vessels, aircraft, or other mode of transport. To safeguard the Antarctic environment and its dependent ecosystems and to ensure Protocol compliance, Treaty Consultative members regulate inspections individually or collectively. All members should cooperate with observers conducting inspections and ensure that observers have access to all areas of stations, installations, and equipment, among other things. Finally, all members who have signed the Antarctic Treaty's Protocol on Environmental Protection have the opportunity to comment; those reports, along with any comments, should be circulated to all Parties and the Committee, and then made publicly available.

To respond to environmental emergencies, each Committee Party agrees to take effective action if they occur while conducting scientific research, tourism, or any other governmental or non-governmental activity on the Antarctic continent. All Parties should cooperate in the implementation of emergency plans for incidents that could have a negative impact on the Antarctic environment or associated ecosystems. Additionally, all Parties should comply with the recommendations of appropriate international organizations when implementing this Article. The Parties' Annual Reports should include notifications made pursuant to the Articles, such as contingency plans, as well as any other information required by this Protocol in the absence of any other provision governing the circulation and exchange of information. All Reports should be prepared in accordance with these guidelines and distributed to all members and the Committee prior to consideration at the upcoming Antarctic Treaty Consultative Meeting. They should also be made publicly available. If a disagreement arises regarding the interpretation of this Protocol, all Parties should consult with one another in order to resolve it through negotiation, mediation, conciliation, judicial settlement, or any other method agreed upon by the Parties to the dispute. The procedure for resolving a disagreement is not simple. The Arbitral Tribunal lacks jurisdiction over any matter governed by Article IV of the Antarctic Treaty. Additionally, nothing in this Protocol should be construed as conferring authority on the International Court of Justice or any other tribunal established for the purpose of resolving disputes between Parties to decide or rule on any matter falling within the scope of Article IV of the Antarctic Treaty.

Considering the fact that the various territorial claims that existed prior to the treaty's signing are not abrogated by signatory nations, periodic meetings of signatory representatives focused on the conservation of Antarctic fauna and flora, as well as the preservation of historic sites, are necessary to address a variety of issues.

The Antarctic Treaty and its associated agreements are collectively referred to as the Antarctic Treaty System (ATS). It began in 1977 with the accession of Poland, and was followed by the accession of West Germany in 1981, as well as Brazil and India (1983). The treaty included 29 consultative parties (including the original signatories) and 25 non-consultative parties in 2015. The Antarctic Treaty Consultative Meeting (ATCM) was convened for the first time in 1961. Since then, the Antarctic Treaty has evolved into a system comprising a number of components that meet the expectations of managing Antarctic activities while safeguarding national interests. This regime is administered under the auspices of the annual ATCM.

The Antarctic Treaty also included a number of organizations that assist the decision-making forums in their work. The Treaty system encompasses the Consultative Meetings' measures, recommendations, decisions, and resolutions on a wide variety of subjects (protection of the Antarctic environment, scientific harmonized cooperation, conservation of the plants and animals, preservation of historic sites, management of tourism, information exchange, designation and management of protected areas, hydrographic charting, logistic cooperation, communication, and safety).

To accomplish the objectives related to these issues, the Treaty Parties have established specific agreements, and the development of these agreements has enabled the regulation of activities in Antarctica to be implemented with greater precision. Additional legal instruments, such as the Scientific Committee on Antarctic Research (SCAR) and COMNAP, assist the Treaty parties in carrying out their work (Council of Managers of National Antarctic Programs).

The SCAR is responsible for coordinating Antarctic research programs and fostering scientific collaboration. Additionally, is capable of providing expert information on a variety of disciplines and the scientific implications of the Treaty meetings' operational proposals.

The CONMAP is composed of the heads of each of the national Antarctic operating agencies and meets annually to exchange logistical information, to foster cooperation, and to develop advice to the Treaty parties or other practical measures.

Other organizations with which the Antarctic Treaty has developed a close relationship with the environmental community include the International Union for the Conservation of Nature, the United Nations Environment Program Antarctic, and the Southern Ocean Coalition, which is invited as an expert to treaty meetings. At the Treaty meetings, there are bodies composed of technical specialists who contribute to the discussion of the Treaty. The International Association of Antarctic Tour Operators is a trade association that represents the interests of Antarctica's growing tourist industry.

CHAPTER 3

TOURISM ACTIVITY

3.1 Discovery of Antarctica

Unlike the majority of the places that were discovered by other civilizations, the Antarctic has never had a native human population. The main idea of the ice continent was first mooted by ancient Greek philosophers. They acknowledged the existence of the Arctic, which they called Arktos, (the bear), after the constellation of the Great Bear, from sailing voyages records, description and stories. They had proven that the world was a sphere and so postulated that there should be something at the pole opposite to the Arctic to balance the world out. They called this undiscovered landmass Ant-Arktos, meaning “opposite the bear”. The continent of Antarctica thus appeared on world maps for hundreds of years prior to anyone ever approaching it. Large ice continent labeled “Terra Australis”" is shown even though there was no evidence at the time for its existence. In the later 1700s and early 1800s, sealing and whaling voyages would venture ever further south when rounding Cape Horn at the tip of South America. By going further south often meant stronger winds and greater speed, though at grave risk of hitting floating ice of all sizes and of winds and seas that could be fatal not only to the vessel but also to the crew. On the 17th of January 1773, Captain James Cook with the vessel HMS Resolution and HMS Adventure was the first to cross the Antarctic Circle and go into the Ross Sea region where he saw deposits of rock held in icebergs indicating that a more southerly land existed. The first sighting of Antarctica, as mentioned before in another chapter, acknowledged to have taken place in the 28th of January 1820 (the voyage of two Russian ships, the Vostok and Mirnyi) under the command of Captain Fabien Gottlieb von Bellingshausen during a two-year exploratory expedition around the world with the purpose to discover new lands for the Russian Empire. For many years it was thought that Edward Bransfield (Irishman) was the first person to sight the Antarctic continent (instead of the offshore islands) on the 30th of January with the vessel named Williams. The same vessel the previous year under the command of Captain William Smith reported that he discovered the South Shetland Islands and while returning to Chile (Valparaiso), the Captain Shirreff of the British Royal Navy, chartered the ship and decided to return south with the purpose to investigate the area further. The British-American Captain John Davis with the ship named Cecilia was claimed to be the first to land on Antarctica on the 7th February 1821. The challenging part is when specifying when and where exactly happened at the Antarctic continent because, on the Antarctic coast, the islands are temporarily or permanently attached to the mainland by ice of various forms and so it be difficult to tell if all those attempts were standing on an island, the mainland or simply in some form of ice platform over the sea. Another thing about the sealers and whalers hunters was that they were so notoriously secretive about their hunting grounds and they would not be interested in the kudos of becoming the first foot on the “new” continent because they would not want to give away their rivals exactly where they had been hunting for their prey (Paul Ward, 2001).

3.2 A new tourism destination

Tourism in Antarctica dates all the way back to the late nineteenth century. However, commercially organized tourism began in the mid-1960s, when tour operator Lars-Eric Lindblad and a Swedish adventurer chartered an Antarctic liner. In the mid-1970s, commercial airliners from Australia, New Zealand, and Chile started performing sightseeing overflights (Wouter Pierre Hanekom, 2014).
In November 1979, there was a crash of a New Zealand airliner into Mount Erebus on Ross Island, with the loss of all 257 passengers and crew. That was the main reason when tourist overflights lost popularity, however in the 2007-2008 season, some 45.000 tourists visited the continent by cruise ship and other means before their numbers declined markedly following the global financial crisis the following year (Strongman, L., & Young, R. (2011).
The Patriot Hills Base Camp was established in 1987 in Ellsworth Land, and it was the first semi-permanent tourist base, as it was serving as a staging point for inland tourist expeditors. The implementation of the International Maritime Organization's Polar Code in 2017 limited operations by very large cruise vessels and the tourist arrivals rebounded by the 2012-2013 season, but still, the numbers were below pre-crisis numbers. There are plenty of adventurous tourists that have ventured into or across the continental interior by private aircraft or skis. Since then, the Operations have moved to Union Glacier Camp, which is also located in Ellsworth Land. The majority of the tour operators are members of the International Association of Antarctica Tour Operators, which is a self-regulating industry body and contact point with the Antarctic Treaty System (Springer, Dordrecht 2005). The main and strong motivation for polar exploration in the early 1900s was the National and personal prestige in attaining the Earth's poles as well as the territorial acquisition and scientific inquiry. The South magnetic pole, the point of the vertical orientation of a magnetic dip needle was predicted by the German physicist Carl Friedrich Gauss to lie at 66° S, 146° E, inspired the unsuccessful quest, approximately 1840, of the seafarers Charles Wiles of the United States and Ross who has earlier discovered the north magnetic pole (Watt, Lize-Marié van der. 2021).
The South Pole of Earth's rotation was the unattained goal of Shackleton in 1908-1909 but in December 1911, Norwegian explorer Roald Amundsen reached it. After Amundsen and Scott attained the South Pole, the idea that haunted people's minds was the overland crossing of the continent. In 1905, there was a strike with his ship known as "Endurance" and was caught and later crushed in the pack ice of the Weddell Sea. The crew managed to survive and escape to South Georgia via Elephant Island and until nowadays is considered to be one of the most enduring tales of polar heroism. The main idea for a Trans-Antarctic crossing lay dormant for several decades, came to fruition with the British Commonwealth Trans-Antarctic Expedition led by Vivian Fuchs, with Edmund Hillary being the leader of the support team.
Finally, using tracked vehicles and aided by aerials flights, the part left Shackleton Base on Filchner Ice Shelf in November 1957 and by way of the South pole approached the New Zealand Scott Base on Ross Island in March 1958. Regarding the heroic era, it is generally accepted to have finalized with Shackleton's death in 1922 during the Shackleton-Rowett Expedition (Vivian Fuchs, 2021). Through the decades, after the discovery and exploration of Antarctica, this ice continent became a tourism destination. IAATO and ATCPs were the main stakeholder groups involved in the management of Antarctic tourism. In 1991, they were founded by seven tour operators in which IAATO is a self-regulatory tourism industry association with the vision of promoting, advocating, and practicing safe environmentally responsible travel to the Antarctic (Vivian Fuchs, 2021).
Over the last years, the IAATO membership has reached more than 100 companies including all of the main commercial organizers of Antarctic cruise tourism. Moreover, it has been recognized as the key player in managing Antarctic tourism. From 1990 to 2010, the tourism issues have received increasing attention by the ATCPs. The modern era of Antarctic tourism started in the late 1950s and early 1960s with the Argentinian vessel "Les Eclaireurs" taking 100 tourists on two journeys down to the South Shetland Islands and the west coast of the Antarctic Peninsula. The tourism period starts usually from November and March each year and the reason for visiting the white continent in those months is due to the temperature. When temperatures are higher

and sea ice melts enough to allow access to cruise ships. The majority of the tours existing for the Antarctic continent are on a cruise ship and nowadays there are various itineraries from which travelers can choose from. Due to this rapid tourism development, the demand for more unique trips is high and some activities such as kayaking and camping on the ice are nowadays available.

