

International Ocean Information

# 國際海洋資訊

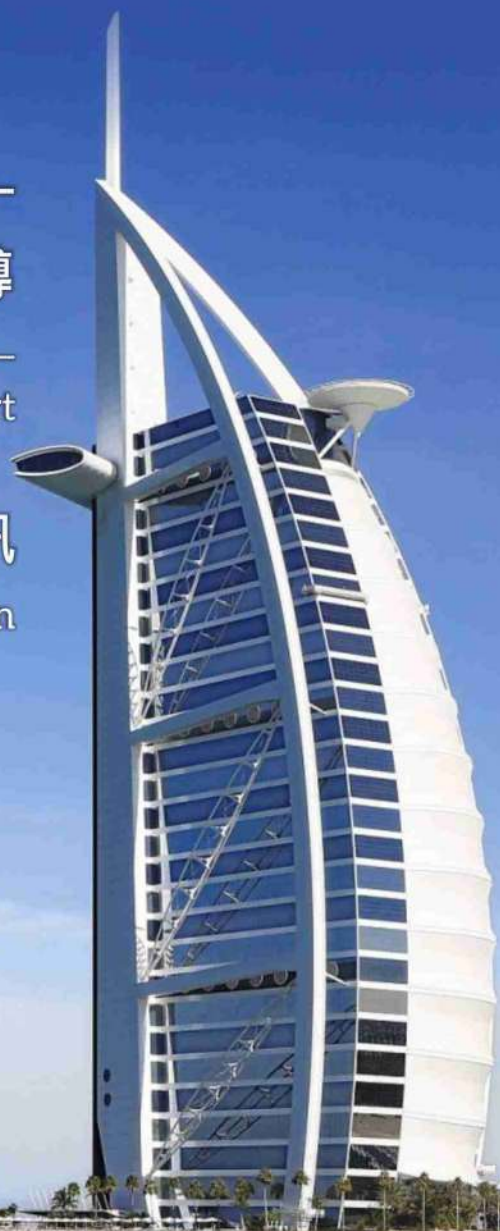
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海洋星球・躍升主流——  
「2023國家海洋日」報導

Ocean Planet - Rising as Mainstream—  
2023 National Oceans Day Special Report

阿拉伯聯合大公國海洋資訊  
United Arab Emirates Ocean Information



海洋委員會  
Ocean Affairs Council

發行

International Ocean Information

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## The Rise of the Ocean Planet: The Value of Taking Actions to Protect the Oceans

Minister of the Ocean Affairs Council: Bi-Ling Kuan

Translated by Chung Hua Translation Service

For this issue of International Ocean Information, the "Special Report" provides detailed information about the "2023 National Oceans Day" organized by the Ocean Affairs Council in Kaohsiung from June 7 to June 10, 2023.

This event, which includes the "2023 Taiwan International Ocean Forum", award ceremony, celebration ceremony, ocean-themed exhibition, Hai An No. 11 Maritime Exercise and an Ocean Concert, aims to inspire the people of the country to collectively endeavor to "transform the action of protecting the ocean into Taiwan's mainstream value". The series of activities on National Oceans Day not only demonstrate our country's dedication to ocean sustainability and our contribution to maintaining regional peace and stability through ocean conservation and sustainability, but also provides opportunities for learning in various fields.

With a focus on climate change, biodiversity loss, pollution, and the sustainable ocean economy, the "International Issues" section of this publication holds a discussion on the global outlook for the ocean in 2023. It is argued that all products and services generated by the ocean as a medium constitute the "blue economy", which emphasizes the balance and symbiosis between human activities and ocean ecology. This includes activities that pose a threat to the overall marine ecosystem, weaken oceanic carbon sequestration, and other destructive practices that can impact industries related to the ocean.

The "Industry Dynamics" section primarily introduces the "Abu Dhabi Blue Carbon Demonstration Project", enabling readers to understand the integrity of Abu Dhabi's coastal blue carbon ecosystems and how this project supports the region in developing local management capacity for blue carbon ecosystems. The rigorous scientific approach adopted by Abu Dhabi in investigating the carbon stock of its coastal ecosystems can provide valuable and reliable reference data for the development of coastal protection management and environmental sustainability policies.

On the other hand, "Organization Focus" introduces the Ministry of Climate Change and Environment (MOCCA) of United Arab Emirates (UAE), highlighting its innovative and sustainable practice, as well as the development and implementation of climate change response policies and projects. For example, facilitating sustainable energy improvements to enhance environmental quality; and enhancing the work efficiency of agricultural, animal, fishery and water fishery departments.

"Latest News" offers an overview of the UAE's coastal habitat projects, highlighting the rich species diversity and biodiversity environment nurtured by its unique ocean and coastal habitats. This section provides comprehensive and reliable knowledge and information, including the location and current status of key coastal habitats. Such information plays a crucial role in implementing and designing effective management measures. In addition, the "Regulatory Systems" section briefly discusses the safety initiative between Abu Dhabi's research vessel, "Jaywun", and Emirates Shipping Line (ESL). This initiative aims to address the deteriorating marine environment and extreme climate through ocean technology and research, while also promoting the development of the blue economy.



## Ocean Planet – Rising as Mainstream— 2023 National Oceans Day Special Report

Chia-Wen Chung and Kai-Jou Tu (Assistant Research Fellow, Taiwan Institute of Economic Research)

Translated by Linguitronics

Keywords: sustainable oceans, ocean education, National Oceans Day

In line with the theme of the United Nation's 2023 World Ocean Day, "Planet Ocean: Tides are Changing," the theme for National Oceans Day was "Ocean Planet – Rising as Mainstream." Starting from June 7, a series of events were held, including the 2023 Taiwan International Ocean Forum, an award ceremony, event celebrations, ocean-themed exhibitions, Hai An No. 11 Maritime Exercise, and an ocean music festival. These events were held in the hope of working together with the public and instilling ocean conservation in society as one of Taiwan's mainstream values.



Figure 1/ (Top left) Minister Bi-Ling Kuan of the OAC; (top right) performances at the celebration events; (bottom left) enthusiastic response at the ocean-themed exhibitions; (bottom right) Hai An No. 11 Maritime Exercise  
Images by the Ocean Affairs Council

Table 1 / Events of 2023 National Oceans Day

Date	Event	Description
June 7	Taiwan International Ocean Forum	Hosted a forum with ocean experts, facilitating in-depth discussion regarding ocean-related issues, including marine ecology, maritime security, and marine industry.
June 8	Ocean Award Presentation Ceremony	Presented the Ocean Awards, encouraging and celebrating contributions to ocean protection from various sectors and individuals.
June 8 - 10	Ocean-themed exhibition	Held a diverse ocean-themed exhibition with activities that offered visitors an opportunity to learn more about different aspects of the ocean up-close.
June 10	Hai An No. 11 Maritime Exercise	Safety exercises included anti-hijacking operations, bomb disposal, vessel interception and capture, boat anti-hijacking operations, and rapid helicopter evacuation exercises.

Source/ made by the authors



## 2023 Taiwan International Ocean Forum - Marine Education and Ecological Conservation Both Indispensable

Minister Bi-Ling Kuan presented the opening remarks to this year's Taiwan International Ocean Forum. She said that this year marked the fourth time the forum was held since 2019. For the past few years, the forum had to be held in alternative ways due to the COVID-19 pandemic. This year, the forum could be physically held, and in-depth discussions were facilitated, which were well worth the celebration. The focus of this year's forum is on presenting concepts related to ocean sustainability and the UN's SDG 14: Life Below Water, which is to "conserve and sustainably use the oceans, seas and marine resources for sustainable development," thereby ensuring biodiversity and preventing deterioration of ocean environments. The forum was also devoted to ocean conservation and ocean sustainability efforts that contribute to maintaining regional peace and stability.



Figure 2/ VIPs of 2023 Taiwan International Ocean Forum Group Photo  
Image by the Ocean Affairs Council

The keynote speaker for the morning session was Dr. Sachiko Oguma, Senior Administrator from the Sasakawa Peace Foundation's Ocean Policy Research Institute, who spoke on the Ocean Education for Enhancing the Symbiotic Relationship between Mankind and the Ocean. Dr. Oguma spoke about how, across the globe, various fields are focusing on cultivating the next generation of talents. The ocean research is no different. Nurturing ocean literacy is an issue of international concern, and the world needs to proactively promote marine education and ocean literacy to improve the general understanding of our oceans. This is so that concrete actions can be taken to foster ocean sustainability and protect our oceans, because humans rely on the ocean for survival.

For the thematic panel discussion on marine ecology, the first seminar topic, "Biological Invasion and Impact on Marine Biodiversity," was presented by Dr. Sergej Olenin, Professor at the Marine Research Institute of Klaipeda University, Lithuania. Dr. Olenin talked about how tens of thousands of ships and vessels are constantly travelling across the world's oceans, alongside coastal marine life which engages in frequent migrations. Thus, modern research into biological invasions include not only studies of biology, but have also rapidly developed into a cross-disciplinary field requiring data analysis to help assess marine life activity and how marine life travels from one region to another.

The second seminar topic, "Navigating the Complex Ecosystem: Charting a Course for Multi-Species Fisheries Management and Bycatch Reduction," was presented by Dr. Ting-Chun Kuo, Assistant Professor of the Institute of Marine Affairs and Resource Management, National Taiwan Ocean University. Dr. Kuo introduced how fishery resource management and marine conservation efforts are not targeted solely on a single species. In recent years, the 30x30 Initiative had been proposed internationally, aiming to conserve at least 30% of the world's oceans as marine protected areas. Taiwan relies on ocean resources for survival, which is why strategies for managing various fishery resources, reducing fishing bycatch, and ocean conservation are of such relative importance. In the future, these strategies hopefully can lead to more balanced and refined methods for managing catches of multiple and single marine species.



The third seminar topic, "Impact of Climate Change on Coastal Ecosystems of Taiwan," was presented by Dr. Li-Lian Liu, Professor at the Department of Oceanography at National Sun Yat-sen University. Dr. Liu explained how the most serious sources of pollution are greenhouse gases and suspended solids. When suspended particulates find their way into the ocean, they will fuse together with marine animals and plants, leading to a chain reaction that further harms the health of various life forms. This requires us to constantly monitor the resilience of our oceans and implement the appropriate measures.

