

MARINE ENVIRONMENTAL PROTECTION: TOWARD GLOBAL SUSTAINABILITY THE UNITED ARAB EMIRATES AS A MODEL

PROTEÇÃO DO MEIO AMBIENTE MARINHO: RUMO À SUSTENTABILIDADE GLOBAL OS EMIRADOS ÁRABES UNIDOS COMO MODELO

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Abstract

The marine environment represents one of the most vital natural resources on Earth, playing a fundamental role in providing essential resources such as food, freshwater, and oxygen. It further contributes to regulating the global climate and sustaining the carbon cycle. Nevertheless, marine ecosystems face grave threats due to pollution stemming from human activities, including plastic waste, chemical contaminants, and industrial emissions, all of which accelerate ecosystem degradation and diminish biodiversity. This study seeks to examine the challenges confronting marine environmental protection and to explore strategies for mitigating marine pollution. Particular attention is devoted to the role of international organizations and to the efforts of the United Arab Emirates in formulating and implementing environmental policies that reduce marine pollution. The research also reviews UAE's legislative frameworks and institutional initiatives dedicated to safeguarding marine ecosystems in pursuit of marine sustainability. Moreover, the study highlights the importance of international cooperation among governments, non-governmental organizations, and the private sector in fostering environmental awareness and in advancing innovative, sustainable solutions to pollution. Special emphasis is placed on the UAE's initiatives aimed at conserving marine biodiversity and ensuring the resilience of aquatic life. The findings indicate that strengthening environmental laws and standards at both the national and international levels, coupled with public awareness and innovation in environmental solutions, constitutes the cornerstone for ensuring the sustainability of marine ecosystems and protecting them from pollution. The study concludes with a recommendation to enhance international collaboration and to reinforce partnerships

Resumo

O ambiente marinho representa um dos recursos naturais mais vitais da Terra, desempenhando um papel fundamental no fornecimento de recursos essenciais como alimentos, água doce e oxigênio. Além disso, contribui para a regulação do clima global e para a sustentação do ciclo do carbono. No entanto, os ecossistemas marinhos enfrentam graves ameaças devido à poluição decorrente de atividades humanas, incluindo resíduos plásticos, contaminantes químicos e emissões industriais, que aceleram a degradação dos ecossistemas e diminuem a biodiversidade. Este estudo busca examinar os desafios enfrentados pela proteção do ambiente marinho e explorar estratégias para mitigar a poluição marinha. Dá-se especial atenção ao papel das organizações internacionais e aos esforços dos Emirados Árabes Unidos na formulação e implementação de políticas ambientais que reduzam a poluição marinha. A pesquisa também analisa os marcos legislativos e as iniciativas institucionais dos Emirados Árabes Unidos dedicadas à salvaguarda dos ecossistemas marinhos em busca da sustentabilidade marinha. Além disso, o estudo destaca a importância da cooperação internacional entre governos, organizações não governamentais e o setor privado no fomento da conscientização ambiental e na promoção de soluções inovadoras e sustentáveis para a poluição. Dá-se especial ênfase às iniciativas dos Emirados Árabes Unidos voltadas para a conservação da biodiversidade marinha e para a garantia da resiliência da vida aquática. Os resultados indicam que o fortalecimento das leis e normas ambientais, tanto a nível nacional como internacional, aliado à consciencialização pública e à inovação em soluções ambientais, constitui a pedra angular para garantir a sustentabilidade dos ecossistemas marinhos e



among key stakeholders engaged in marine environmental protection.

Keywords: Marine Environmental Protection. Marine Pollution. Sustainability. International Cooperation. Environmental Organizations.

protegê-los da poluição. O estudo conclui com uma recomendação para reforçar a colaboração internacional e as parcerias entre as principais partes interessadas envolvidas na proteção do ambiente marinho.

Palavras-chave: *Proteção do Ambiente Marinho. Poluição Marinha. Sustentabilidade. Cooperação Internacional. Organizações Ambientais.*

1 INTRODUCTION

The marine environment is among the most vital natural resources on Earth. As stated in the Holy Qur'an: *“And He is the One Who has subjected the sea, so from it you may eat tender seafood and extract ornaments to wear. And you see the ships ploughing their way through it, so you may seek His bounty and give thanks to Him”* (Surat An-Nahl, Verse 14).

Expressing gratitude for this divine blessing entails safeguarding it from any harm, primarily by protecting it against all forms of pollution. This responsibility lies both at the individual and collective levels, requiring a commitment to cleanliness, heightened awareness of the importance of marine ecosystem sustainability, and recognition of the long-term implications of conservation. Preserving this ecological system reflects a deeper understanding of the enduring sustainability it secures for humanity and nature alike (Abdelhady, M. A. E. 2024).