The stunning icescapes, as well as the diverse wildlife and its rich history, are the main things that travelers are driven by. Antarctica's wildlife, extreme climate condition, and isolation from the rest of the world all contribute to its increased popularity over the years. With the introduction of IAATO, there are many regulations regarding tourism activity in Antarctica. It is a fact that practices and standards are being updated in order to ensure the environmental impacts of tourism in Antarctica are minimized and as tourism increases with the same rhythms, its ecological impacts are monitored with the potential to preserve this dramatic wilderness well into the future (Burnham Arlidge, 2015). King George Island and the South Shetlands appear to be well-known areas for land-based development. A recent addition in this area was E-base, which was established in 2006 by NGO2 in the vicinity of Bellingshausen Station on King George Island and currently the only non-governmental operated permanent land-based tourism facility. At this point, the land-based tourism activity was very limited because back then in November 1987, the concept of landing aircraft was on wheels on blue-ice fields, rather than relying on smaller ski-equipped aircraft. In 1987, the Canadian Adventure Network International (ANI), operated at the beginning as Antarctic Airways, establishing a semi-permanent camp at Patriot Hills. ANI provided logistics in order to support land-based private expeditions and adventure tourism operations, and organized flights to the South Pole and Vinson Massif, and served as an IAATO emergency contact center. Then, in the mid-1990s, flights from Cape Town to Dronning Maud Land and the Patriot Hills camp to the Dawson-Lambton Glacier were added to the itineraries. In 2003, ANI was purchased by Antarctic Logistics & Expeditions (ALE). Nowadays, ALE operates the Patriot Hills camp in conjunction with ANI and due to the high cost for land-based calls to Antarctica and expedition-style camping, ANI/ALE itineraries draw from a relatively limited target group of clients, and so land-based activities have not increased substantially. Notwithstanding their relatively small scope, the land-based activities are regarded with concern by the policy-makers but those concerns regarding this type of activities have not yet reached out to specific political action. Considering the regulatory procedures adopted by the ATCPs contain various general tourism-related resolutions, measures,
recommendations, and decisions, and others did not receive specific regulatory mention. The question that arises whether, due to the absolute numbers involved, addressing ship-based activities development is a far more pressing issue. Finally, another issue that arises is whereas the land-based tourism progress, as well as the construction of additional facilities on the continent, are non-issues largely due to a relatively low probability of this progress taking off in the near future (Liggett et al., 2011).

3.3 Tourism evolution in Antarctica

During the first two decades of the 20th century, also known as the "heroic era" of Antarctic exploration, great advances were made in not only geographic but also scientific knowledge of the continent. After the turn of the century, expeditions scrambled to explore Antarctica and they proved the practicability of Antarctic overwintering and introduced new technologies.

There were several countries that sponsored Antarctic expeditions during this time period. Among them, vessels from Norwegia, Britain and Belgium sailed to the continent even though some of these trips were mostly of an exploratory and scientific character, there might have existed recreational aspects to them (Kariminia, S., Ahmad, S. S., & Hashim, R. 2012).

Until recently, Antarctic waters were a notoriously difficult destination to approach, with access restricted by early explorers and the whaling and seal industries (Roura, R. 2012). Seal hunting began in the 1800s, with the fur seal nearly extinct by 1830, and whale hunting began in 1904 with the establishment of the Grytviken whaling station in South Georgia. The International Whaling Commission suspended commercial whaling in 1986. (Burnham Arlidge, 2018).

Tourist activity did not begin until the late 1950s, when 500 visitors sailed to the South Shetland Islands, north of the Antarctic Peninsula. Lars-Eric Lindblad continued this tradition of expedition cruises with an educational component in 1966, when he guided travelers to Antarctica. Throughout the 1960s, sea tourism was the primary mode of access to Antarctica. Lars-Eric Lindblad began the expedition cruises with landings, sailing from Ushuaia, Argentina, to the Shetland Islands. The cruises last between ten and twenty-one days.

In 1966, he built the world's first expedition ship and after the passage of a few years, he commissioned the building of the M/S Lindblad Explorer. Expedition cruises became an annual feature and other tour operators added itineraries to their catalogs.

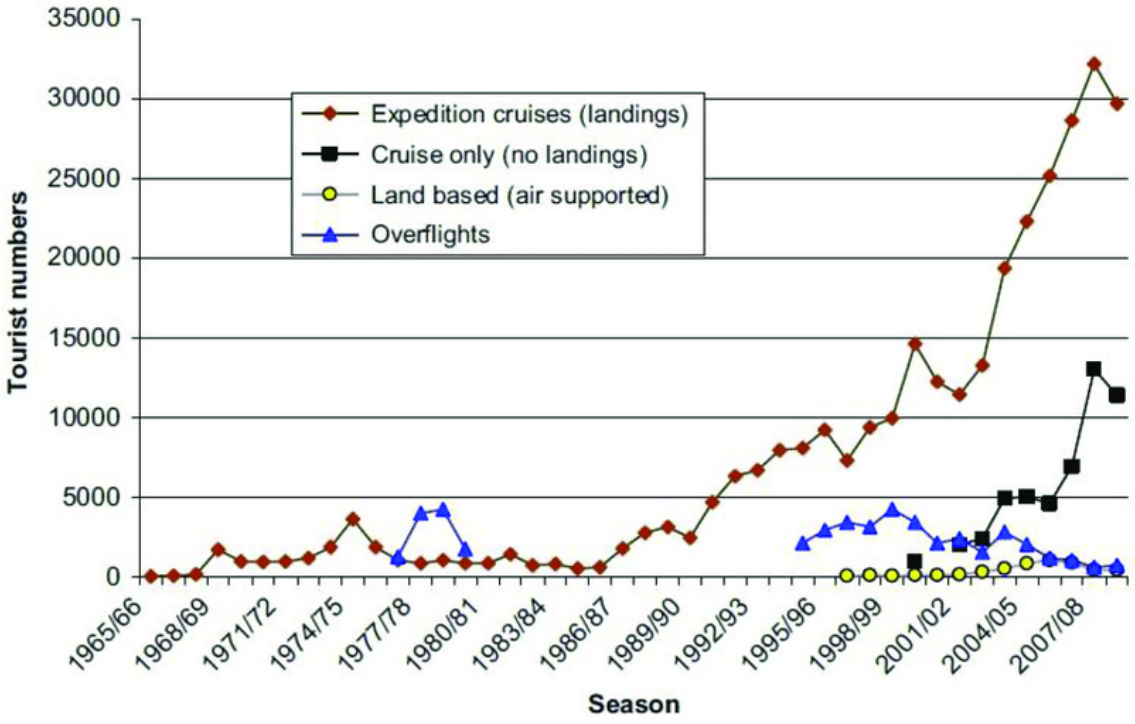

Fig. 5 Estimated numbers of Antarctic tourists in 1965-2009, (Source: Liggett et al., 2011)

As the graph shows, there is an increase in the number of tourists from the 1960s to the 1970s. Although during the latter decade, there is no increase in the number of visitors from year to year. The number remained relatively the same throughout the decade except for the years 1976 -1977 when the total number of visitors almost reached 5000 (Liggett et al., 2011).

Overflights were launched during the Antarctic season of 1977-1978 as a means of seeing Antarctica. These flights were run by Qantas (Australia) and Air New Zealand, and their passenger numbers increased significantly during the next two seasons, hitting at least 4000 passengers in each. This burst of operation ended just as abruptly as it did, shortly after an Air New Zealand flight crashed into Mt. Erebus in 1979, killing all 257 passengers on board. The next season, their numbers reduced dramatically, to the point that they ceased to operate entirely in 1981-1982, only to be reintroduced 15 years later (Roura, R. 2012).

In the mid-1980s, some Chilean airlines began offering daily flights to Teniente Rodolfo Marsh Martin Station on King George Island, where tourists stayed in a guest house. The progress's growing success reflects the interdependence of land-based tourism and aircraft, as well as base station assistance. The latter serves as a reminder that National Antarctic Stations and Antarctic Programs have a sizable impact on the resources open to Antarctic tour operators. Teniente Rodolfo Marsh Station has a guest house, which was built in 1982 and is also known to be one of the first permanent tourism facilities in Antarctica. When Chilean airlines declined to transport travelers on official routes, the guest house ceased tourist facilities (Liggett et al., 2011).

Despite the cessation of overflights, adventure cruises with landings persisted until 1986-1987, with the annual number of tourists remaining nearly the same. Since that year, with a few variations, the amount of tourists has consistently risen. For example, approximately 15,000 visitors traveled there on expedition during the 1999-2000 season. Between 2009 and 2010, this number more than doubled to 37,000 tourists.After the dissolution of the Soviet Union in the early 1990s, cruise tourism in Antarctica experienced exponential development. The justification for this was the existence of long-term charter vessels from the former Soviet fleet.

Overflights resumed operations after a 15-year hiatus during this "boom" period in Antarctic tourism, however, unlike expedition cruises, their numbers have been dwindling since the 1999-2000 season (Liggett et al., 2011).

In the early nineteenth century, owners of larger ships without landings on the ice continent began offering cruise-only itineraries. Concerns have been raised regarding the increase in Antarctic tourism between 1990 and 2010, which some believe is related to the ice continent's varied activities' environmental effects. Antarctic cruise ship itineraries have been developed, and tourism in this field has increased significantly, reaching approximately 13,000 in 2009. However, cruise ships are not the only route for tourists to reach the Antarctic Peninsula. In 1997, the year that flight tours began, and afterwards, scenic flights became more frequent. In this scenario, you may mix the two methods in order to explore the continent by landing in various locations and then continuing by cruise ship. These flights last about 14 hours, including four hours spent traveling across the globe. Travelers with little time or who are seasick will travel to King George Island, take a trip around the Antarctic Peninsula, and then fly out.

Besides this, land-based air support activities existed in the mid-1900s but never attracted a sizable participant base. Additionally, the increasing risk of serious injury and incidents in Antarctica was considered (Liggett et al., 2011).

