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Protection of Marine Environment during Armed Conflict in Indian Ocean and Its legal Perspectives

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Abstract

As the world become more dependent on the oceans for trade and transportation, the protection of the marine environment during wartime is becoming more and more significant issue. A major worldwide shipping route, the Indian ocean in particular, is suspectable to the aftermath of hostilities. In order to protect the marine environment in the Indian ocean during armed conflict, this study will analyse several legal perspectives on the issue. The research takes into account states responsibilities to safeguard the marine environment during armed conflict as well as the available enforcement mechanism. The research also examines the practical obstacles to upholding these legal obligations, such as the limitations of seeing and recording environmental damage caused by war. The study emphasizes the need of encouraging cooperation among the nations in the Indian Ocean Region and implementing effective enforcement mechanisms to protect the marine environment during times of armed conflict. Highlighting the significance of fulfilling International legal obligations and the need for further investigation into the intricate difficulties linked with safeguarding the marine environment in times of warfare, is the primary focus of this study.

Key Words: *Maritime Laws, Humanitarian Law, Marine Environment, Indian Ocean, Armed Conflicts*

1. Introduction

The marine environment, encompassing oceans, seas, and their connecting waterways, is vital and requires protection, especially during armed conflicts. Article 1 of the UNCLOS 1982, defines the area beyond national jurisdiction, including the seabed and ocean floor (Talmon, 2022). International Humanitarian Law plays a critical role in safeguarding this ecosystem by regulating warfare's impact on non-combatants and imposing restrictions on combat methods.

For decades, it was believed that the vast oceans could absorb pollutants without harm. Recent studies have debunked this notion, revealing significant environmental damage due to over a century of pollution. Oil pollution, exemplified by disasters like the 1990 Gulf War and the 2011 BP Gulf of Mexico spill, is a major contributor.

The Indian Ocean, the world's third largest, holds strategic importance for energy and resource transportation. However, the Indian Ocean Region (IOR) faces challenges like national security and marine protection during conflicts. Special legal measures are necessary to safeguard the ocean, upon which the economic well-being of these nations and the global economy indirectly relies.

An increasingly strategic area for global trade routes has been developed by the Indian Ocean in the last two decades, with the region being passed through by approximately 12% of all ships traded in 2015, including 2,000 oil vessels and nearly 1,000 container ships. Opportunities for wider maritime exploration have been opened up by this. However, significant threats and challenges are faced by the region, which require cooperation among the international community. Common transnational crimes in the Indian Ocean Rim are piracy, terrorism, human trafficking, drug and weapons smuggling, and fish theft. Serious attention and effective handling are required to address these issues (Kaszubska, 2017).

Countries in the IOR collaborate through the Indian Ocean Rim Association (IORA) to mutually benefit from their cooperation. Ocean pollution poses a global issue, impacting human health, resources, and marine life directly and indirectly. Major causes of marine pollution include oil spills, toxic discharges, and hazardous substances dumped into the water, with maritime conflicts exacerbating these risks.

International law offers legal protection for the marine environment during armed conflicts through various instruments. The Additional Protocol I set standards to reduce environmental harm, prohibiting attacks on the natural environment and mandating protective measures. The Geneva and Hague Conventions aim to mitigate warfare's impact on populations and the marine ecosystem, obliging conflict parties to minimize environmental harm and limit damage from military activities. However, Law of the Sea 1892, lacks precise guidance for preventive actions during conflict.

The legal frameworks such as ENMOD, Additional Protocol I, and humanitarian laws comprehensively protect the marine environment during hostilities. Despite potential implementation challenges, these instruments play vital roles in promoting sustainable use and safeguarding the marine ecosystem.

2. Literature Review

a. Protecting the Environment During Armed Conflict: An Inventory and Analysis of International Law

Despite worldwide environmental protection laws, Mrema Elizabeth and her co-authors highlight the often-overlooked environmental impact of violent conflicts. Since 1999, the UNEP has completed four assessments and over 20 post-conflict evaluations using advanced scientific

research to analyse war's environmental impacts. These findings show that natural resource exploitation and illegal commerce often extend armed conflicts, especially in nations with weak or failed laws and procedures. The paper emphasises strengthening international environmental rules during wartime.

