MAPPING COASTAL HABITATS IN THE UNITED ARAB EMIRATES

TOOL FOR SUSTAINABLE DEVELOPMENT

PROJECT LED BY

Emirates Nature-WWF is an environmental non-governmental organisation established to drive positive change in the United Arab Emirates to conserve the nation's natural heritage. Established in 2001 under the generous patronage of H.H. Sheikh Hamdan bin Zayed Al Nahyan, Ruler's Representative in Al Dhafra region, we work with partners to devise policies, educate communities and implement conservation solutions to ensure the future health of the Earth, its ecosystems and inhabitants. We are part of the global WWF network, which has a 50-year legacy of environmental conservation and is supported by more than 5 million people worldwide.

For more information about Emirates Nature-WWF,
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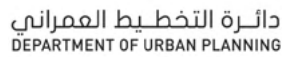**Expert Reviewer:**
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& ENVIRONMENT**

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EXECUTIVE SUMMARY

The United Arab Emirates (UAE) are custodians of diverse and productive coastal and marine habitats of local, regional and global importance for biodiversity. Healthy thriving coastal and marine habitats provide a wealth of benefits including food security, coastal protection, mitigation of pollution and opportunities for the growth of ecotourism, ultimately contributing towards a Sustainable Blue Economy. Achieving sustainable development is at the heart of the UAE Vision 2021 and UAE Centennial Plan 2071.

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A comprehensive, reliable and up-to-date knowledge of the nation's important coastal and marine habitats is required in order to deliver international commitments under the United Nations (UN) Sustainable Development Goals (SDGs), the Convention on Biological Diversity (CBD), and the UN Framework Convention on Climate Change (UNFCCC). These commitments are also reflected in the objectives of the UAE Vision 2021 and the National Biodiversity Strategy and Action Plan (2014-2021) pointing to the need for biodiversity integration in decision making.

To inform effective conservation and habitat restoration actions in the UAE and specifically in the waters of the north-western Emirates (Ajman, Ras Al Khaimah, Sharjah and Umm Al Quwain), this project produced the first detailed and comprehensive map of the region's coastal and shallow marine habitats. The new map significantly improves the knowledge of the spatial distribution, quality and quantity of coastal and marine resources, and offers a reliable tool to help deliver national and international sustainable development goals. This map offers a foundational data layer for enhanced coastal zone management, marine spatial planning, impact assessments, restoration strategies, and the design of area-based conservation actions.

Over the course of a year, an innovative mapping approach was implemented integrating local ecological knowledge (LEK), satellite images and remote sensing analysis, as well as extensive field surveys to maximise reliability in the mapping process. The coastal and marine habitat map was co-created with the support of Environmental Competent Authorities, as well as local stakeholders and experts. This approach demonstrated the tremendous value of strong multi-sectoral collaboration involving a high level of knowledge exchange among stakeholders including environmental authorities, research institutions, non-governmental organisations and the private sector.

WHAT IS CRITICAL HABITAT?

An ecosystem type of high biodiversity value including habitats of significance to endangered and threatened species, aggregating species, unique species and ecosystems and areas associated with key evolutionary processes.

UAE National Plan of Action for the Conservation & Management of Sharks (2018-2021)

THE PRIMARY OBJECTIVES OF THE HABITAT MAPPING PROJECT WERE:

- To provide reliable and up-to-date spatial information on important and critical coastal and marine habitats that will support decision making processes and management.

- To work with key stakeholders to incorporate local ecological knowledge into the mapping process.

- To ensure that the map is fit-for-purpose to support the implementation of ongoing initiatives of each Emirate and UAE's national and international environmental and sustainability commitments.

COASTAL & MARINE HABITAT MAP OF THE NORTHERN EMIRATES
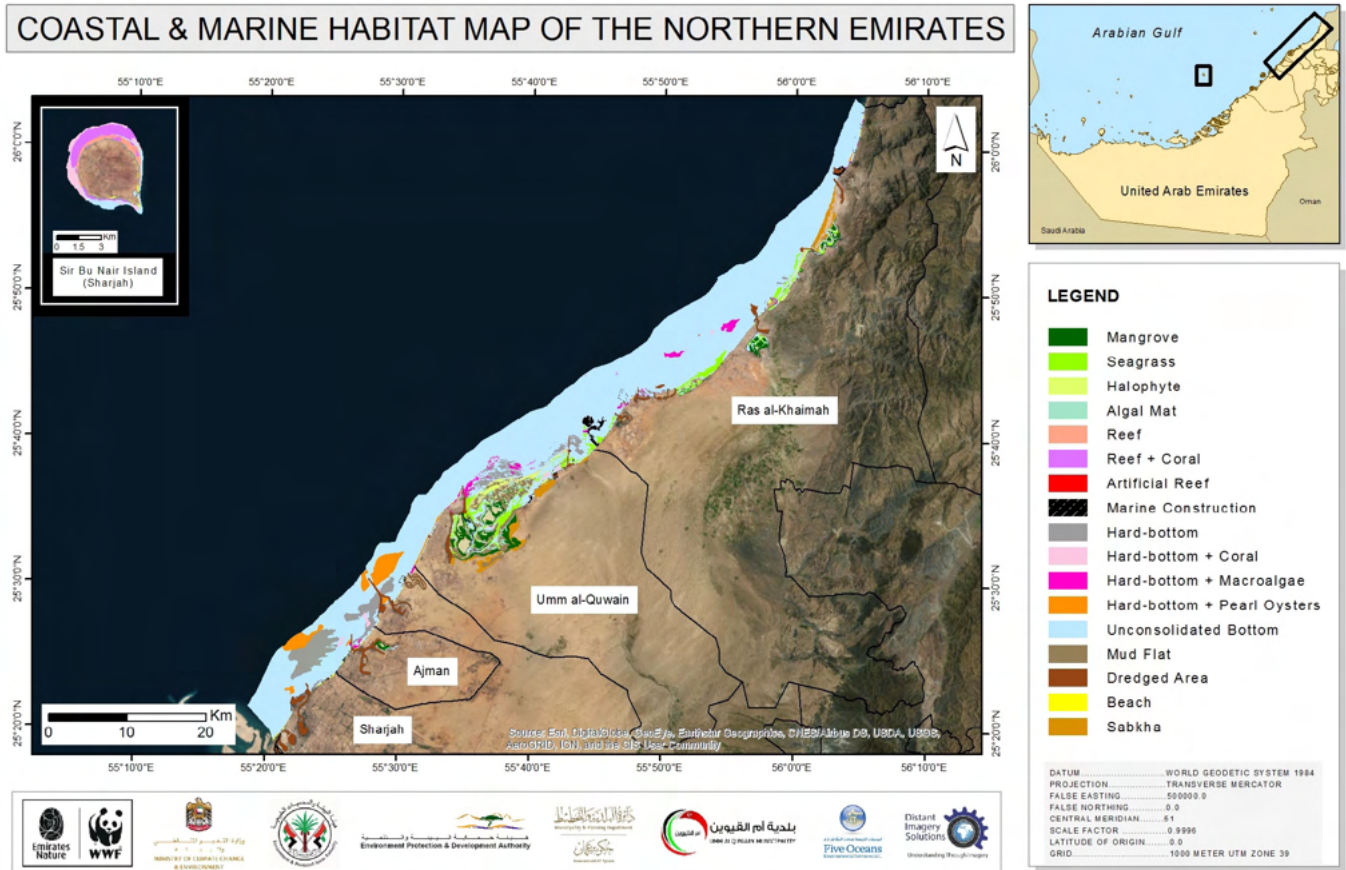
The report includes a summary of the key national and international policies that the habitat map supports, a broad description of the remarkable seascapes with high conservation importance in each of the four north-western Emirates, and how this tool can support sustainable development.

Reliable geographical information on coastal habitats, particularly critical habitat for endangered and threatened species and habitat that is sensitive to human disturbance, is necessary to support responsible coastal development and achieving a Sustainable Blue Economy.

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THE KEY RESULTS AND FINDINGS OF THE PROJECT ARE:

783.2 km²

The coastal and marine habitat map of the north-western Emirates covered **783.2 km² 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 (sabkhas), oyster beds, halophyte and seagrass meadows.

10%

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.

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).

The map highlights the **rich habitat diversity in the *khors* 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.

Oyster beds discovered and mapped for the first-time in the north-western Emirates. The project mapped two large offshore oyster beds that together cover 10 km² of seabed and four nearshore oyster beds covering 6 km² of seabed.

THE NEW MAP PROVIDES DIRECT SUPPORT FOR PROGRESS TOWARD UAE'S SUSTAINABLE DEVELOPMENT POLICY AGENDA.
The map provides opportunities to:

Promote awareness of the importance of coastal wetlands, update national wetland inventory, assist in effective management and consider new Ramsar sites of international importance. With the UAE serving as Chair of the Ramsar Convention Standing Committee (SC56), further achievements on coastal wetland conservation and sustainable use can enhance the country's legacy within the Ramsar Convention.

Explore a whole-site approach to place-based biodiversity conservation and restoration efforts aligned with the principles of ecosystem-based management and ecological connectivity. Coastal lagoons, *khors*, a prominent feature of the UAE's coast, is characterised by interconnected habitat types. A whole-site approach will focus on the integrity of the interconnected ecosystems rather than a focus on individual habitat types, maintaining the flow of ecosystem services and strengthening the resilience of an area.

Support decisions on spatial management of economic activities taking place in the coastal zone and marine realm by pinpointing areas that require special management attention to avoid any negative impacts on natural ecosystems and the socio-economic services they provide. Coastal zone management and (Strategic) Environmental Impact Assessments can use the habitat map to inform their analysis, site-specific recommendations and decision making.

ACHIEVING A SUSTAINABLE BLUE ECONOMY

Sustainable Blue Economy can only be realised if our ocean's health is secured. We need to restore, protect and sustainably manage ocean assets in order to realise the ocean's potential to support human development well into the future.

WWF (2018) Sustainable Blue Economy Finance Principles

NW Emirates Habitat Map

- Awareness
- Fisheries management
- Restoration
- Blue carbon stocks
- Whole-site approach
- Coastal economic activities
- UAE's natural capital
- Marine Protected Areas
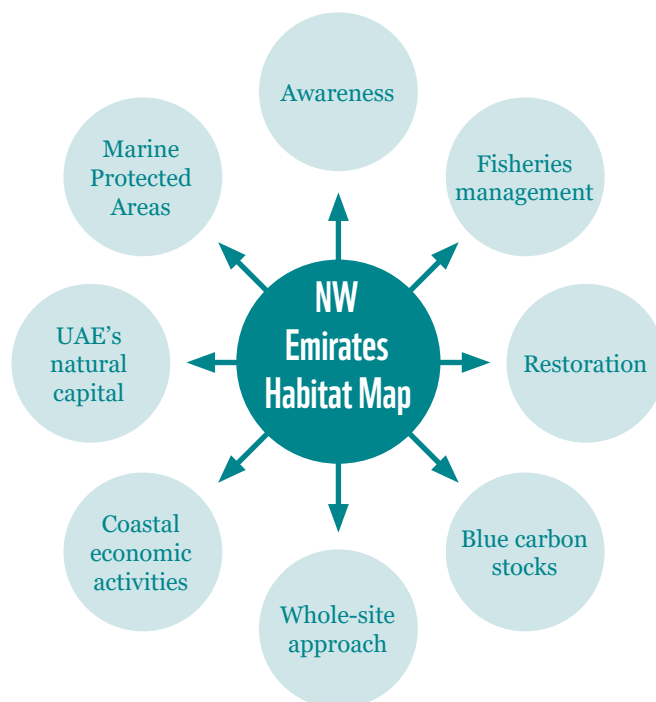
Evaluate the size, shape and placement of existing protected areas, examine management strategies and evaluate potential conservation actions taking into consideration the distribution of sensitive and vulnerable habitats (Aichi Target 10). This will help identify and locate marine Areas of Particular Importance for Biodiversity (APIBs) and can help integrate marine protected areas and other effective area-based conservation measures into the wider seascape and landscape management. Connectivity and integrated management is required by CBD Aichi Target 11, the UAE National Biodiversity Strategy and Action Plan (NBSAP), the UN SDG 14 (Life Below Water) and is expected to be further emphasised under the upcoming post-2020 Global Biodiversity Framework targets.