3.3.1 Coronavirus and Antarctica

Antarctica, as a strategic and geographical space, received scant coverage during the pandemic's initial stages. The wider consequences for life on and across the continent, as well as for Antarctic management, were not publicly discussed at this early stage. However, the interaction of such Antarctic impacts with the pandemic's broader effects, including global recession and internal threats to state security, as well as current challenges in the Anthropocene, raises concerns over various time scales (Frame, B., & Hemmings, A. D. 2020). There are three hypothetical time spans in which assumptions are made on potential impacts on human existence and activity in the Antarctic, as well as possible effects on the Antarctic's foreign governing structure. By early 2020, the majority of National Antarctic Programs (NAPs) will have completed their operational season and the majority of ships and aircraft will have departed Antarctica. Both stations were closed for their customary Antarctic winter isolation until December 2020, and no signs of infection were discovered, which is lucky given the logistical challenges associated with foreign medical assistance and the restricted medical capability. While the majority of Antarctic stations are isolated, some are clustered, and contamination will contribute to the isolation problems of preventing spread between the stations. Certain programs have air capability which will lose supplies throughout the winter and spring. This involves surveillance in order to reduce the possibility of contamination, and although Antarctica is known to be a low-risk environment for this form of threat, it cannot be completely risk-free due to the global pandemic and the required communication and operability each summer. While the station did not record any cases, elevated levels of covid-19 infection were detected on a returned cruise ship, the "Greg Mortimer" (Frame, B., & Hemmings, A. D. (2020). Along with exceptional measures to prevent transmission during station staffing changes and resupply, even the minimal fieldwork that is practicable must ensure no danger to native biota. There are many reports that international field activities and programs may be reduced in response to the pandemic, in order to control danger in a global setting where multiple states might be at varying stages of pandemic management. In 2020, the ATCM scheduled to begin in late May in Helsinki was cancelled due to the pandemic, and Finland declined to host a postponed or virtual ATCM; as a result, the next meeting will take place in Paris, France in the middle of 2021. While the ATCM meetings are decision-making bodies, there has been no formal capacity to collectively consent on any solution to the pandemic, such as not authorizing cruise ships to dock at the stations, exchanging risk management details, or considering risk and precautionary legislation for Antarctic wildlife the following summer (Frame, B., & Hemmings, A. D. 2020).

There has been discussion of the apparent environmental rebound, especially in the global media, during the first stage of the pandemic's shutdown of large swaths of human activity. Nonetheless, the Antarctic continent is devoid of human activity and is not exposed to an activity whose cessation will result in similar transformations. Worldwide, cruise tourism has suffered significantly as a result of covid-19, with several cruises proving to be failures in terms of passenger contamination and spread. Numerous and multinational firms are decommissioning vessels and strategies, implying that the global conveyor belt of massive cruise tourism will come to a halt and that the industry will likely struggle to rebound. Tour operators specializing in the Antarctic continent face additional difficulties, and some can succumb to the pressures of covid-19. Many travelers fly long distances to enter Antarctic cruises, and even after foreign travel returns, there is a risk of being subject to significant uncertainty due to continued onerous border restrictions and quarantine conditions. Another potential problem for cruise ships is forthcoming problems with port connectivity for embarkation and disembarkation. These possibilities and considerations mean that the pandemic's influence on Antarctic tourism may well outweigh the consequences of the 2007/08 Global Financial Crisis, which took a decade to rebound from. The medium-term implications for the Antarctic government are contingent on three interlocking elements. The first is the response of individual states and multinational organizations to the pandemic, as well as the ramifications for the functioning of the broader global order and foreign structures. And, the magnitude of covid-19's financial implications and the depth of the stagnation that ensues. Finally, whether discussing the biophysical or strategic Antarctic, the final aspect is the region where the pandemic magnifies, and as time passes, these aspects become inextricably connected to economic development and science study. It is self-evident that the pandemic has resulted in a significant contraction of NAPs, and tourist development is likely to reverberate through Antarctic relations for years. Although making long-term predictions about the broader systemic

Antarctic operation and governance is difficult, researching scenario mechanisms for socio-environmental environments is a robust and well-established method of assisting decision making. It is a technique that fosters collaboration between Antarctic studies by leveraging climate change expertise (Frame, B., & Hemmings, A. D. 2020). In terms of Antarctic government, the ATS has a number of advantages, not the least of which is its systematic persistence over seven decades. However, that has always suffered from structural hollowness, which has become worse in the three decades after its last big instrument was adopted. Not only which states and other actors stay officially involved, but even which actors become successful drivers of whatever the ATS is. The pandemic seems to have exacerbated already-existing geographical tensions and, at the operational level, if we believe that, in the short to medium term, the ATS developed to provide certain frameworks for virtual service, remote management, and decision-making (Frame, B., & Hemmings, A. D. 2020). Tourism on the Antarctic plateau ranges from operations focused on ships adventure sailing to those dependent on aircraft, with major consequences for facilities such as accommodation, smaller boats, and airstrips. More possibly, as with the GFC, there will be a five- to ten-year recovery from the pandemic to basically the current tourism model, particularly given the recent influx of new polar vessels. Alternatively, it may be a good incentive to accelerate the development of novel modes of travel, such as immersive tourism, in which Antarctica serves as a more overt metaphor for a subliminal encounter, a distant continent of imagination. Tourism may either resume regular operations but with significantly diminished numbers within the next decade, or it may transition to a highly creative mode of tourism in which Antarctica acquires a modern form of cultural heritage and becomes relevant to an evolving new global context. Additionally, tourism will change in the future. Either fundamentally decline for a decade or more before resuming its current type and scale by conversion to traditional air-supported mass tourism, or develop into something completely different (Frame, B., & Hemmings, A. D. 2020).

3.4 Environmental Consequences of Antarctic Tourism

One of the main reasons that tourists want to visit Antarctica is to see the wildlife, and particularly penguins which is a popular attraction. For the last 12 years, the UK Antarctic Heritage and the British Antarctic Survey are the ones who have the confidence in operating Port Lockroy on Goudier Islands. They have been studying breeding performance in ten colonies of gentoo penguins, including 600 pairs in sites visited by tourists and 200 pairs of gentoos in colonies off the tourist trail. The results of this study showed that two of the six visited colonies are showing a significant statistical decline but it may not be to visitors (Kariminia, S., et al 2013). However, in case tourism will increase significantly or is not going to be well managed, there is a massive potential to impact wildlife. This is the main reason why those studies are so important to assist as much as they can in order to determine effective management measures and further research is obligatory looking at breeding possible eggs that are laid and hatched. The possible impact on the marine environment is even greater than the potential impact on the land (Budeanu, A., 2005). In November 2007, near the South Shetland islands, there was the sinking of the M/V Explorer and the disastrous human accident impacted the marine environment. All crew managed to be safely rescued but 178,000 liters of fuel and 24 tons of lube oil is probably since then sitting in the bottom of the ocean and which will be gradually released into the marine environment. The Antarctic Treaty Consultative is working towards greater monitoring over tour ships in the area (Shah, R. M., 2013). In April 2009, there was a measure that was banning vessels that were carrying more than 500 passengers from landing in Antarctica and restricting other landings to a maximum of 100 passengers ashore at any time, with a minimum ratio to every 20 passengers. Such a procedure was voluntarily adopted by IAATO for many years. Additionally, the Treaty Parties have been working with the International Maritime Organisation (IMO) in order to prevent vessels from carrying and burning heavy fuel oil in Antarctic waters and came into force in mid-2011. That means that big cruise vessels, which operate heavy fuel oil, will not be able to sail in the area unless they use an alternative, more environmentally-friendly fuel. The Treaty Partie as well as IAATO have instigated rules in order to improve communications and vessels report their position. In December 2009, the IMO adopted revised guidelines for ships operating in polar waters and currently is actively working on an obligatory Polar Shipping Code which is potentially to be adopted in 2012 (Kariminia, S., et al 2013). This Code will set standards for vessels that are intending to operate in the high latitudes. The UK already requires British cruise ships to reveal that they are not operating in isolation whilst in Antarctic waters and that is a way to encourage other Antarctica Treaty Parties to act accordingly. In the past, many vessels tried to be out there alone in order to provide this remarkable wilderness experience, but now the industry encourages the vessels to cooperate with one another so they are able to offer support in the event of a possible incident[3]. From a wide view, the impacts can be categorized into direct and indirect, polluted and unpolluted and physical and non-physical groups. The environmental impacts are based on many and different factors, namely land use, waste generation, energy consumption, biotic diseases, and psychological aspects (Kariminia, S., et al 2013).

Many researchers have stated that land alteration is the most important environmental change which contributed to increasing greenhouse gases. Now, in the tourism industry, tourist facilities and infrastructure contributed to a big proportion of impervious surface which causes more runoff (oil, gas, and suspended particles) and that is why infrastructure development is a very important part of land alteration. In the continent, the ice-free surface includes only 2% of the total surface. Additionally, the expeditions were mostly ship-based and the land exploration included short-term ashore visits. The tourism infrastructure in Antarctica is mostly for the air base stations and supports and still remains in a low amount. The accommodation facilities are allocated to the scientific programs and tour operators. As the only non-governmental permanent tourism air-based facility, the E-base was found by an NGO in King George Island and it aimed to enhance public awareness on protecting the Antarctic ecosystem. Another aspect is the waste production and the disturbance that is being caused. In general, the role of tourism in environmental pollution and disturbance contained travel and destination-related aspects. The construction and maintenance of facilities generated waste material as well as energy, which affected the surrounding ecosystem. The effect of construction in this continent, although limited, was considerably higher compared to urban areas (Kariminia, S., et al 2013).

Energy consumption affects the pollution in Antarctica, due to the fact that a large part of the energy use worldwide is generated by fossil fuel consumption. According to the Intergovernmental Panel on Climate

Change (IPCC, 2007), the transportation sector relied on fossil resources, especially petroleum (supplies 95% of the world's total energy use by transport). Transport was responsible for 94% of the total contribution of tourism to global warming being the most important part of leisure-related energy use and GHG emissions. The Antarctic tourism activity used energy for two purposes mainly; transport and destination-related. There are seven different types of vessels that are used to ferry tourists; expedition ships, dive boats, icebreakers, motor yachts, Russian ships, sailing vessels, and small ships.