The fourth seminar topic, "Study of Patent Activity Regarding the Protection of the Marine Environment and Marine and Coastal Ecosystems in the Direction of 'Marine ecosystem,'" was presented by Tetiana Kvasha, Head of Forecast and Monitoring of Innovation Development, State Scientific Institution "Ukrainian Institute of Scientific and Technical Expertise and Information" (UkrISTEI) of Ministry of Science and Education of Ukraine. Kvasha illustrated how Ukraine has conducted research on marine and coastal ecosystems, conducting studies related to fisheries and aquaculture, marine life breeding, marine life conservation, coastal cleanup technologies, and marine planning. Based on technical analyses of patent trends, sub-fields such as kelp farming and aquaculture appear promising for future development.

### Focus on Maritime Security in South China Sea—Marine Industries Concentrate on Sustainable Fisheries, Offshore Wind Power, and Cargo Shipping

The thematic panel discussion in the afternoon session was on maritime security. The first seminar topic, "China's South China Sea Policy after the 20th National Congress and Its Impact on Vietnam," was presented by Dr. Vu Quy Son, Research Fellow of the Institute of China Studies of the Vietnam Academy of Social Sciences. Dr. Vu explained how China issued the trial outlines on military operations other than war (MOOTW) in 2022 to guide its South China Sea policy. Dr. Vu also elaborated how China wants to prevent the United States from further exerting its influence in the South China Sea region after the 20th National Congress of the Chinese Communist Party, and strengthens the threat of their gray zone activities. These measures not only may potentially reduce Vietnam's autonomy in the South China Sea, but also put more severe pressure on Vietnam (such as on its fishery activities).

The second seminar topic, "A Study on China's Gray Zone Strategy - Taking the Maritime Militia as an Example," was presented by Dr. Jui-Chung Kao, Director of the Institute of Marine Affairs and Business Management, National Kaohsiung University of Science and Technology. Director Kao indicated how China has, in recent years, mobilized large numbers of fishermen and fishing vessels to serve as backup forces of the People's Liberation Army for declaring territorial sovereignty, resolving changing issues, and avoiding direct confrontations as part of China's gray zone strategy. They help to reinforce China's controversial claims to sovereignty, further resisting international law. Taiwan needs to continue monitoring and studying the situation in order to fight back against China's gray zone tactics.

The third seminar topic, "The Study for Taiwan's Management Strategies Suggestions in the South China Sea under the U.S.-China Conflict," was presented by Dr. Hsiang-Yu Ma, Associate Professor of the Department of Ocean and Border Management, National Quemoy University. The seminar discussed four main subjects: the fundamental causes of the South China Sea dispute, changes to the international environment in the past five years, Taiwan's position on the South China Sea disputes, and suggested courses of action. Due to changes in US-China relations in recent years, a new cold war may very well get underway. Under these circumstances, Dr. Ma believes that Taiwan should be even more proactive in strengthening collaborations with other countries on issues related to its ocean territories, so that it can be included in related projects and programs implemented by various regional organizations. Additionally, Taiwan should look to stand firm on supporting the principles of "respecting the spirit of international law," "participating in multi-party dispute settlement mechanism," "duties of related countries to uphold freedom of navigation across the South China Sea," and "shelving disputes and jointly creating a win-win outcome."



The fourth seminar topic, "Going Back to the Grand Bargain: Advancing a Rules-based Maritime Order in the South China Sea," was presented by Dr. Jeffrey Ordaniel, Director for Maritime Security, Pacific Forum based in the Philippines. Dr. Ordaniel mentioned that while leaders of different nations have all emphasized the importance of enforcing rule-based order in the South China Sea, there is also a lack of consensus on the international regulations and the maritime security policies in this region. This has led to ambiguous sovereignty of territories due to overlapping claims to marine rights and interests, and exclusive economic zones (EEZs). As territorial sovereignty must be underpinned by regional maritime order prescribed by the United Nations Convention on the Law of the Sea, each country can justify its claims to territorial waters based on this convention and other relevant international laws, regardless of the size and power of the country. International disputes can be resolved by appealing to these rules and regulations.

For the thematic panel discussion on marine industry, the first seminar topic, "An Ecosystem, Labor and Community Friendly Fishery in a SIDS: the Maldives Tuna Fishery," was presented by Dr. Azmath Jaleel, a researcher of School of Earth and Ocean Sciences, Cardiff University, UK. Using the Maldives as an example, Dr. Azmath conducted a deep investigation into four aspects: sustainability of fishery resources, eco-friendliness and economic benefits, social engagement, and benefits of fishermen. Dr. Azmath explained that the local fishing industry mainly utilizes line fishing and small-scale fishing vessels, and therefore the country does not have any long-distance fisheries. As such, they have no ocean trash and bycatch issues. This also means that incidences of human trafficking or migrant worker abuse are rare.

The second seminar topic, "Sustaining the Oceans while Implementing Green Strategies," was presented by Mr. Alexander Hickethier, President of the Hickethier Merchant Marine Training Services – Maritime Consulting and Publishing Company, based in the United States. Hickethier discussed how both the United States and Taiwan currently have offshore wind power projects, with most of these projects involving floating offshore wind turbines. However, offshore wind power still faces numerous long-term challenges that require the private and public sectors working together. These issues include marine conservation concerns of researchers related to how wind turbines are affecting whales, economic concerns on how costs for offshore wind power can be controlled, and environmental concerns pertaining to recycling wind turbines. These issues need to be resolved through analyzing risks and responsibilities, and promoting communications with stakeholders.

The third seminar topic, "Shipping Dynamics and Sustainability," was presented by Dr. Chin-Shan Lu, Professor of the Department of Transportation and Logistics Management, National Yang Ming Chiao Tung University. The presentation focused on ocean-related issues in the international shipping industry. 80% of global trade is conducted through sea shipping. Thus, it is important to use knowledge on sustainability to improve the sustainability of sea shipping. For example, worker rights and working conditions are important social issues that also affect the economy in a broader sense. Additionally, net-zero carbon emissions has become a heated topic in the past few years. Sea shipping is one of the contributors to carbon emissions, and some major international shipping companies have gradually begun implementing sustainability policies and operations.

The fourth seminar topic, "New Southbound Actions of Taiwan Nearshore Fishery," was presented by Dr. Jen-Ming Liu, Associate Professor of the Department of Fisheries Production and Management, National Kaohsiung University of Science and Technology. In 2030, as the global human population would approach 9 billion, the world would begin to face various challenges related to food shortage, water resource shortage, and pollution. These problems need to be tackled by implementing policies and taking concrete actions, such as by installing artificial reef balls in the sea, designing and installing coastal nets, developing cage culture technologies, holding coastal recreation activities, and developing coastal tourist resorts. The promotion of blue transition programs requires greater communication between experts, organizations, and groups, to be effectively implemented.



Finally, Dr. Wen-Ling Hong, Deputy Minister of Ocean Affairs Council (OAC), gave a closing speech where she expressed that, with the participation of many international experts, the 2023 Taiwan International Ocean Forum had been able to facilitate much in-depth discussion on many ocean-related issues. The importance placed by each expert on these ocean issues is invaluable and meaningful. From the keynote speech on Ocean Education for Enhancing the Symbiotic Relationship between Mankind and the Ocean to the three thematic panel discussions on the marine ecology, maritime security, and marine industry, all of which revolving around our oceans. In the future, we hope to better examine and understand our oceans, and turn this understanding into concrete actions.

### Celebrating and Recognizing Contributions to Our Oceans

On June 8, the Ocean Award Presentation Ceremony was held, with awards conferred to outstanding civil servants of ocean affairs agencies and grants awarded to vocational school students for outstanding research projects. The Exemplary Marine Conservation Contribution Award, Outstanding City/County Marine Environment Management and Assessment Award, Outstanding Marine Conservation Diver Award, Best Marine Conservation Activist Award, and Outstanding Marine Conservation Fleet Award were also conferred, encouraging individuals and representatives from the public sector, schools, and the private sector all across the country for contributing to protecting our oceans. Additionally, a three-day ocean-themed exhibition included a diverse range of ocean themes, featuring parent-child tours, interactive experiences, public services, environmental protection, technological governance, coast guard equipment, and ocean-related publications. This gave visitors an up-close opportunity to better understand ocean policies, ecology, security, industries, technological research, international issues, and culture and education. Meanwhile, the Hai-an No. 11 Exercise was held on June 10, which included land counter-terrorism operations, anti-hijacking operations, and bomb disposal, as well as water-based operations such as vessel interception and capture, boat anti-hijacking operations, and rapid helicopter evacuation exercises, displaying Taiwan's high competency in adapting to different situations.



Figure 3 / (Left) Ocean Award Presentation Ceremony; (right) speech from President Ing-Wen Tsai  
Images by the Ocean Affairs Council

### Conclusion

Through a series of events held for the 2023 National Oceans Day, the OAC has not only succeeded in disseminating ocean-related knowledge and information, it has also promoted interaction and exchanges between industries in Taiwan, public agencies, academic institutions, and researchers, and global experts in ocean-related fields. All of the knowledge and experiences shared through these events have provided the directions of promoting ocean sustainable development. The events have also helped to proactively facilitate participation of domestic ocean researchers and personnel in international activities, as well as Taiwan's participation in various international domains and international maritime organizations.



# World Ocean Outlook 2023: Inspiring Hope through Practical Action

Compiled by Cheng-Chi Chung (Distinguished Professor, Department. of Shipping and Transportation Management, National Taiwan Ocean University)

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Keywords: World Ocean Outlook, sustainable development, blue economy, marine conservation

The blue economy refers to all the goods and services created through the utilization of the ocean, emphasizing the balance and symbiotic relationship between human activities and marine ecosystem. Prior to the outbreak of the COVID-19 pandemic, the global blue economy generated an annual economic value of \$2.5 trillion, equivalent to the gross domestic product (GDP) of the world's 8th largest economy. However, climate change, overexploitation of natural resources, and other destructive human activities continue to pose threats to the overall marine ecosystem, weakening the ocean's carbon fixation and impacting other ocean-related industries. This article focuses on four key issues based on the World Ocean Outlook, 2023: climate change, biodiversity loss, pollution, and sustainable ocean economy [1]. As an island economy, the ocean industry is fundamental to Taiwan's economy. Currently, Taiwan is eminent in various sectors of the ocean industry, including the shipping industry, long distance fishery, aquaculture, and yacht manufacturing. In recent years, Taiwan has been actively promoting the installation of offshore wind power to align with the trend of renewable energy development. When facing ocean-related issues, it is important for Taiwan to seek international inspiration and take concrete actions to inspire hope. This is a matter of great significance to the people of Taiwan.

