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Organization

جامعة الإمارات العربية المتحدة
United Arab Emirates University

UAEU College of Science

AQUATIC ECOSYSTEM
HEALTH & MANAGEMENT SOCIETY

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- Dr. Ruwaya Al Kindi (UAE University, UAE)

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Our warm welcome to beautiful Al-Ain

It is well known that the Gulf's marine environment has long suffered due to the extraction of oil, effects of drilling, refining, dredging and landfilling, as well as global maritime transportation. The impacts of coastal development, multiple stressors and emerging issues, such as climate change, invasive species and costal alterations, have further degraded the Gulf ecosystem. These negatively affect water quality, fisheries, aquaculture and tourism which are all economically critical to the region.

The Aquatic Ecosystem Health and Management Society (AEHMS) is not new to the region, over the last 15 years it has been actively involved in organizing scientific conferences on the health of the Gulf marine ecosystem. The Society was instrumental in organizing and publishing the first comprehensive book "The Gulf Ecosystem: health and sustainability" (Khan et al., 2002) which was sponsored by the Kuwait Institute for Scientific Research (KISR). This was followed by the convening of the first GULF conference in collaboration with United Arab Emirates University, Al Ain, in 2006, which resulted in the publication of an AEHM special issue entitled "The State of the Gulf Ecosystem: future and threats (AEHMS, 2007)" sponsored by UNESCO. The Society continued its Gulf work with the convening of the GULF II conference in Kuwait, during 2011, which also resulted in the publication of a special issue, "Changing Gulf ecosystem: Ecology, health and management" (AEHMS, 2012), which was heavily downloaded online by the readers. The next event was GULF III conference in the UAE, which also resulted in the publication of two special issues, "Managing the health of the Gulf ecosystem: Dealing with climate change, invasive species and coastal alterations", part 1 and 2 (AEHMS, 2019, 2020).

The GULF4 conference is a continuation of the highly productive collaboration between the AEHMS and the United Arab Emirates University (UAEU). This conference deals with major environmental issues which strain the Gulf ecosystem. It will encourage collaboration and the exchange of scientific knowledge of expert researchers. This has inspired the AEHMS to take the lead in teaming up with the UAEU to organize the GULF4 international conference at Al Ain. We are pleased that the response to the conference has been quite encouraging, with a program of 47 presentations – 36 orals (5 keynotes) and 11 posters in the following sessions:

1. Harmful Algal Blooms (HABs) & Invasive Species
2. Anthropogenic Stressors
3. Marine Ecology
4. Coastal Habitats
5. Climate Change

The presentations originate from 7 countries, including 18 presentations from the host, the UAE. The conference will conclude with a synthesis session and a panel discussion.

The conference committee is indeed pleased to welcome you to Al Ain, UAE. We hope that GULF4 will be productive and benefit from the dissemination of the latest information and knowledge. Hopefully the conference will be useful in highlighting the problems, issues and research for future implementation of ecosystem-based management approaches and policies for the protection of the Arabian Gulf.

We extend a very warm welcome to all delegates to the beautiful surroundings of Al Ain.

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Profile of the United Arab Emirates University

The United Arab Emirates University (UAEU) is a comprehensive, research-intensive university enrolling about 14,500 students, with more than 900 faculty and more than 65000 alumni, holding key positions in government, industry, commerce, and all business areas throughout the region. International students and faculty representing more than 65 countries enrich and enliven the campus and the classrooms and provide stimulating cultural diversity. As the country's flagship university, UAEU offers a full range of internationally accredited high-quality graduate and undergraduate programs through its nine Colleges in almost all major disciplines.

Since its inception in 1976, UAEU has evolved from an undergraduate teaching institution to a comprehensive university with much greater emphasis on a research mission. As a research-intensive university, UAEU works with its partners in industry to provide research solutions to challenges facing the nation and the region. Nine research centers of strategic importance to the country and the region are advancing knowledge in critical areas. In addition, the "Science & Innovation Park," through its business incubators, serves as a hub for innovation, entrepreneurship and leadership to foster the transitioning of the UAE economy towards a knowledge economy.

With its distinguished faculty, state-of-the art campus, and full range of student support services, UAEU offers a living-learning environment that is unmatched in the region. In summary, UAEU is a mature university with significant accomplishments and a clear trajectory for continuous improvement with a goal to be recognized internationally as one of the world's best universities.

The GULF4 conference will continue the collaboration between the AEHMS and the United Arab Emirates University. This conference is confirming the serious intention of the UAE to tackle major environmental problems which stressing the Gulf ecosystem, through the exchange of scientific knowledge of both international and regional experts.

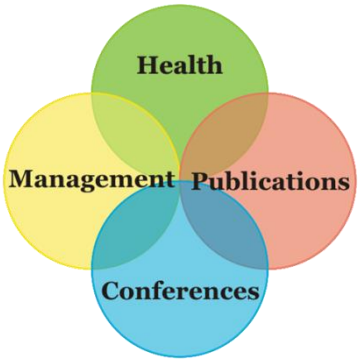
UAEU جامعة الإمارات العربية المتحدة United Arab Emirates University

www.uaeu.ac.ae

AEHMS's global mission

The Aquatic Ecosystem Health & Management Society (AEHMS) is a not-for-profit scientific international society initiated in Canada in 1989. Its mission and objectives are as follows:

- Promote the ecosystem health approach and ecosystem science-based concepts for the conservation and management of global aquatic resources.
- Encourage integrated, multidisciplinary, multi-trophic and sustainable practices for the remediation and restoration of marine and freshwater ecosystems.
- Enhance understanding of ecological health and integrity by applying holistic initiatives, novel methods, models and technologies.



ACTIVITIES:

The Society has four broad objectives centering on health, management, the convening/sponsoring of conferences/symposia, and publications via its international primary journal, monograph series and its website (www.aehms.org). The following are carried out:

1. Convening of timely national and international conferences, symposia and workshops.
2. Establishing Working Groups to focus collaboratively on research themes and management approaches. Working Groups have been established by the AEHMS on the Great Lakes of the World (GLOW), and Marine & Freshwater Invasive Species (MFIS).
3. Publication of the AEHMS's international primary journal: Aquatic Ecosystem Health & Management (AEHM) quarterly. It is an ISI-rated journal which also publishes special issues on selected themes and topics. So far over 50 special issues have been published by the journal (see http://aehms.org/publications/journal/) on international issues and topics.
4. The Ecovision World Monograph Series (EWMS) focuses on the paradigm of life on our ever-changing planet and its sustainability under the impact of physical, chemical, biological, and human influences. It covers detailed and comprehensive treatments of various topics, issues and ecosystems. It focuses on the interactions of multiple stressors originating from air, water, and land. The Ecovision book series is a peer-reviewed publication which is dedicated to integrated and ecosystem science-based science, merging the high quality of a journal with the comprehensive approach of a book. Currently more than 20 peer-reviewed books have been published on diverse topics (http://aehms.org/publications/ecovision/).

MEMBERSHIP:

The Society welcomes researchers, managers, students and senior scientists from a variety of disciplines who are interested in global topics dealing with ecosystem health and ecosystem science-based management. The AEHMS cordially invites colleagues to join the AEHMS to support global conservation and education. Membership includes 4 quarterly issues of the journal with on-line access, as well as discounts on conference registration fees, purchases of Ecovision books and back issues of our journal. A discounted membership is available for students and retired persons and colleagues from developing countries. Please see our website for more info (www.aehms.org).

AQUATIC ECOSYSTEM
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Things to Remember:

All presentations and posters are the property of the presenter. Audio recordings, copying, videotaping or photography of the presentations is prohibited. Media should obtain the permission of the conference chairs for use of any conference material.