The fuel consumption though, from all these types of vessels results in emissions of GHGs like carbon dioxide (CO2), nitrogen oxides (NO2), and sulfur dioxide (SO2) which contribute to harm biogeochemical cycles and impact the composition of the atmosphere and the most important degradation outcome of these emissions is global warming. Moreover, energy use also contributed to alterations in other fields of the global environment such as the possible increase of dispersion of diseases and water crisis which is expected to exacerbate in the future due to climate change and the growing human population. In general, travel agencies are defined as those whose facilities and individuals are involved in providing services for tourists. Large vessels are facilities that have high potential risk as they might have a crash or accident, ground on uncharted rocks, break the ice lands, or pollute the water.

Tour operators went for large vessels as small vessels were not financially worth enough. Between the years 1967 - 2003, there were reported in Antarctica twenty-nine accidents and incidents such as damage, aircraft crash, ship grounding, and oil spoil. However, half of all accidents occurred during the last 12 years. The International Convention has banned the use and carriage of heavy and intermediate fuel oils for the vessels in the Antarctic Treaty area for the prevention of Pollution from Ship since 2009. According to IAATO (2011), tourism in the Antarctic continent currently comprises eight activities: ship-borne expeditions, kayaking, extended walk, small boat landing, station visit, scuba diving, science support, and camping. There is a high possibility that these activities can damage the ice layers, provoke waste generation and littering, site degradation, and sewage that lead to wildlife disturbance. Additionally, opportunistic organisms could easily choose debris as their habitat, which causes alterations to the compositions of the ecosystem.

The result of human mobility is due to the enormous exchange of species which leads to disruption of natural systems, homogenization of biota and international commerce, trade-in live organisms are ways to transport species between different environments. The dispersion and exchange of diseases (the last thirty years have reached thirty) through transporting infectious organisms was also a decisive aspect of travel. In fact, tourism contributed to the extinction of species both directly and indirectly. The direct ways include voluntary acts such as noise disturbance, littering, and collection of natural objects. They can also indirectly disturb the species when transporting exotic species, viruses, insects, bacteria, or other small organisms (Kariminia, S., Ahmad, S. S., & Hashim, R. 2012).

Tourists may transport non-human microbes through their bodies, clothes, goods, food, seeds, which could increase the risk of flora and fauna diseases. Furthermore, the accommodation facilities, for example, importing plant species alien to the environment are causing alterations because its indigenous biota is very vulnerable to human-mediated introductions on non-native species. Tourism is believed to contribute to climate change which involves old and re-emerging infectious diseases. El Niño Southern Oscillation (ENSO) phenomenon was partly the result of climate change which led to the reduction in the thickness of the ice layers (IPCC, 2007). In Antarctica, an area so isolated, tourists exert considerable pressure on animals while closely interacting with them and that is one of the main reasons that reduces breeding success or threatens them with human pathogens. The tours are offered usually in the austral summer, which means from November to March is the critical time for the wildlife to breed. This period is the courting season for penguins, seals, and penguins that start to fledge. Tourists affect the wildlife habits because animals scrounge for the food given by tourists and this could make them accustomed to human food, which obviously will affect their behaviors. In the case of the seal and krill, there have been spotted changes in the population where one of the results of the marine environment degradation was in Antarctica. Also, penguins show both behavioral and physiological responses to visitors which could change their breeding and survival pattern. And finally, the increasing number of tourism activities contributes to alterations in the wildlife habitats (Kariminia, S., Ahmad, S. S., & Hashim, R. 2012).

Construction and repair operations produce waste material and electricity, which has an adverse effect on the local environment. However, tourism growth was not prioritized due to the fact that Antarctic expeditions were mostly ship-based and tourists often stayed ashore for a brief period. Antarctica's tourism-related constructions were mostly for air base stations and maintenance services. In addition to providing facilities for national Antarctic programs, associated stations enabled tour operators to use these airstrips as transportation networks. Additionally, in 1987, a Canadian corporation founded a semi-permanent camp at Patriot Hills. This camp scheduled flights and offered logistical assistance for airborne tourism activities and private expeditions. Owing to the high cost of expeditions, airborne tourism growth did not attract a large number of Antarctic visitors. Additionally, the ATCPs' legislative mechanisms focused mostly on ship-based tourism. Policymakers, on the other hand, expressed anxiety over the building and destruction of facilities in Antarctica (Kariminia, S., Ahmad, S. S., & Hashim, R. 2012).

CHAPTER 4

IMPLEMENTATION OF ENVIRONMENTAL LEGISLATION IN RELATION TO TOURISM ACTIVITY

4.1 Regulating Antarctic tourism: A challenge to the ATS

It's worth noting that Antarctic tourism policy encompasses more than just environmental concerns; it also involves financial responsibility, quest, and complicated political issues surrounding the continent's use as a jurisdiction. There are arguments and strong financial interests in the Antarctic Settlement Structure as a matter of unresolved sovereignty. This form of conflict can elicit a response from the ATS, which can then be used by individual states to further their own agendas.Tourism in Antarctica is a leading example of global governance in private operations in many ways, since it is the only large-scale multinational activity on land that is not strictly controlled by the government. International law allows for more imaginative ways, such as the extension of domestic legislation to individuals that engage in substantial actions within the negotiating groups. Numerous claims support the notion that each contracting party is required to consider all relevant factors when assessing the jurisdictional extent of operation of the implementing regulation (Kriwoken, L. K., & Rootes, D., 2000). The Contracting Parties should extend their implementing legislation to these operations, as the Protocol's explicit reference seems to suggest, and this understanding also applies to the Treaty's Article X and Article XIII. Additionally, concerns can emerge about business interests' or private citizens' claim of land rights, such as the long-term utilization of a venue, which may require the development of tourist facilities. In the future, the construction of such facilities on the continent may have a significant impact on legal authority and the ownership of land rights, which are significant concerns for certain groups, including some claimant states. At the ATME, New Zealand recommended prohibiting such services, which was accepted by a number of claimant and non-claimant Consultative Parties, although a number of claimant states raised reservations regarding specific forms of tourism and jurisdictional issues. Numerous states are likely to advance their interests in a number of forms. For example, in the 1980s, Chile opened the first Antarctic hotel adjacent to one of its stations. Cape Town seemed interested in delving deeper into this topic, but New Zealand proposed a more established research at the ATCM in Stockholm (Montarroyos, D. C. G., de Alvarez, C. E., & Bragança, L., 2019).

Antarctic tourism is thriving. It has grown from approximately 4800 visitors in 1990-1991 to over 19,500 landing passengers in 2003-2004 in less than fifteen years. Antarctic tourism is projected to expand much further in the future, owing to the global growth of nature-based tourism and specific trends in the Antarctic tourism market. Members of the Antarctic Treaty System are currently debating the need for additional steps to handle Antarctic tourism in addition to the Protocol. However, the steps introduced at the twenty-seventh ATCM, as well as the remainder of the alternatives under review, should be defined as "conditions" that do not resolve the more basic problems confronting Antarctic tourism in the medium and long term. The Consultative Parties' initiatives so far have largely tackled real concerns that occur currently (e.g., the expenses of search-and-rescue operations for visitors in need of assistance) and for which adequate evidence remains. The additional steps taken by the sector are targeted at preventing or mitigating the detrimental consequences of tourism. Although the IAATO's commitment is deserving of recognition, the policies implemented have had no impact on the existing tourist industry's ability to pursue initiatives and continue to expand.

4.1.1 Environmental impact evaluations for the design and service of scientific stations

To ascertain if all scientific stations established in Antarctica had their EIAs made publicly available, a study of the Antarctic Station Catalogue maintained by the Council of Managers of National Antarctic Programs (COMNAP) was conducted (Council of Managers of National Antarctic Programs (COMNAP), 2017). The catalogue mentions 76 science stations; however, this analysis contains six scientific stations that were designed, upgraded, or enlarged after 2006. Apart from the EIA records and the catalogue study, the last ATCM papers from 2006 to 2017 were reviewed (Montarroyos, D. C. G., de Alvarez, C. E., & Bragança, L. 2019). It was checked in these papers if one of the chosen scientific stations was discussed during the conference, whether any consultative parties voiced concern regarding the effect of the scientific station's building, and whether parties updated the EIA reports. To achieve this, we scanned all 21 ATCM files for the names of the six selected science stations, as well as the keywords "CEE", "IEE", "Scientific station", "house", and "construction activities". The details are arranged alphabetically by the scientific station's name, accompanied by the year of publishing. These meeting findings helped in the interpretation of the EIA validation method and in finding weaknesses and possibilities for the improvement of Antarctica's environmental assessment. Additionally, the study contained an overview of CEE-related debates (Montarroyos, D. C. G., de Alvarez, C. E., & Bragança, L. 2019).

4.2 The Antarctic Treaty System and existing legal instruments to address cumulative impacts

The mentioned trends in Antarctic tourism and the associated questions about accumulated impacts raise the issue of who is responsible for resolving these concerns. Numerous wilderness areas in the world are shielded from the harmful consequences of human action by the state that has sovereign control over the land in question. Antarctica, on the other side, does not possess undisputed national supremacy. Antarctic Treaty and Protocol on the Environment Seven states asserted sovereign rights to portions of the continent during the first half of the twentieth century, but these claims were the focus of diplomatic conflicts. The Antarctic Treaty was ratified in 1959 by the applicant states and five other states participating in Antarctic studies. 17 A key aspect of the Treaty is Article IV's "agreement to differ" clause: each contracting party's stance on Antarctica's legal status is recognized, and the contracting parties consent to handle Antarctica jointly. The Antarctic Treaty is built on two pillars: maintaining world stability and guaranteeing the independence of scientific study. Additionally, it was decided that other states seeking to become Treaty contracting partners and demonstrating an involvement in Antarctica by "substantial scientific research effort" should be granted "consultative status". There are now twenty-nine Consultative Parties (ATCPs, 2004). At the Antarctic Treaty Consultative Meetings (ATCMs), the Consultative Parties address Antarctic management problems and achieve consensus on resolutions. Σince the Treaty's inception, numerous additional protocols and over two hundred proposals have been accepted, forming a set of instruments dubbed the Antarctic Treaty System (Auburn, 1982; Scott, 2003; Molenaar, 2003).

Protecting the Antarctic ecosystem became the third cornerstone of the ATS with the introduction of the Protocol on Environmental Security to the Antarctic Treaty (Protocol) in 1991. Through signing and ratifying the Protocol, the signatories "agree to the holistic conservation of the Antarctic climate and [...] declare Antarctica as a natural reserve dedicated to peace and research" (The Antarctic Treaty).