## Climate Change

Various types of climate change, such as sea-level rise, floods, and storms, are posing threats that impact the future development of tourism, fisheries, and aquaculture worldwide [1]. Until the end of this century, sea-level rise caused by climate change is expected to lead to frequent and severe floods in low-lying areas and coastal erosion. Extreme sea-level events that used to occur once a century may become an annual occurrence [2].

Governments, industry, the financial sector and others are increasingly becoming cognizant of the links between ocean health and climate change, as well as the extent to which ocean health has an impact on the sustainability of many sectors. These include the United Nations drafting the "Global Plastics Treaty," and a partial ban by the World Trade Organization on harmful fishing subsidies. It is the hope that making significant multilateral decisions will contribute towards preventing further deterioration of the marine environment [1]. As an example, the United Nations adopted the "The United Nations Convention on the Law of the Sea on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction, BBNJ" in June 19, 2023, with the goal of protecting at least 30% of the global ocean by 2030. This treaty aims to mitigate the impacts of climate change and other threats to the marine environment.

Climate change also leads to ocean warming and acidification. Carbon pollution is reducing the capacity of the oceans to absorb carbon dioxide, making the ocean more acidic. The ocean has absorbed about 29% of global carbon dioxide emissions since the end of the preindustrial era. Estimates of future



carbon-dioxide levels, based on business-as-usual emission scenarios, indicate that by the end of this century the surface waters of the ocean could have a pH around 7.8. Furthermore, since 1993, the rate of ocean warming has more than doubled. The ocean has absorbed over 90% of the excess from human activities, and if this trend continues, ocean temperatures are projected to rise by 1–4°C by 2100 [1].

### Biodiversity Loss

With industrialization and large-scale development occurring worldwide, the depletion of global marine resources is becoming increasingly severe. Overfishing affects 95% of large fish species, and 75% of commercially caught fish are on the brink of extinction. Many developed countries, in an effort to address the depletion of marine resources resulting from past years' consumption, have convened multiple regional and international conferences. Their goal is to reach mutual understanding and subsequently sign relevant conventions and regulations to mitigate the loss of marine biodiversity [3].

Currently, less than 3% of the world's oceans are protected by Global Network of Marine Reserves. In December 2022, during the 15th meeting of the Conference of the Parties held in Montreal, the 30×30 initiative was established. Thirty-by-thirty (30×30) refers to efforts by the global community to conserve 30% of terrestrial and marine ecosystems by 2030. It is a confirmed target within the framework of global biodiversity conservation [1].

According to the definition provided by the International Union for Conservation of Nature (IUCN), protected areas should prioritize "nature conservation" as their primary objective. They should be legally recognized, effectively applied, and managed through the establishment of designated regions to achieve long-term protection of nature and ecosystem services. Over the past 30 years, Taiwan has established various marine protected areas under different ministries, totaling approximately 31,718 square kilometers, including no-take areas and fishing gear no-takes [4]. In the past, there have been issues such as lack of connectivity, inadequate survey and monitoring efforts, insufficient incentives for establishing marine protected areas, and inadequate enforcement powers. It is crucial for Taiwan to thoroughly review and improve these aspects, as it is an urgent problem that needs to be addressed at the current stage [5]. In response to these challenges, the Ocean Conservation Administration, Ocean Affairs Council has recently announced a comprehensive management effectiveness assessment of 45 marine protected areas in Taiwan. They are also actively promoting integrated efforts in conducting surveys of important marine ecosystems, ecological monitoring, strengthening legal and regulatory frameworks, and enforcing regulations. These measures aim to enhance the management effectiveness of marine protected areas throughout Taiwan and foster local engagement and support [6].

### Pollution

With rapid global economic development and continuous population growth, pollution problems are gradually intensifying. According to the latest report from the World Ocean Outlook, 2023, approximately 80% of global marine pollution originates from land inhabitation. The most severe sources of pollution include plastic waste, chemical waste, and the shipbreaking industry. According to a survey conducted by Economist Impact, the majority of public, business, and government sectors agree that in the current stage of marine conservation, ensuring control over the first two sources of pollution is of utmost urgency. Top priorities for restoring ocean health are shown in Figure 1.

In terms of plastic pollution, approximately 11 million metric tons of plastic waste enter the oceans each year. Over the past 60 years, plastic production has increased by 560 times, leading to a continuous accumulation of microplastics in the marine environment [7]. Regarding chemical pollution, there are over 500 pollutants derived from wastewater, including identified compounds such as pharmaceuticals,



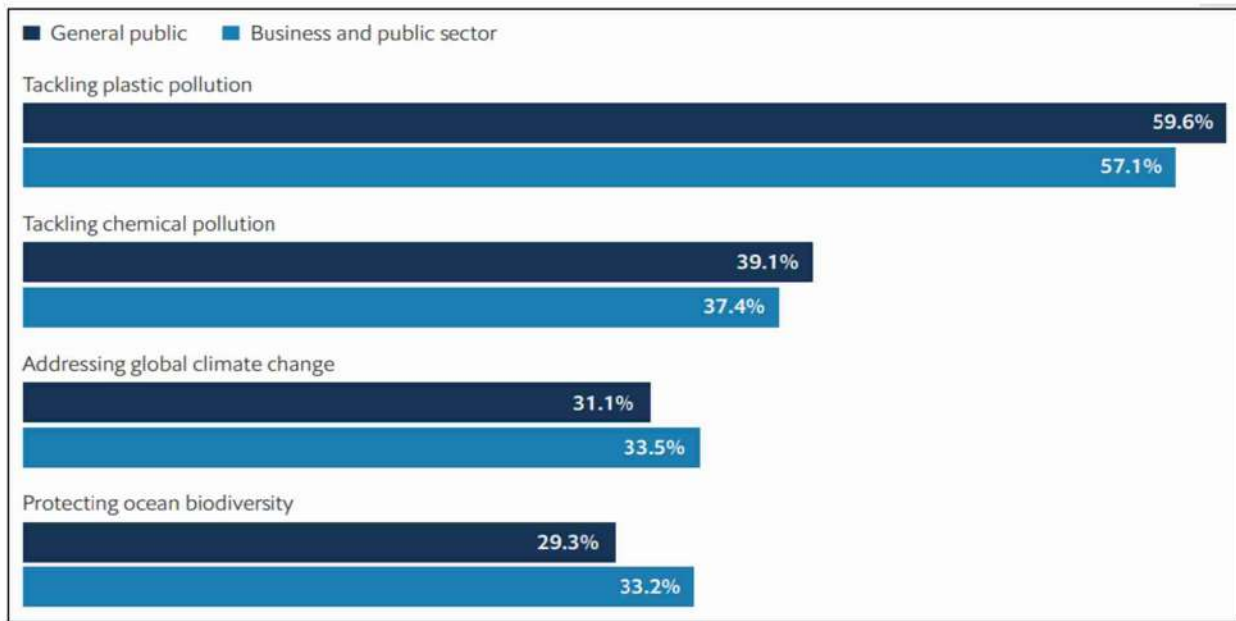


Figure 1/ Top Priorities for Restoring Ocean Health  
Source/ World Ocean Outlook, Economist Impact (2023)

personal care products, food additives, and industrial chemicals [8]. In addition, over the past decade, 80% of global electronic waste has been directed to countries such as China, India, Pakistan, Vietnam, the Philippines, and others. Improper disposal methods include shredding, incineration, and illegal dumping in the sea. In the shipbreaking industry, the release of toxic substances during ship dismantling operations poses a great threat to the coastal environment and biodiversity after mixing with seawater [9]. Over 1,000 ships are dismantled annually, which creates local employment opportunities and yields certain benefits in terms of recovering raw materials like steel and aluminum. However, the toxic waste generated during the dismantling process, such as asbestos and waste oil, poses serious hazards to the workers involved and the surrounding ecology [1].

Understanding where pollution originates from is key to formulating good policies for how to tackle it. According to data from Our World in Data, plastic packaging is the largest source of plastic waste. The United Nations Environment Assembly has agreed to develop a binding treaty to curb plastic pollution by 2024. Implementing plastic reduction policies to raise public awareness is currently a primary measure adopted by governments worldwide. However, it is still necessary to improve waste management systems to achieve a circular economy for the overall plastic supply [10]. Taiwan plans to completely ban plastic products such as shopping bags, disposable tableware, take-out beverage cups, and plastic straws by 2030. The challenges in addressing chemical pollution include the scattered nature of existing international regulations and the differences in chemical control measures and standards among countries. The Occupational Safety and Health Administration under the Ministry of Labor in our country has established a platform for the reporting and licensing of chemicals. They have also implemented regulations such as hazardous chemical labeling and general rules for chemical safety. To mitigate the hazards and pollution associated with shipbreaking activities, the Basel Convention and the International Maritime Organization (IMO) have collaborated to establish rules and regulations that must be followed in shipbreaking operations. Some relevant measures include using safety equipment for mechanical cutting, pre-cleaning of ships before they arrive at the ship-breaking yard, improving labor regulations, conducting regular environmental impact assessments, and reducing insurance premiums for green ships [1].



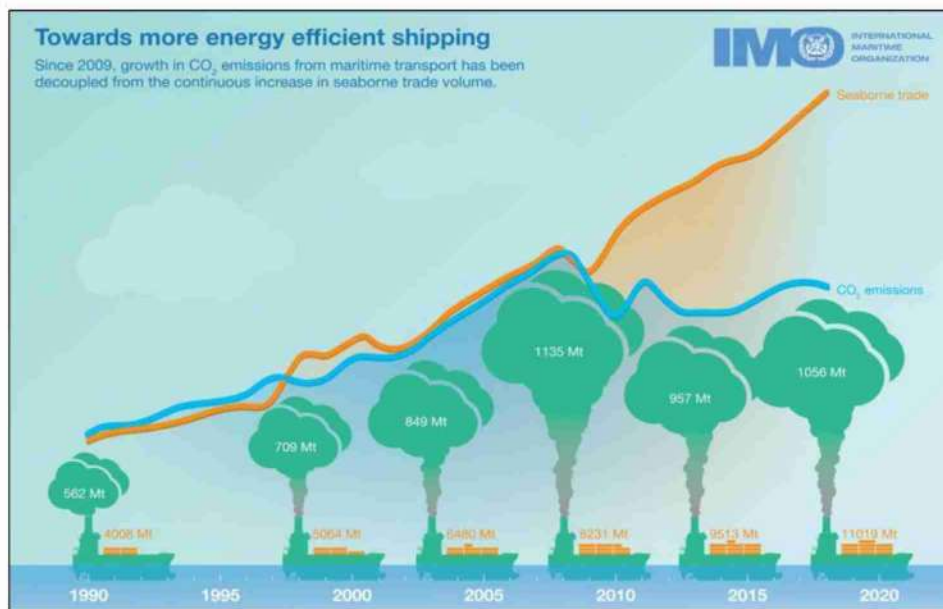


Figure 2/ CO<sub>2</sub> emissions of global maritime transport and seaborne trade  
 Source/ IMO (2022)

## Sustainable ocean economy

The sustainable ocean economy can be explored through various aspects, such as the international shipping industry, offshore renewable energy, fisheries, and tourism. The international shipping industry is one of the major contributors to global pollution, accounting for approximately 3% of global carbon emissions. The annual carbon emissions of the shipping industry depend on the bunker consumption over a certain period multiplied by the carbon emission factor of the bunkers. It can be expressed as follows:  $\text{Shipping CO}_2\text{emissions} = \text{Bunker consumption} \times \text{Bunker CO}_2\text{emission factor}$ , usually measured in metric tons. The relationship between maritime trade and vessel carbon emissions as shown in Figure 2.