The marine ecosystem underpins numerous aspects of both human and natural life. It provides food and other essential resources such as freshwater and oxygen, while also playing a pivotal role in regulating the global climate. Its capacity to sustain the carbon cycle is particularly critical to maintaining climate stability. The health of the marine environment is thus highly dependent on a delicate natural balance among marine organisms, vegetation, water systems, and climate patterns.

Despite its indispensable role, the marine environment faces serious threats from pollution caused by a range of human activities. Such pollution includes plastic debris, toxic chemicals, and industrial waste—all of which accelerate marine ecosystem degradation. These pollutants adversely affect marine life by destroying habitats, reducing biodiversity, and altering marine food chains, thereby producing destructive

consequences for aquatic organisms as well as for human health, which relies heavily on marine resources.

In light of these challenges, international organizations, governments, and states assume a central role in combating marine pollution and safeguarding marine ecosystem sustainability. These efforts encompass the development and enforcement of international agreements aimed at protecting seas and oceans, alongside monitoring the environmental impacts of human activities and raising public awareness of the importance of marine ecosystems. Furthermore, international organizations provide technical and financial support to developing countries, enabling them to formulate and implement effective policies and programs for combating marine pollution (Badran, D. M. I., Al-Amari, K. B. S. & Abdelhady, M. A. (2024)..

In this context, the United Arab Emirates presents a pioneering model in the efforts undertaken to protect the marine environment. The UAE has implemented a wide range of environmental initiatives aimed at conserving oceans and seas, including the enforcement of stringent regulations to curb marine pollution and the promotion of marine sustainability. The country also plays a prominent role in regional and international cooperation on marine environmental protection, having participated in the development of agreements dedicated to safeguarding oceans and their natural resources. Furthermore, the UAE continues to strengthen its capacities in scientific research and sustainable technologies, while also advancing community awareness of the importance of protecting marine ecosystems from pollution.

Nevertheless, these organizations and states encounter multiple challenges that hinder the realization of their objectives. Among the most pressing challenges are inadequate funding, difficulties in effectively implementing environmental agreements, and the lack of robust enforcement mechanisms to ensure compliance with international law. In addition, political, economic, and technological constraints pose further obstacles to the preservation of marine environments.

Despite these difficulties, significant opportunities remain to enhance ongoing efforts and ensure the protection of marine ecosystems. These can be realized through reinforcing international cooperation among states and non-governmental organizations, increasing financial allocations for environmental projects, and expanding the scope of scientific research and innovation to develop new environmental solutions. Equally important is the need to raise public awareness and encourage sustainable practices across

marine sectors, thereby reducing negative impacts on the marine environment and securing its sustainability for future generations.

1.1 The significance of the research

The significance of this study lies in its focus on protecting the marine environment from pollution to achieve enduring marine sustainability, as well as highlighting the necessity of strengthening both international and local efforts toward environmental sustainability in marine ecosystems. Marine pollution represents one of the most significant threats to the world's oceans and seas in the contemporary era, with impacts extending to marine life, human health, and the broader ecological system. This study provides a comprehensive perspective on the efforts undertaken by international organizations and the United Arab Emirates to safeguard the marine environment.

Furthermore, the study emphasizes the importance of understanding the role of different nations in addressing these challenges, particularly the role of the UAE, which is recognized as a leading country in this field. By examining these efforts, the study identifies successful policies and effective environmental practices that could be adapted and implemented in other nations. Additionally, it contributes to raising environmental awareness and guiding both local and global communities toward adopting innovative and sustainable solutions to mitigate marine pollution.

Through this research, clear foundations can be established for the development of effective global environmental strategies, enhancing collaboration among governments, international organizations, the private sector, and civil society to preserve the marine environment and ensure its sustainability for future generations.

1.2 Research problem

The marine environment constitutes one of the most vital ecological systems that significantly contribute to the sustainability of life on Earth. However, it is increasingly threatened by marine pollution resulting from diverse human activities. Despite the efforts undertaken by states, as well as international and local organizations, to protect marine ecosystems from pollution, these initiatives continue to face persistent challenges such as inadequate funding, the difficulty of effectively implementing environmental policies,

and the absence of robust mechanisms to ensure compliance with international laws and agreements.

The core problem addressed by this study lies in identifying the factors that hinder the success of marine environmental protection efforts and exploring strategies to overcome these obstacles. The study further seeks to examine the opportunities available for developing more effective policies and strategies to combat marine pollution and to promote environmental sustainability. Central to this inquiry is the question of how international and regional cooperation can be enhanced, and how the scope of environmental innovation can be expanded to generate sustainable solutions to ecological challenges that transcend national borders.