We request participants to switch off mobile phones in the conference hall.

You should consider your personal name badge as your entry ticket. Please wear your badge at all times during the conference.

Liability: Neither the organizers, the AEHMS, the UAE University, nor any of the conference sponsors can be held responsible for damage, loss or theft during the conference. Please take precautions to ensure the safety of yourself and your valuables.

Parking at the UAEU:

Parking will be available in the male students parking lot next to the F3 Building Graduate Studies, where a bus will take participants to the conference building (IT Building (E1), Female side).

Any participants who arrive to the parking area and need help to reach the conference building, please contact any of the following telephone numbers. These three colleagues will be available to assist participants to the conference meeting room.

1. Prof. Khaled El-Tarabily

Calling from an international number: 00971 50 673 5210
Calling from within the UAE: 0 50 673 5210

2. Dr. Betty Matew (00971 55 489 7143)

Calling from an international number: 00971 55 489 7143
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3. Mr. Bader A. Hama (00971 55 778 1815)

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Program at a Glance

DAY 1	Tuesday, November 26th	
9:00-10:30 am	Registration	
10:30-12:00	Opening Ceremony	
12:00-1:30pm	Lunch	
1:30-2:00	Keynote: Prof. Roberto. Tomasicchio (Italy)	
2:00-3:00	Parallel A (Hall: G053)	Parallel B (Hall: 1003)
	Session 1 - HABs & Invasives	**Session 2** - Anthropogenic Stressors
3:00-3:30	Break	
3:50-4:50	**Session 1** continued	**Session 2** continued

DAY 2	Wednesday, November 27th	
9:00-9:30 am	Keynote: Prof. Paolo Galli (Italy)	
9:30-10:00	Keynote: Dr. Stephen Chua (Singapore)	
10:00-10:40	Parallel A (Hall: G053)	Parallel B (Hall: 1003)
	Session 3 - Marine Ecology	**Session 4** - Coastal Habitats
10:40-11:10	Break	
11:10-12:10	**Session 3** continued	**Session 4** continued
12:00-1:30pm	Lunch	
1:30-2:00	Keynote: Dr. Susana Carvalho (Saudi Arabia)	
2:00-3:00	**Session 3** continued (Hall: G053)	
3:00-3:30	Break	
3:30-4:10	**Session 4** continued (Hall: G053)	
4:15-6:15	Poster Session	
	Transport to banquet dinner	
6:30pm	Banquet Dinner	

DAY 3	Thursday, November 28th
9:00-9:30 am	Keynote: Dr. Mohiuddin Munawar (Canada)
9:30-10:10	**Session 5** - Climate Change
10:10-10:40	Break
10:40-11:20	**Session 5** continued
11:20-12:20	Panel Discussion
12:20-1:50pm	Lunch
1:50-2:50	Conference Synthesis
3:00-3:40	Closing Ceremony

Program

Tuesday, November 26th			
9:00am	**Registration**		
10:00-10:30	**Refreshment service**		
10:30-12:00	**National Anthem**		
	Welcome remarks from the UAE University Chancellor, H.E. Zaki Anwar Nusseibeh		
	Opening Statement by H.E. Dr. Maitha Bint Salem Al Shamsi, UAE Minister of State		
	Greetings from the President of the AEHMS, Dr. Mohiuddin Munawar		
12:00-1:30	**Lunch**		
1:30-2:00	**Keynote: Prof. Roberto Tomasicchio**		Coastal hazards and risks caused by climate change in low-lying areas
	Parallel A (Hall: G053)		
Session 1.	**Harmful Algal Blooms & Invasive Species**		
	Chair: Humood Naser; *Rapporteur*: Taoufik Ksiksi		
2:00-2:20	S1.01	Juan Sempere-Valverde	Biofouling in NEOM, Kingdom of Saudi Arabia: Assemblages' composition and biological pollution in coastal areas before major development
2:20-2:40	S1.02	Angelo Poliseno	Setting the baseline: characterizing non-indigenous fouling species in Saudi Arabia to establish a national monitoring program
2:40-3:00	S1.03	Sergey Dobretsov	Harmful Algal Blooms in the Sea of Oman: Dynamics, Drivers, and Ecological Impacts
3:00-3:30	**Break**		
3:30-3:50	S1.04	Igor Polikarpov	Harmful algal blooms in northwestern Arabian Gulf: Diversity, occurrence, and long-term trends
3:50-4:10	S1.05	Sahar Chebaane	Monitoring of non-indigenous species in the Arabian Gulf (Saudi Arabia): Spotlight on Ascidians
4:10-4:30	S1.06	Nadia Kettell	Investigating an unusual abundance of invasive upside-down jellyfish, Cassiopea sp in Al Khaledia lagoon, Sharjah, UAE
	Parallel B (Hall: 1003)		
Session 2.	**Anthropogenic Stressors**		
	Chair: Ruwaya AlKendi; *Rapporteur*: Mayank Gururani		
2:00-2:20	S2.01	Igor Polikarpov	Preserving the Gulf: The Intersection of Tradition and Conservation

Tuesday, November 26th			
2:20-2:40	S2.02	Noran Mousa	Sustainable Enhanced Oil Recovery Using Imidazolium-Based Ionic Liquids in Emirati Tight Oil Reservoirs
2:40-3:00	S2.03	Fatima AlHammadi	Space Based Observations on Underground Water Variability in the United Arab Emirates (UAE)
3:00-3:30	**Break**		
3:30-3:50	S2.04	Shama Sehar	Enhanced Wastewater Treatment Efficiencies in Constructed Wetland by exploiting interplay between divalent Cation (Ca2+) and Biofilm Kinetics
3:50-4:10	S2.05	Seham M. Al Raish	An Assessment of the Knowledge, Attitude, and Practices Towards General Waste Segregation Among the Population of the United Arab Emirates
4:10-4:30	S2.06	Khaled El-Tarabily	Investigating the impact of microplastic-degrading bacteria in contaminated marine water
4:50-5:10	S2.07	Francesco Saliu	Anthropogenic stressors and emission of biogenic volatile organic compounds by marine micro-algae: A perspective in the ROPME Sea-Area

Wednesday, November 27th			
9:00-9:30am	**Keynote: Prof. Paolo Galli**		MaRHE Center, Marine Research and Higher Education Center: A Model of Research Center Transferable to the UAE?
9:30-10:00	**Keynote: Dr. Stephen Chua**		How understanding past sea levels aid present and future adaptation and mitigation for sustainable coasts
	Parallel A (Hall: G053)		
Session 3.	**Marine Ecology**		
	Chair: Susana Carvalho; *Rapporteur:* Mohammad Al-Deeb		
10:00-10:20	S3.01	Muzaffar, S.	Long-term population trend and diversity shifts among shorebirds: A predictor of biodiversity loss along the Arabian Gulf coasts
10:20-10:40	S3.02	Stahl, H.	First recorded outbreak of Crown-of-Thorns Sea Stars (Acanthaster spp.) in the Gulf of Oman, UAE
10:40-11:10	**Break**		
11:10-11:30	S3.03	Montalbetti, E.	Metabolomics reveals distinct phenotypical traits across different population densities of crown-of-thorns seastar (Acanthaster planci) in the Gulf of Oman (United Arab Emirates)
11:30-11:50	S3.04	Almansoori, H.	Investigating the mass mortality induced factors of Pearl Oyster (Pinctada radiata) at Abu Dhabi Pearls Farm, UAE
11:50-12:10	S3.05	Malik, S.	Characterizing bioaccumulated toxic elements in tissues of bio-economically important pelagic fish, narrow-barred Spanish mackerel (Scomberomorus commerson), from the Arabian Gulf
	Parallel B (Hall: 1003)		
Session 4.	**Coastal Habitats**		
	Chair: Roberto Tomasicchio; *Rapporteur*: Ranjit Vijayan		
10:00-10:20	S4.01	Naser, H.	Impacts of reclamation on coastal habitats in the Arabian Gulf
10:20-10:40	S4.02	Louis, Y.	Bioconcentration of emerging and organic contaminants in sponges and Ascidians from coastal areas of the United Arab Emirates
10:40-11:10	**Break**		
11:10-11:30	S4.03	McFarlane, C.	Evaluating small cetacean population and anthropogenic threats in the urban waters of Abu Dhabi, United Arab Emirates

Wednesday, November 27th			
11:30-11:50	S4.04	Natoli, A.	Declining Presence of Small Cetaceans in Dubai's Coastal Waters: Evidence from Eight Years of Surveys and Mitigation Recommendations

Note: After lunch, the final presentations in sessions 3 and 4 will be given in Hall: G053, one after the other. They are no longer parallel in the afternoon.