The IMO has implemented mandatory regulations, starting from January 1, 2023, for shipping companies to implement the Energy Efficiency Existing Ship Index and the Carbon Intensity Indicator. These regulations aim to set a zero-carbon emission target for international shipping by 2050, marking the arrival of the era of green shipping [11]. Singapore and Rotterdam, the Netherlands, are both major fuel supply ports globally. In 2022, the two countries signed a memorandum of understanding to establish the world's longest green digital shipping corridor. The goal is to achieve full utilization of low-carbon and zero-carbon emission vessels on this route by 2027 [12]. Facing the global decarbonization trend in the energy system, offshore renewable energy holds tremendous potential. Existing offshore power generation technologies include offshore wind power, solar energy, wave energy, and tidal energy. Recently, due to the energy crisis caused by the Russia-Ukraine conflict and international market factors such as the EU's carbon tax, the cost of constructing offshore wind turbines has significantly increased in the Asian region. However, countries continue to adopt integrated design and system thinking for renewable energy, incorporating them into future large-scale deployment and construction projects [1].

In terms of fisheries, the Food and Agriculture Organization of the United Nations (FAO) states that the global demand for seafood continues to increase each year. Many governments have implemented relevant conservation policies to address the damage to fishery resources caused by overfishing. Taiwan passed the "Ocean Basic Act" in 2019, and the "Marine Conservation Act" is currently under review. The tourism industry contributes to 10% of the global GDP. To prevent excessive resource consumption from commercialized tourism in the future, the United Nations World Tourism



Organization encourages governments, businesses, and local organizations to introduce and implement the concept of sustainable tourism at the local level [1]. Taiwan has garnered support from various groups and individuals for sustainable travel that integrates local culture, respects community values, and emphasizes environmental and ecological conservation. There are also internationally recognized certifications for sustainable tourism offered by relevant organizations in Taiwan.

## Concluding Remarks

The issues discussed in this article align with the United Nations Sustainable Development Goals (SDGs) 14, "Life Below Water," which focuses on sustainable oceans and conservation. Looking back at 2022, despite the overshadowing of the pandemic, countries around the world continued to maintain the sustainable blue economy. This includes engaging in binding negotiations on plastic pollution, curbing harmful fisheries subsidies, and working towards the protection of 30% of the Earth's surface area [1]. To keep up with international standards, Taiwan relies on government sustainable governance strategies, corporate social responsibility, and public initiatives. Meanwhile, technology is being integrated into monitoring and management processes, and environmental protection education is being introduced in schools. These efforts extend to the daily lives of citizens and are expected to be put into practice.

Looking ahead to 2023, in addition to the regulations implemented by the IMO and the pursuit of international shipping carbon neutrality, the rise of blue bonds and carbon trading markets has led countries to actively expand the use of renewable and clean energy sources. Taking a comprehensive view, for both technologically advanced developed countries and developing countries, there is a committed attitude towards achieving sustainable development in the future ocean economy. There is a commitment to unite their strengths and take practical actions together towards their goals.

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# Abu Dhabi Blue Carbon Demonstration Project: Establishing Scientific Data and Protecting Coastal Ecosystems Service Values

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Blue carbon ecosystems refer to the ecosystems in the ocean and coastal areas, including mangroves, salt marshes and seagrass beds. Due to their ability to absorb and sequester a significant amount of carbon dioxide while storing carbon elements for an extended period of time, they are also known as "blue carbon". Blue carbon ecosystems play a crucial role in global carbon cycling and climate regulation, as they help to mitigate climate change and alleviate the negative impacts of carbon emissions. The "Abu Dhabi Blue Carbon Demonstration Project" primarily investigates the carbon stock of the Abu Dhabi coastal ecosystem using rigorous scientific methods. Its purpose is to provide valuable and reliable reference data to facilitate the formulation of coastal protection management and environmental sustainability policies. This project will continue to support the integrity of the blue carbon ecosystems and water along the Abu Dhabi coast and assist the region in managing blue carbon ecosystems, thereby further contributing to the area, region and even the international community (most of the content in this article is from the Abu Dhabi Blue Carbon Demonstration Project [1]).

## Introduction to Abu Dhabi

Located in the northeastern region of the Arabian Peninsula near the Persian Gulf, the emirate of Abu Dhabi (hereinafter referred to as the Abu Dhabi) is the largest emirate in the United Arab Emirates. The land area of Abu Dhabi is approximately 67,340 km<sup>2</sup>, with over 600 km of coastline [2]. The Abu Dhabi city, known as the capital of Abu Dhabi, is also the capital of the United Arab Emirates [3]. Within only 40 years, Abu Dhabi has transformed from a small fishing village into a renowned emirate in the United Arab Emirates.

The coastal areas of Abu Dhabi are teeming with diverse marine life, plants and bird species, and have various protected zones and natural parks. With over 200 islands along the coastline, Abu Dhabi provides abundant opportunities for fishing, bird watching, canoeing, diving and immersing oneself in nature, making it a beloved vacation destination cherished by both travelers and local residents.

Abu Dhabi's blue carbon ecosystems include not only those that sequester carbon dioxide, such as mangroves (14,117 ha), seagrass beds (158,262 ha) and salt marshes (4,770 ha), but also candidate blue carbon ecosystems, such as algal mats (10,930 ha). Algal mats have the potential not only to capture but also store carbon dioxide, which is why they are considered as candidate blue carbon ecosystems. Additionally, there are other associated blue carbon ecosystems that, despite not sequestering carbon dioxide, have the potential to capture carbon. These ecosystems are, for examples, coastal sabkha ecosystem (i.e., coastal salt marshes; 389,331 ha), seaweeds ecosystem, and coral reefs ecosystem.



## Abu Dhabi Blue Carbon Demonstration Project

Launched by the Abu Dhabi Global Environmental Data Initiative in November 2012, the one-year "Abu Dhabi Blue Carbon Demonstration Project" received support from the United Nations Environmental Programme (UNEP), UNEP-World Conservation Monitoring Center (UNEP-WCMC), the non-profit organization "Forest Trends," and world-class coastal carbon scientists from around the world. This project aims to explore the value of Abu Dhabi's coastal and oceanic ecosystems and to maintain the country's environment and cultural heritage. The launch of this project can enhance our understanding of carbon capture and storage (CCS) as well as Abu Dhabi's blue carbon ecosystems and the ecosystem services provided thereby. The scientific information obtained through this project can also be used as a reference for formulating policies.

The promotion of the Abu Dhabi Blue Carbon Demonstration Project carries significant implications and benefits, including: being the first demonstration project that implements carbon storage assessment in Central East; incorporating coastal ecosystems to embody the integrity of ocean space and management planning; facilitating regional and international cooperation through blue carbon scientists from different countries; embody the value of blue carbon ecosystems by quantifying carbon and its ecosystem services; and recognizing the importance of having the right information for making wise decisions.

The "Abu Dhabi Blue Carbon Demonstration Project" has five key components to achieve its objectives: carbon baseline assessment, geographic assessment, ecosystem services values assessment, policy feasibility assessment and financial feasibility assessment. Firstly, carbon baseline assessment for mangrove carbon, seagrass carbon, salt marsh carbon, algal mats & coastal sabkha carbon is conducted. Coupled with geographic assessment of these ecosystems, a carbon map is created. With this map, services values of ecosystems are assessed. The subsequent policy feasibility assessment, financial feasibility assessment, and the service values will serve as a basis for making future decision of carbon actions. The abovementioned five key components are summarized as follows [4]:

### ● Carbon baseline assessment

A quantitative survey has been conducted using scientific methodologies to assess the carbon stock of various blue carbon ecosystems, including the carbon stock in aboveground biomass and soil (total, organic, and inorganic). Besides, to better understand the entire carbon cycle mechanism, scientists have collected various data at testing stations, including water table depth, pore-water chemistry, root zone redox potential, and soil respiration.

The carbon stock of blue carbon ecosystems is calculated in the laboratory, while carbon and nitrogen are analyzed using an elemental analyzer. All sampling and analysis were conducted following scientific standards and procedures. The assessment results of the carbon stock reveal that Abu Dhabi's blue carbon ecosystems store over 41 million tonnes of CO<sub>2</sub> equivalent, surpassing the annual carbon emissions from the country's oil, gas and hydropower sectors. The analysis of these data can help scientists to understand the potential and value of blue carbon ecosystems in terms of mitigating climate change. The scientists have also been proactive in developing approaches that allow for the sustainable implementation of the blue carbon project.

### ● Geographic assessment

The team of the "Abu Dhabi Blue Carbon Demonstration Project" has developed an online toolkit called the "Abu Dhabi Blue Carbon Mapping Toolkit" ([www.bluecarbontoolkit.ae](http://www.bluecarbontoolkit.ae)). This toolkit integrates geographic information assessment and provides information on the total carbon stock and area of Abu Dhabi's blue carbon ecosystems, as well as an overview of the carbon stock within the blue carbon



ecosystem area. By offering effective technical instructions, the scientific team enables users of the toolkit to understand the natural carbon stock of Abu Dhabi, and further analyze data and assess spatial requirements. Decision makers can also utilize this toolkit to evaluate, verify, and manage blue carbon ecosystems online.

- **Ecosystem services values assessment**

Abu Dhabi's blue carbon ecosystems offer abundant ecosystem services that enhance human well-being across local, regional, and global scales. At the local level, these ecosystems support the livelihoods of local communities, provide sustenance, mitigate the impact of storms, and enhance coastal resilience. On a regional scale, blue carbon ecosystems play a crucial role in maintaining biodiversity and ecological equilibrium in bays and coastal areas, serving as habitats and breeding grounds for marine organisms. Globally, understanding the benefits provided by blue carbon ecosystems, along with the threats and challenges they face, generates valuable knowledge and experiences for other regions worldwide.