However, the authors' praiseworthy attempts to safeguard the environment during wartime lack detail about land or marine battles. Their focus on overall environmental conservation overshadows maritime environment preservation. (Elizabeth Mrema, 2009)

b. International law protecting the environment during armed conflict: gaps and opportunities.

Bothe, Michael, and their colleagues noticed three major problems with the modern International Humanitarian Law regarding environmental preservation during hostilities: a narrow and unclear definition of excessive environmental pollution, legal ambiguities about treating environmental elements as civilian objects, and difficulties applying the proportionality principle to ecological damage viewed as "collateral damage". They proposed framework enhancements. The writers of this research critiqued well the uncertainties and gaps in international humanitarian law because IHL is mute on the aforementioned topics. They have yet to work on the safety of the living and non-living natural and Non-natural resources in the Oceans. (Michael Bothe, 2010)

c. Eco-struggles under Using international criminal law to protect the environment during and after non-international armed conflict

Gillett, M. G., C. Stahn, J. M. Iverson, and J. S. Easterday stated that the implementation of international environmental law during hostilities is one possible strategy for overcoming some of the shortcomings of international humanitarian law. Many rules, standards, methodologies, and mechanisms that may be established in international environmental law may also help to clarify and expand the fundamental rules of IHL to prevent, address, or evaluate accountability for environmental harm that is affected by armed conflict. (Gillett, 2017) Gillett and his colleagues did an excellent job on this study since they discussed environmental protection after and during armed conflicts that are not of an international nature. Although their research focuses on non-international armed conflicts, environmental conservation is important in all forms of conflicts.

d. **Environmental issues in international armed conflict**

Roberts, Adam in his article explained as, even with the most advanced scientific methodologies, it is possible that future ecological impacts cannot be accuratelypredicted. One example of this is the oil contamination episode that happened during the Gulf War. Research conducted on the Gulf War has shown that the conflict's impacts on the surrounding ecosystem were not nearly as catastrophic as was initially feared. (Roberts, 1996) Prof Adam Roberts did an excellent job in his paper on the future consequences of armed conflict on ecosystems. Even in the modern day, he claims, it is impossible to predict the effects of conflict on the environment. In this study, he only discussed the effects of international armed conflict, and he was unable to focus on developing new methods for protecting the maritime environment.

e. Violent maritime spaces: conservation and security in gulf of Mannar Marine

National Park, India

Muralidharan, Rahul, and Nitin D. Rai. The article stated that the prohibition ofTran's frontier pollution is the fundamental tenet of contemporary international environmental law. In accordance with this tenet, states are tasked with the obligationof ensuring that activities taking place within their jurisdiction or under their controldo not degrade the ecosystem of other nations or of regions that fall beyond thepurview of national authority (Rahul Muralidharan, 2020). Furthermore, there is currently a sizable set ofinternational treaties establishing precise rules for various environmental sectors. The authors of this paper discussed the state's duties. They also urged the nations not tointerfere with the jurisdiction of other nations while carrying out any activity. However, they failed to saywhether states shall not injure or destroy marine organisms and resources inside theirown jurisdictions.

f. Oceans law, the maritime environment, and the law of naval warfare

Walker, George K.in his article discuss that, recent wars on a global scale have brought to light certain fundamental problems regarding the connection betweenarmed conflict and International Environmental Law. (Walker, 1996) Even during a conflict, international environmental laws are considered to apply. However, the ideas that are typically emphasized stay at a very abstract level throughout the entire discussion. Walker, George K. focused on the relevance of international environmental law in this article. He also stated that the norms of international environmental law apply during hostilities. However, the author was unable to conduct an examination of environmental legislation. It should also be noted that there is a need for regional collaboration between adjacent and interested states to protect the maritime environment. (Walker, 1996)

3.1. Research Objectives

1. To highlight the significance of the marine environment, and to propose approaches for the protecting and mitigating these effects during wartime.

2. To explore the significance of the Indian Ocean in terms of marine shipment, marine resources, and its impact on humanity.

3. To explore whether the destruction of the marine environment causes issues for maritime shipment, marine resources, and humanity.

3.2. Research Questions

1. What is the importance of marine environment, and what measures can be taken to protect the marine environment during wartime?