Identify areas that are ecologically suitable for restoration and habitat creation compatible with the surrounding seascape. Examples include restoring mangroves, seagrasses and corals in locations suitable for their long-term survival while aiming to enhance ecological connectivity between critical habitats.

Contribute to the UAE's natural capital accounting and mapping of ecosystem services to better understand the type and distribution of natural capital. Mapping and valuing the ecosystem services associated with critical habitat types and entire seascape mosaics is key to communicate their socio-economic importance. The habitat and natural capital map can further support strategic planning and communication strategies engaging with the private and finance sectors in the context of a Sustainable Blue Economy for the UAE. Coastal habitats are a key asset for the viable future of ecotourism and sustainable recreation opportunities that can support a resilient economy.
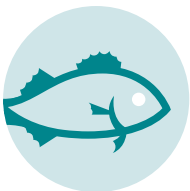
Support strategic planning and implementation of ecosystem-based fisheries management by advancing knowledge on the role of coastal ecosystems in providing essential habitat for fish. Mapping and conserving fish nursery, spawning and feeding areas for key fishery species can benefit biodiversity conservation efforts and is crucial for sustainable fisheries. This can be aligned with the UAE's Fisheries Recovery Plan, as well as other area-based strategies to support the fisheries sector and food security of the country.

Assess blue carbon stocks within the coastal habitats of the UAE and ultimately inform national and local climate change mitigation strategies and plans. Conservation and restoration of blue carbon habitats is a Nature-based Solution that would help reduce greenhouse gases in the atmosphere through sequestration of carbon dioxide and avoidance of additional emissions if these habitats are lost. The importance of natural ecosystems and protected areas as a key strategy to support climate change resilience is reflected in the National Climate Change Plan of the UAE (2017-2050). International conventions including the UNFCCC and the CBD have now recognised that climate change action can benefit from Nature-based Solutions and encourage countries to include such solutions in their Nationally Determined Contributions (NDCs).

PROJECT BACKGROUND

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THE IMPORTANCE OF COASTAL HABITATS TO UAE'S SUSTAINABLE DEVELOPMENT

Coastal habitats in the UAE support the highest biodiversity in the nation delivering essential ecosystem services with important cultural and economic value (Jones *et al.*, 2002). A healthy productive ocean ecosystem is recognised as a key component of the cultural fabric of the UAE and an essential pillar of the past, present and future development of the nation. UAE's commitment to sustainable development is at the heart of the country's vision for its future. High-level and near-term strategic priorities of the UAE Vision 2021 are *'to ensure sustainable development and preserving the environment'*; *'defend fragile ecosystems from urban development'* and *'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 (UAE Vision 2021).

In line with the UAE Vision 2021, government authorities in Northern Emirates are implementing policies and local actions for transitioning to green and diversified economies for sustainable futures. Ajman's Vision 2021, Umm Al Quwain Vision 2021, Ras Al Khaimah Municipality and the Emirate of Sharjah's Environment & Protected Areas Authority (EPAA) all strive to achieve sustainable development and community well-being recognising that the goal of sustainable development is underpinned and interlinked with healthy ecosystems.
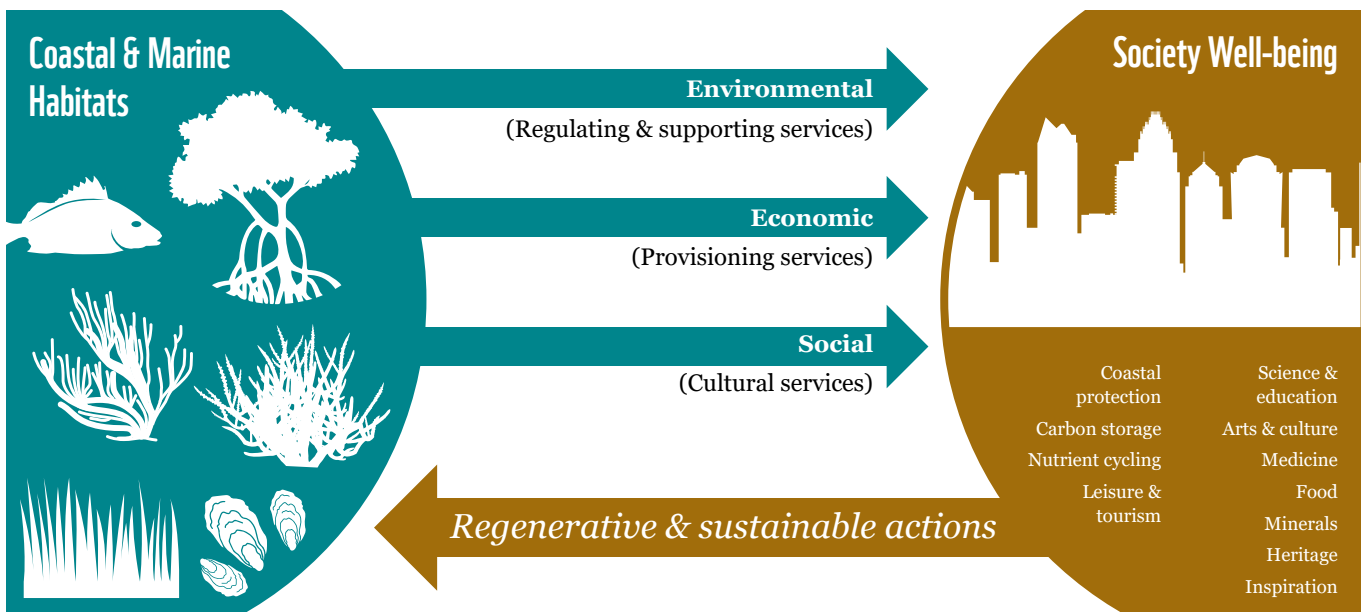
Accelerated progress towards effective conservation of biodiversity and sustainable development is a high priority for UAE. A sustainably managed environment supports one of the pillars of the UAE Centennial Plan 2071 (UAE Centennial 2071) for a future-focused government with a long-term vision and inspirational leadership that anticipates and prepares for the future. Comprehensive knowledge of UAE's important coastal habitats directly supports progress towards a balanced, sustainable, robust and efficient integrated planning process. Integrated marine planning and management are crucial to achieve sustainability strategies (UAE Green Agenda) and can help decision makers respond proactively to the challenges of sustainable development in a rapidly changing world.

Managing healthy, diverse, productive and resilient coastal habitats creates opportunities for economic diversification including the growth of a Sustainable Blue Economy (WWF, 2018). The UAE hosts diverse and productive coastal habitats with local, regional and global importance for biodiversity and ecosystem services. Healthy habitats offer multiple benefits to society including productive fisheries, coastal protection against storms and flooding, carbon storage, tourism and recreation, and can promote health and mental well-being. The UAE 2030 Agenda for Sustainable Development sets a national framework facilitating the implementation and reporting on the SDGs including the SDG 14 Life Below Water (UAE 2030 Agenda for Sustainable Development, 2017).

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BENEFITS OF HEALTHY COASTAL HABITATS

Marine natural capital and the flow of ecosystem services

Coastal habitats provide a wide range of ecosystem services that not only provide direct goods and benefits to society but also maintain, regenerate and regulate the processes required to ensure their quality, productivity and continued flow (Daily *et al.* 2009).

Coastal & Marine Habitats

Environmental
(Regulating & supporting services)

Economic
(Provisioning services)

Social
(Cultural services)

Regenerative & sustainable actions

Society Well-being

Coastal protection
Carbon storage
Nutrient cycling
Leisure & tourism

Science & education
Arts & culture
Medicine
Food
Minerals
Heritage
Inspiration

"HABITAT MAPS BUILD PUBLIC AWARENESS, ENHANCE GENERAL KNOWLEDGE OF THE MARINE SPATIAL LANDSCAPE, ...AND PROVIDE A STARTING PLACE FOR ECOSYSTEM-BASED MANAGEMENT"

(Cogan *et al.* 2009)

SDG 14 highlights the linkages between a healthy resilient ocean, the role of protection and the need for sustainable use of marine resources to support sustainable development. The transition to a knowledge-based sustainable economy, as stated in Vision 2021 (Pillar 3 - Competitive knowledge economy), recognises the importance of scientific data, technological innovation and evidence-based policy in implementing targeted actions and smart strategic planning to accelerate the Green Economy initiative and accomplish the SDGs (UAE 2030 Agenda for Sustainable Development, 2017). Maintaining resilient coastal ecosystems can also support progress in achieving multiple SDGs such as SDG11 (Sustainable Cities) and SDG 13 (Climate Action).

SUSTAINABLE DEVELOPMENT GOAL 14: CONSERVE AND SUSTAINABLY USE THE OCEANS, SEAS AND MARINE RESOURCES FOR SUSTAINABLE DEVELOPMENT

Target 14.2 Sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans.

COASTAL AND MARINE HABITAT MAPS ARE ESSENTIAL TOOLS FOR ECOSYSTEM-BASED MANAGEMENT (EBM)

"Ecosystem-based management is an integrated approach to management that considers the entire ecosystem, including humans. The goal of ecosystem-based management is to maintain an ecosystem in a healthy, productive and resilient condition so that it can provide the services humans want and need"

(McLeod *et al.* 2005)

HABITAT MAPS – BUILDING BLOCKS TO ACHIEVE BIODIVERSITY CONSERVATION GOALS

Reliable and up-to-date information on the distribution and status of coastal habitats is crucial to the Ramsar Convention on Wetlands of International Importance, a high priority international agreement for UAE since 2007, which has resulted in 10 site designations. As a contracting party, UAE is committed (Resolution VII.20) to maintaining a comprehensive national inventory, including assessment and monitoring of wetlands. The inventory is the basis for activities to achieve the wise use of wetlands, including policy development, identification and designation of Ramsar sites, documentation of wetland losses, and identification of wetlands with potential for restoration.

As a signatory to the Convention on Biological Diversity (CBD), UAE is committed to a global vision to strive for a world where people live in harmony with nature and where *'by 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people'* (CBD Strategic Plan for Biodiversity 2011-2020). Comprehensive knowledge of UAE's important coastal habitats and associated species supports national efforts to achieve excellence in addressing the CBD Aichi Biodiversity Targets (UNEP/CBD/COP/10/27/Annex).

The new digital map product has direct application to support multiple goals, targets and actions required for implementation of the CBD through the UAE NBSAP (NBSAP 2015), UN SDGs, Convention on Migratory Species (CMS) and a number of key UAE policies and strategies as illustrated in Figure 2. For example, Aichi Target 10 requires action to reduce pressures on coral reefs, while Aichi Target 11 requires the identification of APIBs and ecosystem services.

CBD STRATEGIC PLAN FOR BIODIVERSITY 2011-2020

Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity

Target 11: By 2020, at least 17 per cent of terrestrial and inland water areas and 10 per cent of coastal areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscape and seascape.

These global targets relevant to coastal ecosystems are addressed through the UAE NBSAP. Integrating coastal habitats as part of an evidence-based coastal zone planning process that includes marine biodiversity protection, is an important process in addressing all high-level goals of the NBSAP. For the north-western Emirates, a knowledge gap exists in the distribution of coastal habitats. A critical first step in ensuring that coastal habitats are adequately considered in future planning processes is to address the knowledge gap by producing a new up-to-date, comprehensive and more biologically detailed digital habitat map for the region. A new map supports a robust assessment of the status, extent and condition of coastal habitats.

Knowing exactly where important coastal and marine habitats are located is necessary information to guide actions that help achieve targets under all NBSAP goals (see Figure 1).