Among Abu Dhabi's coastal ecosystems, seagrass beds have the greatest area and therefore the highest potential value (including carbon stock and other associated benefits). Additionally, the ecosystem services provided by different ecosystems can vary. By integrating these ecosystems, we can identify five areas with the highest blue carbon potential value. It is worth mentioning that different ecosystems and their services can be interconnected. For instance, the coral reef ecosystem can reduce coastal erosion risks by absorbing 85% of wave energy. Therefore, damage to the coral reef ecosystem can have repercussions on mangroves. Consequently, when formulating the ocean and coastal management plan, Abu Dhabi should consider the ecosystem services, value, and impacts of all related ecosystems. Analyzing the distribution of current coastal habitats, coastline conditions, and historical data, scientists can assess the value of ecosystem services at the local, regional, and national scales.

- **Policy feasibility assessment**

The "Abu Dhabi Blue Carbon Demonstration Project" contributes crucial scientific information to climate change mitigation and the development of related plans and policies. Blue carbon ecosystems not only serve as carbon sinks but also provide a range of valuable ecosystem services, such as supporting fisheries, coastal protection, and promoting tourism. The demonstration plan has successfully integrated blue carbon and ecosystem services to establish a policy and political framework for Abu Dhabi. This framework aims to address climate change impacts and promote sustainable development in the region.

- **Finance feasibility assessment**

The demonstration plan has employed the net present value approach to convert projected future benefits and costs into present financial value. The preliminary research findings indicate that, if 50% of mangroves and salt marshes as well as 20% of seagrass beds are protected, the net present value will be negative.

The primary results of the one-year "Abu Dhabi Blue Carbon Demonstration Project" are summarized as follows:

- Given its commitment to protecting coastal ecosystems and the value it places on them, Abu Dhabi can serve as a demonstration for other regions around the world that share similar development goals.
- Abu Dhabi's high-salinity waters, high temperatures, and drought-prone environment can serve as a reference for future climate changes.



- Abu Dhabi's blue carbon ecosystems store a significant amount of carbon. If these ecosystems are damaged, a substantial amount of carbon dioxide will be released into the atmosphere.
- Among the United Arab Emirates, Abu Dhabi has the highest carbon stock level. However, when compared to other regions around the world, its carbon stock level per unit is relatively lower.
- Abu Dhabi's blue carbon ecosystems encompass not only mangroves, salt marshes, and seagrass beds but also algal mats that have the potential for high concentrations of blue carbon. While coastal sabkha is classified as a blue carbon-related ecosystem, it does not contribute to carbon sequestration. There is still a significant scientific gap in understanding seagrass beds and sabkha, necessitating further discussion and research.
- Blue carbon ecosystems offer a wide range of ecosystem services, encompassing not only carbon sequestration but also coastal erosion mitigation, maintenance of water quality, support for fisheries development, and recreational and cultural value.
- The holistic service functions of blue carbon ecosystems, including carbon sequestration and habitat provision, should be integrated into ocean protection and management policies. In the meantime, spatial and financial planning for the ocean should be approached from a comprehensive perspective.
- This project has successfully increased awareness of blue carbon ecosystems at regional and global scales, particularly highlighting the significance of blue carbon scientific research in arid climates that was previously overlooked. Consequently, the project has also fostered exchanges among scientists from all nations.

## Conclusion

The "Abu Dhabi Blue Carbon Demonstration Project" focuses on five key components. By quantifying the carbon stock of Abu Dhabi's coastal ecosystems and providing valuable data and analysis, this project explores the ecosystem value and the potential for developing carbon sinks. Supported by advanced hardware equipment, software facilities, satellite positioning, and other high technologies, this project enables the analysis of Abu Dhabi's geographic information and the continuous update of data on the distribution of existing blue carbon ecosystems. These tools assist decision-makers in gaining a deeper understanding of and effectively managing blue carbon resources, leading to the development of optimal environmental policies for Abu Dhabi's coastal ecosystems and making well-informed financial decisions.

The "Abu Dhabi Blue Carbon Demonstration Project" will persist in supporting the integrity of Abu Dhabi's coastal blue carbon ecosystems and waters. It will also aid in building the capacity of regions to manage blue carbon ecosystems, thereby making valuable contributions to the local area, region, and even the international community.

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## The United Arab Emirates (UAE) Ministry of Climate Change and Environment

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The impacts of climate change are multifaceted, affecting not only the environment but also the economy, social equity, and public health. As a result, it is critical to consider the risks and opportunities associated with climate change in policy and decision-making processes across all type of sectors. United Arab Emirates (UAE) has taken several measures to address the impacts of climate change and transition towards a low-carbon and sustainable economy. These includes the creation of the Ministry of Climate Change and Environment (MOCCA), that will implement national strategies on renewable energy and energy efficiency, promoting green building standards, and investing in research and development of new technologies. UAE has also established various environmental laws and regulations to reduce greenhouse gas emissions, manage waste, and conserve natural resources. However, given the urgency and scale of the climate change challenge, it is necessary to accelerate and scale up these efforts to meet the ambitious goals set by the country. As such, UAE is committed to enhancing its climate action through various initiatives, including promoting innovation and increasing public awareness and engagement on climate change. To achieve the responsibility, the MOCCA, works closely with relevant stakeholders to identify and address environmental challenges, promote sustainable practices, and establish regulations and standards that ensure the protection and sustainable use of natural resources.

### The History of the Ministry of Climate Change and Environment

Situated in the city of Dubai, the Ministry of Climate Change and Environment (MOCCA), in 2016, was established as a result of the nation's steadfast dedication to alleviate the impacts of climate change by augmenting the functions of the antecedent Ministry of Environment and Water, which previously held the responsibility [1]. The inception of this new Ministry was aimed at directing and enhancing the organization and commitment of the nation in addressing the persistent challenges and fostering cooperation among various stakeholders to sustain and further advance the accomplishments attained in preceding years.

The MOCCA was created with the vision to become a pioneering entity in the field of environmental protection and sustainable development. This entails adopting innovative and sustainable practices that enable United Arab Emirates (UAE) to achieve its socio-economic objectives while preserving its natural resources for future generations. Simultaneously, its mission is to collaborate with its partners to protect the environment, preserve its resources, and invest them efficiently to ensure their sustainability. This has required the Ministry to adopt a comprehensive approach that considers the economic, social, and environmental dimensions of sustainable development [2].

Moreover, the water-scarce hyper-arid environment in which UAE is located poses significant challenges in terms of climate adaptation. Climate adaptation measures are necessary to address the



potential impacts of climate change on natural resources, such as water and land, which are essential for the country's economy and social development. This necessitates collaboration among various stakeholders, including government entities, private sector companies, and civil society organizations, to develop effective and equitable climate adaptation strategies that can be implemented at both national and local levels, to which the organizational chart of the MOCCAЕ outlines the various departments and positions responsible for developing and implementing policies and programs to address climate change, promote sustainable energy, improve the quality of the environment, and enhance the agriculture, animal, fisheries, and aquaculture sectors, providing education and training programs, conducting public outreach campaigns, and partnering with civil society organizations and the private sector to achieve shared environmental objectives [3].

### The Functions of the Ministry of Climate Change and Environment

The MOCCAЕ is responsible for formulating plans, strategies, and policies related to environmental protection, agriculture, animal husbandry, and fisheries, as well as optimal land use and conserving biodiversity. These measures are crucial to ensure the sustainability of the country's natural resources. To ensure food security and biosafety in UAE, the MOCCAЕ aims to increase the contribution of the sectors mentioned before, to the GDP, this will be achieved by implementing safety procedures, preventing epidemics and other diseases, and promoting sustainable practices.

The Ministry recognizes that environmental protection is essential for socio-economic development. Therefore, it strives to integrate environmental protection into all socio-economic development plans and promote sustainable use of vital resources. This approach ensures that economic growth is achieved without compromising the sustainability of natural resources. It also aims to enhance the quality of different types of cultivars and production. This is achieved by rising and employing standards and regulations that ensure the safety and quality of these products, promoting research and development in these sectors, and adopting innovative and sustainable agricultural practices [4]. It acknowledges the importance of research and development in achieving its objectives. Therefore, it also establishes laboratories and centers for research and applied studies to support its objectives. Likewise, it offers different online databases for public information, or the option to request certain specific information [5].

The MOCCAЕ proposes legislation and formulates plans, strategies, policies, programs, and initiatives to mitigate the impact of climate change in the country. This approach ensures that UAE is prepared to face the challenges posed by climate change. It is important to emphasize that the Ministry monitors climate change issues at the regional and global level in collaboration with the concerned authorities. This approach ensures that UAE is up-to-date with the latest developments in climate change and can respond effectively to any emerging issues. Joining relevant international treaties and conventions and proposes partnership agreements with regional and global organizations in coordination with the Ministry of Foreign Affairs and International Cooperation and other concerned authorities. This approach ensures that UAE is aligned with the international community's efforts to tackle environmental issues representing the country in relevant international organizations and at appropriate international events in coordination with the mentioned Ministry of Foreign Affairs and other concerned bodies. This approach ensures that the UAE's voice is heard on the international stage regarding environmental issues.

The MOCCAЕ performs any other functions assigned to it by law or decision of the UAE Cabinet. This ensures that the Ministry is flexible and adaptable to the changing needs of the country's environmental protection and sustainability initiatives.



## Strategies Goals of the Ministry of Climate Change and Environment

In line with the UAE's ambitious sustainability agenda, which aims to promote economic growth and development while preserving the environment for future generations, the goal of the Ministry is working closely with stakeholders across the public and private sectors to identify and promote sustainable business practices, reduce carbon emissions, and support the development of renewable energy technologies, for which 7 strategic goals have been proposed, which are [6]:

### **I. Safeguard environmental health and facilitate the country's transition to a green economy.**

The MOCCAEE is dedicated to protect the environmental health of UAE and facilitating the country's transition to a green economy through a multifaceted approach encompassing policy formulation, stakeholder engagement, innovation, education and international cooperation. By steadfastly pursuing this vision, the Ministry strives to ensure a sustainable and prosperous future for the nation while preserving the environmental integrity of UAE engaging strategic partnerships.

### **II. Ensure the sustainability of the country's ecosystems.**

Recognize the critical importance of warranting the sustainability of the country's ecosystems is about collaborating with a range of partners to develop and implement initiatives that promote biodiversity conservation, ecosystem restoration, and sustainable land use. These efforts are guided by the principles of sustainability and resilience, which are critical to ensuring the long-term health and vitality of the UAE's ecosystems.