In this context, the research poses a central question: *What are the principal challenges facing states and international organizations in their efforts to protect the marine environment from pollution, and how can these challenges be addressed to ensure a clean and safe marine environment for future generations?*

1.3 Research methodology

This study adopts a descriptive-analytical approach aimed at examining marine environmental protection in the context of global sustainability. It seeks to analyze the challenges confronting the protection of marine ecosystems from pollution and to evaluate the efforts undertaken by international organizations and states— with a particular focus on the United Arab Emirates— to combat this issue. The research relies on collecting data from diverse sources, including prior studies, environmental reports, and international documents related to marine environmental protection.

The study will assess protection policies and evaluate their effectiveness in reducing marine pollution, with particular emphasis on sustainable solutions that can be applied in this domain. Additionally, it will include a case study of the UAE's environmental efforts, highlighting the initiatives implemented by the state to safeguard the marine environment.

This research is closely tied to community service, as it contributes to raising awareness of the importance of preserving marine ecosystems and protecting them from pollution, which directly affects both human health and natural resources. By providing practical recommendations and strategies, the study aims to foster greater environmental

awareness within society and encourage individuals and institutions alike to adopt sustainable practices that safeguard marine ecosystems. Furthermore, the research contributes to strengthening collaboration among governments, environmental organizations, and the private sector, thereby creating a shared framework that ensures the protection of marine resources for future generations.

2 CONTRIBUTIONS OF INTERNATIONAL ORGANIZATIONS TO PROTECTING SEAS FROM MARINE POLLUTION

In a rapidly changing world, marine pollution represents a critical environmental challenge that threatens marine ecosystems, biodiversity, and human health. Marine waters constitute a vital source of life on Earth, playing a fundamental role in providing food, freshwater, clean air, and other natural resources essential for both humans and living organisms (*Al-Masdi, 2025*). Nevertheless, the intensification of human activities—such as industrialization, agriculture, maritime transport, and coastal tourism—has significantly increased levels of marine pollution. In response, international organizations have developed multiple mechanisms to combat marine pollution and safeguard marine ecosystems (*Al-Shamrani, 2024*).

International organizations work toward achieving stability, sustainable development, environmental protection, human rights, and international cooperation. They serve as essential platforms for negotiation and collaboration among states to address global issues and challenges. Moreover, they play a crucial role in strengthening global partnerships and fostering solidarity among nations and peoples. These organizations also provide a forum for the exchange of expertise and knowledge, and for the adoption of joint strategies to address transboundary challenges—thus contributing to the building of a more just, peaceful, and sustainable world (*Al-Khalidi, 2022*).

Broadly speaking, the primary aim of international organizations is to realize shared objectives among member states. These objectives often include environmental protection, the promotion of peace and security, the advancement of sustainable development, the protection of human rights, and coordinated responses to global health, financial, and security crises (*Basheer, 2021*).

International organizations are entities or institutions that operate at the global level, bringing together multiple states as members—or acting with their consent—in

order to achieve shared, well-defined objectives (*Malndi, 2021*). These organizations are characterized by several distinctive features, including:

- International organizations bring states together to collaborate across a wide range of domains, enabling the exchange of knowledge, expertise, and resources to address issues that transcend national borders.
- They offer forums through which states can engage in constructive dialogue and diplomatic negotiation, thereby contributing to the resolution of international disputes and the strengthening of mutual understanding and cooperation.
- International organizations play a key role in formulating international norms and regulations in diverse areas such as human rights, environmental protection, and global trade. This contributes to the harmonization and implementation of standards at the global level (*Al-Jousaiman, 2022*).
- They provide financial and technical assistance to developing countries to advance sustainable development and overcome economic and environmental challenges.
- International organizations function as permanent platforms for addressing global challenges and crises in real time, thereby enabling timely responses to transboundary problems.

Accordingly, international organizations are essential instruments for fostering international cooperation and coordination. They play a pivotal role in advancing sustainable development, safeguarding the environment, and promoting international peace and security (*Abdelghani, 2023*).

2.1 The role of international organizations in protecting the marine environment

International environmental organizations are institutions and bodies operating at the global level to promote the protection of marine ecosystems, preserve their integrity, and maintain ecological balance worldwide. Their objectives include developing international marine environmental policies and legal frameworks (*Ameen, 2023*), as well as strengthening cooperation among states to combat marine pollution, safeguard natural marine environments, and conserve biodiversity (*Al-Marzouqi, 2016*).

The functions and goals of these organizations are diverse, encompassing the prevention of both marine and terrestrial pollution, the promotion of sustainability in the

use of natural resources, the advancement of environmental awareness, the development of sustainable environmental technologies, and the support of sustainable economic and social development. Among the most prominent of these organizations is:

First: The United Nations Environment Program (UNEP)

UNEP is the UN's principal body responsible for environmental issues at both the international and regional levels. Its mandate is to advance environmental protection and sustainable development by fostering international cooperation and shaping global environmental policy. UNEP's tasks include providing member states with scientific and technical advice on environmental issues, offering technical support for the formulation of national and regional environmental policies, raising public awareness on environmental challenges, and strengthening cooperation among states, international organizations, civil society, and the private sector in environmental protection.