Where the habitat map supports NBSAP

UAE National Biodiversity Strategy and Action Plan (2014-2021)

Goal 1: Mainstreaming biodiversity into all sectors and society
- Target 1.1 Action 1 **Awareness**
- Target 1.2 Action 1 **Integrated planning**

Goal 2: Strengthening the knowledge base and building capacity for conservation, management and sustainable use of biodiversity
- Target 2.1 Action 1, 2, 4, 5, 7 **Assess & monitor**
- Target 2.2 Action 3 **Local knowledge**

Goal 3: Improving the status of biodiversity by safeguarding ecosystems, species and genetic diversity, rehabilitating degraded ecosystem
- Target 3.2 Action 1, 2, 4, 6 **Protection**
- Target 3.3 Action 4 **Species & habitats**
- Target 3.4 Action 1 **Track changes & threats**
- Target 3.5 Action 1, 2 **Restore**
- Target 3.6 Action 1, 2, 3 **Restore**

Goal 4: Reducing pressures on terrestrial and marine ecosystems
- Target 4.1 Action 2, 3 **Sustainability**
- Target 4.3 Action 2 **Effectiveness**
- Target 4.5 Action 1, 2 **Action plans**

Goal 5: Enhanced cooperation and coordination at local, regional and international levels in areas related to biodiversity conservation
- Target 5.1 Action 1 **Cooperation**

Figure 1 The goals of the UAE National Biodiversity Strategy and Action Plan (2014-2021) supported by the the Coastal Habitat Map of the north-western Emirates

Coastal and marine habitat map for the north-western Emirates supports multiple policy goals, targets & actions

National Climate Change Plan
(2017-2050)

National Framework for Sustainable Fisheries
(2019-2030)

National Biodiversity Strategy and Action Plan
(2014-2021)

National Plan of Action for the Conservation of Marine Turtles
(2019-2021)
Goals 1-4

UAE Green Agenda
(2015-2030)

Convention on Biological Diversity

CBD Aichi Biodiversity Targets
(2010-2020)

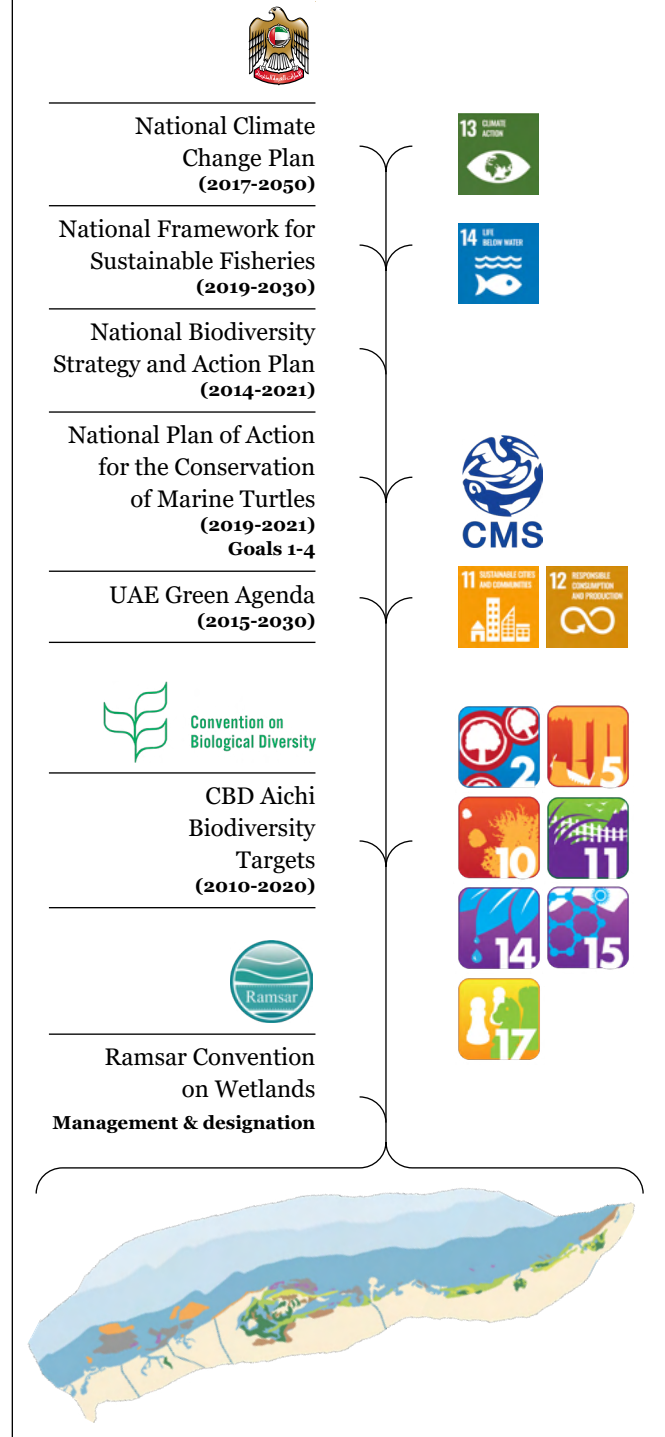Ramsar Convention on Wetlands
Management & designation

Figure 2 Examples of various policies supported by the Coastal and Marine Habitat Map for the north-western Emirates

UAE'S CRITICAL COASTAL HABITATS

The coastal habitats of the UAE provide diverse ecosystem services that are essential to societal well-being and are a key focus of the NBSAP. Interconnected mosaics of critical habitats such as coral reefs, seagrasses, oyster reefs and mangroves are key to the survival of viable populations of commercially and culturally important marine fish species.

These habitats are crucial to sustainable fisheries and the existence of endangered and threatened marine animals such as turtles, dugongs and Socotra cormorants. Other important habitats are found around islands and across tidal

inlets and lagoons (*khors*) with extensive intertidal flats and saltmarshes that serve as essential feeding and breeding grounds for a diversity of species including migrant birds travelling to and from distant breeding grounds (Sheppard *et al.* 2010).

Some of the coastal wetland sites are recognised as wetlands of international importance under the Ramsar Convention. Ramsar Resolution VIII.32 recognises the conservation importance of mangroves and associated coral reefs, seagrass beds and intertidal flats and Resolution XIII.20 recognises the conservation importance of intertidal wetlands and ecologically associated habitats.

UAE coastal marine habitats of conservation importance

	Habitat	Ramsar	Convention on Biological Diversity	NBSAP
Subtidal habitats	Coral communities	VIII.32	Target 10 & 11	Targets 2, 5, 8, 9-10, 11, 13-14 & 18
	Seagrass	VIII.32	Target 10 & 11	Targets 2, 5, 8, 9-10, 11, 13-14 & 18
	Oyster beds	XIII.20	Target 11	Targets 2, 5, 8, 9-10, 11, 13-14 & 18
	Reefs	XIII.20	Target 11	Targets 2, 5, 8, 9-10, 11, 13-14 & 18
Intertidal habitats	Saltmarsh	VIII.32	Target 11	Targets 2, 5, 8, 9-10, 11, 13-14 & 18
	Mangroves	VIII.32	Target 10 & 11	Targets 2, 5, 8, 9-10, 11, 13-14 & 18
	Coastal sabkha	XIII.20	Target 11	Targets 2, 5, 8, 9-10, 11, 13-14 & 18
	Coastal lagoons	XIII.20	Target 11	Targets 2, 5, 8, 9-10, 11, 13-14 & 18
	Algal mats	XIII.20	Target 11	Targets 2, 5, 8, 9-10, 11, 13-14 & 18
	Mud flats	VIII.32	Target 11	Targets 2, 5, 8, 9-10, 11, 13-14 & 18

MAPPING THE COASTAL HABITATS IN THE UAE

ARABIAN GULF

UAE

OMAN

STUDY AREA
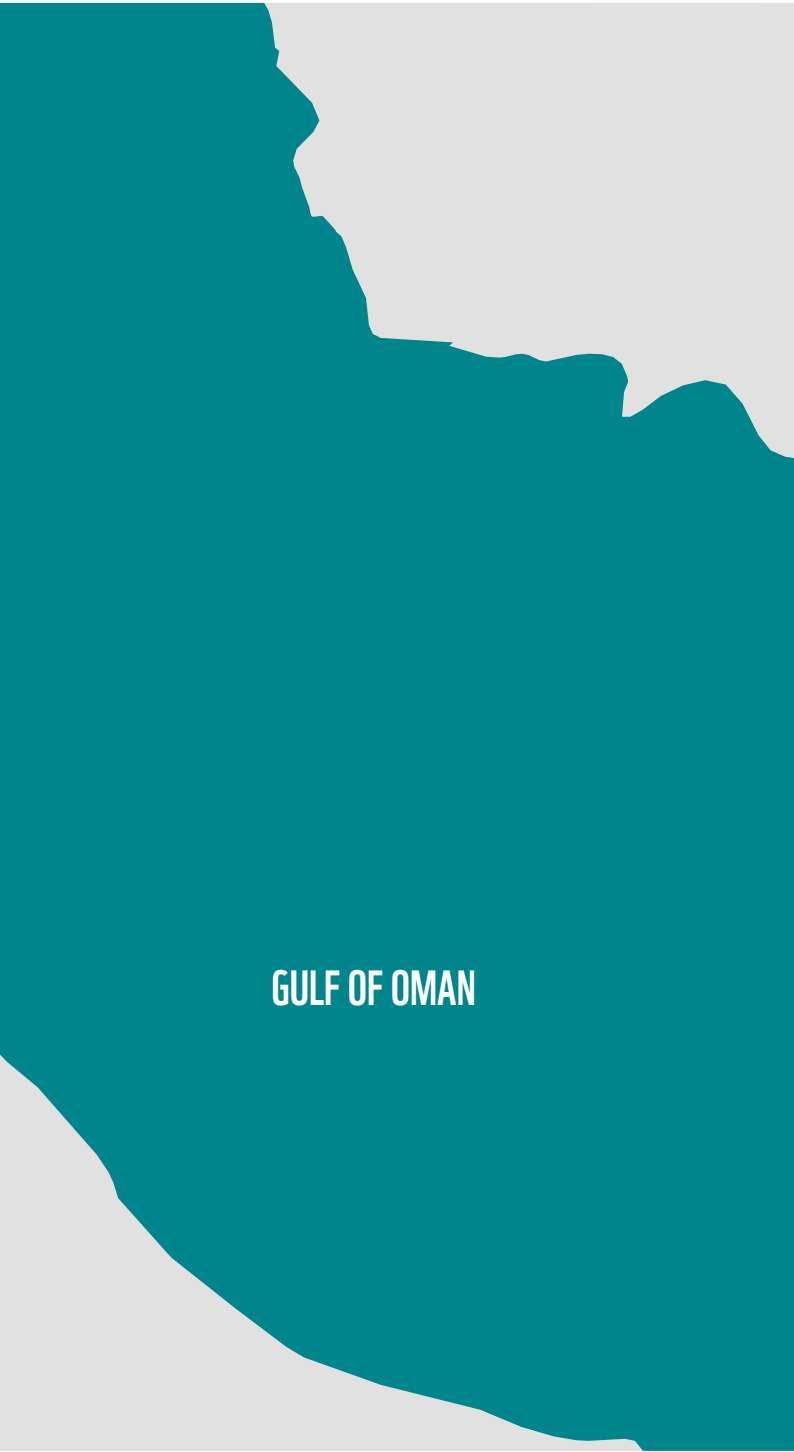
PROJECT OBJECTIVES

The project was designed to achieve the following key objectives:

- To provide a digital map that shows the **geographical distribution of coastal habitats of the north-western Emirates** including the locations of critical habitat and details of habitat composition and condition.

- To provide reliable **baseline spatial information** that can support further prioritisation 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 the UAE** led by MOCCAE and multiple priorities stated in the NBSAP.
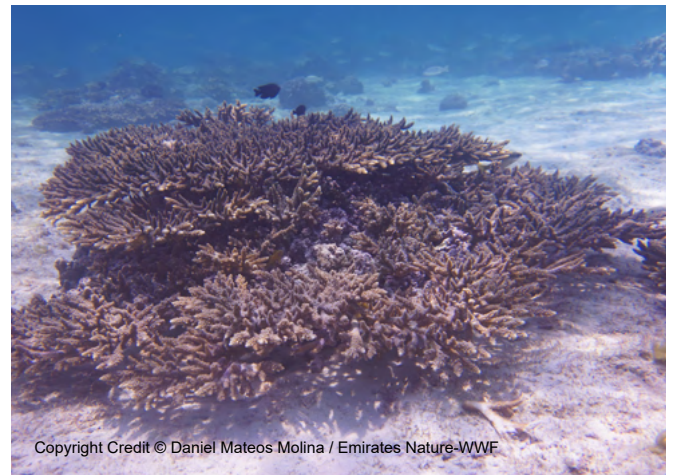
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WHAT IS CRITICAL HABITAT?