2. What is the Importance of the Indian Ocean, and why its protection is important?

3. How does war affect the marine environment, including impacts on marine shipment and marine resources?

3.3. Research Methodology

This research study focuses on protecting the marine environment during times of war using a qualitative methodology. It utilizes both primary and secondary data sources to gain a comprehensive understanding of the subject matter. Primary sources, like international laws and customs related to humanitarianism during wartime, provide foundational knowledge. Secondary sources, including published materials, offer additional insights and allow for the comparison of various viewpoints from organizations and institutions. Technological sources, such as websites and databases, may also contribute to the research.

The study employs an analytical and descriptive approach to explore marine environment protection, encompassing causes, effects, and solutions to harm. The analytical method deconstructs complex ideas to facilitate comprehension, while the descriptive approach offers a detailed account of the issue. This combined approach enables a nuanced analysis of marine environment protection during armed conflicts.

The research also discusses gaps and loopholes within relevant international conventions objectively. The goal is to identify areas where these conventions may inadequately safeguard the marine environment during wartime. By analysing these deficiencies, the study aims to propose recommendations for improving the legal framework governing marine environment protection. Overall, this research adopts a comprehensive and systematic approach to enhance our understanding of how to better safeguard maritime environment during times of war.

4. Marine Environment

It is one of the environmental factors, which elaborate in brief. The term “Environment” includes our homes, places of work, the air, the water, and all earthly and human happening that affect us. All constituent parts of a state (land, water, and air), also considered as an environment. Internationally, earth is known as environment, in states is bound to give safety to man through Law, which is connected with humanity's hereditament and the safeguarding of this planet in its many parts, including the border of man's state of residence, through international norms. (Oxman, 1983)

The marine ecosystem is defined by Law of the Sea, 1982 as an ecosystem, or a collection of ecosystems, based on newly emerging scientific idea of the ecosystem, which focuses on researching a particular point in place and time, including the living animals present, physical and climatic situations, and a link between animals and their surroundings. (Lee, 2005)

As a result, ME is a component of ecosystem which includes seas, oceans, and the side stream that flow into them, as well as the living things that inhabit them, including both plants and animals, as well as other resources like metals of various types. These animals rely on and interconnect with one another in a healthy way. Consequently, marine environment is significant from an economic and biological standpoint (Ronald Mitchell, 1999).

The marine environment contains a diverse range of habitats, such as coral reefs, kelp forests, sea grasses, and deep-ocean trenches. It is a house to different species, including fish and dolphins. Marine ecosystem is also important for global climate and weather patterns because the oceans maintain the temperature and absorb carbon dioxide from the atmosphere. The oceans tribute an important part in the water cycle, as evaporation from the ocean's surface contributes to the formation of clouds and precipitation (Grolin, 2019).

4.1. Reasons for protection of Marine Environment

The global community is struggling to reduce marine pollution since it is vital for human well-being and has impact on individuals. Under UNCLOS 1982, maritime ecosystem is considered an ecosystem or multiple ecosystems based on current scientific understanding of ecosystems, which examines living organisms, their relationships with one another and their surroundings, and the physical and climatic situations at a specific time and place. (Chengyong Liu, 2023)

As a result, the marine environment, which includes seas, oceans, and their tributaries, as well as diverse living organisms such as plants and organisms, and riches such as various metals, is a significant component of the ecosystem. These biological beings are linked and interact in a balanced way. (Ronald Mitchell, 1999) The marine ecosystem holds great economic and ecological importance.

4.2. The Biological Significance of Marine Environment

The interconnection of the oceanic environment is what allows its parts to influence one another. Due to its high surface heat retention and low temperatures below, this ecosystem is vital to preserve the Earth's climatic balance. Due to the ocean's capacity to absorb a lot of sunshine, water evaporates into the air, forming clouds that eventually deliver rain, an essential root of freshwater for life on land. (Wijanarko, 2022) The capacity of the maritime environment to absorb carbon dioxide via photosynthesis carried out by phytoplankton, which are prevalent in seawater, further defines the oceanic environment. Other marine life depends on these bacteria to release oxygen and remove Carbon dioxide from the ocean. Carbon atoms are consequently liberated and changed into organic material. (Wijanarko, 2022)