12:00-1:30pm	**Lunch**		
1:30-2:00	**Keynote: Dr. Susana Carvalho**		A decade of research on Red Sea coastal habitats: An integrated approach advancing regional conservation and environmental regulation
Session 3.	**Marine Ecology continued** *Chair:* Martin Van der Knaap; *Rapporteur:* Youngwook Kim		
2:00-2:20	S3.06	Behl, A.	Evaluating Heavy metal levels in Blackspot snapper may offer clues for public health and the marine ecosystem in the Arabian Gulf
2:20-2:40	S3.07	Muzaffar, S.	Foraging ecology of Socotra cormorants in the Gulf of Salwa, Arabian Gulf
2:40-3:00	S3.08	Thangadurai, T.	Acropora growth anomaly-associated bacterial metagenome reveals no distinct but varied bacterial abundance between healthy and lesion tissues in diseased corals
3:00-3:30	**Break**		
Session 4.	**Coastal Habitats continued**		
3:30-3:50	S4.06	Cerri, F.	Mangrove Resilience in the Gulf: Phytochemical Insights into Avicennia marina Under Extreme Environmental Conditions
3:50-4:10	S4.07	El-Tarabily, K.	Enhancing the growth of Avicennia marina in the United Arab Emirates through the utilization of consortium of rhizosphere-competent actinobacteria displaying several plant growth-promoting characteristics
4:15-6:15	**Refreshment Break & Poster Session**		
6:30pm	**Banquet**		

Thursday, November 28th			
9:00-9:30am	**Keynote: Dr. Mohiuddin Munawar**		Transferring North American Great Lakes management experience and skills to the GULF ecosystem: International Cooperation and Agreements
Session 5.	**Climate Change (Hall: G053)**		
	Chair: Paolo Galli; *Rapporteur*: Amit Kumar		
9:30-9:50	S5.01	Usman, M.	Space-time analysis of the sea level variability of the Arabian Sea using satellite altimetry data
9:50-10:10	S5.02	Manlik, O.	The Arabian Gulf as a natural laboratory to investigate adaptation to climate change using genetic, genomic and epigenetic approaches
10:10-10:40	**Break**		
10:40-11:00	S5.03	Usman, M.	A tale of sea level dynamics in the Arabian Gulf
11:00-11:20	S5.04	Sharma, H.	Identification of Genes Important for Adaptation to Climate Change in a Marine Copepod
11:20-12:20	**Panel Discussion** *Moderator:* Prof. Taoufik Ksiksi *Panel Members:* All Keynotes, Waleed Hamza and Mohiuddin Munawar *Rapporteur:* Synan Abu Qamar		
12:20-1:50	**Lunch**		
1:50-2:50	**Conference Synthesis** Martin Van der Knaap and Sabir Muzaffar *Rapporteur:* Jennifer Lorimer		
2:50-3:45	**Photo**		
	Publication plans		
	Closing Ceremony		
	Certificates		

Abstracts

Oral abstracts are given in session in order of presentation, followed by poster abstracts.

KEYNOTE

Presenter: Tomasicchio, G.

Coastal hazards and risks caused by climate change in low-lying areas

Tomasicchio, G.

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Global warming and climatic change processes determine different impacts. Evident impacts are sea level rise (SLR) and more frequent and intense Extratropical cyclones.
Sea level is considered a key indicator of climate change, and its estimation provides an essential constraint for global climate models. Since the sea level variability affects the coastal areas, it is also an important factor to be considered to mitigate the consequences of natural disasters both at the global level and at local/regional scales, particularly in coastal regions where there are substantial aggregations of population and properties, and for strategic beach-management plans.
Sea level rise produces a potential risk for coastal flooding at low lying-areas all over the world and causes a major concern at areas with many infrastructures and larger population.
High-resolution analysis of coastal flooding for different SLR projections related to IPCC emissions scenarios are now made available because of research projects.
The lecture intends to give an overview of the impacts of SLR projections, particularly focused on the Mediterranean Sea and the Arabian gulf.

S1.01 (Harmful Algal Blooms & Invasive Species)

Presenter: Sempere-Valverde, J.

Biofouling in NEOM, Kingdom of Saudi Arabia: Assemblages' composition and biological pollution in coastal areas before major development

Sempere-Valverde, J.,[1]* Aylagas, E.,[1] Semin, V.,[1] Texeira, M.,[1] Kolbasova, G.,[1] Ruiz-Velasco, S.,[2] Chebaane, S.,[1] Curdia, J.,[1] Cadiz, R.,[1] Cottrell, D.,[1] Desiderato, A.,[3] Marzucchi, M.,[1] Torres, F.,[4] Eweida, A.,[5] Carvalho, S.[6]

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The introduction and spread of non-indigenous species (NIS) in new environments pose significant ecological and economic challenges, making the understanding and management of bioinvasions a global priority. The interplay between maritime traffic, coastal urbanization, and the spread of NIS can be better understood through monitoring fouling communities in areas slated for development. NEOM, a largely pristine region in Saudi Arabia's northern Red Sea, is set for various development projects. Establishing a baseline of the fouling community will lead to a better understanding of the potential effects of coastal development on the dynamics of fouling NIS. We used PVC settlement panels along with eDNA filtration to catalogue biodiversity using a combination of morphological and molecular approaches. Sampling was done in November 2023 and February 2024 at seven sites, with three settlement panels and five water samples retrieved per site and sampling time. Over 40 plate-coverage assessments and 900 voucher samples were collected for morphological and molecular identification, as well as 70 water filtration and 42 panel-scraping samples for eDNA analysis. The results offer the first comprehensive assessment of the fouling community and NIS presence in NEOM, also contributing to a wider fouling species library. The low NIS richness and abundance registered indicate NEOM's relatively good ecological status compared to other Red Sea habitats. However, the Sharma coastal lagoon in NEOM showed a considerable abundance of cryptogenic and NIS bryozoans. This could be related to it being a confined water mass hosting a relatively high human activity, and to the presence of pontoons (floating substrata) in the sampling sites. Overall, this study enhances our ability to detect and manage marine NIS in the Red Sea and sets a crucial baseline in an understudied region, which will allow more comprehensive fouling dynamics and NIS monitoring studies as NEOM develops.

S1.02 (Harmful Algal Blooms & Invasive Species)

Presenter: Poliseno, A.