An ecosystem type of high biodiversity value including habitats of significance to endangered and threatened species, aggregating species, unique species and ecosystems and areas associated with key evolutionary processes.

UAE National Plan of Action for the Conservation & Management of Sharks (2018-2021)

GULF OF OMAN

A COLLABORATION OF MULTIPLE STAKEHOLDERS AND EXPERTS

Through coordination and collaboration with an extensive network of partners, Emirates Nature-WWF was able to develop the first detailed and reliable coastal and marine habitat map for the north-western Emirates. The final map is a unique product that has emerged from the integration of advanced geospatial technologies combined with local ecological knowledge (LEK) provided by many stakeholders across the nation. Multi-stakeholder engagement is an established part of UAE's policymaking process and aligns with Goals 2 (to consider local knowledge) and Goal 5 (to enhance cooperation and coordination with competent authorities) as stated in the UAE National Biodiversity Strategy and Action Plan.

COASTAL & MARINE HABITAT MAP OF THE NORTHERN EMIRATES

LEGEND
- Mangrove
- Seagrass
- Halophyte
- Algal Mat
- Reef
- Reef + Coral
- Artificial Reef
- Marine Construction
- Hard-bottom
- Hard-bottom + Coral
- Hard-bottom + Macroalgae
- Hard-bottom + Pearl Oysters
- Unconsolidated Bottom
- Mud Flat
- Dredged Area
- Beach
- Sabkha
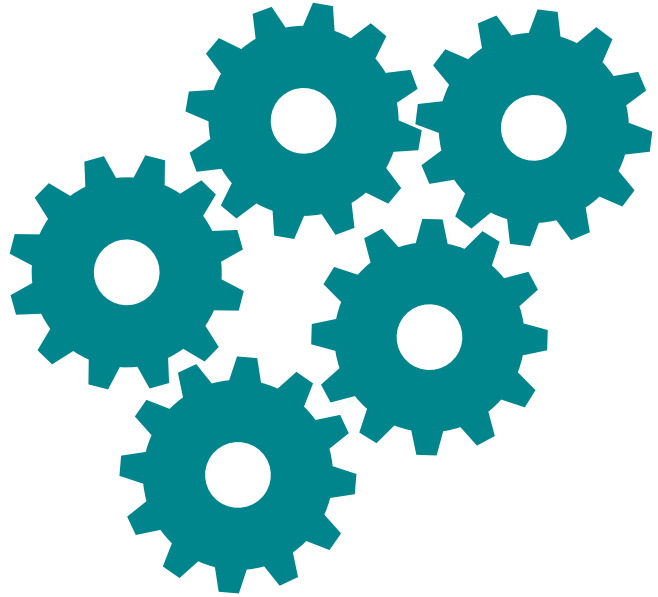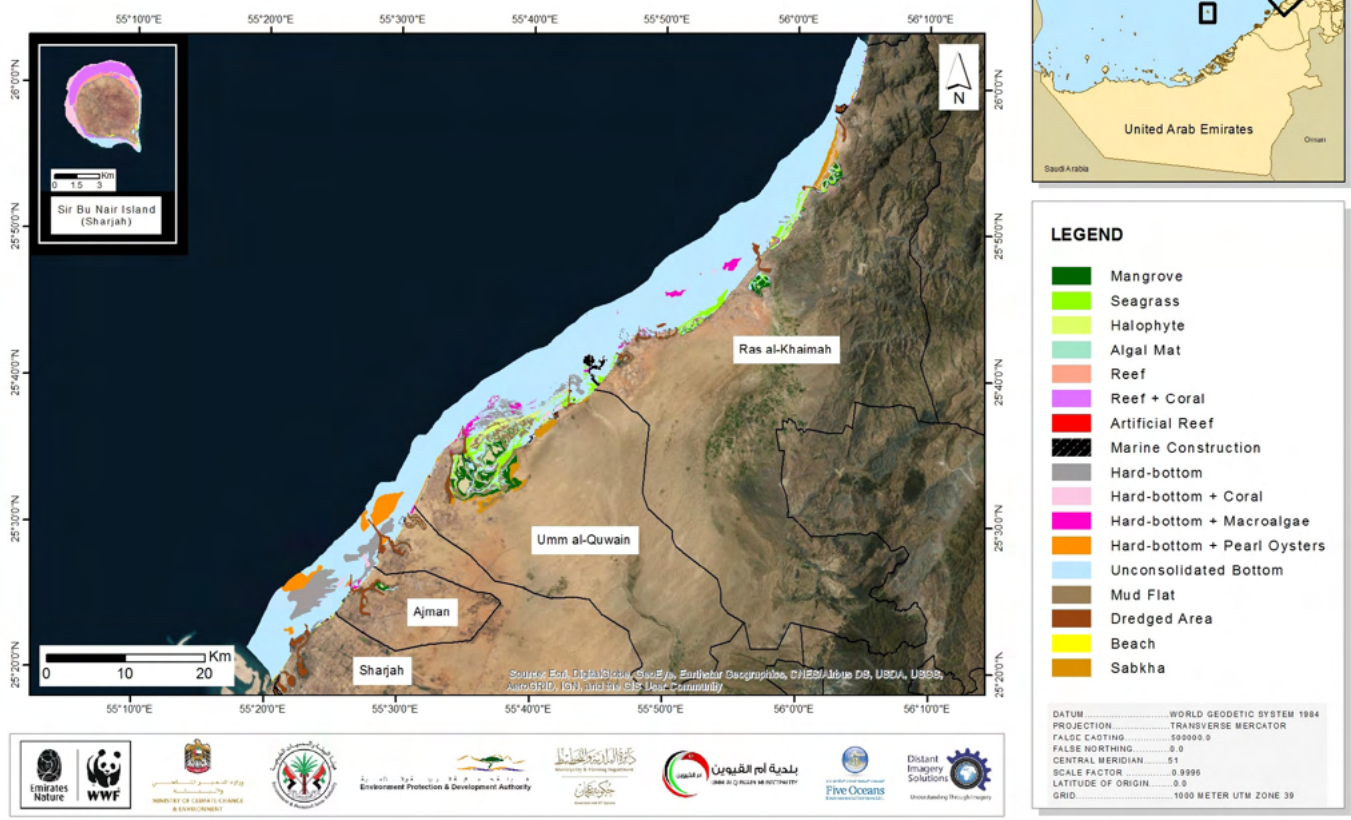
CHARACTERISING THE REMARKABLE SEASCAPES OF THE NW EMIRATES

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The marine and coastal habitat map highlights the complex mosaics of habitat types that exist to make some areas highly important seascapes for biodiversity conservation. The term seascape places emphasis on the structurally complex and interconnected nature of an ocean space which together supports higher species richness than low complexity areas (Pittman 2018). 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. Longer-term benefits from conservation are more likely when strategies and actions are focused on mosaics of priority habitats rather than individual habitat types.

CORAL SEASCAPES OF SIR BU NAIR ISLAND – SHARJAH'S PEARL

Sir Bu Nair, a designated Protected Area and Ramsar wetland site of international importance, is an offshore island ecosystem blessed with extensive (6.4 km²) and diverse coral reefs including vulnerable branching and plate-like *Acropora* spp. corals, large *Porites* spp. colonies and encrusting and massive faviid corals (Emirates Nature-WWF 2020).

The island supports some of the most intact and resilient coral communities in the UAE and the Arabian Gulf region representing an important biodiversity hotspot and providing a supply of coral larvae to other areas. Most of the coral is found at depths of between 5 and 12 meters. Coral communities support diverse fish assemblages with groupers, snappers and emperors, parrotfish, damselfish, butterflyfish and angelfish.

The island and its diverse and structurally complex marine habitats together provide an important nesting and feeding area for critically endangered hawksbill turtles and seabirds such as the sooty gull and bridled tern. UAE has identified Sir Bu Nair as a place of global biological and ecological importance under the international classification of Ecologically or Biologically Significant Marine Areas (EBSAs) as required for the CBD.
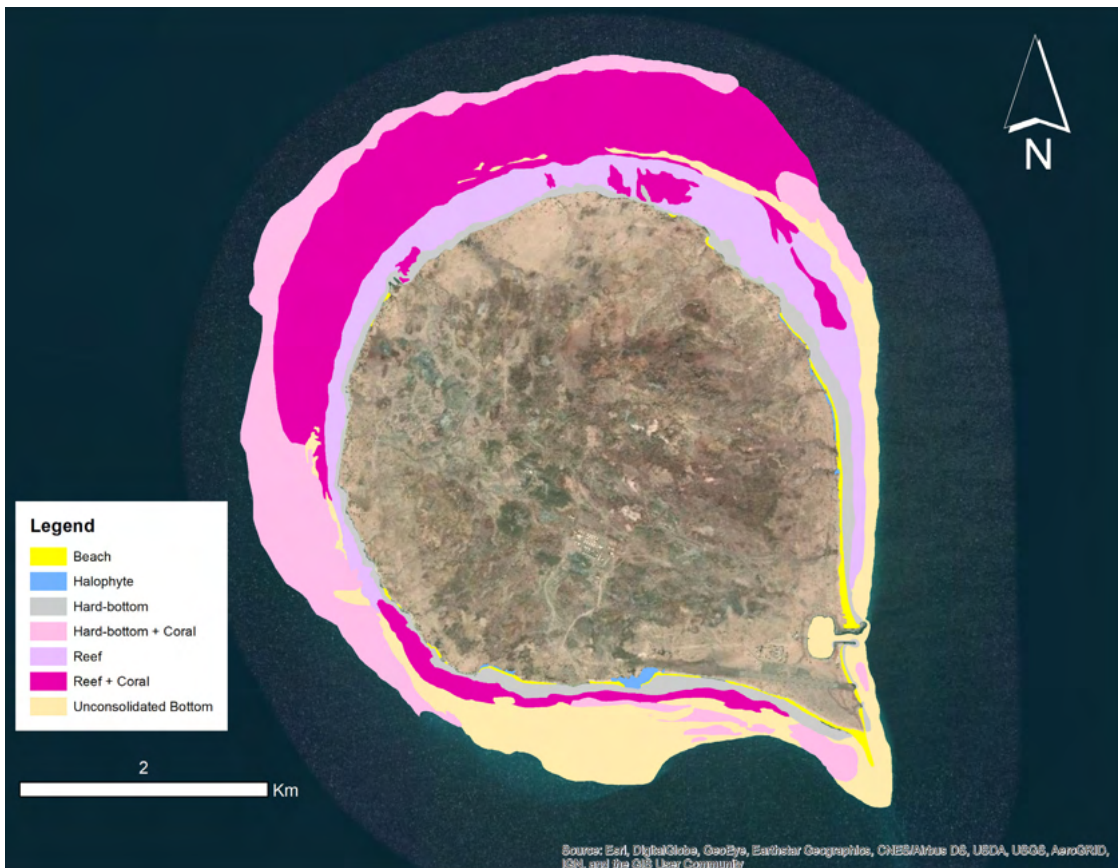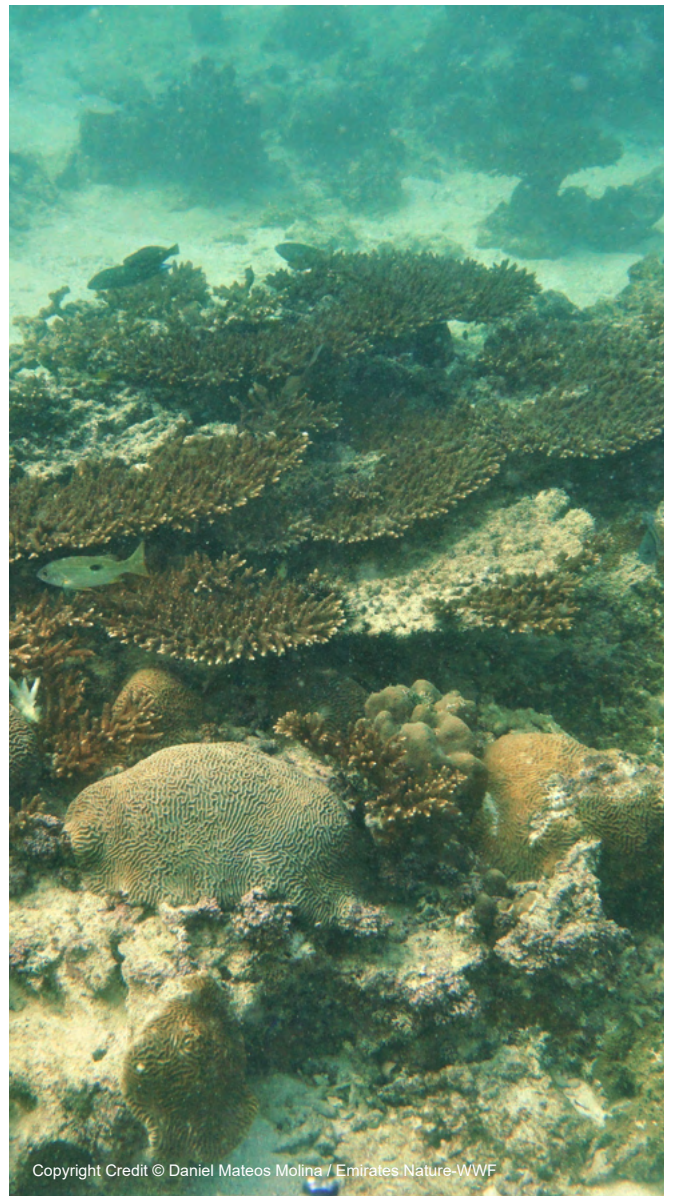
Legend
- Beach
- Halophyte
- Hard-bottom
- Hard-bottom + Coral
- Reef
- Reef + Coral
- Unconsolidated Bottom