The Protocol became operational in January 1998 and encompasses the overwhelming majority of human operations south of sixty degrees south latitude. Article 3 of the Protocol defines basic environmental concepts, specifying specifically that the Protocol safeguards "the Antarctic landscape and dependent and related habitats, as well as the inherent nature of Antarctica, including its wilderness and aesthetic qualities, as well as its value as a place for scientific study." It is illegal to participate in mineral resource operations for non-scientific purposes, any such activities must obtain a prior environmental impact evaluation (EIA). Licenses are needed for taking or causing damage to Antarctic flora and fauna, importing non-native organisms into Antarctica, and accessing Antarctic Specially Protected Areas. Additionally, provisions regulating waste disposal on land and sea must be adhered to.

The Protocol expressly forbids the destruction of any heritage site or memorial. However, it calls for the completion of an appendix on environmental liability. A Committee for Environmental Protection (CEP) was created to advise the ATCM on Protocol implementation and furthering Antarctic environmental protection. The ATCM can take additional steps in compliance with Article IX of the Antarctic Treaty on the advice of the CEP or on its own initiative. Instruments applicable to resolving accumulated impacts under the Protocol But for a few specified protected areas covering a negligible portion of the Antarctic continent (Hansom & Gordon, 2000), no region of Antarctica is in fact off limits to the tourist industry. At the moment, tour operators' travel to Antarctica is largely governed by EIA criteria. Parallel to environmental surveillance, the EIA is the Protocol's primary tool for detecting, mitigating, and managing the environmental effects of tourism operations.

The Protocol's Article 8, paragraph 2 makes it clear that the EIA requirements often extend to tourism operations. While reservations regarding tourism growth were raised during the Protocol's negotiations, "the prevailing opinion was that the Protocol and its Annexes should be intended to generically include all activities in Antarctica" (Richardson, 2000). The Protocol demands that accumulated impacts be treated as part of the EIA process, but does not specify the degree of study required for this "consideration. Effect evaluations may be broadly described as "the method of assessing the long-term effects of a present or proposed intervention (Measure 14 2014, Annex).

To calculate total impact, an EIA should evaluate the results of the planned operation in combination with those of other nearby operations (Cooper and Sheate, 2004). Both historical and existing events, as well as those that can be realistically predicted in the immediate future, must be regarded. Thus, the composite effect evaluation serves to "extend the assessment's temporal and spatial limits and situate the assessment within the sense of the

greater field or zone" (Cooper & Sheate, 2004). The requirements for deciding the amount of EIA needed under the Protocol were established based on the severity and length of the impacts. The Protocol's three-tiered EIA scheme applies to impacts that are smaller than, equal to, or greater than "minor and transitory." The greater the impact's severity and length, the more information and inspection are expected in the EIA. Cumulative effects, where and when they arise, can be "minor or transitory," according to the Protocol's language, but they can also be more serious. For instance, tourism may inevitably lead to the introduction or translocation of foreign species or diseases, but the mechanism is poorly understood and controlled. Although the likelihood may be minimal, the possible effects may be serious, and the impacts are challenging to determine in an Antarctic environmental impact assessment. To our mind, one of the limitations in the current EIA framework as applicable to Antarctic operations is the estimation of accumulated impacts. As William Bush said, “The combined effect of less important practices is likely to be the primary backdoor from which activities will continue without appropriate caution” (Bush, 2000). Conceptual limitations often hinder the Protocol's expected application of EIA to tourism. These findings are the result of adapting an EIA framework designed for research activities and related logistics at a few isolated locations, where environmental reference states can be formed and impacts tracked by operators, to the transient, fast-moving, multisite activities that characterize contemporary Antarctic tourism. Current impact evaluation procedures are inadequate for assessing cumulative effects (Hemmings & Roura, 2003). Additional restrictions are functional in nature and pertain to the manner in which tour operators comply with EIA specifications. The latter generated fewer than 20% of all Initial Environmental Assessments (IEEs) between 1991 and 2002 (Hemmings and Roura, 200).

According to a new review of tourism EIAs, "key elements of EIA, such as scoping, critical evaluation, reporting, and auditing, are either underdeveloped or missing" (Gee, 2004). No Comprehensive Environmental Assessments, the Protocol's highest level of EIA, have been conducted for Antarctic tourism, notwithstanding the fact that some IEEs describe such tourism as "involving several cruises within a season and across many years, involving the transportation of several hundreds (possibly thousands) of persons to tens of different sites spread across a vast area". This is a significantly more complicated case than the IEE implementation anticipated” (Hemmings and Roura, 2003).

Additionally, tourism EIAs are often limited to assessing the impacts of a single season or a few seasons at most. They typically may not discuss the effect on areas being visitor "destinations," that is, places that will continue to be visited by visitors on a seasonal basis for the near future and will therefore be subjected to ongoing human activity. Numerous plans have been made to use additional instruments to test Antarctic tourism. This category includes strategic environmental evaluations, geographic assessments, and estimates of combined impacts (Kriwoken and Rootes, 2000).

The International Association of Antarctica Tour Operators (IAATO) performed a “programmatic” EIA for its 1997-1998 season in accordance with US domestic law (Kriwoken & Rootes, 2000), and several industry IEEs also included the activities of five or more firms. However, concerns remain on whether these "programmatic" EIAs offer a more detailed measurement of accumulated impacts or are merely "big" EIAs intended to mitigate the proponent's paperwork. Ex post environmental reporting is complementary to ex ante effect evaluation. Numerous efforts have been made over the years to track the effect of tourist visits on individual locations (Giese, 1998; Patterson et al., 2003); a non-profit group, Oceanites Inc., undertook a large-scale analysis of tourism landing sites on the Antarctic Peninsula (USA, 2004).

Certain Treaty parties and the tourism industry financially and logistically endorse this job (UK, 2004). The nature of this Chapter precludes a thorough study of environmental surveillance in Antarctica, which appears to be a source of dispute and intersessional work. However, although the existing surveillance systems are useful in and of themselves for inventorying the flora, fauna, and other characteristics of different tourist destinations, they will find it challenging to create direct cause-and-effect associations between tourism operation and environmental changes. There are just too many possible factors of environmental change, including natural variations of indicator organisms and climate change, as well as the potential contribution of human activities, such as tourism. Thus, it remains to be seen if new surveillance methods can have the answers required to advise tourism management decisions in a timely manner. We conclude that the Protocol's EIA and reporting specifications are relevant but inadequate to sufficiently resolve the problem of accumulated impacts (Antarctica New Zealand, 2000).

There are holes in our awareness about the possible detrimental combined consequences of tourism events, and existing surveillance programs are insufficient to narrow these gaps. For example, what is the state of wildlife species at tourist hotspots? Has tourism had some impact on this status? Ses essential questions will possibly be addressed with confidence for just a few famous tourist destinations. Additionally, there are many questions about the current and possible impacts of tourism, as well as the future growth of the Antarctic tourism industry. Ses complexities and awareness differences pose doubts regarding the precautionary principle's status in Antarctic management and its functional importance to the Antarctic tourism debate.

4.3 Guidelines for environmental impact assessments

In the first phase of the study procedure archives and regulation activities in the continent were accumulated such as the Rules of Procedure of the Committee for Environmental Protection, Environment Protocol, Annex 1, Antarctic Treaty, ATCM Rules of Procedure (SAT; Secretariat of Antarctica Treaty), and Guidelines for EIA in Antarctica. These archives are available publicly on the Secretariat of the Antarctic Treaty Website (establish procedures and guide the activities with the purpose to implement projects in Antarctica, hence the study initially involved analysis of the Environmental Protocol which is the main form to support environmental monitor in the content, including the updated articles and annexes. All those papers on the EIA strategies were inspected. Furthermore, the research involved resolutions that potentially could influence the preparation of the EIA reports, and reports of the ATCM and the selected documents were the latest reports from the era of 1961 to 2017 of the ATCM, and these resolutions whose group was defined as “environmental protection”, “comprehensive environmental evaluation”, or “CEP strategy”. The information was organized according to the year of publication for historical understanding and the appreciation of such documents made possible the delimitation of the study, the examination of the publicity accessible data, the analysis of the environmental assessment process in Antarctica, and last the comparison between the procedures performed by nations and the procedures suggested by the Antarctic Treaty Consultative Party (ATCP).
Regarding the EIA reports for any possible construction activities in Antarctica is that the EIA drafts, archives and processes prepared by the nations shall be made accessible to the public. Consequently, the EIA database for the activities in Antarctica are available on the website of the Secretariat of the Antarctic Treaty (SAT), in the section of the EIA and Environmental Protocol subsection. The data were categorized according to the assessment type such as Initial Environmental Evaluation (IEE), and Comprehensive Environmental Evaluation (CEE), the party or nation, the topic, as well as the year of publication classified as drilling, science, construction and tourism amidst various activities.
The Consultative Parties and industry – through IAATO – are justified in extending the precautionary principle to a small degree. The preceding consideration of Antarctic tourism demonstrates the precautionary principle's possible usefulness for Antarctic management and dispels the myth that its operation often results in draconian measures, such as absolutely excluding specific categories of human activity. New external strategy choices and management steps should be explored in the future to avoid irreversible harm. These options and initiatives may be developed in reaction to scenarios forecasting Antarctic tourism growth over the next decade.
These trends and associated questions regarding possible cumulative impacts could necessitate the implementation of restrictions on Antarctic tourism activities now or in the immediate future. Restriction examples include banning certain practices at vulnerable sites; prohibiting visits to "fresh," previously unvisited sites; prohibiting the development of tourism facilities ashore; and prohibiting or restricting such new forms of activities, such as fly-cruise operations. In the long run, it might be important to suggest consolidating tourism activities into defined, well-managed zones. The industry's participation in debates regarding tourism management is important, and its self-regulation efforts are welcomed, however the Consultative. Notably, the estimated average number of passengers for the 2003-2004 season, including those who did not land, exceeds 27,000 (2003-2004). Parties should therefore be mindful of the inherent limits of self-regulation in terms of the economic interests concerned. Finally, tourism management plans and policies should be driven by the Antarctic Treaty's goals, aims, and values. The precautionary principle can prove helpful in guiding us during times of uncertainty. The aim of this data analysis was to quantify the process of developing CEE and IEE reports for building, as well as to determine the number and type of activities undertaken in Antarctica that necessitated the preparation of EIA reports.