Setting the baseline: characterizing non-indigenous fouling species in Saudi Arabia to establish a national monitoring program

Cottrell, D.,[1] Aylagas, E.,[1] Syomin, V.,[1] Cadiz, R.,[1] Sempere-Valverde, J.,[1] Kolbasova, G.,[1] Chebaane, S.,[1] Poliseno, A.,[1]* Couëdel, M.,[2] Keppel, E.,[3] McCann, L.[3]

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In the context of increasing coastal urbanization and maritime activity, the establishment of non-indigenous marine species (NIS) present ecological risks and management challenges. This study represents a pioneering endeavour to characterize NIS within fouling communities along Saudi Arabian Gulf and Red Sea coastlines , setting a foundational framework for a national NIS monitoring initiative. Our approach integrates morphological and molecular identification methods alongside quantitative assessments to achieve two primary objectives: (1) create a species reference library and (2) improve NIS detection by combining results from water, sediment, and fouling samples. Fieldwork spans 12 months across 34 sites at 11 locations (7 in the Red Sea, 4 in the Arabian Gulf), visited quarterly. Each quarter, five PVC settlement panels (three month deployment) and 10 water samples were collected at each site. Additionally, five scrapings from pontoons and/or seawalls and five sediment samples were collected once per site. Panels and scrapings were analyzed following a DNA metabarcoding approach from a subsample of the blended biological material; all morphospecies were DNA barcoded (Cytochrome c oxidase subunit I; COI). Water and sediment samples were analyzed for environmental DNA (eDNA). This project involves taxonomists from around the world to identify voucher samples, enhancing reference collections and DNA databases. This far, it has led to at least 15 new NIS or cryptogenic species records (such as serpulid Hydroides elegans and sabellid Branchiomma bairdi) and several new species discoveries. Even at this preliminary stage, it can be concluded that many “cosmopolitan” species recorded from the region are in fact separate species. Nearly 5000 voucher specimens have been collected thus far, advancing understanding of Saudi Arabia's native and non-native biodiversity in man-made marine environments. The methodologies and findings from this study offer valuable insights for similar initiatives addressing urbanization and maritime traffic impacts globally.

S1.03 (Harmful Algal Blooms & Invasive Species)

Presenter: Dobretsov, S.

Harmful Algal Blooms in the Sea of Oman: Dynamics, Drivers, and Ecological Impacts

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The Sea of Oman frequently experiences harmful algal blooms (HABs) that threaten food and water security by impacting fisheries, aquaculture, freshwater supplies from desalination plants, and tourism. While the global understanding of factors contributing to HAB expansions is improving, the dynamics controlling HABs in the Sea of Oman remain underexplored. The FORCA-HAB project aims to characterize the ecology of HABs, identify their key drivers, and understand their dispersion along the northern Omani coasts as well as investigate bacteria associated with HABs. We proposed a comprehensive approach combining regular on-site sampling with a network of autonomous gliders and moorings. Water samples for bacterial, plankton and nutrient analysis were collected. Additionally, CTD vertical profiles were collected, providing data on temperature, salinity, and chlorophyll. From September to December, the thermocline deepened gradually, with increased salinity and temperature near the bottom. Biological data revealed 82 bacterial isolates, including potentially pathogenic genera such as Klebsiella, Bacillus, Vibrio, Acinetobacter, and Stenotrophomonas. Metagenomic sequencing of bacteria showed diverse microbial communities associated with HABs. The dominant HAB species was Noctiluca scintillans, with a notable increase in abundance over the sampling period, peaking at 50,000 individuals per cubic meter in October 2023. These findings highlight the need for ongoing monitoring and analysis to understand the ecological impacts of HABs and associated bacterial communities to protect regional marine resources and industries.

S1.04 (Harmful Algal Blooms & Invasive Species)

Presenter: Polikarpov, I.

Harmful algal blooms in northwestern Arabian Gulf: Diversity, occurrence, and long-term trends

Polikarpov, I.,* Saburova, M., Al-Kandari, M., Al-Yamani, F.

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The northwestern Arabian Gulf boasts distinctive oceanographic and biological features, yet faces significant anthropogenic pressures amid local hydrological shifts and regional climate variations. Year-round phytoplankton blooms in Kuwait's waters stem from a proliferation of diverse microalgae species, cyanobacteria, and photosynthetic ciliates. This habitat reveals a rich array of potentially harmful diatoms and dinoflagellates known to induce human poisoning syndromes. These waters also host a diverse range of ichthyotoxic dinoflagellates, raphidophycean, and haptophycean flagellates linked to large-scale mortality among marine biota. A chronological overview of recorded algal bloom events provided a present-day pattern of phytoplankton blooms diversity, spatial distribution, seasonality, and long-term trends. The most ecologically relevant species of microalgae were identified, which may impact coastal areas, fishery resources, and public health. Alarming trends in harmful algal blooms (HABs) over time, showcasing toxic and high biomass blooms, raise concerns about marine life preservation. Shifts in phytoplankton composition are intricately tied to changes in inorganic nitrogen, phosphorus, and silicate ratios, instigated by reduced Shatt Al-Arab River flow and escalating anthropogenic input from land sources. Comprehensive taxonomic and molecular investigations, coupled with preliminary phycotoxin identification, enhanced the reliability of taxonomic identification for bloom-forming species and facilitated precise HAB monitoring, prediction, and risk evaluation. The presence of bloom-forming and toxin-producing microalgae underscores the risks to marine life, human health, and coastal activities.

S1.05 (Harmful Algal Blooms & Invasive Species)

Presenter: Chebaane, S.

Monitoring of non-indigenous species in the Arabian Gulf (Saudi Arabia): Spotlight on Ascidians

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Over the past four decades, coastal marine waters have witnessed a significant increase in invasions by non-indigenous species (NIS). Among these NIS invaders, ascidians have emerged as particularly noteworthy. Their rapid dispersion, frequent population outbreaks, and associated negative ecological and economic impacts have elevated invasive ascidians to a global concern. Despite increased NIS studies in the Arabian Gulf, knowledge about the species composition of ascidians remains limited. Assessing the impact of ascidians requires understanding the existing species in the region. In this study, we investigated 13 marinas and harbors within Saudi Arabian waters in the Arabian Gulf. We collected more than 212 ascidian samples and employed molecular tools to confirm species identification. Notable non-indigenous ascidians recorded include Polyclinum constellatum and Symplegma brakenhielmi. This research contributes valuable insights into the distribution and diversity of ascidians in the Arabian Gulf, emphasizing the need for continued monitoring and management strategies to mitigate their impact.

S1.06 (Harmful Algal Blooms & Invasive Species)

Presenter: Kettell, N.

Investigating an unusual abundance of invasive upside-down jellyfish, Cassiopea sp in Al Khaledia lagoon, Sharjah, UAE

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The out-of-season occurrence and unusually high abundance of upside-down jellyfish, Cassiopea sp., in Sharjah's Al Khaledia Lagoon were investigated using a multidisciplinary approach. While a similar rapid increase in Cassiopea sp. abundance was observed in nearby coastal lagoons in Sharjah, it occurs only in low quantities in most other coastal areas of the UAE, except for Yas Island in Abu Dhabi. Several possible hypotheses were explored, including rising sea temperatures due to global warming and anthropogenic impacts. Cassiopea sp. abundance was monitored over several months, and water chemistry and phytoplankton data were analyzed to infer

environmental conditions. The results suggest that a population of Cassiopea sp. is now well-established in the Khaledia Lagoon, most likely due to favorable environmental conditions rather than rising sea temperatures. However, global climate change may be a contributing factor, as water temperatures in the lagoon have been rising steadily over the past 10 years. This research highlights the necessity of using interdisciplinary methods to inform evidence-based management plans for the conservation of marine biodiversity.

S2.01 (Harmful Algal Blooms & Invasive Species)

Presenter: Polikarpov, I.