### **III. Promote food diversity and ensure its sustainability.**

This involves supporting the development of sustainable agriculture practices, promoting local food production, and encouraging the use of innovative technologies to increase food security and reduce waste. These efforts are guided by the principles of sustainability, equity, and resilience, and are critical to ensuring that the UAE's food system is secure, sustainable, and able to meet the needs of its growing population.

### **IV. Reduce the impact of climate change in line with economic development priorities.**

Acknowledge the urgent need to decrease the impact of climate change in line with economic development priorities. To achieve this goal, the Ministry is working closely with stakeholders across different sectors to identify and promote climate-friendly business practices, reduce greenhouse gas emissions, and support the development of renewable energy technologies. These efforts are critical to ensuring that UAE can continue to grow and prosper while reducing its carbon footprint and mitigating the impacts of climate change.

### **V. Strengthen the enforcement of environmental legislation.**

This involves working closely with law enforcement agencies to ensure that environmental regulations are effectively enforced and that violators are held accountable for their actions. The Ministry also supports efforts to raise public awareness about the importance of environmental protection and encourages individuals and businesses to adopt sustainable practices and behaviors.

### **VI. Provide high-quality administrative services in an efficient and transparent manner.**

This involves working closely with stakeholders across the public and private sectors to identify and address their needs, streamline administrative processes, and promote the use of innovative



technologies to enhance service delivery. These efforts are guided by the principles of efficiency, effectiveness, and transparency, and are critical to ensuring that the Ministry can effectively carry out its mandate to protect the environment and promote sustainable development.

## **VII. Create a culture of innovation at work.**

Guarantee creating a culture of improvement at work involves promoting a culture of creativity, collaboration, and continuous advance, and encouraging employees to develop new and innovative approaches to the challenges faced by the Ministry. By fostering a culture of innovation, the Ministry can enhance its capacity to address complex environmental issues and develop effective solutions that promote sustainable development and protect the environment.

### **Strategies of the Ministry of Climate Change and Environment**

The MOCCAEC demonstrates a profound understanding and extensive knowledge in a diverse range of subjects, stemming from their previous substantial efforts and endeavors. These endeavors encompass a wide array of strategic plans and initiatives that are currently being actively implemented, effectively addressing and embracing numerous goals and targets that were previously discussed. The Ministry's commitment to tackling climate change and preserving the environment is evident through their well-established track record of action, supported by their comprehensive understanding of the complex issues at hand. By leveraging their expertise and experience, the Ministry is steadfastly driving forward transformative measures to mitigate the impacts of climate change and protect the ecological balance upon which our planet depends [7].

The different type of plans, conventions, reports and studies made, bulletins or guides aim to assess the potential impacts of climate change on key sectors and identify climate risks that require immediate action. By undertaking this initiative, the Ministry endeavors to make UAE one of the world's most climate-resilient nations. To identify the most effective adaptation measures for UAE, the Ministry conducted a comprehensive risk assessment on four priority sectors: health, energy, infrastructure, and environment. This assessment relied on a review of existing research, participatory stakeholder consultation, and expert inputs. On other hand, the Ministry's plans are a comprehensive framework that reflects the UAE's unwavering commitment to climate action and sustainable development. It builds upon the UAE Green Agenda 2015-2030 and other national policies, while incorporating inputs from various stakeholders from the public, private, and non-governmental sectors [7]. Those plans serve as a complement to existing policies and is specifically designed to address the urgent need for climate action.

### **Partnership of the Ministry of Climate Change and Environment**

Throughout the entirety of this comprehensive document, it has been reiterated that the MOCCAEC collaborates extensively with diverse entities. In this regard, it is of utmost relevance to expound upon the notable organizations with which the Ministry has diligently worked in tandem, forging fruitful partnerships to effectively realize its ambitious objectives [8]. These esteemed partners encompass both international and domestic entities, each playing a pivotal role in the pursuit of the Ministry's overarching vision.

At an international level, the Ministry has engaged in meaningful cooperation with esteemed organizations such as the International Union for Conservation of Nature (IUCN), a globally recognized authority on conservation and sustainable development. The IUCN's expertise and influence have proved invaluable in shaping and implementing conservation strategies that align with international



best practices [9]. Similarly, the Ministry has established collaborative ties with the International Fund for Houbara Conservation, an institution dedicated to the preservation and rehabilitation of the iconic Houbara bustard species. Through joint efforts, critical measures have been undertaken to safeguard the Houbara bustard's habitat and mitigate threats to its existence [10]. Additionally, the Ministry has partnered with the International Fund for Animal Welfare, an eminent organization committed to safeguarding and advocating for the welfare of animals worldwide. This partnership has facilitated the implementation of comprehensive initiatives aimed at protecting endangered species and addressing animal welfare concerns on a global scale [11].

Turning to domestic partnerships, the Ministry has fostered collaborations with various federal institutions, each bringing its unique expertise to the collective endeavor of combating climate change and ensuring environmental sustainability. Notable among these institutions is the Federal Competitiveness and Statistics Authority, which plays a critical role in gathering and analyzing pertinent data, facilitating evidence-based decision-making processes [12]. Furthermore, close collaboration with the Ministry of Foreign Affairs and International Cooperation has enabled the Ministry to effectively engage in international climate negotiations and promote the UAE's environmental interests on the global stage [13]. Similarly, cooperation with the Ministry of Energy and Industry has fostered the development and implementation of strategies to transition towards cleaner and more sustainable energy sources, reducing carbon emissions and advancing the nation's sustainable development agenda [14].

At the local level, the Ministry has forged valuable partnerships with institutions that actively contribute to its efforts on a day-to-day basis. The American University of Sharjah, renowned for its academic excellence and research capabilities, has been a key collaborator in conducting scientific studies and providing expert advice on environmental matters [15]. The Fishermen Co Operative Association, a vital stakeholder in the conservation of marine resources, has joined forces with the Ministry to establish sustainable fishing practices and ensure the long-term viability of marine ecosystems [16]. Additionally, the Civil Defense has been an essential partner, collaborating closely to enhance preparedness and response mechanisms for climate-related disasters, safeguarding lives and property [17]. The United Arab Emirates Armed Forces, with their operational capabilities and commitment to national security, have actively engaged in environmental protection efforts, emphasizing the integral link between environmental sustainability and national resilience [18].

These collaborations, both international and domestic, exemplify the Ministry's steadfast commitment to forging partnerships and leveraging collective expertise in the pursuit of its ambitious agenda. Through these synergistic alliances, the Ministry endeavors to foster a comprehensive and inclusive approach to addressing climate change, environmental conservation, and sustainable development, transcending boundaries and ensuring a harmonious coexistence between human endeavors and the natural world.

## Conclusion

UAE faces significant climate risks that, if left unaddressed, could lead to significant development challenges. Nonetheless, the UAE's history and culture have long emphasized resilience, as evidenced by the ability of its people to adapt and thrive in the harsh desert environment for centuries.

It is worth noting that UAE has already implemented a wide range of adaptation measures in various sectors, placing it in a favorable position. However, innovative and ambitious ideas and actions are necessary to transform climate challenges into opportunities.



The establishment of MOCCAEE represents a significant contribution to the global efforts in mitigating climate change. Notably, UAE has emerged as one of the pioneering developing countries to proactively address the challenges posed by climate change by designating dedicated ministries. By creating this specialized governmental body, UAE has demonstrated its firm commitment to combating climate change and fostering sustainable development on a comprehensive and strategic level. Such proactive measures not only reflect the country's recognition of the urgency and magnitude of the climate crisis but also exemplify its leadership in prioritizing environmental concerns within its national governance framework. By devoting substantial resources and institutional capacity to tackle climate change, UAE is setting a compelling precedent for other developing nations to follow suit in establishing dedicated ministries and mobilizing efforts towards a more sustainable and resilient future.

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## Introduction to the Mapping Coastal Habitats in United Arab Emirates

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Keywords: United Arab Emirates, UAE, Habitat Mapping, Coastal, Mapping Projects

United Arab Emirates (UAE) is located at the southeastern part of the Arabian Peninsula and borders the Kingdom of Saudi Arabia to the west and south and the Sultanate of Oman to the southeast (Figure 1). UAE area is approximately 71,024 km<sup>2</sup> of land, including some islands in the Arabian/Persian Gulf, in addition to 27,625 km<sup>2</sup> of territorial water. UAE is a constitutional federation of seven emirates, including Abu Dhabi (the capital, 86.7% of the total area), Ajman (0.3%), Dubai (5.0%), Fujairah (1.5%), Ras Al Khaimah (2.2%), Sharjah (3.3%) and Umm Al Quwain (1.0 %). Arabic is the official language, and Islam is the official religion [1].

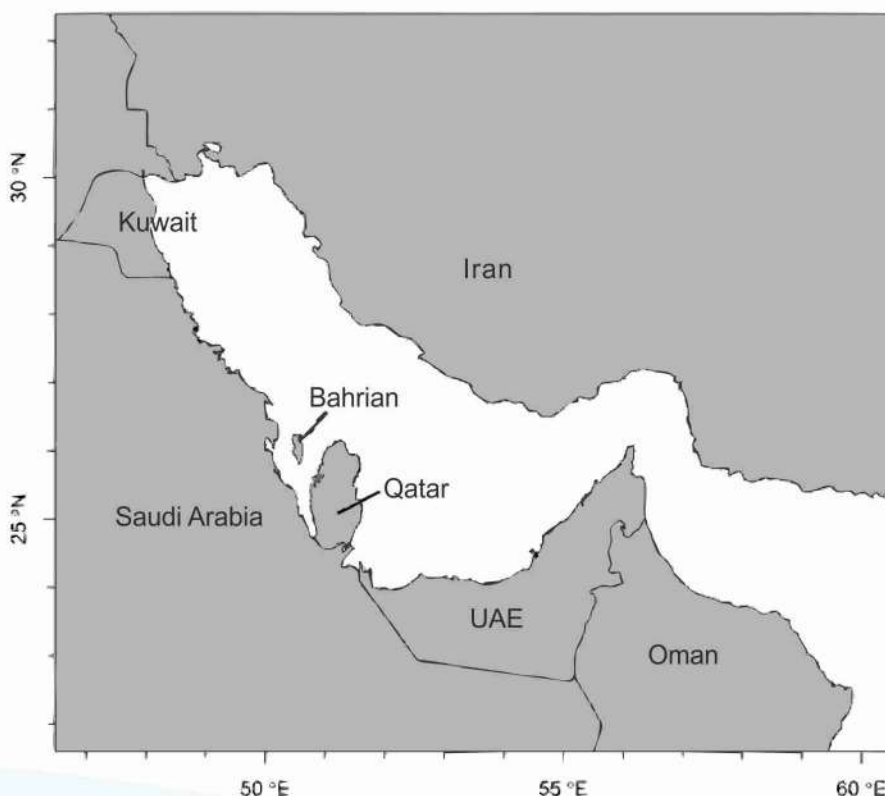


Figure 1/ Map of jurisdictions in the Arabian/Persian Gulf, including Bahrain, Iran, Kuwait, Oman, Qatar, Saudi Arabia, and United Arab Emirates (UAE)  
Image made by the author

UAE maintains a desert climate with a low precipitation and great temperature contrast. The yearly average amount of precipitation is 94.7 mm and average precipitation day is 25.5 days. The precipitation occurs mostly during the cool season, December to March, contributing 86.7% of total yearly precipitation. It is relatively cooler in the winter (mean temperature in January in Dubai is 16.9°C and ranges usually from 16 to 25°C) and hot and humid in the summer (mean temperature in August is 41.3°C and ranges usually from 31 to 42°C). The coastal areas are usually more humid and it is generally cooler and drier in the eastern mountains. Strong north-westerly winds blowing from Saudi Arabia, known as Shamal (north) in Arabic, are developed from seasonal low-pressure. These winds boost up the desert sand and bring the dust storms (or sandstorms) with reduced visibility to as low as a few hundred meters.