4.3.1 Applying the Precautionary Concept from 1991 to the Antarctic tourism

From 1991 to 2004, the Antarctic tourism debate: Is the Precautionary Principle being followed?
Between 1991 and 2003, the Antarctic tourism debate raged. Since 1991, the ATCMs' discussions on tourism in Antarctica have demonstrated that, on the whole, the Consultative Parties regard tourism in Antarctica as a legitimate "use." Although tourism does not fall under the same category as the core activities of the Antarctic Treaty and Protocol – peacekeeping, international cooperation, scientific research, and comprehensive environmental protection – the total prohibition of tourism in the Antarctic has never been discussed. However, as early as 1991, a number of Consultative Parties expressed concern that the Protocol would be incapable of adequately regulating Antarctic tourism. These states proposed, at the sixteenth and seventeenth ATCMs in 1991 and 1992, that the Protocol be amended to include a separate annex on tourism (Chile and others, 1992; Richardson, 2000), but consensus on the necessity of such an annex could not be reached. Consensus was reached on a non-legally binding approach at the eighteenth ATCM in 1994.(ATCPs, 1994) through the adoption of Recommendation XVIII–1, which includes both visitor guidelines for the Antarctic and organizer guidelines for nongovernmental expeditions. Between 1994 and 2001, "tourism and nongovernmental expeditions" was a separate agenda item at the ATCMs, but the tone of the discussions indicates that the issue was not a priority, and no significant additional legal measures regulating Antarctic tourism were adopted (Richardson, 2000).
Since 2001, increased attention has been paid to the issue of additional measures. At the twenty-fourth ATCM that year, it was noted that "there is an increase in the diversity of tourism activities, which may present new management challenges," and the Consultative Parties agreed on the "importance of appropriate management of Antarctic tourism." (ATCPs, 2001). Several contracting parties and observers submitted papers on the management of Antarctic tourism to the ATCMs in 2002 and 2003, but discussions were brief and no legally binding measures were considered (ATCPs, 2003). Antarctic self-regulation: International Association of Antarctic Tour Operators (IAATO) For some Consultative Parties, the existence of a tourism industry association capable of self-regulation may have been a factor in deferring discussions on tourism management at the ATCMs. IAATO was founded in 1991 by seven tour operators to represent the Antarctic tourism industry's interests (Splettstoesser, 2000). It is "dedicated to appropriate, safe, and environmentally responsible private sector Antarctic travel (Bastmeijer, K., & Roura, R., 2004).
Currently, the association has 69 members (in various categories) (IAATO, 2004b). It takes numerous initiatives to raise its members' environmental awareness. The IAATO bylaws include an obligation to adhere to the Protocol's relevant provisions – which is especially important for members from states outside the Antarctic Treaty System – as well as a number of additional requirements regarding the qualifications and experience of expedition staff and the number of visitors permitted to land in Antarctica (Bastmeijer, K., & Roura, R., 2004). Along with the bylaws, specific guidelines have been adopted, such as the Marine Wildlife Watching Guidelines. A member organization must host an IAATO observer on one of its expeditions. After determining whether the tour operator complies with IAATO standards, the observer submits a report to the IAATO annual meeting for consideration of the application for membership. IAATO is a member of the ATCM with expert status and is represented on several national delegations. While IAATO's work is generally regarded positively, the discussions at the twenty-seventh ATCM appear to indicate that an increasing number of Consultative Parties are doubtful that the Antarctic environment can be adequately protected through self-regulation (Bastmeijer, K., & Roura, R., 2004).

4.3.2 Environmental impact assessment of Antarctic tourism

The TEF is more frequently used for trips of varying duration, locations, origins, and modes of transport. According to their perspective, the overall Ecological Footprint consists of two components: From a different vantage point, they divided the entire into two sections: Where you go is frequently just as important as where you come from. When they conduct research on the impact of increased flight pollution on climate change, they do so in the context of fossil fuel use. They even go so far as to assert a long—and to assert that it encompasses the area of a soccer field. Hunter and Shaw (2007) calculated the annual TEF for international tourism using flight time, energy consumed per visitor, irradiation of an equal location, and energy generated per acre. As a result, data on tourism items in high demand in a particular region would need to be collected. As with TEF, Hunter and Shaw proposed broadening the concept to include additional strategies and modes of transportation, but their approaches went a step further. In conjunction with research on the global and regional value of tourism, the Antarctic Ecological Footprint (ATEF) should be used to track data on a local level and to account for different time and distance considerations. The delicate habitats may be harmed by constant visitation and light use, which may contribute to major environmental problems. Tourism's sustainability component is focused on meeting visitor needs as well as three critical conditions: connectivity, balance, and the climate's natural characteristics. The permitted population of a region acts as a resource cap in its entirety, making it possible to maintain a leisure balance. Additionally, because the relationship between the natural environment and its visitors requires some degree of correlation, a reliable instrument such as the Antarctic Tourism Capacity (ATC) is required to gauge the area's tourist activity. Environmental monitoring must be conducted efficiently and effectively.

The effect of TEC can be classified into three categories: location, scale, and progressiveness of the destination. Additionally, TC is based on biophysical and behavioral knowledge, as well as the sector's varying rates of development and technological innovation. Additionally, this approach can be established for individual events, for example, using data on Antarctic tourists, behavioral trends, social status, infrastructure, and the biological system. [ATEF and ATEC] can be used as dynamic, up-to-date steps. Once the total ATED level exceeds the continent's environmental carrying capacity, the continent ceases to be viable. In any case, the existing surveillance framework must be strengthened and effective methods for resolving what was obtained implemented.

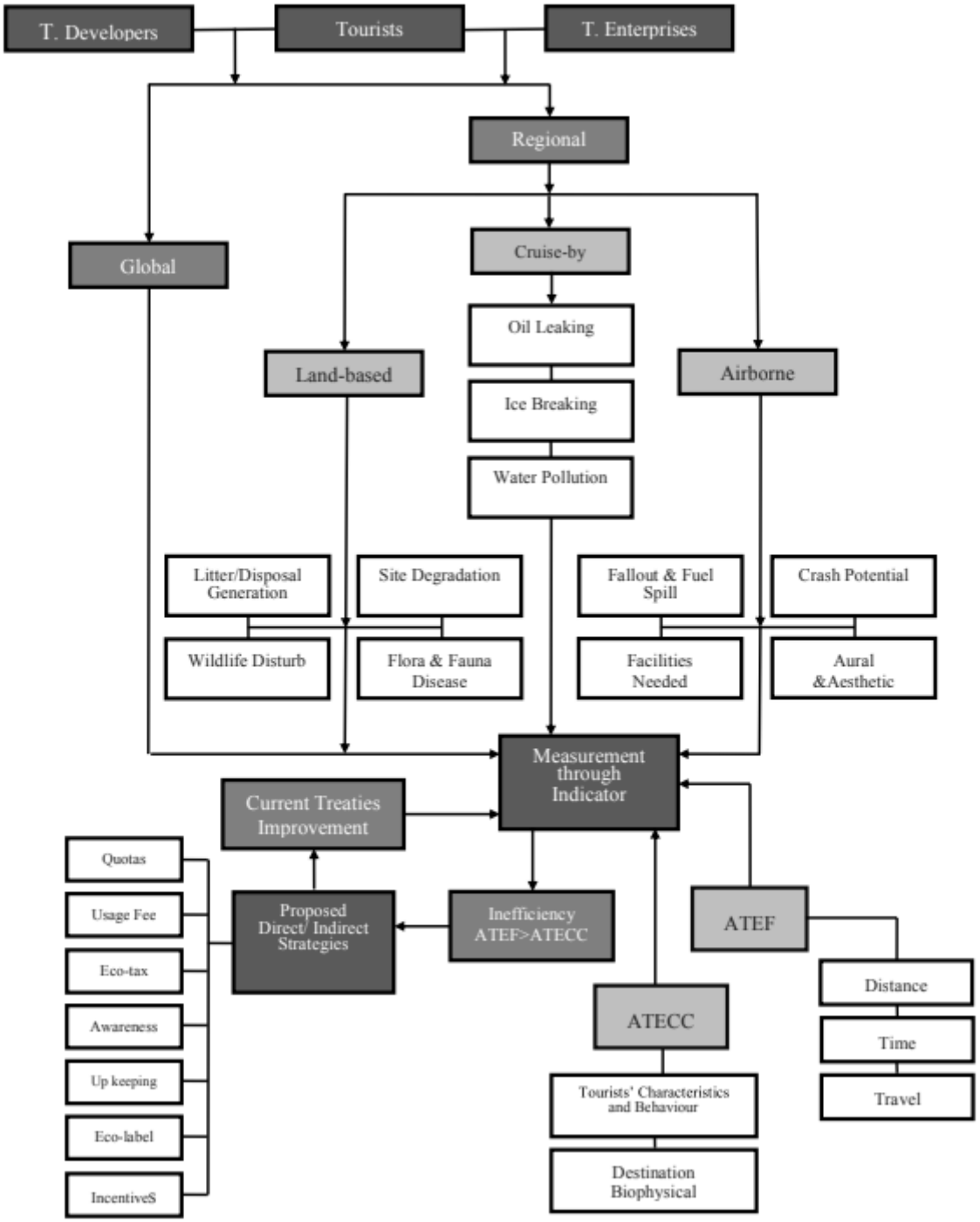

Fig. 6, Proposed Antarctic tourism impact, assessment, and management procedure

To effectively manage tourism's environmental impact, effective policy instruments, including financial regulations and institutional instruments, are needed (Logar, 2010). Owing to the diversity and complexity of the operations, designing and implementing management processes is difficult. New tourism practices can impose a variety of environmental pressures and consequences. Thus, prospective tourism may pose a prolonged challenge to the Antarctic management framework currently in place. Technological advancements, modern modes of transport, and expanded destinations have led to the inefficiency of existing instruments. Recent patterns necessitate new forecasting techniques, distinct rules, and management methods. In light of the previous definitions and features of the Antarctic landscape, as well as its present tourism status, this report suggests the following management techniques, which are classified as direct and indirect. Obviously, plans can be revised regularly in light of the outcomes of effect analyses (Fig. 3) (Kariminia, S., Ahmad, S. S., & Hashim, R. (2012).