Many countries now comprehend the significance of the maritime environment and its capacity to reduce the quantity of atmospheric CO2, as the rise in carbon dioxide levels on Earth poses a hazard to both people and the ecosystem. (Brander, 2010)

4.3. The Scientific Significance of Marine Environment

The Marine Scientific Research (MSR) program has significantly advanced our understanding of Earth’s ecosystem, particularly the oceans. It has provided insights into ocean climate, air patterns, and the marine area’s impact on Earth’s climate. The program has also enabled us to explore the ocean floor, monitor ocean depths, and understand ecological processes for better fisheries management and hydrocarbon resource discovery. (W. R. Penrose, 1974)

Agenda 21’s Chapter 17 emphasizes the need for scientific capacity enhancement and evidence-based decision-making for sustainable ocean management. It particularly stresses the need to bolster scientific capability in developing countries. Moreover, oceans and seas are vital globally, and marine scientific research often ties in with environmental research, including fisheries research. Such research helps identify environmental impacts, like pollutants’ effects on marine life, and offers insights into the continental shelf related to seismic activity and natural disasters like the 2004 Pacific Ocean tsunami. (Shimshon Belkin, 2006)

4.4. The Global Significance of Marine Environment

The ocean ecosystem is critical to human and other living beings' food supply because it is abundant in diverse species of ocean creatures with high nutritional figure, particularly fish (Snelgrove, 1997). Furthermore, the oceans contain a plethora of mineral resources that often surpass those present on land, including but not limited to tin reserves in the seas of Thailand and Malaysia, as well as sponge and diamond deposits (Louis W. Botsford, 1997). Despite the development of the most advanced and cutting-edge modes of transportation, the ocean remains a vital mode of global transportation. Shipping can transport goods from one country to another that cannot be transported by air. The oceans also have significant quantities of crude oil and gas, which contribute significantly to global economic success. The seas also provide freshwater through processes such as evaporation and rain, and seawater desalination is an important solution for countries with limited freshwater resources. (Ventikos, 2002)

5. Ways to protect Marine Environment during Wartime:

Marine Environment during Hostilities can be safeguarded by the following suggestions.

I.Reformations in the current legal framework

Marine environment protection during armed conflict is covered by a number of international laws and principles. These legal frameworks aim to ensure that military operations do not harm the marine ecosystem. During armed conflict, international laws and principles are established to safeguard the marine environment such as Humanitarian treaty laws, including the Geneva Conventions and Additional Protocol I (AP1), along with customary principles, aim to mitigate environmental damage. However, the rigorous and vague threshold required to prove harm poses problems. The Environmental Modification Convention (ENMOD) explicitly prohibits the use of environmental modification techniques during conflicts. Furthermore, environmental laws, such as UNCLOS 1982, focuses on protecting the marine environment during Hostilities. (Michael Bothe, International law protecting the environment during armed conflict: gaps and opportunities, 2010)

However, despite the existence of these legal instruments, challenges remain in effectively protecting the marine environment during wartime. The effectiveness of Articles 35 and 55 of Additional Protocol I to the 1949 Geneva Conventions in protecting the environment during armed conflict is hindered by the stringent and imprecise threshold required to demonstrate damage. The triple cumulative standard of proving "widespread, long-term, and severe" damage is practically difficult to achieve due to the vague definitions of these terms. Although provisions in humanitarian law indirectly protect the environment through restrictions on means and methods of warfare and the protection of civilian property and objects, their implementation and enforcement have been limited (Greenwood, 1999). Additionally, The lack of a permanent international system to supervise legal infractions and manage compensation claims for environmental harm caused by armed conflicts weakens preventative measures even more. Due to the lack of established criteria, general humanitarian principles like distinction, necessity, and proportionality may not be able to sufficiently avoid environmental harm. In the face of scientific ambiguity concerning the environmental impact of particular weapons, a cautious approach is emphasized. (Pocar, 2001)