Preserving the Gulf: The Intersection of Tradition and Conservation

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The Arabian Gulf, a region rich in biodiversity and cultural heritage, faces significant environmental challenges. Overexploitation of marine resources, pollution, and climate change have placed immense pressure on its delicate ecosystems. To effectively conserve the Gulf's marine resources, harnessing the power of marine heritage and traditional knowledge is imperative. The coastal communities of the Arabian Gulf have accumulated a wealth of knowledge and practices over centuries, deeply rooted in their interactions with the marine environment. Marine heritage and traditional knowledge offer time-tested practices for sustainable resource management, enhance community engagement and stewardship, and provide valuable insights that complement scientific research. Recognizing and integrating these cultural assets into modern conservation efforts can enhance our ability to protect and manage the Gulf's marine ecosystems for future generations.

S2.02 (Anthropogenic Stressors)

Presenter: Mousa, N.

Sustainable Enhanced Oil Recovery Using Imidazolium-Based Ionic Liquids in Emirati Tight Oil Reservoirs

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In response to the increasing global demand for energy and the limitations of conventional oil recovery methods, this study investigates the potential of imidazolium-based ionic liquids (ILs) as novel agents for enhanced oil recovery (EOR) with a focus on mitigating environmental impacts. The effects of four imidazolium ILs—1-decyl-3-methylimidazolium chloride, 1-dodecyl-3-methylimidazolium chloride, 1-dodecyl-3-methylimidazolium tetrafluoroborate, and 1-hexadecyl-3-methylimidazolium bromide (C16mimBr)—on phase behavior, interfacial tension (IFT), and wettability between oil, water, and rock were examined in the context of Emirati tight oil reservoirs.
Thermal stability of these ILs was investigated under extreme temperatures up to 600℃ using thermogravimetric analysis. Experiments conducted across a range of temperatures (up to 110℃), IL concentrations (0, 500, 1500, and

3000 ppm), and salinities (seawater and formation brine) showed substantial IFT reductions and wettability shifts toward more water-wet conditions. Notably, the IL with the longer alkyl chain (C16mimBr) reduced IFT by over 99% in formation brine at 3000 ppm and 110℃, altering contact angles to as low as 15.37° and significantly enhancing oil displacement potential. Emulsification experiments with a 1:1 mixture of light crude oil and IL solutions at 500 ppm, followed by 24-hour incubation at 90℃, were analyzed under a microscope to measure water droplet sizes in the microemulsions. Findings highlight the crucial role of alkyl chain length and environmental parameters in optimizing EOR strategies using imidazolium-based ILs.
This research highlights the dual benefits of imidazolium ILs in enhancing oil recovery and mitigating environmental stressors. By improving EOR efficiency and reducing the environmental footprint of oil extraction, imidazolium-based ILs offer promising solutions for sustainable energy practices and environmental remediation.

S2.03 (Anthropogenic Stressors)

Presenter: AlHammadi, F.

Space Based Observations on Underground Water Variability in the United Arab Emirates (UAE)

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In the UAE, underground water is heavily mined for irrigation. Due to arid conditions, withdrawal always exceeds recharge, causing a gradual decline in these reserves. Satellite gravimetry is a powerful tool to examine underground water status. In this research, we used the Gravity Recovery and Climate Experiment (GRACE) and Follow-On (GRACE-FO) satellite data to analyze the time series of five major areas (Abu Dhabi, Dubai, Fujairah, Ras Al Khaimah, and Al Ain). To ensure stationarity, we decomposed the time series into seasonal and trend components. We found the trend to be linear at all five locations and modeled it using simple linear regression. The intra-annual cyclic component can be modeled with non-linear least squares fits (first-order Fourier series). The lowest decline was in Abu Dhabi at -0.017 cm/month, and the highest in Fujairah at -0.037 cm/month. Dubai and Ras Al Khaimah had similar decline rates of -0.027 cm/month, while Al Ain's rate was -0.029 cm/month. The seasonal component shows input from rainfall on an intra-annual scale. Overlaying the seasonal component with reanalysis (ERA-5) rainfall data showed good agreement. At some locations, there is a phase shift between rainfall peaks and satellite gravimetry data. The phase lag depends on runoff timing. Quick runoff means storage is proportional to precipitation, while slow runoff means storage equals the integration of precipitation. In the UAE, with population growth, water demand will rise, and continued decline could lead to serious water scarcity. This could affect the nation’s efforts toward sustainability. A major shift in water conservation policies is necessary.

S2.04 (Anthropogenic Stressors)

Presenter: Sehar, S.

Enhanced Wastewater Treatment Efficiencies in Constructed Wetland by exploiting interplay between divalent Cation (Ca2+) and Biofilm Kinetics

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During the last decade, the importance of microbial biofilm in environmental sustainability is gaining incredible attention owing to their active participation in organic matter decomposition, nutrient dynamics, biogeochemical cycling, water distribution systems, bioelectricity production bio-filtering municipal and industrial wastewater, and biofilm-based wastewater treatment technologies. Therefore, the fundamental role of microbial biofilm for biological wastewater treatment technology particularly constructed wetland was explored by comparing treatment efficiencies using wide variety of vegetation. In addition, possible factors (divalent cations (Ca2+) and extracellular DNA (eDNA) that could regulate the mechanics of biofilm were studied by introducing divalent cations (Ca2+) in the constructed wetland soil. The in-vitro investigations of soil samples collected at various retention times revealed that the addition of Ca2+ facilitate to form well organized biofilm patterns in comparison to calcium depleted soils. Afterwards, Ca2+ ions were intentionally subjected into the soil of lab-scale constructed wetland to examine its superior treatment efficiency towards various chemical and microbiological contaminants removal. The current work therefore is a first step towards a combination of theoretical prediction and its experimental execution on a real time existing biofilm mediated wastewater treatment technology. Hence, the same approach can effectively be utilized for pilot scale wetland systems as well as other biofilm mediated wastewater treatment technologies.

S2.05 (Anthropogenic Stressors)

Presenter: Al Raish, S.

An Assessment of the Knowledge, Attitude, and Practices Towards General Waste Segregation Among the Population of the United Arab Emirates

Al Raish, S.,* Hassooni, S., El-Tarabily, K.

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This study presents a descriptive cross-sectional analysis evaluating the associations between Knowledge, Attitude, and Practices (KAP) concerning waste segregation among the population of the United Arab Emirates (UAE). A total of 391 respondents, aged 18 years or older and residing in the UAE, completed an online questionnaire designed to measure their KAP towards waste segregation. The study reveals a strong correlation between gender, attitude, and practice, with a significance level of $P < 0.001$. Moreover, the data analysis indicates significant and positive correlations among the KAP dimensions ($P < 0.001$).

The findings uncover noteworthy variations between males and females in terms of their KAP towards waste segregation. These differences emphasize the potential for targeted educational and policy interventions to enhance waste segregation behaviors. The study also highlights the necessity of further research to explore the underlying mechanisms of these correlations and develop tailored strategies to promote sustainable waste management practices across different demographic groups in the UAE.

This research underscores the critical role of understanding KAP in improving waste management practices, which is pivotal for environmental conservation and sustainable development. By enhancing the population's knowledge and attitudes towards waste segregation, the UAE can progress towards achieving its sustainability goals, reduce environmental risks, and foster a more circular economy.

S2.06 (Anthropogenic Stressors)

Presenter: El-Tarabily, K.