4.4 Responsibilities and Liabilities of Tour Operators and State Parties

Tourism in Antarctica started in the 1950s, when the first tourist aircraft entered Antarctica at Punta Arenas on 23 December 1956 and flew over the South Shetland Islands and the peninsula's northern part. Although the notion of an Antarctic cruise was formulated as early as 1910, it began in 1966 with the establishment of daily tourist cruises. Following that, there was a notable rise in the number of Antarctic visitors, especially in the 1990s, when the number more than doubled between 1990-a and 1995-6 seasons. It is very difficult to determine how necessary legislation will be due to the existing lack of information about the effect of tourism on the climate, but it will be extremely difficult to ban Antarctic tourism. The primary residents of Antarctica are tour operators and scientists from states other than the plaintiffs who travel for a short period of time. The continent is not sovereign, semi-sovereign, or quasi-sovereign in legal terms, and it tends to operate as an international commons zone governed by states that have entered numerous lawful appendages of the Antarctic Treaty Structure. The legal defense of the Antarctic area is dependent on the joint efforts of the Protocol's Contracting Parties, since it is not subject to undisputed state jurisdiction, and therefore each state must take steps to ensure that Antarctic practices are not counterproductive. The steps shall be initiated and carried out in compliance with the Protocol's requirements by individuals subject to its jurisdiction.

The Antarctic Treaty does not expressly address tourism, but acts under the premise that all operations are allowable unless banned. Tourism thus falls beyond the scope of the Antarctic Treaty, as long as it does not conflict with the Treaty's objectives. However, since the Treaty makes no mention of tourism, the applicable control of Antarctic tourism may be defined as insufficient, ad hoc, and of dubious legal standing. To continue, since the parties had never treated the problem of Antarctic tourism in a comprehensive way, a dispersion rule focused on several recommendations was not the most effective option the Antarctic Treaty Framework might have provided to control Antarctic tourism. Additionally, the terminology used to address tourism is often insufficient and ambiguous, and the Antarctic Treaty lacks regulatory jurisdiction for breaches of tourism terms, although it fits the typical trend of foreign treaties, which is focused on mutual and appropriate compliance. The Protocol on Environmental Protection to the Antarctic Treaty, concluded on October 4th, 1991 in Madrid and came into force in 1998, notwithstanding the fact that it contains six annexes, encounters significant and functional difficulties in tracking Antarctic tourism in a proportionate manner. One major obstacle to developing a legislative instrument on this subject is defining tourism in such a manner that it distinguishes between non-governmental and tourist operations in Antarctica.

Additionally, Article 3 of the Protocol specifies that operations in the Antarctic Treaty area shall be performed and prepared on the basis of adequate evidence to enable advance evaluations and educated decisions regarding their possible impact on the Antarctic landscape and related and based habitats, as well as on the Antarctic's importance for conducting scientific study. The primary problem with the environmental assessment (EIA) is that it was designed for associated logistics and research operations at a few specific locations where environmental reference states can be formed and results can be monitored by the operators, in comparison to the fast-moving, temporary, and multiplicity of sites involved in tourism activities. The Protocol is based on scientific research in Antarctica, and tourist operations have never been subjected to the highest degree of oversight, the Critical Environmental Assessment (CEE). Generally, the Initial Environmental Assessment (IEE) is sufficient for tourism operations; additionally, the EIA framework would not include all facets of tourism activities owing to its structure, which developed mainly to address national research initiatives. Additionally, their responsibilities were mostly predicated on independent, long-term, fixed-point science and support operations at a few select locations where there was a fair probability of collecting or receiving evidence sufficient to create the original reference condition and thereby controlling the activity's actual results. On the contrary, tour operators conduct a variety of activities in various locations where standardized records are often unavailable and controls are ineffective. As a result, the Protocol's EIA processes were drawn from a more limited range of activities than they are currently expected to apply.

There is an argument that the Madrid Protocol conflicts with the concept of "environmental emergencies" in Annex VI to the Antarctic Treaty Liability for Environmental Emergencies Protocol. Article 8 of the Protocol requires that planned operations in Antarctica undergo an Environmental Impact Assessment (EIA), with the proposed operation being classified as having less than a minor or transitory effect, a minor or transitory impact, or more than a minor or transitory impact on the climate, depending on the type of the proposed activity. On the other hand, the terms "accident" and "major and detrimental effects on the Antarctic climate" are used in Annex

VI. The term "accident" may be viewed as indicating a lack of motive. Thus, it seems that if damage happens as a consequence of malicious actions with the intent to do harm, the situation would not constitute an environmental catastrophe, and therefore responsibility under the Annex does not apply. The term "accident" has a slightly narrower definition than the term "activity" used in the Madrid Protocol. The accident must have a major and adverse effect on the Antarctic climate, as described in the Annex. Accidents that occur in a minimal or transitory effect or a minor impact may be viewed as being removed from the Annex's service. If the Protocol uses the term "minor and transitory effect," the Annex uses the term "major and negative impact," which could create a discrepancy. Perhaps Article 3(2) of the Madrid Protocol may be used to complement the concept of "important and dangerous effects" on the Antarctic climate, since the Protocol defines certain concepts that function as the bedrock for all Antarctic operations. Among other aspects, operations in the Antarctic Treaty area shall be prepared and performed in such a manner that adverse effects on the Antarctic atmosphere and dependent and related habitats are minimized; adverse effects on climate or weather trends are minimized; significant adverse effects on air or water quality are minimized; substantial adjustments in the atmospheric, coastal (including aquatic), glacial, or marine conditions are minimized; and detrimental effects on the Antarctic environment and dependent and associated species are minimized. However, contrary to the usage of the phrase "important and adverse effects," tourism operations in Antarctica generally have an indirect influence on the Antarctic climate rather than a direct impact. While accidents such as oil spills from visitor vessels can be traced to having had a direct influence on the Antarctic climate, the majority of events had an indirect influence on the Antarctic environment. For example, according to a United Nations Environment Program study, the Adelie penguin's breeding population decreased by 50% during a six-year period due to stress induced by frequent tourist visits. Additionally, major shifts in the soil surface were found also at less regularly visited tourist destinations. This change is likely to decrease soil water supply, which is understood to be a major determinant of Antarctic invertebrate distribution. Apart from that, tourism movements have an indirect effect on the introduction of non-native animals, viruses, and microorganisms to Antarctica.

Strict responsibility for breaches of sustainable tourism Article 6(3) of Annex VI to the Antarctic Treaty Protocol on Environmental Protection Responsibility Arising from Environmental Emergencies provides for enormous liability as a consequence of an offense that has a detrimental effect on the Antarctic climate, and liability shall be strict without the need to provide mens rea. Mens Rea can not be understood solely in the form of environmental offenses; it may be blamed by proving the wrongdoer's "recklessness" or "negligence" in triggering environmental emergencies. Strict responsibility can therefore be extended to environmental wrongs perpetrated during tourist operations, including related logistic support activities. If the offenses are strictly criminal, the Annex's concept of "environmental emergency" is somewhat ambiguous, as mentioned previously. It applies to any unintended occurrence that occurs after the entry into force of this Annex and has a major and detrimental effect on the Antarctic climate, or imminently threatens to have one. They are difficult to protect against when they are articulated in such a general term. A broad definition of an offense provides no clarity to the tourism industry about what constitutes unethical activity and therefore cannot be seen as a deterrence. Where a standard is incapable of being reached, no matter how severe the punishment, it would have no deterrence impact. The Annex's Article 3 allows the parties to take preventative steps to mitigate the likelihood of environmental emergencies and their possible harmful effects, whereas Article 4 needs them to establish contingency plans for reacting to accidents. Although Article 5 allows operators and states to respond quickly and adequately to environmental crises, failure to do so would result in financial penalties. The operator is liable under Article 6(b) to compensate a sum that matches as near as practicable the costs of the response action that should have been taken. The Annex's response steps are intended to avert damage or further loss; they do not provide repair measures.

Possibility of creating an environmental liability fund Under Article 12, the Antarctic Treaty Secretariat shall establish and manage a fund, in compliance with the terms of reference to be adopted by the Consultative Parties, for the purpose of reimbursing Parties or Parties for fair and justified costs incurred in taking answer action. However, the Annex omits the process and balance payable to those funds. Any group or parties can make a request to the Antarctic Treaty Consultative Meeting for reimbursement from the fund according to Article 12(2). The Antarctic Treaty Consultative Meeting may accept such a resolution, in which case it shall be accepted by way of a Decision. Although any individual will submit a suggestion, the consultative members have the ultimate word about the process or refund to be charged to the fund. This scenario may deter non-consultative representatives from enacting the law integrating Annex VI. Additionally, Article 12(4) allows for voluntary donations to the fund by any State or person. Article 12(4) contradicts the "polluter pays" concept that where financial donations to the fund do not represent individual harm or minimize rewards for mitigation,

prevention fails. A fund cannot resolve this issue by later investigating the real polluter. Such expense recovery usually resulted in the fund benefiting only from big, solvent firms, not from any insolvent companies, which implies that solvent corporations will be liable for not only their own losses, but also for those incurred by insolvent rivals. Additionally, there is a considerable dispute about whether a fund can pledge only ELF commitments or should compensate for environmental harm more generally. Clearly, an ELF fund will pay only environmental harm that is covered by the ELF. However, does it compensate for environmental harm that is exempt or omitted from the ELF, or that does not satisfy the ELF's terms, or under which the operator has a shield or is generally immune from liability? Covering injury that is not covered by ELF responsibility would be inconsistent with this legal regime which would introduce needless problems. Any payment made by the fund should therefore be solely related to the involvement of an operator held liable under the ELF for the alleged injury.

The risk for liability encompasses both governmental and non-governmental operations that include prior notification under the Antarctic Treaty, including tourism. Thus, the structure of responsibility for operators is "mixed," regardless of whether they are political or non-governmental actors. This is important since the government performs or funds a vast amount of operations in Antarctica. Every State party is expected to order its operators to take appropriate preventative steps, implement contingency plans for reacting to events that could have a detrimental impact on the community, and take timely and efficient intervention action in the case of an emergency arising from their operations. If the operator fails to react, the relevant group, as well as other groups, are "encouraged" to do so after notifying the operator's party, if such notification is possible. Any operator that fails to respond promptly and effectively is responsible for the costs of the response action taken by parties. If a defaulting operator is a State operator because no party takes response action, the State operator is responsible for the expense of the response action that could have been taken. The residual state's responsibility for failing to take effective action to protect its citizens from damage caused by non-State entities could also be a consideration in the Annex's non-ratification. The Madrid Protocol should have a simple pre-tour environmental impact evaluation provision prior to a tour to Antarctica, as well as ex post environmental testing complements, aka ex ante assessment of impacts.