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

BIODIVERSITY AND BLUE CARBON SEASCAPES OF AJMAN'S AL ZORAH NATURAL RESERVE

The Al Zorah Natural Reserve and Ramsar Wetland of International Importance encompassed dense mature mangroves (0.89 km²) surrounded by small areas (0.06 km²) of intertidal mudflat that fringe urban development. Mature mangroves have the highest carbon stocks of all coastal habitat types through storage of carbon in their biomass and sediments (Schile *et al.* 2017). The mangrove *khor* which supports diverse bird life, including grey herons and greater flamingos and provides important fish habitat, is connected to the ocean by a channel that has been heavily modified.

Subtidal waters adjacent to the channel mouth support significant areas of hard substrate with pearl oysters, corals, sponges, ascidians, and macroalgae. Larger oyster beds were also discovered and documented farther offshore in deeper waters (5-10 meters) which together with nearshore oyster beds, that span neighbouring Emirates, form some of the most extensive (2.14 km²) oyster beds in the region. These last remaining oyster beds support unique biodiversity, provide important habitat for commercial fish species and benefit water quality through extremely efficient filter feeding. The pearl oyster beds of Ajman also have cultural significance as important heritage sites for the pearl diving industry and for cultural tourism.
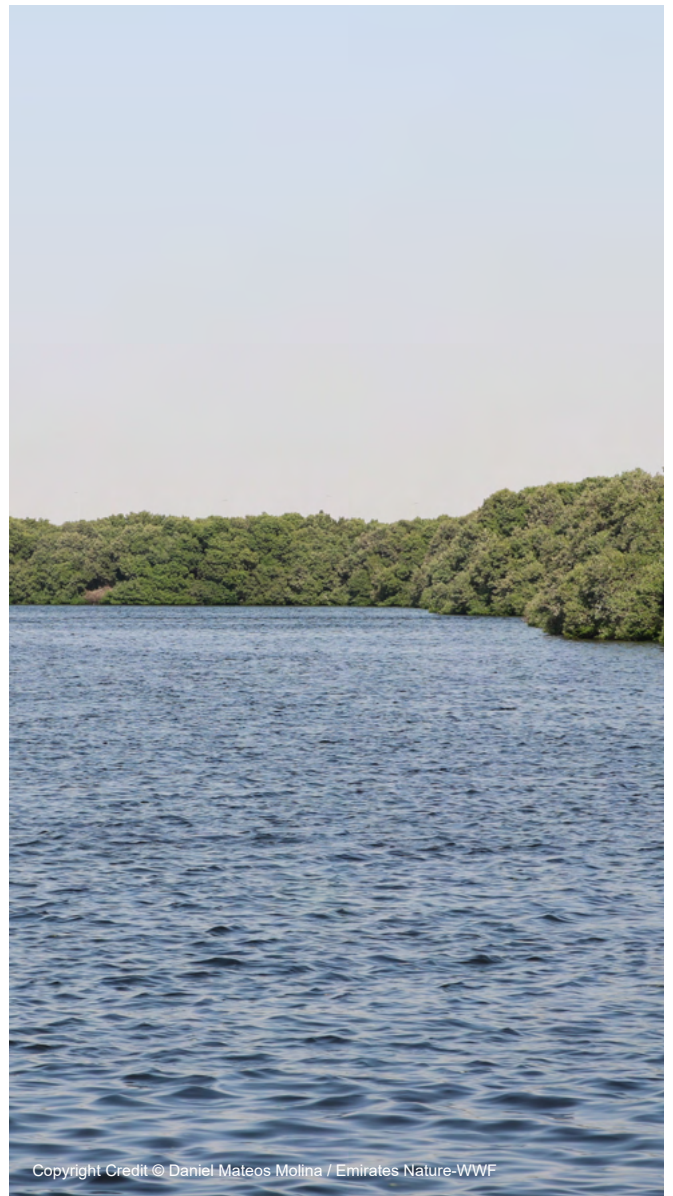
LAGOONAL KHOR SEASCAPES OF UMM AL QUWAIN

Mapping the complex mosaic of intertidal and subtidal habitat types at Khor Al Beidah has revealed the extent and co-existence of many important habitat types (sabkha, halophytes, mangroves, seagrasses, mud flats, algal mats, oyster beds and coral communities) that combine to make this seascape one of the most important of the UAE's coastal lagoons for biodiversity conservation and a hotspot for blue carbon sequestration. Coastal and intertidal habitat types accounted for 56% of the mapped area with mangroves covering 14.2 km² and mudflats covering 21.4 km².

Extensive (11.1 km²) dense seagrass beds line the lagoons and channels providing food for green turtles and important nursery habitat for commercial fish species. Hard-bottom areas colonised by pearl oysters are widespread (1.4 km²) along the western coast towards Sharjah and immediately offshore in shallow water (3-5 m depth) are patches of healthy coral communities (1.8 km²) dominated by faviids and *Porites* spp. colonies with occasional *Acropora* spp.

More than 420 different species of bird have been recorded in this designated Important Bird and Biodiversity Area (IBA). The barrier islands host a large Socotra cormorant nesting colony representing 15-35% of the global population for this species. Further exploration of this important area and a greater understanding of its ecological significance and vulnerability to human activity should be a high priority.

Legend
- Algal Mat
- Halophyte
- Hard-bottom + Coral
- Hard-bottom + Pearl Oysters
- Mangrove
- Mud Flat
- Reef + Coral
- Coastal Sabkha
- Seagrass
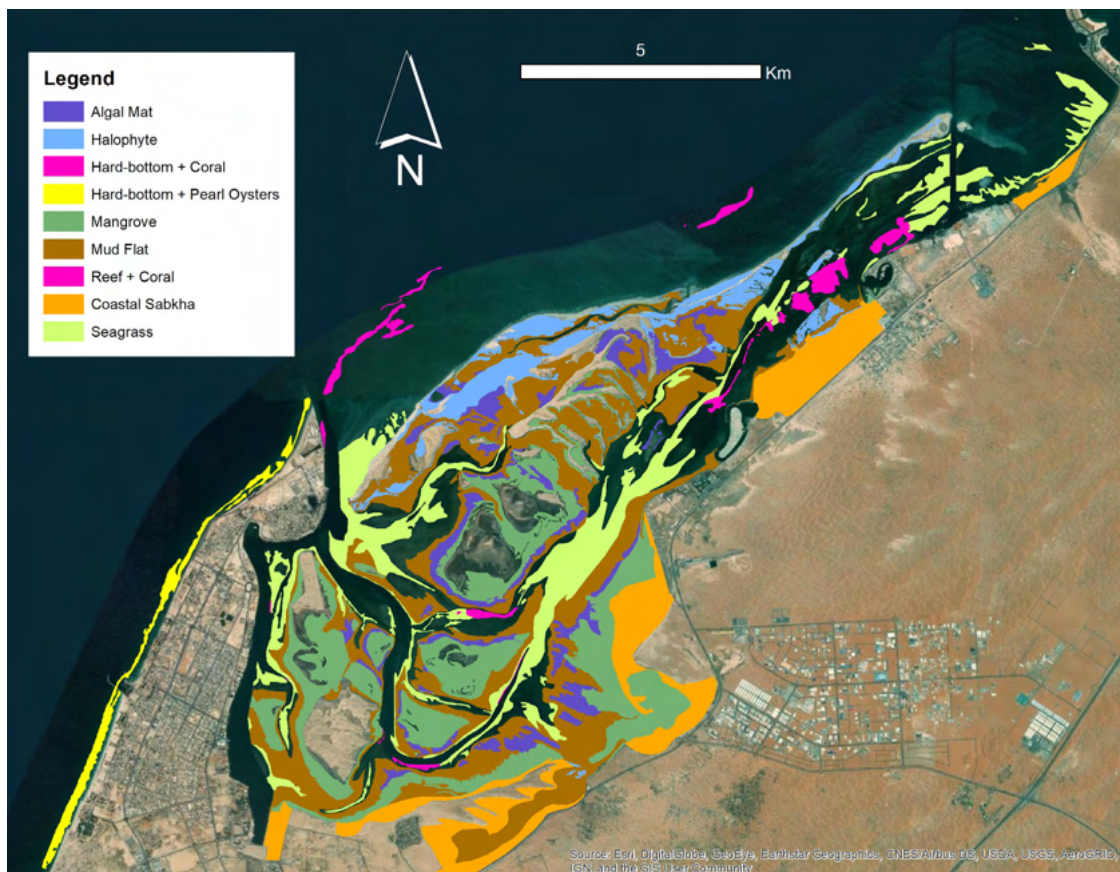
Copyright Credit © Five Oceans Environmental Services LLC