Investigating the impact of microplastic-degrading bacteria in contaminated marine water

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Microplastics, also known as MPs, are tiny pieces of plastic that are smaller than 5 millimeters in size and are an increasing problem of contamination in the marine water bodies of our globe. MPs pollute the marine environment as they are both difficult to clean up and quick to form. In addition to this, MPs are quite harmful to marine and aquatic life as they contain chemical additives such as plasticizers and persistent organic pollutants (POPs). Fortunately, some microorganisms have developed the ability to degrade these MPs. This capability can potentially be harnessed and utilized to clean the water contaminated with MPs. The focus of this study was to isolate and identify bacteria present in MP-contaminated natural marine water bodies, and compare their MP-degrading efficiency. A total of 12 water samples were collected from three natural water bodies. Next, the water samples were filtered through porous PTFE filters to capture plastic particles. Afterward, the samples were centrifuged, serially diluted, and streaked onto cellulose-supplemented minimal media to isolate bacteria. These strains were then tested to ascertain their replicative ability to form a biofilm on the MPs. 16S rRNA gene sequencing analysis was performed on nine bacterial strains that were identified from the growth on MPs. The isolated bacteria were not able to grow anaerobically on MPs, as they only produced very small colonies. Eleven bacteria were isolated from water samples from the Naser lakes and nine were isolated from Manzala Lake. According to Naeslund's criteria, these strains belong to the genera Bacillus, Ochrobactrum, Klebsiella, and Pantoea. It was later discovered that bacteria belonging to the genus Bacillus were the most effective at degrading the MPs. These bacteria made up the majority of the bacteria that were isolated.

S2.07 (Anthropogenic Stressors)

Presenter: Saliu, F.

Anthropogenic stressors and emission of biogenic volatile organic compounds by marine micro-algae: A perspective in the ROPME Sea-Area

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Bioorganic volatile organic compounds (BVOCs) play an important role in the Earth's radiative budget. They induce secondary organic aerosol formation, alter cloud properties and precipitation. Marine phytoplankton is the primary sources of BVOCs emitted from the ocean into the atmosphere. During phytoplankton blooms, BVOCs can constitute up to 63% of the total aerosol. Under this view, the link between surface ocean properties, phytoplankton communities, and BVOC emissions is fundamental to understanding the current planetary changes and also, their possible impact on a regional scale. Currently, there is limited knowledge about the effects of anthropogenic stressors on marine algae and related BVOC emissions. For this reason, we have established a new research project that includes the development of innovative mass spectrometry methods to be applied in situ for profiling BVOCs and determining the concentration levels of anthropogenic pollutants, as well as in vitro assays to trace the BVOCs emissions from different micro-algae strains in response to stresses. At present, we have highlighted significant variations in the expression of species-specific BVOCs under different stress conditions, and we have also tested an innovative SPME-APCI interface coupled to a portable ion trap mass spectrometer. Further developments in the ROPME sea area are here discussed.

KEYNOTE

Presenter: Galli, P.

MaRHE Center, Marine Research and Higher Education Center: A Model of Research Center Transferable to the UAE?

Galli, P.

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The Marine Research and Higher Education Center (MaRHE Center) of the University of Milano-Bicocca, The Center was established. in 2009, thanks to an agreement with the Maldivian government, serves as an exemplary model of a multidisciplinary research institution dedicated to environmental science, marine biology, tourism science, and human geography. The Center's mission is to safeguard the delicate marine ecosystems and promote sustainable management practices through advanced research and education.
This presentation explores the feasibility of replicating the MaRHE Center's successful framework in the United Arab Emirates (UAE). The MaRHE Center's integrative approach, which blends cutting-edge technology with sustainable development principles, has proven effective in addressing critical issues such as coral reef preservation, marine biodiversity conservation, and the socio-economic impacts of environmental changes.
We will delve into the Center's significant contributions to coral reef research, shark and marine mammal studies, and the innovative methodologies employed in these areas.
The collaborative framework that includes partnerships with local and international institutions, both governmental and non-governmental, will be examined as a key factor in fostering a successful research environment and enhancing resource-sharing.
Potential challenges and strategic considerations for establishing a similar center in the UAE will be discussed, taking into account the region's specific environmental, socio-economic, and political contexts. By drawing parallels between the Maldives and the UAE, we aim to highlight how the principles and practices of the MaRHE Center can be effectively transferred to support marine conservation and sustainable development in the UAE.

KEYNOTE

Presenter: Chua, S.

How understanding past sea levels aid present and future adaptation and mitigation for sustainable coasts

Chua, S.

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More than 1.3 billion people today live within 100 km of tropical coasts and are vulnerable to climate change and associated sea-level rise (SLR) under rates unprecedented in the Anthropocene. Tropical regions, such as Singapore and the United Arab Emirates, are generally situated in 'farfield' regions relative to polar ice sheets and subject to unique land and sea-level responses to ice sheet melt during the Holocene (11,700 years to present). Rapid sea-level rise during the early to mid-Holocene played a key role in transforming global coastal systems from estuaries to deltas. Coastal evolution reconstructions therefore provide case studies that can help project the response of modern coastal systems to future SLR (e.g., identify tipping points).
I will present a series of studies centred upon understanding past sea-level rise and resultant geological and geomorphological responses of the Singapore coast. My new 3D geological model reveals complex stratigraphy driven by sea-level change on orbital cycles at magnitudes of up to 130 m. I obtained new sea-level index points to extend the Singapore sea-level record by ~1,000 years showing SLR from 20 m below present levels. Using a multi-proxy approach, I reconstructed the dynamic coastal response to early-mid Holocene SLR of between 4 – 15 mm/yr which is within range of IPCC projections of future SLR. A key finding is the local extinction of mangroves which could not keep up with SLR. Lastly I will show preliminary results from my ongoing coastal and offshore work with implications for tropical countries like ours, with implications for modern mitigation and adaption measures amidst background sea-level and climate change.

S3.01 (Marine Ecology)

Presenter: Muzaffar, S.

Long-term population trend and diversity shifts among shorebirds: A predictor of biodiversity loss along the Arabian Gulf coasts

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Bahrain represents a group of small islands in the western Arabian Gulf forming the western edge of the Central Asian Flyway (CAF) for shorebirds. Development and oil exploitation has caused major changes to the coastal zones of this region with notable effects on biodiversity. We surveyed shorebird communities in Bahrain between January 2010 to December 2021 covering 13 sites over 12 years. A total of 39 species were encountered of which

27 species were common, regular migrants to all the study sites and were selected to test the population trend analysis. Five species represented 77% or more of the total wintering shorebird population. All the shorebird species assessed exhibited significant declining trends over the years. Designation of protected areas, habitat management and prevention of disturbance at coastal foraging sites could help to protect declining shorebirds in Bahrain.

S3.02 (Marine Ecology)

Presenter: Stahl, H.

First recorded outbreak of Crown-of-Thorns Sea Stars (Acanthaster spp.) in the Gulf of Oman, UAE

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Crown-of-Thorns Sea stars (CoTS), Acanthaster spp, are significant coral predators whose population outbreaks can cause extensive coral reef damage. This study documents a localized CoTS outbreak in January 2024 off the coast of Khor Fakkan, UAE, at Martini Bay and Hole in the Wall Bay. Thirty-two belt transects (150m² each) were surveyed, revealing a total of 86 CoTS with a mean density of 179 ± 39 sea stars/ha. Martini Bay exhibited higher CoTS densities compared to Hole in the Wall Bay. The outbreak density aligns with previous reports from the Indo-Pacific region. Notably, this event marks the first CoTS outbreak reported in UAE waters, presenting an unusually high density for the Gulf of Oman. The CoTS were observed preying on diverse coral species, primarily Platygyra spp, Porites spp, and Dipsastraea spp. Adjacent sites with similar coral composition and environment showed negligible CoTS presence, suggesting localized outbreak dynamics. Although only the Acantaster planci species was confirmed through DNA analysis, the diverse morphotypes observed during this study hint at the potential coexistence of A. planci and A. mauritiensis, necessitating further molecular analysis for accurate species identification. Given the vulnerability of UAE reefs to both natural and anthropogenic stressors, this outbreak underscores the urgent need for in-depth studies to understand the outbreak's drivers and differential impacts. Such insights are crucial for developing effective management and mitigation strategies to protect the coral ecosystems in the Gulf of Oman.