CHAPTER 5

CONCLUSIONS

5.1 Best practices in Antarctica

The Antarctic continent is where supporting logistics and science are the dominant human activities, with over 30 states undertaking regular science programmes in the region. The policy makers in their decision-making processes have to register the information available, including the scientific information in order to identify and implement an agreed course of action to address a problem or opportunity. Then, the policy makers inevitably have to balance the competing stakeholder interests when making those decisions. They have to take into consideration the principles and previous experience but a closer look is taken on building environmental policies based upon the best available evidence taking under consideration the uncertainties in that evidence. In the time of formulating advice and recommendations to the ATCM in connection with the implementation of the Protocol, the CEP (Committee of Environmental Protection) brings only the best available relevant scientific evidence. That shows the importance of effective communication between Antarctic scientists and policy makers. The protocol emphasizes and acknowledges the important role played by the scientific team, and SCAR contributes to further shaping Atlantic environmental policies. The environmental information to policy makers was made challenging for several reasons. The first reason was that the knowledge of the environment of this continent and its scientific understanding is incomplete due to the changing circumstances, uncertainties and the implication of these made the situation complex for the policy makers who are deciding based on certain and available evidence. On the contrary, the rapid rate of development in many scientific fields can mean that it is challenging for policy makers to remain up-to-date on policy-relevant scientific data. Furthermore, it is often difficult for them to integrate evidence from various academic fields, in order to determine the impacts of climate change and present it in a relevant form. Furthermore, the cultural barrier between science and communication production makes the process time-consuming and challenging, especially when many countries are involved as is increasingly the case. It is possible that no single country has access to an expert scientific opinion on all the Antarctic environmental topics within its own research community and due to that fact, the consultation between international experts is essential to provide their best available advice. Finally, there are language barriers and unfortunately, there is limited access to research journals including important and relevant information that may make it difficult to access and be able to understand all the available research evidence. The efforts to enhance Antarctic environmental protection would be strengthened by developing greater synergies between the science community and the governance bodies. Fortunately, there are tools already in place linking governance and scientific evidence with SCAR playing a key role. Scientists need to clearly communicate the policy implications of their research and policy makers need to communicate their priorities and related science requirements in order to support the progress on environmental protection in Antarctica. Consequently, there has to be transparency between policy makers and scientists increasing the likelihood of progress. The Antarctic policy priorities need to be clarified and totally understood by both national and SCAR representatives that participate in ATS meetings. Those priorities are available and outlined in the meeting reports of the CEP, ATCM, and CCAMLR and are accessible to the Antarctic Treaty Secretariat and CCAMLR websites. The better communication of policy priorities will help to raise awareness among scientists and in this regard, at its meeting in 2017, the CEP agreed to create a list of its priority science needs as a tool to approach and to enhance communication between SCAR and national Antarctic science funding bodies and science communities.Moreover, when preparing for ATCMs, numerous government policy makers engage with Antarctic researchers because they seek advice into meeting papers and national positions and that is an exemplary behaviour for other delegations to follow. The truth is that the lack of scientific certainty is used as a reason to defer decisions in political settings and that is a big question at the end of how much scientific certainty is enough for decision makers. A great example is the issue of non-native species in Antarctica and CEP has been aware of this topic for many years now. During the Polar year, 2007 - 2008 the initiatives of SCAR and COMNAP and those of international programmes that conducted that year, the threat to the Antarctic terrestrial and marine environment due to the non-native species in a context of climate change was

more than defined and had a high priority for the CEP with the input of SCAR. It was agreed by the Committee relevant guidelines to help stakeholders, scientists, national Antarctic programmes and the tourism industry with the purpose of minimising the risk of non-native species introductions. The combination of the ATS and the Parties to the ATS agreements could effectively work towards developing mechanisms in order to promote financial support for research to address policy priorities (a great example would be the current forecasting population and ecosystem responses to changing impacts and climates). As the focus is given to research and individual scientists, those who influence the funding policy will find it more straightforward to justify their national resources and their time on that research that focuses on the agreed priorities, while not losing sight of the scientific integrity. Finally, as for the mounting threats from local and global human impacts in Antarctic environments, the policy makers have never been in greater need of scientific evidence on which to develop appropriate policy and strategies for better management of the continent.

5.1.1 ASMA & Tourism

The issue that has been a source of contention between the scientific community and tourism stakeholders for many years is the high volume of tourist activities in Antarctica, which threatens to irreversibly alter the pristine and fragile ecosystem. For example, the IAATO claimed in 2004 that in 35 years of Antarctic tourism, there has been very little discernible impact from tourist activities at any landing sites on the continent. On the other hand, the Antarctic and Southern Coalition (ASOC) is arguing that, while the tourism industry claims there has been no environmental impact since tourism began several decades ago, To determine which issues should be addressed through regulation of tourism, it is necessary to define its impact on the ATS's three holdings, which are the environment, science, and peace. To illustrate, Maher (2005) stated that several common issues exist when it comes to the various types of tourism impact. Damage to the landscape on a physical level, Invasion of wildlife, Foreign pathogens introduced into penguin colonies, Marine pollution and the introduction of exotic marine organisms, as well as safety concerns. Given that the purpose of this research is to assess the current environmental regulatory framework for increasing tourism activities in Antarctica and to gain a better understanding of the potential environmental impacts, it is possible to classify potential shipping impacts such as damage to marine seabed communities caused by repeated anchoring at the same location. Fuel and oil spills, erroneous sewage and waste disposal, Interference with wildlife caused by ship and small-boat activities Pollution caused by the emissions of ship engines. As an illustration of the marine pollution and environmental impacts associated with Antarctic tourism, on January 28, 1989, the Argentine Polar Transporter and Tourism Vessel Baha Paraiso ran aground two miles from Palmer Station. The vessel was on its way to resupply the nearby Argentine stations and had stopped at Palmer Station to allow tourists on board to visit the scientific station. Another incident occurred when the M/V Explorer sank due to a hull break while sailing through an ice field in the Bransfield Strait on November 23, 2007. (Ford, 2009). These two examples illustrate how a lack of experience sailing in Antarctic waters or an excessive amount of confidence can result in irreversible damage to the Antarctic ecosystem's fragile ecosystem. This research effort will evaluate the region's regulatory framework for environmental protection in light of increasing tourism activity in Antarctica. The focus will be on the critical nature of preserving Antarctica's pristine state and the environmental impact of increased human activity in that region. Additionally, the purpose of this research is to determine whether the number of tourism vessels visiting Antarctica is increasing, as well as all the factors that jeopardize operations in Antarctica, such as the limited assistance available in a critical situation. Additionally, to discuss the various controls that are implemented on the vessels that navigate these waters.

5.2 Conclusions

Effective communication between scientists and policymakers is clearly necessary for the development of informed policy and relevant and directed research efforts that protect Antarctica and the Southern Ocean effectively from current and emerging environmental threats. Despite existing and newly developed initiatives to improve communication, additional opportunities for scientists and policymakers to collaborate exist. The situation could be improved by raising scientists' awareness of the ATS's potential for informing environmental policymaking. Unfortunately, there are existing gaps and in order to advance the tourism monitoring in Antarctica, it is very important to address the gaps first. Effective communication between National Delegations to the ATS and their domestic science funding agencies is necessary to establish a transparent mechanism for commissioning and funding applied research that addresses specific policy needs. Without a clear connection between policy needs and national funding, it is unlikely that targeted policy-relevant science will be delivered. While improved communication between scientists and policymakers, as well as a more deliberate and proactive integration of scientific knowledge into policy making, are unquestionably desirable, the reality is, as is frequently the case, extremely complex, and it would be naive to believe that the obstacles we are currently facing are easily overcome. We have attempted to bring together a variety of general suggestions as well as examples of good practice that demonstrate how the situation could be improved in this paper. Our recommendations emphasize thoughtful incremental improvements with the greatest possible impact, rather than a complete overhaul of the existing system, which is not always necessary or even feasible.
With Antarctic environments increasingly threatened by local and global human activities, policymakers have never had a greater need for timely, high-quality, and relevant scientific evidence upon which to base appropriate policy and management responses. Conservation best practices developed elsewhere in the world may be usefully tailored to the Antarctic's unique circumstances. However, encouraging the scientific community to conduct policy-relevant research is critical if Antarctic policy is to keep pace with current and emerging conservation and environmental management challenges. This requires the establishment of open channels of communication as well as targeted funding at the national and international levels.
It is critical for tour operators organizing such tours to educate and train their staff as well as individual tourists prior to their arrival in Antarctica in order to avoid incidents that could harm the Antarctic environment or wildlife. Additionally, it must include the concept of wilderness values as a basis for developing regulations, such as those restricting certain types of development, such as land-based facilities and modes of transport. Individual tourism requires the implementation of proactive initiatives based on various future development and commercialization scenarios. Additionally, a comprehensive tourism framework based on a clear vision for Antarctic tourism in the coming decades is required, as is its application of the precautionary principle as a guiding principle in the advancement of this principle. To accomplish all of the above, it is critical to include tourism as a distinct concern in an additional Annex to the Antarctic Treaty's Environmental Protocol. All research and monitoring should serve as a foundation for making rational decisions that take cumulative impacts into account. Additionally, the vessels should incorporate port state controls at gateway marinas to ensure that those journeys are authorized and well prepared in order to avoid potentially catastrophic accidents. Additionally, proactive use of zoning as part of a cohesive environmental management system in conjunction with other management tools is critical for site access and the type of tourism activities permitted. Another option for mitigating Antarctica's growing environmental harm is for tour operators to continue tourism ship-based activity and establish an observer scheme onboard tourist vessels. Another critical issue for tour operators should be the discussion of tourist capacity limits. To promote high environmental standards on a national scale, the introduction of an accreditation and training program for tourism operators. It is critical to incorporate cumulative impact into Environmental Impact Assessments and to improve the effectiveness of communicating requirements and regulations to individual tourists via targeted outreach at strategic locations. Raising awareness is critical for minimizing environmental damage on the Antarctic continent.

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APPENDICES

Fig. 1 Antarctic Region
This map shows the major geographical features on the Antarctic continent and the USA and UK research stations, to accompany the Landsat Image Mosaic of Antarctica (LIMA). For information about LIMA and to access the imagery, go to http://lima.usgs.gov (U.S. Geological Survey, Antarctic Overview Map

Fig.2 Temperature change in Antarctica

This map shows the temperature change in Antarctica per decade from 1957-2008, NASA,2009.

Fig. 3 Antarctic Ice sea Extent
Antarctica's total sea ice depth during the past five years in comparison to the 30-year average.

Fig. 4 Arctic Sea Ice Extent
The Arctic's total sea ice depth during the last five years in comparison to the 30-year average.

Fig. 5 Estimated numbers of Antarctic tourists in 1965-2009, (Source: Liggett et al., 2011).

Fig. 6 Proposed Antarctic tourism impact, assessment, and management procedure.