With respect to marine protection, UNEP plays a pivotal role in coordinating international efforts to reduce marine pollution and safeguard marine ecosystems. The Program develops international policies and initiatives aimed at enhancing marine protection (*Al-Bashi, 2021*), including the regulation of marine waste, the conservation of marine biodiversity, and the promotion of sustainable use of marine resources.

Furthermore, UNEP strengthens international cooperation by fostering partnerships with regional and global organizations, facilitating knowledge exchange, and disseminating best practices in marine environmental protection. These efforts contribute directly to achieving the Sustainable Development Goals (SDGs) and to preserving the environment for both present and future generations.

Second: The International Maritime Organization (IMO)

The International Maritime Organization is a specialized United Nations agency responsible for international maritime transport. Established in 1948, the IMO develops international rules and standards governing maritime safety and the protection of the marine environment. Its role is fundamental in drafting regulations aimed at reducing maritime emissions and managing harmful marine activities. The IMO sets safety, security, and operational standards for ships, including requirements for safety equipment, training programs, and preventive procedures (*Al-Mansouri, 2019*).

In addition, the IMO develops and updates regulations specifically designed to protect the marine environment. These include measures to limit greenhouse gas emissions from ships, address marine pollution caused by plastic waste, oil spills, and

other hazardous substances. The Organization promotes the adoption of these rules and standards by member states through cooperation, guidance, and capacity-building initiatives, as well as through inspections and monitoring mechanisms to ensure compliance with international maritime law and marine environmental protection (*Díaz-Secades, L. A. 2024*).

Third: The International Council for the Exploration of the Sea (ICES)

ICES is an independent international organization dedicated to monitoring and managing fishery resources in the North Atlantic marine waters. Established in 1902, ICES comprises a network of scientists and experts specializing in marine biology, marine economics, and environmental sciences. The Council focuses on producing scientific reports and policy recommendations to conserve fishery resources and marine ecosystems across the North Atlantic. Its recommendations are grounded in scientific data, field research, and economic analyses, thereby ensuring the sustainable use of marine resources and the preservation of biodiversity among fish species and other marine organisms.

ICES activities include assessing the status of various fish stocks, analyzing the impacts of environmental change on marine species, determining sustainable catch limits, and developing fisheries management measures based on scientific evidence. Furthermore, ICES provides technical and scientific assistance to member states in implementing marine and fisheries legislation and policies, with the aim of preserving marine resources for both present and future generations.

In addition, ICES fosters international cooperation and facilitates the exchange of knowledge and best practices in fisheries management and marine conservation. This is achieved through regular meetings, scientific symposia, and collaborative workshops held with member states and other international maritime organizations.

Fourth: The International Union for Conservation of Nature (IUCN)

The International Union for Conservation of Nature is a non-governmental international organization dedicated to the protection of biodiversity, the conservation of nature, and the sustainable management of natural resources worldwide. Established in 1948, the IUCN brings together hundreds of thousands of members, including governments, civil society organizations, academic institutions, private sector entities, and non-governmental associations. Its mandate encompasses the protection of both marine and terrestrial environments. Within this framework, the IUCN provides scientific

and technical guidance for the conservation of marine protected areas and the sustainable management of marine resources (*Monge-Ganuzas, M. 2024*).

Fifth: The International Labour Organization (ILO)

The International Labor Organization is a specialized United Nations agency concerned with labor issues and human rights in the field of work. Founded in 1919, the ILO aims to improve working conditions and safeguard workers' rights across the globe. In the maritime sector, the Organization plays a critical role in promoting safe and healthy working environments by developing international occupational safety and health standards, delivering training and awareness programs for workers and employers, monitoring and evaluating workplace safety conditions, and fostering international cooperation and the exchange of knowledge and best practices in this domain.

2.2 Challenges facing international efforts to preserve the marine environment

International initiatives aimed at safeguarding the marine environment confront a series of complex challenges arising from the multifaceted and interlinked pressures exerted on marine ecosystems. Addressing these challenges requires effective international cooperation and sustained efforts to develop comprehensive and sustainable solutions that ensure the protection of marine environments for both present and future generations.

Marine pollution represents one of the most pressing challenges of the contemporary era. It stems from diverse sources, including plastic waste, oil spills, and chemical contaminants released from industrial and agricultural activities. Such pollution degrades water quality and coastlines, while inflicting severe harm on marine life, thereby posing a serious threat to biodiversity and the overall health of marine ecosystems (*Mahdi, 2023*).

Climate change further exacerbates these pressures by contributing to rising ocean surface temperatures, altered climatic patterns, and the acceleration of sea-level rise. These factors significantly disrupt marine ecosystems, leading to shifts in ecological dynamics and adverse impacts on marine habitats. Among the most visible consequences are coral reef degradation and the heightened vulnerability of endangered species (*Kafi, 2023*).