II.Responsibility of Armed forces

The marine environment during armed conflict can be significantly protected if armed forces adhere to the general principles of international humanitarian customary law. By adhering to these guidelines, the military may limit the environmental impact of their activities and reduce harm to marine ecosystems. Firstly, the principle of distinction requires accurate identification and targeting of legitimate military objectives, allowing armed forces to avoid unnecessary damage to the marine environment, including sensitive areas such as coral reefs and marine reserves. Secondly, the principle of proportionality ensures that the anticipated military advantage outweighs harm to civilians and civilian objects, encouraging armed forces to consider the ecological consequences of their actions and ensure that any harm caused to the marine ecosystem is proportional to the military objective. Thirdly, the principle of precaution highlights the need to minimize harm, even in the absence of scientific certainty. (Jacobsson, 2003)

Lastly, respecting the natural environment is essential in protecting the marine ecosystem during armed conflict, prompting armed forces to consider the long-term environmental consequences of their actions and avoid activities that could result in significant and irreversible harm to marine resources. By adhering to these principles, armed forces can significantly contribute to the safety of marine environment in wartimes. This includes taking measures to minimize pollution, avoiding the use of indiscriminate weapons, respecting marine protected areas, and considering the long-term environmental impacts of military operations. It is essential for armed forces to integrate these principles into their planning, training, and decision-making processes to ensure the effective safety of the marine environment during hostilities. (McKenzie, 2020)

III. The Role of the IMO and Regional Organizations

The International Maritime Organization (IMO) assumes a pivotal role in safeguarding the marine environment during times of armed conflict. Through the implementation of international conventions, the IMO establishes a comprehensive framework of regulations and standards aimed at preventing pollution caused by ships, even amidst warfare. By promoting effective flag state control, the organization ensures that vessels adhere to stringent environmental guidelines regardless of the circumstances. Furthermore, the IMO encourages port state control, granting coastal states the authority to inspect foreign ships for compliance with environmental regulations. This proactive approach facilitates the prevention and detection of any violations pertaining to environmental protection. In addition, the IMO provides essential guidance on emergency response and preparedness, enabling member states to minimize environmental damage swiftly and effectively during pollution incidents that may occur during wartime. (Michelle Voyer, 2018)

Moreover, the organization fosters a culture of information sharing and cooperation among nations, facilitating a collective response to environmental challenges during armed conflicts. By enforcing these measures, the IMO significantly contributes to the sustainable use and protection of marine ecosystem, ensuring its safeguarding from the detrimental impacts of warfare. Concurrently, in the IOR, countries have a valuable opportunity to enhance maritime security by engaging in collaborative efforts through regional organizations such as the Indian Ocean Naval Symposium (IONS) and Indian Ocean Rim Association (IORA). These platforms serve as catalysts for improving the collective ability to detect and deter potential threats through the exchange of critical information, participation in joint exercises, and coordination of patrols. By leveraging these collaborative endeavours, participating nations not only reinforce the overall security of the region but also foster a sense of unity and mutual trust. This collective approach enables countries

to effectively address common challenges, exchange best practices, and devise coordinated strategies to safeguard the shared waters of the Indian Ocean region (Junindra Duha, 2022).

6. Importance of Indian Ocean

The Indian Ocean, covering 68.556 million square kilometres and containing about 20% of the world's water, is home to various tributary bodies of water and small island states. Its strategic location and rich natural resources have made it a significant player in world history, a role that has only grown with the spread of globalization and the increased focus of major powers on counter-terrorism policies. The Indian Ocean Region has become a hub for commerce, energy, and trade, attracting the attention of countries like the United Kingdom, Australia, Japan, the United States, China, and India. With 80% of worldwide maritime oil commerce flowing through its seas, the Indian Ocean continues to be a crucial trading route. The presence of countries like China in the maritime region has prompted others, such as India, to reconsider their marine plans. Therefore, the Indian Ocean's importance is underscored by its role as a site for economic growth, controversies, conflicts, regional power rivalry, and its critical position in global trade routes. (Anastasia Christodoulou, 2021)

I. Resources in Indian Ocean

The Indian Ocean is endowed with abundant and diverse natural resources. It is a significant participant in the world's energy resources, holding 27.9% of the world's proved natural gas reserves and 16.8% of its proven oil reserves. Moreover, the economies of countries in the Indian Ocean region played a major role in global iron and gold production, accounting for 35.5% and 17.8% respectively in 2017. This highlights the region's substantial contribution to the mining and metal industries worldwide. (Joshua E. Cinner, 2009)