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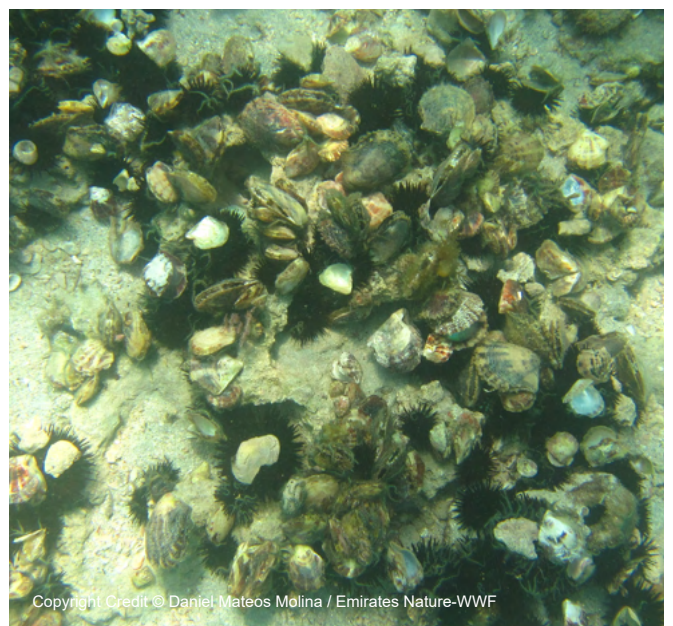
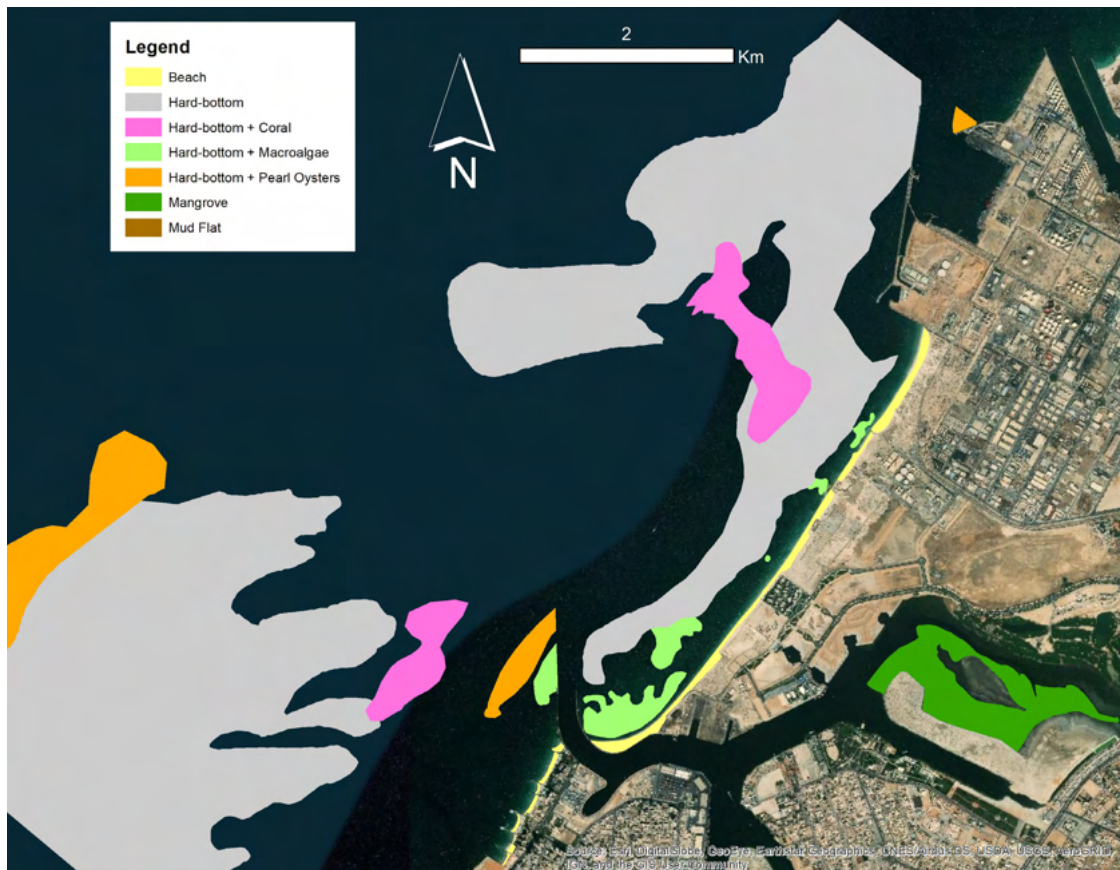Copyright Credit © Daniel Mateos Molina / Emirates Nature-WWF

LAGOONAL KHOR SEASCAPES OF RAS AL KHAIMAH

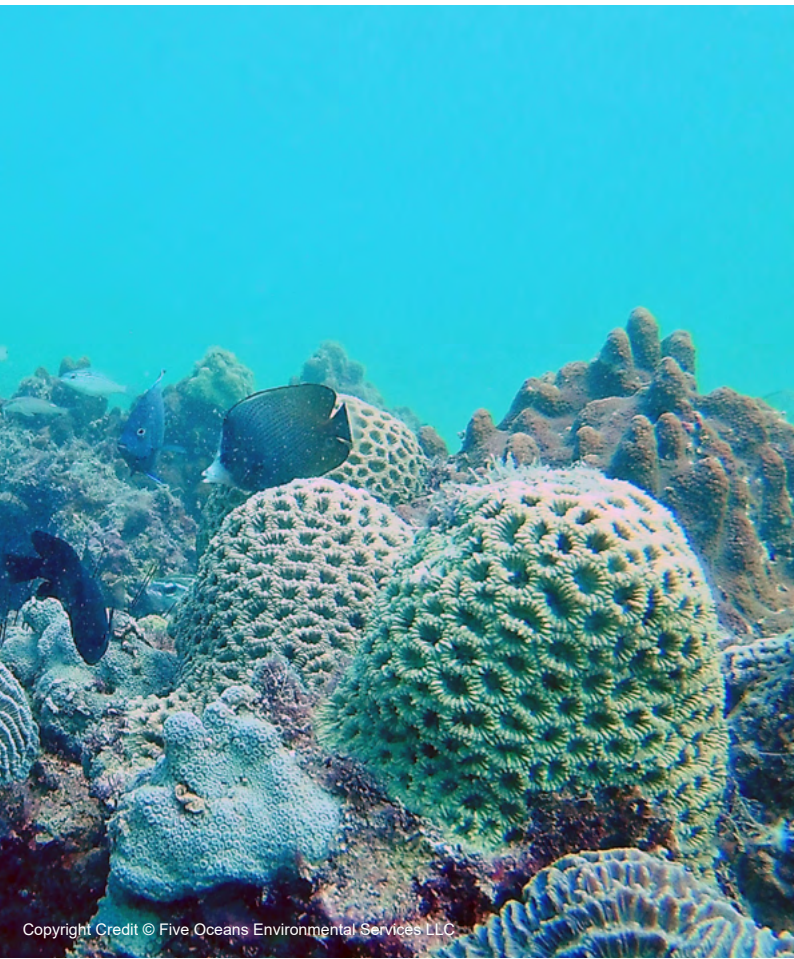The *khor* seascapes of Ras Al Khaimah support a rich mosaic of coastal habitats. Mangroves (4.7 km²) and adjacent dense seagrass beds coexist within the *khors*, particularly at Khor Ras Al Khaimah, Khor Rams and Khor Mazahmi, which in 2018 was declared a protected area by Ras Al Khaimah government. Across the nearshore and lagoonal areas seagrass covered 11.1 km². These seagrasses can survive in extreme conditions where they colonise mudflats and tolerate being completely exposed to the sun at low tide. Large expanses of subtidal seagrasses were discovered and mapped adjacent to Khor Mazahmi and Khor Rams and satellite tracking and underwater observations have revealed these areas as important feeding grounds for many green turtles. Other important habitat types interspersed and interconnected in the *khor* seascapes include mud flats (1.79 km²), algal mats (0.34 km²), halophytic vegetation (1.27 km²) which combine to make these areas important for resident and migratory birds including greater flamingos, small wading birds and raptors.

These sheltered wetlands provide nursery habitat for many fish of commercial and recreational value. Khor Rams is notable for the large area of coastal Sabkha fringing the coastline. The *khors* also provide a wide range of ecosystem services such as ecotourism, blue and green public spaces that promote human health and well-being and provide a regionally significant function through carbon sequestration. These nature-based services are particularly valuable and vulnerable because the *khor* seascapes are surrounded by urban development.

Legend
- Algal Mat
- Halophyte
- Mangrove
- Mud Flat
- Coastal Sabkha
- Seagrass

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RECOMMENDATIONS

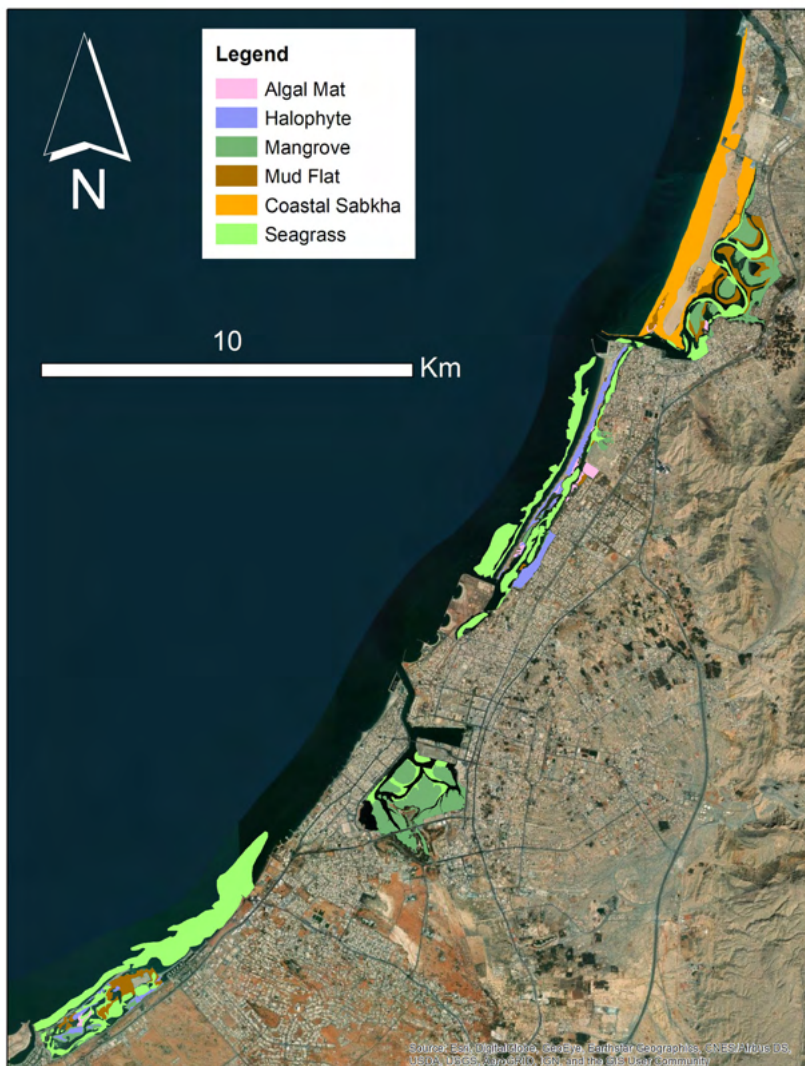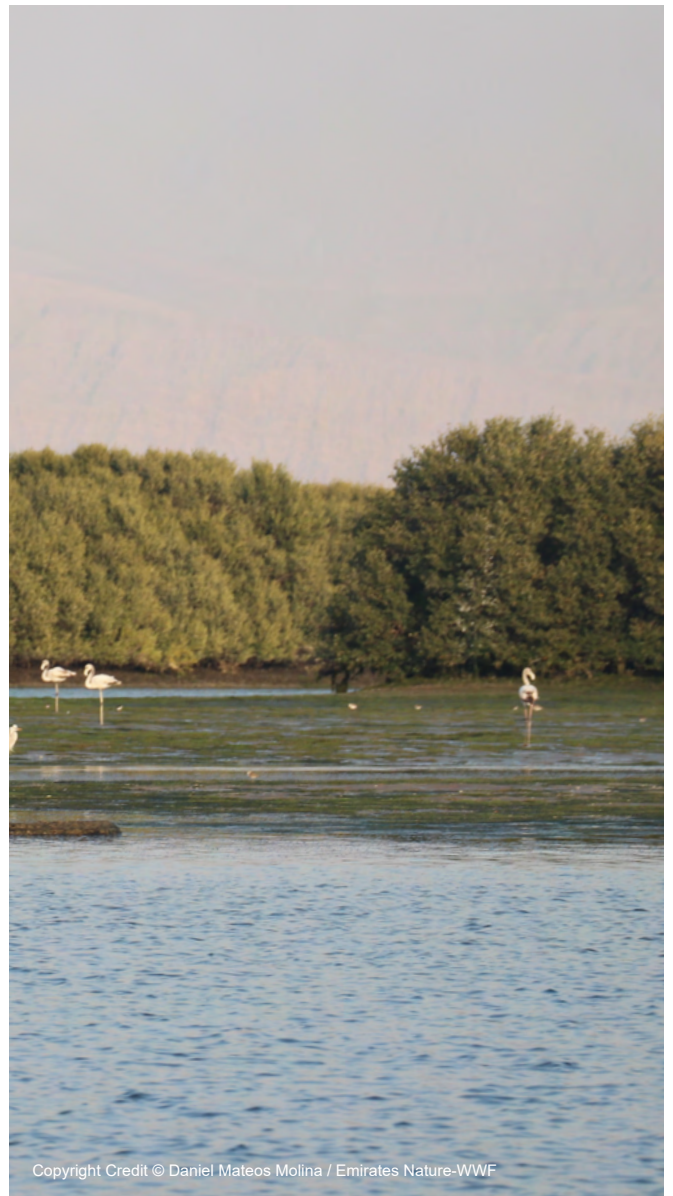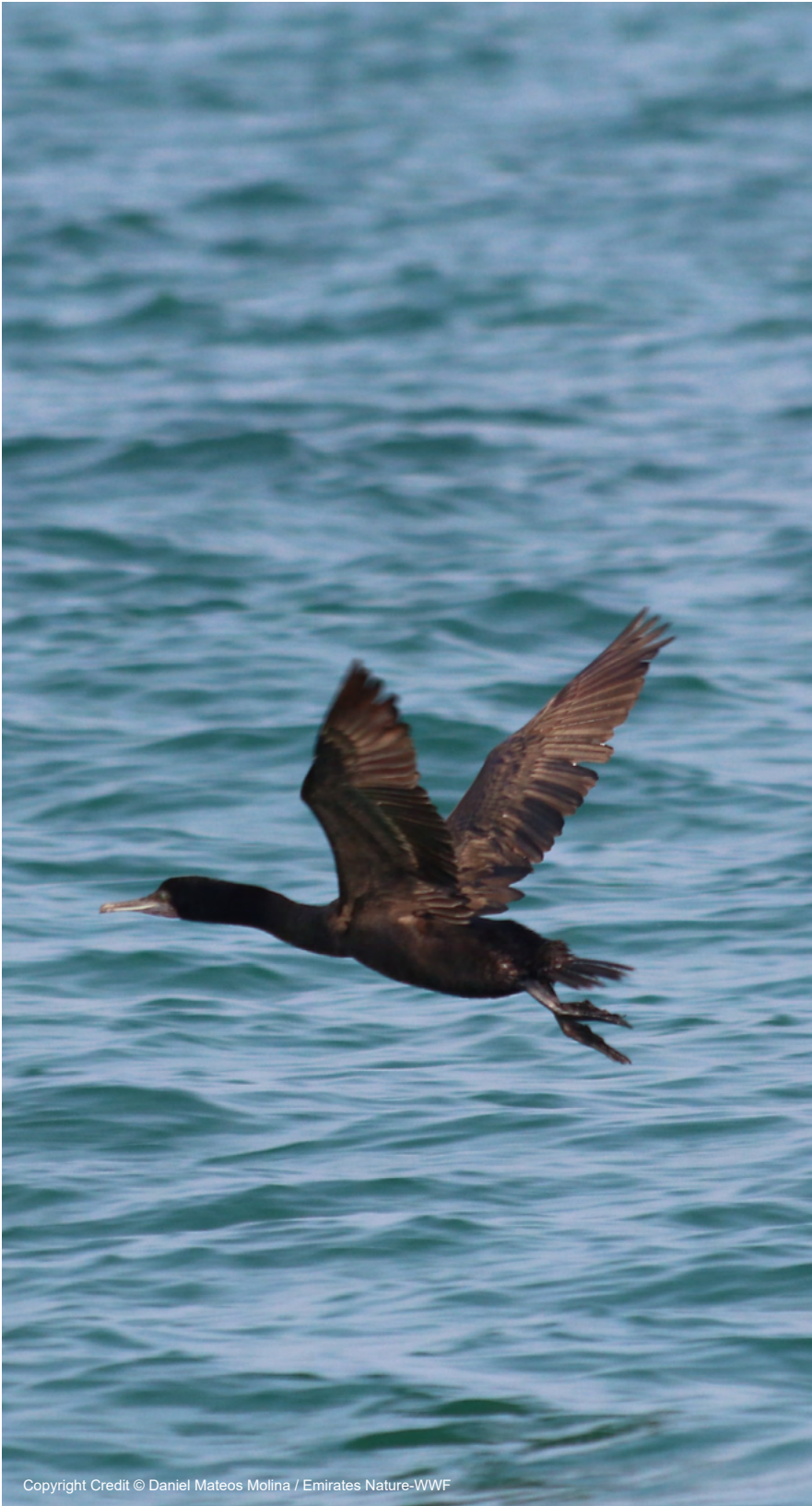## INTEGRATING CONSERVATION ACTIONS INTO THE WIDER LANDSCAPE AND SEASCAPE