Marine biodiversity faces acute threats from human activities such as overfishing, habitat destruction, and persistent pollution. The loss of biodiversity not only diminishes marine species but also destabilizes ecosystems, reducing their resilience and adaptive capacity in the face of future environmental challenges (*Bou Amrah, 2022*).

Unsustainable fishing practices, in particular, constitute one of the gravest threats to marine resources. Overexploitation, destructive fishing methods, and ecosystem degradation collectively result in declining fish stocks and the erosion of aquatic habitats, jeopardizing both global fisheries and the livelihoods of traditional coastal communities.

Equally critical are the challenges of inadequate funding and limited access to effective technologies. Despite the evident global commitment to marine protection, financial constraints hinder the implementation of environmental programs and projects. Moreover, deploying innovative and efficient technologies for marine conservation requires substantial investment in research and development.

Political challenges also play a decisive role. These include fostering international cooperation, ensuring transparent information-sharing among states, and negotiating robust and enforceable international agreements to preserve marine ecosystems. Additional difficulties arise in harmonizing the efforts of diverse international organizations and ensuring coherent coordination of policies and programs across institutional boundaries (*Abdul Hasan, 2023*).

2.3 Legislative measures to combat marine pollution and preserve the marine environment

Legislation plays a pivotal role in addressing marine pollution and safeguarding marine ecosystems by defining the responsibilities and obligations of individuals, corporations, and governments in preserving the marine environment. A robust legal framework provides clear guidance on acceptable conduct, accountability in cases of violations, and establishes stringent standards for maritime safety and environmental protection. These include restrictions on emissions, regulations on the disposal of marine waste, and frameworks for sustainable fisheries management, all aimed at mitigating harmful impacts on the marine environment and advancing sustainability (*Falkawi, 2023*).

Internationally adopted laws and standards also serve a critical function in setting binding regulations for maritime safety and environmental protection. For instance, the International Convention for the Prevention of Pollution from Ships (MARPOL), under the auspices of the International Maritime Organization (IMO), establishes rigorous limits on marine emissions and the discharge of ship-generated waste. These measures encompass restrictions on sulfur, nitrogen, and phosphorus emissions, in addition to the regulation of oil discharges and other hazardous chemicals.

Moreover, such legal instruments provide a framework for regulating fisheries and conserving marine resources. International organizations such as the International Council for the Exploration of the Sea (ICES) play an essential role by analyzing scientific data and issuing evidence-based recommendations to determine sustainable catch limits and develop fisheries management strategies. These measures are integral to maintaining ecological balance within marine ecosystems and preserving biodiversity.

The overarching aim of these legislative standards is to minimize the detrimental impacts on marine ecosystems and ensure the sustainable use of marine resources. By adopting and enforcing these frameworks, states and international organizations are better equipped to strike a balance between utilizing marine resources to meet the needs of present societies and safeguarding the ecological capacity to serve future generations (*Al-Qahtani, 2023*).

2.4 The role of UAE legislation and policy decisions in preserving the marine environment and advancing marine sustainability

In alignment with the United Arab Emirates' strategic vision for sustainable development, the marine environment has emerged as a central priority, prompting the enactment of modern legislation designed to keep pace with global transformations and address escalating environmental challenges. To respond effectively to such challenges, the UAE established the Ministry of Climate Change and Environment in 2016, succeeding the Ministry of Environment and Water founded in 2006. This institutional evolution reflects a national commitment to tackling climate change and strengthening efforts to comprehensively safeguard environmental resources, including marine ecosystems .

The Ministry plays a pivotal role in conserving the marine environment through the implementation of strategic programs and initiatives. These include projects for rehabilitating marine habitats, coral reef restoration, and the installation of artificial reefs to support biodiversity and wildlife. The Ministry also monitors levels of marine pollution—particularly plastic waste—and enforces environmental legislation aimed at protecting and enhancing the environment.

At the federal level, Federal Law No. (43) of 2023 on the new Maritime Law establishes an integrated framework balancing maritime activity with environmental protection. Among its key provisions are the requirement for ships to carry insurance against environmental damage, the introduction of strict regulations for ballast water management to prevent the spread of invasive species, and the reinforcement of liability and compensation mechanisms in cases of marine pollution. This law is supported by complementary legislation, such as Federal Law No. (23) of 1999 on the Exploitation, Protection, and Development of Living Aquatic Resources—amended by Federal Law No. (7) of 2016—which aims to safeguard fish stocks and ensure the sustainability of marine species, as well as Federal Law No. (24) of 1999 on the Protection and Development of the Environment, which strictly prohibits marine pollution in all its forms (Al-Sherman, 2025).