In addition to mineral resources, the Indian Ocean is a hub for fish capture. In 2016, the region accounted for 28% of global fish capture, and this trend has been consistently increasing since the 1950s. The abundant fish resources have built strong foundations for export industries in a number of countries. More specifically, in 2017, the combined exports of frozen fish from Indonesia and India accounted for around 4.5% of global exports. (White, 1989)

II. Maritime Shipment

The Indian Ocean serves as a vital marine route connecting vital regions such as the Middle East, Africa, East Asia, Europe, and the Americas. Not only is it crucial for trade within its own area, but it also transports more than half of all oil exports throughout the world via water. Furthermore, it is home to 23 of the top 100 container ports in the world. (Cordner, 2010) Container traffic through the ports in this region has experienced a substantial increase, growing fourfold from 46 million TEUs (twenty-foot equivalent units) in 2000 to 166 million TEUs in 2017. According to Lloyd's List, the leading Indian Ocean container ports in 2017 were Singapore (34 million TEUs), Dubai (15 million TEUs), and Port Klang in Malaysia (13 million TEUs). It's noteworthy that smaller ports, such as the Port of Colombo in Sri Lanka and Mombasa in Kenya, have seen faster growth rates than bigger ports, such as Singapore and Dubai, with average growth rates of 6.1% and 8.8%, respectively.

In 2017, intra-regional commerce in the Indian Ocean area accounted for 27.2% of overall trade. The region's relations with outside parties have grown, particularly with China, whose trade share rose from 4.8% in 2000 to 16.1% in 2017. Trade shares with the US, Japan, and the EU have all fallen, though. These figures underscore the Indian Ocean region's growing significance in global maritime trade, with increasing container traffic indicating a thriving trade environment. The evolving trade relationships, particularly with China, reflect shifting global trade dynamics, while robust intra-regional trade highlights economic integration within the region itself. (Potgieter, 2012)

III. Threats in Indian Ocean

Emerging threats pose challenges to the stability and prosperity of the IOR. One crucial concern is the need for freedom of navigation to ensure the smooth flow of marine shipment. However, competition among major powers, non-traditional security threats, and environmental degradation continue to jeopardize this freedom. These threats can impede the region's economic growth and security.

The lack of a regional maritime security system is a big challenge. This gap has spurred major powers to vie for control over the Indian Ocean region's resources and sea routes. The possibility of a rise in geopolitical tensions similar to those in the South China marine might disturb the region's accessibility of marine lanes. Such disruptions can have adverse consequences for trade and energy-dependent nations like Sri Lanka. (Pabasara Kannangara, 2018)

Addressing these emerging threats requires concerted efforts from regional and international stakeholders. Cooperation in maritime security, counter-piracy measures, and combating drug trafficking is crucial to maintaining the stability and openness of Indian Ocean Sea routes. Additionally, sustainable management of marine resources and the establishment of a robust regional maritime security framework are vital to ensure the long-term prosperity and security of the region.

7. Impacts of Armed Conflict on Marine Environment

Armed conflicts have a substantial negative effect on marine ecosystems, causing oil spills and toxic waste to damage marine life and have an adverse effect on fishing and tourism. Increased maritime traffic and pollution may result from indirect impacts, such as the damage of ports and harbours.

1. Impact of Russia-Ukraine War on marine Trade

The trade and logistics in the region, especially along the Black Sea, are being impacted by the situation in Ukraine. The investigation of other trade routes has increased the need for land and sea transport infrastructure and services. According to the International Monetary Fund, the conflict will keep shipping costs high and cause them to rise even further. Supply chains will likely become even more stretched if trade between Russia and Ukraine decreases. The conflict has the biggest effects on trade with Russia and ships traveling via the Black Sea. Due to Russia's naval blockade, many major ports in Ukraine are closed, leaving hundreds of ships either at anchor or trapped in ports. As a result, shipping goods from Ukraine is now more expensive. (Pragyan Deb, 2022)