S3.03 (Marine Ecology)

Presenter: Montalbetti, E.

Metabolomics reveals distinct phenotypical traits across different population densities of crown-of-thorns seastar (Acanthaster planci) in the Gulf of Oman (United Arab Emirates)

Montalbetti, E.,[1]* Gaglio, D.,[2] Aramini, T.,[3] Bonanomi, M.,[2] Stahl, J.,[4] Landes, A.,[5] Louis, Y.,[1] Seveso, D.,[1] Galli, P.[1]

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Crown-of-thorns sea stars (CoTS) (Acanthaster spp.) are among the most notorious and highly destructive corallivorous invertebrates, representing a considerable threat to coral reefs. They exhibit fluctuations between extended periods of low population densities (1 individual/ha), during which they have minimal impact on corals, and episodes of high densities, termed outbreaks, during which they can consume most of the living coral cover. The ultimate causes of outbreaks are still unknown despite high CoTS population densities representing one of the major causes of coral reef degradation in the Indo-Pacific. In this study, we adopted a metabolomic approach to investigate the whole pool of metabolites of several individuals of Acanthaster planci, looking for phenotypical differences in the metabolism of specimens from two populations with different individual densities. The selected study sites were two fringing reef areas off the coast of Khor Fakkan (Sharjah) in the Gulf of Oman. The first site, Martini Bay, was selected as a high-population-density, hosting 311,11 ± 65,94 individuals ha-1, while Hole in the Wall was chosen as a low-population-density site, hosting 62,75 ± 20,98 individuals ha-1. Eight random individuals from each site were selected for analysis. Significant differences were observed in the metabolic profiling of specimens from different sites, with an evident clustering of metabolite expression separating high- and low-density populations. Overall, untargeted LC-MS analyses allowed us to discriminate different metabolic and stress response pathways that characterized the two populations. Our results demonstrated that Acanthaster planci metabolism may be influenced by population density and local conditions and that outbreak dynamics may depend on phenotypical differences in the elective metabolic pathways of seastars. Considering this, metabolomics has the potential to shed light on the primary causes of population outbreaks that remain unknown to date.

S3.04 (Marine Ecology)

Presenter: Almansoori, H.

Investigating the mass mortality induced factors of Pearl Oyster (Pinctada radiata) at Abu Dhabi Pearls Farm, UAE

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The aquaculture of shellfish plays a crucial role in enhancing maritime environments by mitigating algal blooms and improving water quality through the filtration of organic matter, suspended matter, and bacteria. This study investigated the environmental factors influencing oyster (Pinctada radiata) mortalities through a comprehensive analysis of water quality in the Al Mirfa and Al Mughirah farming sites of Abu Dhabi (UAE), from February 2021 to February 2022. To understand the main factors that led to mass mortalities of cultivated oysters, monthly sampling and analyses of the farm water, and living and dead oyster shells have been carried out during the study period. The results analyses revealed seasonal variations in water temperature, with elevated temperatures adversely affecting physiological rates, growth, and survival of pearl oysters. High seawater temperatures during summer months were identified as a primary factor influencing oyster mortality. Salinity fluctuations and acidic pH conditions negatively impacted oyster health and shell integrity, increasing mortality rates. Furthermore, low dissolved oxygen levels as the presence of fouling organisms have contributed to increased mortality incidents. Toxic dinoflagellates, specifically Pyrodinium bahamense competed with nutritious algae, causing food shortages and potential toxicity issues, thus triggering oyster mortality. Statistical analyses revealed strong relationships between oyster mortality rates and environmental parameters, with temperature, salinity, pH, dissolved oxygen levels, chlorophyll concentration, and the toxic dinoflagellates identified as significant predictors. This study shows the importance of ongoing monitoring and research to understand the interactions between environmental factors and pearl oyster health for sustainable aquaculture management and marine ecosystem conservation. Moreover, proactive measures such as harmful algal bloom control, and water quality management are essential for minimizing the impact of environmental stressors on pearl oyster populations.

S3.05 (Marine Ecology)

Presenter: Malik, S.

Characterizing bioaccumulated toxic elements in tissues of bio-economically important pelagic fish, narrow-barred Spanish mackerel (Scomberomorus commerson), from the Arabian Gulf

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Marine ecosystems are increasingly overexploited for their ecological services, leading to the expansion of anthropogenic activities that amplify the production of contaminants. The Arabian Gulf, with its unique oceanographic characteristics of being small, semi-enclosed, and having restricted water flow, is particularly susceptible to the accumulation and circulation of pollutants. Over the past three decades, the combined impact of

natural and anthropogenic stressors has significantly affected the marine ecosystem and its organisms. The objective of this study was to analyze the concentration of 21 bioaccumulated potentially toxic elements in the liver and muscle tissues of narrow-barred Spanish mackerels collected from the Arabian Gulf. Additionally, the Metal Pollution Index, fish body conditions, and site differentiation were assessed. Liver and muscle tissues from narrow-barred Spanish mackerels were collected from Umm Al Quwain (UAE) and Bandar Abbas (Iran). The samples were digested and analyzed using inductively coupled plasma spectrometry (ICP-OES). Bioaccumulation of Chromium, Copper, and Iron concentrations exceeded maximum permissible limits. The Metal Pollution Index indicated a significant difference between the two sites, with 20.34% of the fish showing high toxicity levels and 100% of the sampled fish exhibiting poor body conditions. These findings emphasize the urgent need to implement environmental regulations and monitoring programs to mitigate toxic element contamination in the Arabian Gulf, thereby protecting the marine ecosystem including human health.

S3.06 (Marine Ecology)

Presenter: Behl, A.

Evaluating Heavy metal levels in Blackspot snapper may offer clues for public health and the marine ecosystem in the Arabian Gulf

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This study investigates the contamination of heavy metals in Lutjanus ehrenbergii (blackspot snapper) from the coastal waters of Abu Dhabi within the ROPME Sea Area, aiming to assess the potential ecological and human health risks associated with their consumption. The Arabian Gulf, including the Abu Dhabi coastline, faces increasing anthropogenic pressures from urbanization, industrial activities, and shipping, leading to concerns about heavy metal contamination in marine organisms. L. ehrenbergii, a commercially and ecologically important fish species in the region, is likely susceptible to heavy metal bioaccumulation, posing potential risks to both marine ecosystems and human consumers.
This study determines the concentrations of essential and non-essential heavy metals (e.g., mercury, lead, cadmium, arsenic, chromium, copper, zinc) in muscle tissues, gills, and liver of L. ehrenbergii collected from two sites of the Abu Dhabi coastline. Advanced analytical techniques, specifically Inductively Coupled Plasma Mass Spectrometry and Atomic Absorption Spectrometry, are employed to quantify heavy metal concentrations in the fish samples. The study investigates the relationship between heavy metal accumulation patterns in L. ehrenbergii and factors such as fish size, sex, and sampling location to understand the influence of these variables on metal uptake and distribution. Studies on heavy metal contamination in marine fish from Abu Dhabi reveal varying levels of mercury, cadmium, and lead.
Furthermore, the study assesses the potential ecological and human health risks associated with heavy metal contamination in L. ehrenbergii. Estimated daily intake, target hazard quotients, and hazard indices are calculated to evaluate the potential for adverse health effects on human consumers. The preliminary results are available, and the final result will be presented at the conference.