At the local level, Dubai has advanced its leadership by enacting Law No. (11) of 2024, which established the Dubai Environment and Climate Change Authority. This authority is tasked with protecting marine reserves, conducting environmental studies, and reinforcing national policies to address climate change and conserve biodiversity (Al-Zaabi, N., 2017). These efforts complement broader national initiatives, including the designation of more than sixteen marine protected areas and the launch of pioneering research projects, such as the research vessel *Jaywun* operated by the Environment Agency – Abu Dhabi, along with the Yas SeaWorld Research & Rescue Center, which is dedicated to rescuing and rehabilitating marine organisms.

At the regional and international levels, the UAE has reaffirmed its commitment to marine environmental protection agreements, such as the Regional Convention for the Protection of the Marine Environment of the Gulf (ROPME), in addition to its active participation in international conventions on biodiversity and the United Nations Convention on the Law of the Sea. Nevertheless, there remains a need to enhance

transparency in regulating and harmonizing fishing seasons regionally, in order to balance the sustainability of marine resources with the rights of coastal communities.

It is thus evident that the UAE's recent legislation has established a comprehensive institutional and legal framework aimed at achieving marine sustainability, fully aligned with the Sustainable Development Goals (Hassan, A.S., 2021), particularly Goal 14: Life Below Water. This alignment positions the UAE as a pioneering model at both regional and global levels.

In pursuit of preserving the marine environment and sustainably managing living aquatic resources, the UAE has established legislative frameworks governing the exploitation of these resources. These include Federal Law No. 23 of 1999 on the Exploitation, Protection, and Development of Living Aquatic Resources, Federal Law No. 11 of 2002 on the Regulation of International Trade in Endangered Animal and Plant Species, and Ministerial Decree No. 500 of 2014 concerning the Regulation of Shark Fishing and Trade, along with its subsequent amendments.

Additionally, the UAE has issued numerous decrees contributing to the conservation of vital fish species by regulating fishing seasons, permissible catch lengths, and sizes. A wide range of initiatives has also been launched to rehabilitate natural marine habitats and deploy artificial reefs, thereby enhancing fish stocks in national waters. These legislative measures aim to achieve the following objectives:

1. Reducing Marine Waste

The UAE places significant emphasis on safeguarding its marine resources. To this end, it has enacted multiple environmental laws to mitigate marine waste and associated hazards. In the current year, the Ministry of Climate Change and Environment launched a comprehensive program to monitor plastic waste in the UAE's marine and coastal environments. This initiative involves conducting a series of scientific studies whose findings are used to strengthen efforts to limit the spread of marine debris. The studies employ a broad array of methods to measure the quantities and sizes of plastics in the country's waters and along its shores. They also aim to identify the types and amounts of plastic pollution, thereby informing precautionary measures to safeguard human health and marine life. Furthermore, these efforts emphasize the importance of fostering responsible consumption practices within society to reduce plastic waste and prevent its disposal into the sea and the broader environment.

2. Preservation of Fish Stocks

To safeguard and sustain fish stocks, the Ministry of Climate Change and Environment, in partnership with the Environment Agency – Abu Dhabi, launched the Sustainable Fisheries Program for the United Arab Emirates. Implemented from 2016 to 2018, this program achieved several key outcomes, including comprehensive surveys of fish stock levels. Building on the results of this initiative, the Ministry, in collaboration with the Agency, subsequently introduced the UAE National Framework for Sustainable Fisheries 2019–2030. This framework forms part of the government’s broader efforts to protect marine resources and ensure their long-term sustainability. Its objectives include increasing the country’s sustainable fish stocks to 70% by 2030, reducing the environmental impacts of overfishing, and promoting fisheries that are ecologically sustainable, economically viable, and socially responsible. The framework also outlines a national plan to rejuvenate and restore fish stocks across the UAE (Sherman, N, 2021).

3. Enhancing the Marine Environment through the Artificial Caves Program

The Artificial Caves Program is among the most significant initiatives launched by the Ministry of Climate Change and Environment to enrich marine habitats and bolster fish stocks in the UAE. The program aims to enhance the marine environment by providing habitats for aquatic organisms and creating nurseries for juvenile fish. This is achieved through the deployment of environmentally friendly artificial caves in designated areas, coordinated in collaboration with relevant authorities.

Aquaculture, which focuses on breeding selected fish species and providing optimal conditions for their growth and reproduction, has received growing attention in the UAE due to its crucial role in strengthening food security. The Ministry develops national programs to improve the productivity of registered aquaculture farms, attract investment in the sector through technical guidance, and support research identifying species suitable for farming under the UAE’s specific environmental and climatic conditions. These species include crustaceans such as shrimp, local commercial fish like grouper and seabream, as well as non-native species such as seabass and supreme fish.

To preserve marine biodiversity, the UAE has also issued national conservation plans, including the National Shark Conservation and Management Plan 2018–2021 and the National Sea Turtle Conservation Plan 2019–2021.