Because of the positions Russia and Ukraine hold in the agrifood industry and the impact they have on food security and the fight against poverty, grains are a particularly serious concern. Since 2020, grain costs and transportation expenses have increased, primarily as a result of the Ukrainian crisis. The cost of transporting dry bulk goods like wheat increased by 60% between February and May 2022. Costs of consumer food increased by 4% globally as a result of increases in grain prices and freight rates. About half of the increase was attributable to shipping costs. (Orhan, 2022)

Russia is also a major gas and oil exporter. Oil and gas prices have risen as a result of trade restrictions and logistical challenges, as alternative sources have been sought. The cost of shipping has increased overall as a result of the rise in energy prices, which has also caused a rise in the price of marine fuel. By the end of May 2022, the price of very low sulphur fuel oil (VLSFO) had increased 64% globally from the year's beginning. (Nguyen Minh Ngoc, 2022)

II. Gulf war 1991 and its Environmental Effects

Both the Iraq War of 2003 and the Gulf War of 1991 had severe environmental effects. However, all nations in the Persian Gulf, particularly Kuwait and Iraq, experienced increased environmental degradation after the battles. The impacts of war and the use of chemical agents also have an impact on the environment and public health. (Cordesman, 2023)

The 1991 Gulf War had enormous environmental effects since 3.5 million tons of crude oil were spilt into the desert and 800,000 tons were dumped into the Persian Gulf. The burning oil wells released sixty million barrels of oil, which led to the formation of 250 oil lakes covering an area of approximately 50 square kilometres in the desert, and it was estimated that the marine environment was polluted by between six to eight million barrels of oil. (Sand, 2011)

Seabirds and waders were significantly affected by Gulf War, the effects were both directly by the oiling of their feathers and indirectly by ingesting oil while preening. It has been estimated by studies that a decline of between 22% and 50% was observed in the inhabitants of certain species of cormorants and grebes as a side effect of the spill. At the first stage of war, investigations of wader populations along the shores showed a nearly 100% decrease, and the remaining birds found to be contaminated by oil. It is estimated that approximately one lake waders were died because of oil spill in 1991. (Olof Lindén, 2004)

The oil fires also caused air pollution and that pollution had great effects on human health, with a significant rise in oil-related weighty minerals such as vanadium, nickel, selenium, and cobalt found in brain tumours. During the conflict, airborne dust was contaminated by these elements, which could cause DNA damage and promoting lipid peroxidation. (Literathy, 1993)

III. Iraq war and its Effects

Hagopian and co-authors carried out a study in 2011 to calculate the approximate death toll from the Iraq War. A cross-sectional survey of 2,000 randomly chosen households in Iraq was conducted for the study. Interviewers gathered data on the causes of death, as well as the particular causes—such as explosions or gunshots—and those believed to be at fault in the event of war-related casualties. The researchers trained interviewers in suitable questioning tactics to guarantee that sensitive information concerning missing or abducted persons was gathered. In order to account for migration, the researchers examined different data sources to determine the number of Iraqis who had migrated overseas during the conflict. (Amy Hagopian, 2013)

According to the report, there were 4.55 fatalities per 1,000 person-years in Iraq between March 2003 and June 2011. The death rate seen in the 20 months preceding to this era was less than half as high as this rate. Throughout this eight-year span, it was estimated that the conflict caused around 405,000 more deaths. Secondary sources were employed to estimate emigrant mortality rates, and data from these sources indicated that an extra 55,000 fatalities would have been reported if these people had stayed in Iraq. The researchers noted that their study was constrained by the use of older census data and the respondent's extended recollection time. The study discovered that while the majority of the increased mortality was directly related to violence, around a third was caused by indirect variables such flaws in the health, sanitation, transportation, and communication infrastructures. (Riyadh K. Lafta, 2019)

8. CONCLUSION

In conclusion, this Article has thoroughly investigated the legal aspects concerning the safeguarding of the marine environment in the Indian Ocean amid armed conflicts. The study has emphasized the susceptibility of the Indian Ocean's marine ecosystem to harm, which can lead to adverse consequences such as disruptions in maritime transportation, contamination of oceanic waters, destruction of marine habitats, and also detrimental effects on human health. The research outcomes have unequivocally highlighted the immediate requirement to revise existing legal frameworks, establish bilateral and multilateral agreements among nations in the Indian Ocean region, and promote collaborative efforts to ensure the protection and preservation of marine environments during periods of hostility.