CBD Aichi Target 11 requires that protected areas and other effective area-based conservation measures are integrated into the wider landscape and seascape, and relevant sectors, by applying the Ecosystem Approach and taking into account ecological connectivity, climate change impacts and, where appropriate, the concept of ecological networks (Ervin et al. 2010).

Target 11 Technical Rationale extended (COP/10/INF/12/Rev.1)

SUPPORTING BIODIVERSITY CONSERVATION

- **The new map provides an opportunity to integrate MPAs into the wider seascape and landscape considering ecological connectivity and ecosystem functioning as required by CBD Aichi Target 11.** Patches of habitat are influenced by the surrounding context. As reflected in the CBD Aichi Targets 10 and 11, ecological connectivity changes in one area can affect neighbouring marine ecosystems even those farther offshore.

  Therefore, understanding the surrounding context is crucial for designing effective policy and management actions that combine the needs of multiple stakeholders, enhancing ecosystem services and delivering benefits that will extend outside of protected areas.

- **The map underpins the Wetlands Inventory that Signatory States to the Ramsar Convention, including the UAE, are committed to complete.** The inventories support broader integrated management actions and can help identify new areas as candidate Ramsar sites of international importance.

- **The new habitat map provides an opportunity to evaluate the size, shape and placement of existing protected areas, examine effectiveness of management strategies and evaluate actions required to address any pressures on the habitats present within existing MPA boundaries.** This is central to addressing multiple priorities, goals and targets of the UAE NBSAP and is a key step to achieve effective management of MPAs as required by the CBD Aichi Target 11.

- **The map is essential to the task of identifying and locating APIBs** that can support the targets of the UAE NBSAP, as well as the country's pathway Post-2020 in line with the upcoming new Biodiversity Framework.

SUPPORTING THE NBSAP

Goal 2: Strengthening the knowledge base and building capacity for conservation, management and sustainable use of biodiversity

Target 2.1: By 2021, status and trends of key biodiversity components are assessed and monitored in all the UAE and knowledge is shared and linked to decision making

Action 2: Survey, assess, and map habitats and ecosystems important for biodiversity and develop an agreed bioregional classification system

AREAS OF PARTICULAR IMPORTANCE FOR BIODIVERSITY

These special areas are sites that contribute significantly to the global persistence of biodiversity such as areas high in species richness or threatened species, threatened biomes and habitats, areas with particularly important habitats (e.g., KBAs), high conservation value areas, important plant areas, sensitive marine areas, important bird areas, etc.). Identifying and integrating APIBs is central to achieving Aichi Targets 2 & 11 and the priorities of the NBSAP (Dudley et al. 2014).

APPLICATION TO INTEGRATED COASTAL MANAGEMENT

- **Explore a whole-site approach to place-based biodiversity conservation.** Availability of a reliable map of coastal habitats enables a shift in management focus from single habitat types and single conservation targets to a more holistic approach that considers interconnected ecosystem patterns and processes that together determine how an area functions and how it responds to change. This approach is relevant to the conservation of especially complex areas such as the *khor* seascapes where the whole ecosystem is more than the sum of its individual habitat types. The whole-site approach aligns with principles of ecosystem-based management (Rees *et al.* 2020).

- **Support strategic planning and implementation of ecosystem-based fisheries management to attain food security through the UAE Fisheries Recovery Plan.** The habitat map, interpreted through scientific knowledge and local ecological knowledge, enables the mapping of fish nursery, spawning and feeding areas for key fishery species. The habitat map will also serve as a primary data layer in predictive mapping of species and biodiversity distributions (Moore *et al.* 2016).

- **Spatial management decisions on coastal development would need to be based on information related to coastal habitat locations and extent.** Coastal zone management and planning, as well as (Strategic) Environmental Impact Assessments (EIAs) would need spatial ecological information to assess vulnerability on an area and ensure that impacts caused by human activities are mitigated as needed.

- **The new map supports the UAE in the development of site-specific actions to restore degraded coastal habitats** such as coral reefs, oyster beds and mangroves. Using the map to consider the wider seascape when designing restoration activities will help ensure that any restoration actions consider the broader ecosystem integrity and the long-term provisioning of ecosystem services.

- The spatial distribution of coastal habitats as represented in the habitat map is **key to a better understanding of vulnerability to disturbance** including near-term climate change impacts. The new coastal habitat map should enable an up-to-date application of the Coastal Vulnerability Index across the north-western Emirates (AGEDI 2016). The Coastal Vulnerability Index is one of the simplest and commonly used methods to assess coastal vulnerability to sea-level rise driven erosion and inundation.

ENABLING A SUSTAINABLE BLUE ECONOMY

- **The map provides critical information to inform the UAE Smart Map of Natural Capital led by the MOCCAE.** The new habitat map would constitute one layer of the natural capital smart map providing a spatial interpretation of the type and distribution of services associated with ecologically connected coastal ecosystems. This information would help decision makers understand the environmental as well as the economic and social opportunities or consequences of habitat loss by evaluating optimal cost/benefit and trade-offs when prioritising actions and economic activities at sea.

- **The map should be used to engage with public and private economic sectors in the context of a Sustainable Blue Economy for the UAE.** The coastal habitats mapped could provide opportunities for ecotourism, creation of collateral information and support the private sector engagement ultimately enhancing Nature-based Solutions to community well-being, climate change adaptation and implementation of the UAE's Green Agenda. Ecotourism experiences in these sensitive natural areas would need to be designed in tandem with conservation strategies and management plans. This will ensure the overall sustainability of the UAE's natural assets and offer a platform to involve stakeholders and the private sector in marine biodiversity conservation efforts.

- **The area cover of blue carbon habitats can be integrated into the NDCs** under the Paris Agreement (Herr *et al.* 2016). The habitat map provides an opportunity for UAE to update the national accounts for blue carbon supported by more accurate assessments of carbon sinks and design of appropriate management measures based on geographically varying habitat characteristics represented in the map.

- **The habitat map can be integrated into financial and investment decision making frameworks to extend the 'Green Agenda' to the marine environment.** Sustainability is now a central consideration of financial lending and investing. Developments that are funded, or partially funded, by international lending organisations are expected to subscribe to high standards of environmental and social performance, often require specific studies that go beyond EIAs. The habitat map can be integrated into strategic risk management frameworks that help identifying, assessing and managing potential environmental issues in project financing, particularly for critical habitats, vulnerable species and socially important place-based ecosystem features such as fishing grounds.

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MONITORING TRENDS AND RESPONSES TO CHANGE

- This comprehensive habitat map assists in the **design of efficient sampling strategies for ecological monitoring and reporting** in support of both individual Emirates and the National Marine and Coastal Environment Monitoring Programme (2016-2021) launched by UAE in 2016 as part of the National Strategy of Marine and Coastal Sustainability and SDG 14. The new map provides a spatial framework and tool for implementation of adaptive management of coastal ecosystems whereby future change detection can be carried out.

- **The habitat map supports strategic design of actions to protect, restore or create ecological corridors to rehabilitate ecological connectivity for biodiversity conservation and to enhance the provision of ecosystem services.** Analyses of the spatial patterns in the map supplemented with historical information, where available, will help identify habitats that have experienced fragmentation or experiencing dysfunctional connectivity. Fragmentation not only results in loss of habitat area but can disrupt ecological connectivity, increase vulnerability to stress and reduce long term viability (Hilty *et al.* 2019). Reducing the rate of loss of natural habitat by at least 50% and significantly reducing degradation and fragmentation by 2020 is required to achieve CBD Aichi Target 5.

- **Improve understanding of the ecological context for artificial structures in the ocean.** The large number of artificial reefs deployed in the Arabian Gulf waters of the north-western Emirates requires further attention for mapping and ecological characterisation in order to understand the effect on species, natural habitat and sustainable development. These efforts can be integrated into the broader ecological restoration activities across the UAE.

FACILITATING EDUCATION, AWARENESS AND CITIZEN SCIENCE

- **The coastal habitat map provides a digital framework opening up new opportunities for knowledge exchange.** The map has great potential to increase awareness of the local ecology through educational programmes in schools and universities or campaigns and will stimulate new scientific studies of the local ecology.

- **Enabling citizen monitoring programmes.** Monitoring of change can also be made more inclusive through coordinated participatory citizen science activities to track and report on habitat status and trends. Novel integrated multi-stakeholder change detection protocols and best practice could be developed to coordinate and share crowdsourced geospatial information on coastal ecosystems.