The economy of UAE is the 4<sup>th</sup> largest in the Middle East (after Saudi Arabia, Turkey, and Israel), with a gross domestic product (GDP) of more than 500 billion USD in 2022. Its currency is called Arab Emirati Dirham (AED), pegged to the US dollar at the rate 1 USD = AED 3.6725. Currently (June 20, 2023) 1 AED equals to 8.42 new Taiwan dollar. The petroleum and natural gas are the most important source of economic revenue. According to the World Bank Database (<https://www.worldbank.org/en/home>), the oil exports accounted for about 55% of total UAE gross domestic product (GDP) in 1979, and decreased gradually to 15% in 2021 [2], due to an effort to diversify its economic sources. Currently tourism is one of the biggest non-oil sources of revenue in UAE, contributing 11.6% of the total UAE's GDP in 2019.

The coastline of UAE was approximately 1,318 km, including the waters of the Arabian/Persian Gulf and the Sea of Oman, and the offshore islands. The deep mosaics of various marine and coastal habitats contribute complex and interconnected structures that support higher species richness and biodiversity than areas with lower complexity. Many species rely on resources for feeding, refuge and reproduction that can only be accessed through daily or seasonal migrations across interconnected habitat types. Some of these movements link across land and sea, such as the nesting and foraging activities of turtles and seabirds. Benefits from longer-term conservation are more likely when strategies and actions are focused on mosaics of priority habitats rather than individual habitat types [3].

### Mapping Coastal Habitats in the United Arab Emirates

UAE Vision 2021 was launched in 2010, aiming to make UAE among the best countries in the world by the Golden Jubilee of the Union [4]. In order to translate the Vision into reality, its pillars have been mapped into six national priorities, which represent the key focus sectors of government action in the coming years. Sustainable Environment and Infrastructure is one of the natural priorities, showing the UAE's commitment to sustainable development for its future. UAE Vision 2021 has stated the following high-level and near-term strategic priorities:

- To ensure sustainable development and preserving the environment;
- To defend fragile ecosystems from urban development, and
- To act decisively to reduce the nation's ecological deficit.

Reliable and comprehensive regional knowledge on the location and status of important coastal habitats is critical to implementing effective actions that help achieve the sustainable development priorities [4].

To inform effective conservation and habitat restoration actions in UAE, the project entitled "Mapping Coastal Habitats in the United Arab Emirates" is launched, targeting to map coastal marine habitats along the 400-km Arabian Gulf shoreline of the north-western UAE extending across four Emirates (Ajman, Ras Al Khaimah, Sharjah and Umm Al Quwain), the least studied marine system in UAE [5][6]. The primary objectives of the habitat mapping project include:

- To provide a digital map that shows the geographical distribution of coastal habitats of the northwestern Emirates including the locations of critical habitat and details of habitat composition and condition.
- To provide reliable baseline spatial information that can support further prioritization of areas for conservation and to assist protected area management.



- To work with stakeholders to incorporate local ecological knowledge and ensure that the map is fit for purpose to support the implementation of ongoing initiatives of each Emirate and UAE national and international environmental policies.
- To provide a transparent and repeatable participatory approach to habitat mapping that is unique to the project region and provides a suitable framework for unified national mapping efforts.
- To support integrated regional habitat mapping for the Smart Map of Natural Capital of UAE led by the UAE Ministry of Climate Change and Environment and multiple priorities stated in the National Biodiversity Strategies and Action Plans.

The coastal and marine habitat map was co-created with the support of Environmental Competent Authorities, as well as local stakeholders and expert. Satellite imagery data were the main data source, in combination with three other sources: I. existing published and unpublished georeferenced information, including existing data on species satellite tracking as a proxy for habitats; II. local ecological knowledge; III. coastal and underwater ground-truthing, supported by aerial drone georeferenced images in specific hard to access areas. Extensive field surveys were carried out for ground-truthing with an overall accuracy of 77%. This project produced the first detailed and comprehensive map of the region's coastal and shallow marine habitats.

The key results and findings of the project are:

- I. The coastal and marine habitat map of the northwestern Emirates covered 783 km<sup>2</sup> of total area along a 400 km coastline and identified 17 habitat types including critical habitats such as coral reefs, mangroves, saltmarshes, coastal salt flats (sabkha in Arabic), oyster beds, halophyte and seagrass meadows (Table 1).
- II. Almost 10% of the coastal and shallow marine study region is critical habitat, highlighting the importance of protection for these areas existing in proximity to urban development.
- III. Mudflats, seagrasses and mangroves are the three most geographically extensive habitat types of high conservation importance for biodiversity and for sequestering atmospheric carbon dioxide (blue carbon stocks).
- IV. The map highlights the rich habitat diversity in the *khors* (Arabic, meaning creek) and coastal lagoons, forming an interconnected mosaic of different intertidal and subtidal habitats where the function of the whole ecosystem is more than the sum of its individual habitat types.
- V. Oyster beds discovered and mapped for the first-time in the northwestern Emirates. The oyster beds can serve as an important source of food and income for local communities in UAE [6].

The map provides scientific evidence for I. the importance of coastal wetlands, update national wetland inventory and assist in effective spatial management; II. identification and locating marine Areas of Particular Importance for Biodiversity, which can be integrated into area-based conservation measures in the wider seascape and landscape; III. contributing to the UAE's natural capital accounting and mapping of ecosystem services; IV. supporting strategic planning and implementation of ecosystem-based fisheries management; V. facilitating public awareness, education, and citizen science; VI. assessing blue carbon stocks in the coastal habitats of UAE and ultimately inform national and local climate change mitigation strategies and plans; and VII. new research opportunities, such as exploration and mapping of deeper waters (e.g., Lin et al., [7]), creation of a unified coastal habitat map for UAE, and update of species and habitat inventories [6].



Table 1/ Habitat classes and description used to map coastal marine habitats in the north-western emirates

Class	Description
Unconsolidated bottom	All unbound material of varying grain sizes encompassing silt and fine sediments, through to gravels, pebbles, cobbles, and small boulders.
Halophytes	Plants adapted to growing in saline conditions and may be described as saltmarsh in coastal area. The group includes a wide range of plant species including <i>Arthrocnemum macrostachyum</i> , <i>Halocnemon strobilaceum</i> , <i>Halopeplis perfoliata</i> , <i>Salsola drummondii</i> and <i>Suaeda vermiculata</i> . Often associated with sabkha.
Coastal Sabkha	Low lying hypersaline sand flats subject to periodic flooding and evaporation.
Beach	Pebble or sandy shore, found between the high and low tide watermarks.
Mud Flat	An intertidal habitat normally associated with khors and lagoons, consisting of fine sediments.
Mangrove	Salt tolerant trees represented by a single species, <i>Avicennia marina</i> .
Rocky Shore	Intertidal rock platform and rock boulder areas where exposed rock surfaces may be colonized by marine algae, bivalves, and other molluscs, and inhabited by gastropods, crabs, barnacles, and other invertebrates.
Algal Mat	A lower intertidal and nearshore subtidal habitat where high abundances of marine algae colonize unconsolidated fine sediments, primarily in sheltered lagoons.
Seagrass	Represented by three species: <i>Halodule uninervis</i> , <i>Halophila ovalis</i> , and <i>Halophila stipulacea</i> . These plants form beds of varying density in soft sediments in shallow coastal waters, channels, sheltered lagoons and khors. This habitat is highly seasonal in some areas.
Hard-bottom	Sedimentary rock platforms resulting from the deposition of fine sediments and subsequent compression into rock layers – typically extruding limestones, or other carbonate-based formations known regionally as Fasht or Caprock.
Hard-bottom+ Macroalgae	Sedimentary rock platforms colonised by marine plants representative of green (Chlorophyta), brown (Phaeophyta), and red (Rhodophyta) macroalgae. Particularly larger brown algae such as <i>Hormophysa cuneiformis</i> , <i>Padina boergesenii</i> , <i>Sargassum latifolium</i> and <i>Cystoseira trinodis</i> , providing substantial cover (some of which is highly seasonal).
Hard-bottom+ Coral	Sedimentary rock platforms colonised by non-accreting coral communities (poritid and faviid dominated communities). Species include <i>Dipsastraea favus</i> , <i>Favites pentagona</i> , <i>Platygyra daedalea</i> , <i>Pocillopora damicornis</i> , <i>Porites harrisoni</i> , <i>P. lutea</i> , <i>P. nodifera</i> , <i>Turbinaria mesenterina</i> , <i>Goniopora lobata</i> , and <i>Stylophora pistillata</i> .
Hard-bottom+ Pearl Oysters	In areas of exposed hardground which allow for attachment to the underlying rock platform. <i>Pinctada radiata</i> and <i>P. margaritifera</i> .
Reef framework	Accumulation of biogenic carbonates due to corals, coralline algae and foraminifera. It refers only to the carbonate reef matrix without living cover association.
Reef+Coral	Accreting coral communities dominated by faviids, poritiids as well as other boulder and encrusting corals for the most part - with the exception of Sir Bu Nair where <i>Acropora downingi</i> and <i>A. pharaonic</i> were still abundant.
Marine Construction	Human activities such as coastal developments, ports, pipelines etc.
Artificial Reef	Reef Balls and other deployed structures.
Dredged Channel	Primarily dredged channels which were readily distinguishable (as opposed to borrow pits).