4. Mangrove Forests

Mangrove forests have received significant attention in the United Arab Emirates due to their crucial role in carbon sequestration, providing safe habitats for fish and other marine organisms, and protecting coastal areas from erosion caused by waves, marine currents, and certain human activities.

5. Cultivation of 24 Coral Species and Mapping of Reef Distribution

Coral reefs are a fundamental component of the marine environment. Accordingly, the Ministry of Climate Change and Environment, in coordination with all relevant authorities across the country, has established a legislative framework to ensure their protection. The Ministry has also developed a research infrastructure dedicated to coral conservation and cultivation, continuously employing the latest global technologies and launching numerous programs and initiatives to enhance and sustain these reefs.

Among these initiatives is the Coastal Rehabilitation Program, which involves stabilizing and cultivating coral reefs in affected areas, in collaboration with the competent authorities of each emirate. The Ministry has implemented a research project to cultivate 24 coral species along the UAE coastline, enhancing their resilience to climate change impacts. In addition, the Ministry prepared a detailed geographic distribution map of coral reefs along the country's coastline, identifying 210 reef sites and recording more than 55 species of hard corals.

6. Maintaining Marine Water Quality

Thanks to the effective measures and protocols implemented by federal and local authorities to ensure the safety of the marine environment and protect it from natural and human-induced hazards, the Ministry of Climate Change and Environment reported that the UAE's marine water quality reached some of the highest levels in 2022, with a recorded quality rate of 88.6%.

According to the Ministry's latest data, a total of 38 marine water quality monitoring stations were operational across all coastal areas of the UAE last year. These stations play a key role in monitoring essential water quality parameters, including temperature, salinity, pH, and dissolved oxygen. Monitoring marine water quality is considered a critical tool for enhancing and expanding natural marine habitats.

7. Joining International Treaties and Conventions

As part of its participation in global efforts to protect marine and coastal environments, the UAE has acceded to numerous international treaties and agreements. These include the Convention on Biological Diversity, the Convention on International

Trade in Endangered Species of Wild Fauna and Flora (CITES), and the Convention on the Conservation of Migratory Species. The UAE is also a party to memoranda of understanding concerning shark conservation and the management of dugongs (*Dugong dugon*) and their habitats across their range.

Furthermore, the UAE has joined international agreements addressing ballast water and sediment management, transboundary control of hazardous and other wastes, protection of the marine environment from land-based sources of pollution, marine pollution from continental shelf exploration and exploitation, and the International Convention for the Prevention of Pollution from Ships (MARPOL 1973/1978). Regionally, the UAE is a signatory to the Kuwait Regional Convention for Cooperation on the Protection of the Marine Environment from Pollution and its Protocols. Additionally, the UAE joined the Global Oceans Alliance, launched by the United Kingdom, to strengthen global marine and ocean protection against threats such as pollution, climate change, and overfishing.

2.5 Initiatives of the United Arab Emirates for the conservation of marine life

- **Establishment of the Ministry of Climate Change and Environment (MOCCAEE):** In 2016, the United Arab Emirates established the Ministry of Climate Change and Environment to reflect its national commitment to addressing climate change challenges and strengthening efforts to protect the marine environment. The Ministry plays a pivotal role in marine conservation through the implementation of strategic programs and initiatives, such as projects for rehabilitating marine habitats, coral reef cultivation, and the deployment of artificial reefs to support biodiversity and wildlife. It also monitors marine pollution levels, particularly plastic waste, and enforces environmental legislation, including Federal Law No. 24 of 1999 on Environmental Protection and Development. Furthermore, the Ministry seeks to promote marine sustainability through collaboration with local and international stakeholders, implementing national programs to protect endangered species such as marine turtles, monitoring environmental violations, and imposing penalties for marine pollution practices, thereby ensuring the preservation of marine resources for future generations (*Ministry of Climate Change and Environment, 2020*).

- **COP28:** Reflecting the UAE's commitment to marine environmental protection and sustainability, the country hosted the 28th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP28) in Dubai from November 30 to December 12, 2023. This conference underscored the UAE's leadership role in global and regional climate action and provided a prominent international platform to address environmental challenges, including marine pollution, coastal ecosystem degradation, and strategies for emission reduction and marine resource protection (*United Nations Framework Convention on Climate Change, 2023*).