NEW RESEARCH OPPORTUNITIES

- **Exploration and mapping of deeper waters can build on the coastal habitat map.** It is likely that critical habitats also exist in deeper unmapped waters (>15 m). Investments in the exploration and mapping of deeper water seascapes using combinations of acoustic sensors and underwater video is desirable. This is particularly important for documenting offshore oyster beds and the deeper coral communities around Sir Bu Nair.

- **Creating a unified coastal habitat map for the UAE.** Integration of existing maps into a single framework will help identify information gaps and assist stakeholders in detecting special areas for more detailed mapping efforts and determine the next steps towards a national marine atlas for the UAE.

- **Coordinated underwater survey of all sites known to support live coral, including sites that have deteriorated, would provide an insight of current status of these vulnerable ecosystems.** This will help refine the map classification of habitat types with coral communities as well as pinpoint 'sentinel sites' at which to monitor changes to coral community health.

- **Reliable seasonal information on marine plant productivity is important to understanding ecosystem function and estimating the capacity for blue carbon storage.** To better represent macroalgae and seagrass in the habitat map will require acquisition of satellite data at times of peak biomass (summer growing season) together with field sampling to validate satellite data.

- The map can support **future research initiatives** carrying out species diversity inventories in critical habitats such as oyster beds and coral reefs. In addition, targeted scientific research to gain a better scientific understanding of the ecological connectivity between habitats and across seascapes would be beneficial to conservation planning e.g. ecological association between mangroves and seagrass.

- **The habitat map together with existing information on marine species distribution will form a catalyst for new research** where knowledge gaps have been revealed and where the map generates new questions and enables new analyses. Sharing the project results with the research community will help to stimulate advances in regional habitat and ecosystem science to underpin decision making in the development of policies and actions to ensure a sustainable and thriving ocean exists for future generations.

WAY FORWARD

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Stakeholder meetings will help determine effective ways to disseminate project information to support operational needs and exchange knowledge on potential applications and highlight complementary data and research potential. **Creating opportunities to link science with policy** and create dialogue between specialists and other interested parties will be key. These habitat maps can be integrated in spatial management and considered ahead of new development plans to avoid any negative impacts of coastal modification.

It is important to extend the marine and coastal habitat mapping framework in the UAE and the wider region. This can serve as a core source of information combined with expert-informed conservation targets and best available data on species distributions to identify and map marine APIBs and contribute to achieving international recognition of sites under various conventions and initiatives, such as Ramsar, CBD EBSAs, KBAs, etc.

The participatory mapping approach which integrated local ecological knowledge has laid the foundations for more targeted dialogue with local fishers and coastal communities. For example, there is much stakeholder interest in increasing our knowledge of the ecological importance and condition of the extensive pearl oyster beds revealed in this project. Other areas of interest include understanding the significance of lagoonal *khors* and the growing variety of artificial structures along the coast for the fisheries sector. **Research is needed to determine what these areas mean for people, how they are valued and what are the pressures in these areas.**

The map will be used to help stakeholders identify areas for habitat restoration (i.e. mangroves and oyster beds) taking into consideration the need to maintain the diversity of habitat types. This is significant as we enter the UN Decade on Ecosystem Restoration (2021-2030) recognising the need to accelerate global restoration of degraded ecosystems to help mitigate global warming, enhance food security and protect biodiversity on the planet.

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ACRONYMS

AGEDI	Abu Dhabi Global Environmental Data Initiative
APIB	Areas of Particular Importance for Biodiversity
APIMB	Areas of Particular Importance for Marine Biodiversity
CBD	Convention on Biological Diversity
CMS	Convention on Migratory Species
COP	Conference of the Contracting Parties
EAD	Environment Agency – Abu Dhabi
EBM	Ecosystem-Based Management
EBSA	Ecologically and Biologically Significant Marine Areas
EIA	Environmental Impact Assessment
EMEG	Emirates Marine Environmental Group
EN-WWF	Emirates Nature-WWF
EPAA	Environment and Protected Areas Authority
EPDA	Environment Protection and Development Authority
IBA	Important Bird and Biodiversity Area
NDC	Nationally Determined Contributions
KBA	Key Biodiversity Area
LEK	Local Ecological Knowledge
MPA	Marine Protected Area
MOCCAE	UAE Ministry of Climate Change and Environment
NBSAP	UAE National Biodiversity Strategy and Action Plan 2014-2021
OECM	Other Effective Area-Based Conservation Measures
SDG	Sustainable Development Goal
UAE	United Arab Emirates
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WWF	World Wide Fund for Nature

GLOSSARY

Areas of Particular Importance for Biodiversity (APIB)	Areas high in species richness or threatened species, threatened biomes and habitats, areas with particularly important habitats (key biodiversity areas, high conservation value areas, important plant areas, sensitive marine areas, important bird areas, etc.). APIMB has been used to refer to coastal and marine APIBs.
Biodiversity	The variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems. (CBD Article 2).
Blue carbon	Carbon captured by the world's ocean and coastal ecosystems.
Ecologically and Biologically Significant Marine Areas (EBSA)	Special areas in the ocean that serve important purposes, in one way or another, to support the healthy functioning of oceans and the many services that it provides. (https://www.cbd.int/ebsa/).
Ecological connectivity	The movement of populations, individuals, genes, gametes, and propagules (e.g., larvae, seeds, plant parts) between populations, communities, ecosystems and regions, as well as non-living material from one location to another (Hilty *et al.* 2020).
Ecological corridor	A clearly defined geographical space, not necessarily recognised as a protected area or other effective area-based conservation measure (OECM), that is governed and managed over the long-term to conserve or restore effective ecological connectivity, with associated ecosystem services and cultural and spiritual values (Hilty *et al.* 2020).
Ecosystem	A dynamic complex of plant, animal and microorganism communities and their non-living environment interacting as a functional unit. (CBD Article 2).
Nature-based Solutions (NbS)	Refers to ecosystem approaches, biomimicry, or direct utilisation of elements of biodiversity to address a specific problem or challenge(s) such as reforesting mangroves for coastal protection, biodiversity conservation, restoring fisheries habitat or enhancing pollution mitigation.
National Biodiversity Strategy and Action Plan (NBSAP)	The NBSAP was adopted in 2014 is based on the Aichi Biodiversity Targets of the Convention on Biological Diversity (CBD) and guides the UAE's efforts in conserving biodiversity during the coming decade and contribute to the achievement of relevant SDGs, mainly SDG 14 and SDG 15.
Other Effective Area-Based Conservation Measures (OECMs)	A geographically defined area other than a Protected Area, which is governed and managed in ways that achieve positive and sustained long-term outcomes for the in situ conservation of biodiversity with associated ecosystem functions and services and where applicable, cultural, spiritual, socio–economic, and other locally relevant values (CBD/ COP/DEC/14/8).
Seascape	A spatially heterogeneous and dynamic space that can be mapped at a range of scales in time and space. The term seascape recognises the importance of connectivity, spatial configuration and the significance of the surrounding context. It can be a combination of adjacent coastline and sea such as mangroves, coral reefs, seagrass beds, tidal marshes, and deep seas. It includes the features of the geology and morphology of the sea floor as well as the living communities of the benthos, water column, and surface, and it often includes human dimensions (Pittman. 2018).
Sustainable use	The use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations. (CBD Article 2).
Whole-site approach	This ecosystem-based approach to protect sites of greatest biodiversity interest recognises the ecological interdependence of many species and habitats. A mosaic of features can deliver more environmental benefits than the sum of its parts, as well as additional resilience to threats like climate change (Rees *et al.* 2020).

APPENDIX I.

The results of the coastal habitat mapping project have various applications to decision making benefiting national and emirate level policy agendas, as well as economic and social strategies.

DESIGNING EFFECTIVE COASTAL HABITAT RESTORATION STRATEGIES

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- Provides baseline information to identify areas **ecologically suitable for restoration** and habitat creation (planting mangroves, seagrasses or corals)

- Provide information on the spatial arrangement of habitats and the relevance of the surrounding landscape and seascape to **guide restoration design**

- Increase efficiency and long-term success by helping to assess risk from local threats and stressors

- Provide a spatial tool to **monitor and measure** changes to habitats through the restoration process

MAPPING NATURAL CAPITAL AND ECOSYSTEM SERVICES

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- Provide a cost-effective spatial framework for **mapping** and accounting of **natural assets** including **blue carbon** habitats (carbon sinks)

- Enable a comprehensive and up-to-date **wetland inventory** and **digital atlas**

- Assess coastal habitats as **nature-based solutions** for coastal defence, food security, **tourism** and human health and **well-being**

- Support sustainable and ecologically compatible **urban planning**

- **Mainstream natural capital** into decision making

- Better understand the **spatial flow of ecosystem** services from coastal and marine habitats to society

COASTAL HABITATS AS A NATURE-BASED SOLUTION WITH MULTIPLE CO-BENEFITS

Habitat maps help prioritise areas where co-benefits exist, for example, by identifying areas that have both high importance for biodiversity conservation and for climate change mitigation such as high blue carbon storage value

Soto-Navarro *et al.* 2020

DESIGNING EFFECTIVE FISHERIES RESTORATION STRATEGIES

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- Identify and **prioritise essential fish habitat** such as nursery, feeding, resting and spawning areas

- Identify and measure **loss and fragmentation** of important coastal fish habitat

- Inform ecologically relevant place-based **recovery plans** for threatened and vulnerable fish populations

- Recognise areas where **connectivity** between habitat types across the seascape is critical for fishery species

- Design **Other Effective Area-Based Conservation Measures** (OECMs) to complement MPAs

- Strengthen habitat science in support of **ecosystem-based fisheries management**

IDENTIFYING AREAS IMPORTANT FOR BIODIVERSITY CONSERVATION

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- Identify and evaluate the status of **critical habitat** for threatened and endangered species such as turtles and dugongs

- Inform the process for identifying **Areas of Particular Importance for Marine Biodiversity** (APIMBs)

- Support spatial prioritisation of targets through **systematic conservation planning** assessments

- Improve understanding of **species ecology** by linking mapped habitats to species distribution and behaviour

- Identify **connected habitat** types required to support the life history stages of important species and identify areas with impaired connectivity

SUSTAINABLE COASTAL ZONE PLANNING & SUSTAINABLE BLUE ECONOMY

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- Ensure coastal habitats are recognised in UAE **integrated coastal zone management frameworks** and **urban planning**

- Inform robust Strategic **Environmental Impact Assessments (EIA)** and the design of **targeted monitoring** programs

- Consider habitats in **pollution prevention actions** and **response plans** and develop **sensitivity maps**

- Design improved **public access to coastal green and blue spaces** for enhanced benefits for community health and well-being linked with careful zoning

- **Co-design with the private sector** the principles of a Sustainable Blue Economy where conservation of coastal and marine habitats is a central priority

DESIGNING CLIMATE ADAPTATION STRATEGIES & ACTIONS

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- Support climate **vulnerability assessments** of coastal habitats and design of actions to **increase resilience of habitats** to climate stressors

- Develop **forecasts and scenarios** of habitat and species shifts and loss to plan for future resource distributions

- Ensure that coastal habitats are integrated into **climate action plans, as well as mitigation and adaptation strategies**

- Conduct **blue carbon accounting & reporting to be included in NDCs under the UNFCCC commitments**

- Enhance **communication and education** of climate-induced changes to habitats and species across all sectors of society

ECOSYSTEM-BASED MANAGEMENT AND MPA MANAGEMENT

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- Integrate habitats into **ecosystem-based management** for integrated land-sea planning

- Use mapped habitat distributions to inform the **optimal size, shape and placement of MPAs** to achieve ecologically representative and well-connected systems of protected areas (Aichi Target 11)

- Build habitat **monitoring capacity and tools** to measure the change in spatial configuration of habitats inside and outside MPAs

- **Map biodiversity distributions** and key species using habitat maps as part of a suite of spatial predictors

ACHIEVING A SUSTAINABLE BLUE ECONOMY

The true potential of the Sustainable Blue Economy can only be realised if our ocean's health is secured. We need to restore, protect and sustainably manage ocean assets in order to realise the ocean's potential to support human development well into the future.

WWF (2018) Sustainable Blue Economy Finance Principles

BUILDING A FUTURE IN WHICH PEOPLE LIVE IN HARMONY WITH NATURE