Source/ Mateos-Molina et al. (2020) [5]



## Conclusion

In conclusion, the team mapped the spatial distribution of coastal marine habitats in the northwestern emirates of the Arabian Gulf using information combining satellite-based remote sensing data, previously known georeferenced habitat data, local ecological knowledge, species records as proxies for the distribution of their habitats, and other ancillary information. The resulting maps revealed the spatial distribution of critical habitats with an overall accuracy of 77% as examined by ground-truthing with extensive field surveys. This result provides a robust baseline of information to monitor, preserve and manage those habitats, and potentially forms the basis for more detailed marine spatial planning. The team's approach of mapping can facilitate the replication of this habitat map to monitor changes over time, and support any future conservation and management initiatives.

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# A Brief Discussion on Abu Dhabi Research Vessel Jaywun and the UAE Sail Safely Initiative

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Keywords: Marine research vessel 'Jaywun', United Arab Emirates, blue economy, 'Sail Safely' initiative

The most advanced marine research vessel in the Middle East countries, Jaywun, have started operating since February 2023, symbolizing that United Arab Emirates (UAE) declared to improve the deteriorating marine environment and extreme climate through marine research and to develop Blue Economy industries. Jaywun means "precious pearl", reminding UAE that the marine environment where the pearling industry was engaged in before the discovery of oil resources in 1966 had not been seriously disturbed by anthropogenic activities. In recent years, UAE has signed the Paris Agreement, committed to a low-carbon Blue Economy with the goal of sustainable oceans. The strategy makes wonder why UAE, as the world's seventh largest producer of oil and liquefied natural gas, promotes policies that seem to be contrary to its own advantages and interests? How does the marine research vessel Jaywun relate to the maritime safety of UAE?

## Overview of maritime development in UAE

UAE is located on the Arabian Peninsula and consists of 7 emirates. Surrounded by the sea on three sides, UAE has more than 310 seaports thriving with economic activities including shipping, sightseeing, and fishing. The emirates Abu Dhabi and Dubai are the main political and economic entities of UAE. Abu Dhabi's land area and oil reserves account for 85% and 90% of the entire UAE respectively, where oil exploration and production is the main economic income. Instead, Dubai has relatively small oil reserves and thus develops diversified industries and is currently the business hub of tourism and digital economy in the Middle East. In order to achieve a sustainable marine economy, UAE has actively promoted industrial transformation in recent years, including the integration of the shipping industry in Abu Dhabi that originally coordinated the oil industry to strengthen the international shipping, and the vigorous construction of marine tourism in Dubai.

UAE has spared no effort to develop a Blue Economy, which currently accounts for about half of its gross domestic product (GDP). Moreover, UAE also participates actively in internationally promoted environmental protection affairs, including signing the *Paris Agreement* in 2015, promulgating the *UAE Energy Strategy 2050* [1] and the *National Climate Change Plan of the UAE 2017-2050* [2], and also obtained the right to host the 2023 United Nations Climate Change Summit (COP28). The *UAE 2050 Energy Strategy* is set to require clean energy to account for 50% of the total energy production of UAE by 2050 and associated with the reduction of carbon footprint via power generation by 70%. In terms of oceans, according to the *Ramsar Convention*, an international environmental treaty for the protection of wetlands, there have been 6 of 16 UAE marine and coastal protected areas designated as "wetlands of international importance", which subsequently creates a powerful monitoring and management framework for its offshore fisheries.



## Environmental change drives sustainable ocean development in UAE

The threat posed by environmental change is the main reason why UAE, as a major oil-exporting country, supports environmental protection policies such as energy transition, blue economy and net zero carbon emissions. According to a long-term survey and assessment by the Ministry of Energy and Infrastructure of Abu Dhabi, the daily life in UAE is highly dependent on the ocean, including the use of seawater desalination for drinking water production, the fishery and aquaculture for seafood, and the subsea oil fields as an important economic pillar. Thus, the Government and the public must have a high awareness of protecting the marine environment. However, since the mid-20th century, the environment in UAE has become increasingly severe, including I. sea level rise caused by global warming has gradually threatened 90% of the people living in coastal cities in UAE, II. climate imbalance resulted from global warming has intensified desertification in UAE [3], influencing its agriculture and tourism, and also increasing energy consumption such as seawater desalination and indoor air conditioning, III. damage to marine ecosystems as a result of extreme weather events, such as coral bleaching, the proliferation of pathogenic bacteria in seawater, seawater eutrophication, ocean acidification. The above-mentioned effects not only influence the fishery but threaten the aquaculture industry, which has strict requirements on the growing environment.

In order to prevent the continuous deterioration of the marine environment, and to ensure the recovery and sustainability of the economic fish population and communities in the territorial waters, the UAE Government set the goal of achieving climate neutrality by 2050, and decided to build a multi-functional research vessel in anticipation to more efficiently and accurately perform observations and surveys of regional hydrography, chemical characteristics, seabed properties, ecological dynamics, and climate variability.

### Abu Dhabi marine research vessel Jaywun

The new marine research vessel Jaywun was commissioned by the Environment Agency Abu Dhabi (EAD) and supervised by the Abu Dhabi Shipbuilding Company, and built by the Freire Shipyard in Spain (Figure 1). The functions and equipment specifications of Jaywun are specially designed for operations in the Gulf waters of UAE (Table 1) [4]. The main operating areas cover the territorial waters of UAE including the Arabian Gulf and the Gulf of Oman.



Figure 1/ Exterior of the Abu Dhabi marine research vessel Jaywun  
Source/ Abu Dhabi Media Office  
<https://tinyurl.com/3km8xrm9>



Table 1/ Specifications of research vessel Jaywun

Item	Specification
Length	47.1 m
Beam	12.0 m
Draught	4.2 m (work in waters greater than 10 m deep)
Main engines	2xMTU, each 1,840 kW
Maximum speed	13 knots
Endurance	25 days at a cruising speed of 11 knots
Auxiliary engine (power take in, PTI)	200kW electric motor x 1 (convert to full electric at low speeds, effectively reducing fuel consumption, gas emissions and noise)
Capacity	18 crews and 11 researchers
Laboratory	Main laboratory x 6
Additional equipment	A diving team preparation room, and a remotely operated vehicle (ROV)

Source/ made by the author

The research and survey missions of Jaywun include assessment of marine sediments and water chemistry, baseline surveys of marine habitats and deep-sea ecology, assessments of fish species and communities, habitat surveys of corals and seagrasses, populations of cetaceans and megafauna (e.g., dugongs, turtles, etc.). Among the above mentioned, the fishery survey is to achieve the UAE government's 2050 climate-neutral goal. The research vessel also assists the Abu Dhabi Environment Agency in dealing with various marine environmental issues including marine litter, climate change, invasive species, and habitat restoration.

### Implementation of maritime safety guidelines assisted by research vessels

Good maritime management and sound environmental regulations are the basic elements and advantages for the development of shipping, tourism and fisheries in UAE. The maritime safety regulations of UAE are in line with international standards, referring to the International Safety Management Regulations (ISM Code) of the International Convention for the Safety of Life at Sea (SOLAS) formulated by the International Maritime Organization (IMO), so as to achieve the requirement of "ensuring maritime navigation safety and protecting the marine environment". Furthermore, the Roads and Transport Authority of UAE requires that relevant regulations must be implemented in accordance to the highest standards. For instance, the Ministry of Energy and Infrastructure in Dubai launched the "Sail Safely" initiative in August 2021 [5], declaring the maintenance of the marine environment, strengthening maritime safety and security, and protection of human life and livelihoods. Moreover, the UAE Government has noticed through statistics that the vast majority of the accidents at sea are caused by small boats with insufficient navigation safety concepts and technologies. Hence, the UAE Government has particularly strengthened the training of captains of leisure boats and fishing boats to reduce marine accidents.

The environmental protection and control regulations of the sea of Dubai can be referred to the *Licensing of Vessels, Crew and Maritime Activities in Dubai* [6], of which "Marine environment and safe navigation" stipulates the prohibition or control of the discharge of waste (e.g., waste water, exhaust gas), and ships must also be equipped with relevant instruments in accordance government requirements to ensure the safety of ship operators and the protection of the marine environment. Moreover, Dubai Government also published a *Boating Safety Guide* [7], instructing in simple terms the necessary fundamental knowledge, precautions, and standard operating procedures for maritime safety (Table 2). Compared with the general rules formulated by the IMO aiming to the global ocean,



the regulations formulated by the same two emirates are more specific to the bathymetry and bottom characteristics, hydrology and climate, and seaports of the local oceanic area. It is designed based on the environmental characteristics such as facilities and featured marine ecology and can take into consideration the conditions and culture of the nation.

Table 2/ Introduction to the four main sections of *Boating Safety Guide* of Dubai

Section	Content
Section 1	Understand the ships, equipment, safety facilities, clothing, life-saving tools, safe speed, safety checklist, etc.
Section 2	Sailing, collision avoidance, anchoring, lights and signs, etc.
Section 3	Type of emergency, use of life-saving equipment
Section 4	Description of ship pollution regulations, knotting methods, locations of ports and speed limits for navigating waters in Dubai

Source/ made by the author

There seems to be no direct relationship between the marine research vessel Jaywun of Abu Dhabi and the maritime safety guidelines of UAE. Apparently, the research vessel Jaywun is used for scientific research purpose, while the maritime safety guidelines are used to guide maritime navigation safety. However, the research outcomes from the Jaywun research vessel can be used to assist in the development of guidelines for marine safety. For example, designate conservation areas for endangered species, breeding areas, and coral reefs, or regulate or restrict related marine industries or activities based on water quality indicators. In addition, the survey results of the Jaywun research vessel can also be used for effectiveness testing and risk assessment after the implementation of the regulations, which help the Government appropriately adjust the current policies or revise the regulations.

## Summary

The marine research vessel Jaywun of UAE not only undertakes various marine research surveys but also assists in promoting a sustainable blue economy and implementing the UAE maritime safety initiative, to achieve the goals to maintain the marine environment and ecological system, strengthen maritime safety and security, and protect human life and livelihood.

We also learned that the marine policies of the UAE Government are fairly far-sighted, and the regulations can be kept up rapidly with the international trend of ocean sustainability. Such features may help UAE become internationally competitive in the development of the blue economy.

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