The UAE-led consensus at COP28 marked the first agreement on a gradual transition away from fossil fuels, a primary driver of climate change directly impacting ocean temperatures, ice melt, and coral reef degradation. The UAE also contributed to operationalizing the Loss and Damage Fund to support coastal and island nations most vulnerable to sea-level rise. These efforts reflect the UAE's local marine protection initiatives—such as coral reef cultivation, marine pollution monitoring, and sustainable fisheries management—linked to global initiatives presented at the conference, establishing the country as a bridge for international cooperation in safeguarding oceans and marine life for future generations (Al-Sherman, 2024)

- The UAE has developed comprehensive frameworks and issued key decrees to regulate the exploitation of living marine resources and conserve vital fish species.
- Sixteen marine protected areas have been established, covering approximately 12.01% of the UAE's marine and coastal zones.
- The UAE has developed a national framework aimed at increasing sustainable fish stocks to 70% by 2030.
- Artificial reefs and aquaculture initiatives play a critical role in enhancing the country's fish stocks and supporting marine biodiversity.
- The establishment of mangrove forests contributes to creating safe havens for fish and marine life while protecting coastal areas from erosion.
- Thirty-eight monitoring stations have been established along the UAE's coastline to assess and maintain marine water quality.
- The UAE has acceded to numerous international treaties and agreements aimed at protecting marine and coastal environments.

3 CONCLUSION

In conclusion, the pivotal role of the United Arab Emirates and international organizations in protecting the marine environment and promoting global environmental sustainability is evident. Both the UAE and international entities work to establish standards and regulations, provide technical and financial support, and enhance cooperation among nations to address the diverse challenges facing marine ecosystems. These efforts contribute to the preservation of biodiversity and ensure the sustainable use of marine resources. Given the escalating environmental challenges, it is imperative for all stakeholders to intensify global efforts to safeguard the marine environment and secure a sustainable and safe future for the planet for generations to come. Based on this study, the following findings and recommendations emerge:

3.1 Findings

- Achieving global sustainability in marine environmental protection requires strengthening international cooperation and knowledge exchange among countries. It also necessitates the creation of regional and global partnerships aimed at addressing shared challenges and developing innovative solutions to ensure the sustainability of marine resources for future generations.
- The study revealed a significant increase in societal awareness regarding marine environmental issues, driven by educational programs and awareness campaigns targeting all age groups. The private sector has also played a crucial role in supporting environmental initiatives through investments in eco-tourism and clean energy, reflecting a genuine partnership between government and industry in marine conservation.
- The UAE's experience demonstrates the feasibility of balancing economic development with marine environmental protection. The country has successfully developed its economy while safeguarding its natural resources. This experience can serve as a global model, guiding other nations toward more sustainable policies.
- Alignment of national policies with the United Nations Sustainable Development Goals (SDGs), particularly Goal 14: "Life Below Water," has been achieved in

the UAE. This alignment has strengthened the country's regional and international position as a leader in marine environmental protection and sustainable development.

- Multiple initiatives have been undertaken by relevant UAE authorities to ensure the sustainability of marine and coastal environments and their resources. These include enacting and implementing legislation and regulations to prevent pollution, organizing activities within marine and coastal areas, and establishing marine protected areas to preserve biodiversity.
- Protecting the marine environment requires effective international collaboration to address challenges that transcend national boundaries.
- Efforts to combat marine pollution focus on reducing and controlling marine contaminants, enhancing international cooperation, and raising awareness of the importance of the marine environment and the impacts of pollution on its ecosystems.

3.2 Recommendations

- Encourage innovation and scientific research in the field of marine environmental protection. Develop innovative environmental solutions through financial and legislative incentives to promote investment in projects aimed at conserving the marine environment.
- Update and enhance environmental legislation by reviewing existing laws related to marine protection and aligning them with global environmental changes and the UAE's international commitments. Introduce clear provisions to address emerging challenges, such as plastic pollution and activities linked to the blue economy.
- Strengthen integration among relevant authorities by establishing a unified coordination mechanism between federal and local agencies responsible for marine environmental protection, such as the Ministry of Climate Change and Environment and local environmental bodies. This will prevent overlapping responsibilities and ensure rapid response to environmental emergencies.

- Promote partnerships between governments, the private sector, and non-governmental organizations to enhance joint efforts in combating marine pollution and safeguarding the marine environment.
- Launch a national program to combat marine pollution by establishing a comprehensive framework focused on reducing pollution sources, particularly oil and plastic pollution. This program should include stricter monitoring of vessels, provide incentives for companies adopting environmentally friendly technologies, and implement a system of penalties for violators.
- Invest in modern environmental technologies and encourage the use of advanced tools for monitoring the marine environment, including satellites, drones, and artificial intelligence for vessel tracking, pollution monitoring, and real-time environmental data analysis.
- Strengthen regional and international cooperation among nations and organizations by establishing regional partnerships with Gulf countries and other coastal states to exchange expertise and best practices, and participate in joint projects aimed at marine protection and climate change mitigation.
- Arab countries should draw lessons from the UAE's experience in combating marine pollution to achieve lasting sustainability of the marine environment for future generations.

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Authors' Contribution

Both authors contributed equally to the development of this article.

Data availability

All datasets relevant to this study's findings are fully available within the article.

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