Additionally, the study has examined the negative repercussions of armed conflicts on the marine environment, including their impact on maritime shipment, marine resources, and human well-being. It has underscored the interconnected nature of these elements and stressed the necessity of comprehensive measures to safeguard them during times of war. Proposed approaches include the development of revised and up-to-date legal frameworks to address the specific challenges faced during armed conflicts. Furthermore, the study emphasizes the importance of establishing bilateral and multilateral agreements among nations in the Indian Ocean region to foster cooperation and coordination in protecting the marine environment. Regional collaboration is deemed essential for effective implementation of protective measures. By implementing these strategies, it is possible to mitigate the adverse effects on maritime transportation, preserve valuable marine resources, and ensure the well-being of individuals reliant on the marine environment.

Overall, this research study highlights the crucial role of upholding international legal obligations in ensuring the protection of the marine environment in the Indian Ocean during armed conflicts. It emphasizes the need for continued research and exploration into the complex challenges involved in safeguarding the marine ecosystem in times of war. By prioritizing the safety and preservation of the marine environment, we can mitigate the potential devastating impacts of armed conflicts. This requires a concerted effort to promote regional cooperation among Indian Ocean states, fostering collaboration and collective action. Effective enforcement mechanisms must be developed and implemented to ensure compliance with environmental regulations and obligations. By striving towards a sustainable and resilient marine ecosystem, we can safeguard vital marine resources, mitigate pollution, and minimize harm to human well-being. Ultimately, a comprehensive and holistic approach is necessary to protect and preserve the marine environment, enabling future generations to enjoy its ecological, economic, and social benefits.

9. RECOMMENDATIONS

1. **Review humanitarian laws:** It is incumbent upon member states and concerned organizations to review the existing humanitarian law to the protection of the marine environment during armed conflict and propose necessary amendments. Such amendments should aim to interpret ambiguous terminologies such as "widespread," "long-term," and "severe" and establish specific provisions that define penalties for violations of humanitarian law during armed conflict. The proposed amendments should be formulated in a legally precise manner to ensure the comprehensive protection of marine environment and hold accountable those who infringe upon humanitarian laws during times of armed conflict.

2. **Limitation on armed ships:** There should be limitations on the activities of armed ship in the Indian ocean to protect the marine environment. For instance, restrictions could be placed on the use of certain weapons or the disposal of waste materials by these ships. The International Maritime Organization (IMO) should compel contracting states to comply with marine environmental laws and enact restrictions on the immunity provided to armed ships under conventions and treaties. Additionally, the IMO should guarantee that these laws are enforced, and that those who infringe them are held accountable. By doing so, the IMO can limit the actions of armed ships and protect the marine environment.

3. **War-free zone:** It is recommended that the Indian Ocean Rim Association (IORA) establish a designated area within the Indian Ocean and declare it as a "war-free zone" to ensure safe maritime trade during armed conflicts. Given the significant role of maritime trade in the global economy, such a move would help to safeguard the interests of all the stakeholders. Furthermore, the IORA should enact a convention that clearly outlines the rules governing this war-free zone, providing a comprehensive framework to ensure the effective and efficient operation of the zone. By implementing these measures, the IORA can promote the stability of the Indian Ocean and support the safe and free movement of goods and people in the region.

4. **New organizations for monitoring:** It is recommended that states with a stake in the Indian Ocean region establish a new organization through diplomatic means, with the aim of promoting peace and stability in the region as well as monitoring the protection of the marine environment in the event of a hostilities. This new organization should ensure that all states situated in the Indian Ocean region are included as members, and its activities should focus on fostering cooperation and collaboration among member states, as well as providing a framework for peaceful conflict resolution.

5. **Regional and global cooperation:** It is imperative to establish cooperation and collaboration among states that have a vested interest in the Indian Ocean region. This can be achieved through the development of a common framework and sharing of information and resources. By working together, these states can ensure the effective management and protection of the marine environment during wartimes. It is also crucial to encourage international cooperation by enacting bilateral, regional and international treaties and agreements that prioritize the protection of marine environment during hostilities.

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