S3.07 (Marine Ecology)

Presenter: Muzaffar, S.

Foraging ecology of Socotra cormorants in the Gulf of Salwa, Arabian Gulf

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Socotra Cormorants are globally Vulnerable seabirds found mostly in the Arabian Gulf. Current breeding population strongholds are in Saudi Arabia and Bahrain (Gulf of Salwa) and in the United Arab Emirates. Little is known about their movement and foraging patterns in the Gulf of Salwa. We tagged 7 individuals in 2020, 4 individuals in 2021, 20 individuals in 2022 and 20 in 2023 on the Hawar Islands, Bahrain in with Lotek KiwiSat satellite transmitters and Ornitela Ornitrack GPS-GSM tags using a back-pack harness attachment. Birds breeding on Hawar Islands move north and west towards Bahrain for foraging and over the summer expand into the southern and northern parts of Bahrain. During the summer individuals migrate along the Kuwaiti coastline, presumable feeding on local small fish. Others move farther south along the Saudi coastline within the Gulf of Salwa. Few individuals move over the northern tip of Qatar into UAE waters. Cormorants tagged at Hawar visited known colony sites in Saudi Arabia, Qatar, and the UAE, which also highlights the value of regional conservation planning. Most of the breeding Socotra cormorants of Bahrain remain within north and western portions of the Arabian Gulf. Conservation of the species therefore must take a transboundary approach spanning Bahrain, Saudi Arabia, Qatar and Kuwait.

S3.08

Presenter: Thangadurai, T.

Acropora growth anomaly-associated bacterial metagenome reveals no distinct but varied bacterial abundance between healthy and lesion tissues in diseased corals

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Coral growth anomalies (GA) affect a large number of coral genera across the world yet, the etiology of GAs remains unknown, with limited knowledge of associated bacteria. In this study, we investigated bacterial associations between the growth anomalies (GAs) and healthy (H) portions of coral colonies in Acropora faraonis for two seasons to understand microbial dynamics. Additionally, we examined bacteria in water (W), which could

be affecting coral bacterial communities. We found that alpha diversity remained consistent between healthy and GA coral tissues, but their relative abundances differed significantly. Notably, the abundance of Endozoicomonas spp. differed significantly between the two groups, although it remains the dominant species in both GA and H tissue. The high relative abundance of Endozoicomonas spp. in both GA and healthy tissue underscores its role in maintaining coral health and shows that GA tissues survive despite the disease. Structural modifications in GAs, such as changes in polyp sizes or densities, could be responsible for these differences in bacterial abundance. Similarly, microbial community composition remained consistent between different seasons but again differed in abundance. We found differences between microbial community structures of GA and water, while there was no difference between GA and H. The absence of distinct and pathogenic bacteria in GAs, and similar bacterial diversity between GAs and H, along with the persistence of Endozoicomonas sp., implies that the GAs are not likely of microbial origin.

KEYNOTE

Presenter: Carvalho, S.

A decade of research on Red Sea coastal habitats: An integrated approach advancing regional conservation and environmental regulation

Carvalho, S.

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The Red Sea, recognized as a global biodiversity hotspot, is increasingly threatened by various anthropogenic stressors, including coastal development, pollution, maritime traffic with the risk of oil spills, the introduction of non-indigenous species (NIS), and industrial activities such as the expansion of desalination plants. These local pressures are further exacerbated by climate change, which has led to more frequent and intense coral bleaching events. Over the past decade, our research has focused on understanding the spatial and temporal changes in coastal ecosystems to develop strategies for mitigating these impacts and supporting the rehabilitation of degraded systems. To address the scarcity of baseline and standardized data, we established several permanent reef monitoring sites along the Red Sea, providing the first sustained time series that employs both classical and innovative monitoring approaches. Our work emphasizes documenting biodiversity patterns, particularly through molecular-based assessments, and includes evaluating the status and trends of NIS in ports and marinas. By combining morphological taxonomy with DNA barcoding, we are contributing to the creation of the Red Sea Biodiversity Atlas, which includes photo records, reference collections, and DNA barcodes to enhance regional molecular libraries and improve the accuracy of future molecular assessments. Additionally, our research investigates the fate and distribution of contaminants in coral reefs, offering critical insights into the ecological effects of pollutants on marine life and guiding ecotoxicological studies. Through these analyses, we assess the sub-lethal and chronic effects of pollutants on marine organisms, providing a more comprehensive understanding of the tolerance thresholds of local species. This research not only advances scientific knowledge but also informs the development of environmental regulations and compliance frameworks, which are essential for sustainable development in the Red Sea. Collectively, these efforts are vital for guiding sustainable development and ensuring the long-term conservation of the Red Sea's unique marine ecosystems.

S4.01 (Coastal Habitats)

Presenter: Naser, H.

Impacts of reclamation on coastal habitats in the Arabian Gulf

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Coastal developments are carried out in the Arabian Gulf to meet the need for rapid economic, industrial, and social developments. Some of the large-scale projects are created by dredging and reclamation along the coastlines with potential impacts on coastal and marine ecosystems.
Reclamation is generally conducted by extraction of sand and mud from designated borrow areas, which are then dumped into shallow subtidal areas along the coastline or at offshore sites to create artificial islands. Sediments

from dredging and reclamation activities can smother benthic habitats, leading to physical and chemical alterations that can cause a reduction in biodiversity and abundance in the associated macrobenthos.
Spatial and temporal patterns of macrobenthos were characterized to investigate the impacts of reclamation on coastal habitats in Bahrain. A total of 24 transects with three stations (upper, mid and lower intertidal zone) were sampled from three reclaimed intertidal areas and a natural mudflat during August 2019 and December 2020.
A total of 5137 individual organisms belonging to 43 species were recorded in the four sampling areas, of which 38 were collected from the natural mudflat. Higher levels of species richness, evenness and diversity of benthos were recorded in the natural mudflat in comparison with the reclaimed areas. Polychaetes accounted for more than 90% of the benthos in the reclaimed coastal areas. Polychaetes are considered pioneering species that rapidly colonize soft bottoms due to their ability to survive in a wide range of environmental conditions.
Integrated environmental monitoring using macrobenthos is considered critical to understanding ecosystem dynamics and predicting associated changes due to anthropogenic stressors, including coastal reclamation in the Arabian Gulf.

S4.03 (Coastal Habitats)

Presenter: Louis, Y.

Bioconcentration of emerging and organic contaminants in sponges and Ascidians from coastal areas of the United Arab Emirates

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Emerging and organic contaminants, including pharmaceuticals, pesticides, and industrial chemicals, pose significant risks to ecosystems and human health due to their persistence and bioaccumulation. Studying these contaminants in marine sponges and ascidians from Dubai's coastal areas is crucial, as these filter-feeding organisms accumulate pollutants over time, offering a more accurate measure of contamination impacts on biodiversity. In this study, sponges (Callyspongia sp.) and ascidians (Phallusia nigra) were collected from three sites at increasing distances from the Dubai center to evaluate anthropogenic impact. The first site, near Jumeirah Beach, 10 km from center, is influenced by industrial and residential activities. The second site, a beach in Umm Al Quwain, is 70 km away, and the third, in the mangroves of Umm Al Quwain. We studied 13 emerging contaminants (ECs), including caffeine, various pharmaceuticals (e.g., fluoxetine, diclofenac), an insect repellent (DEET), and UV filters. Additionally, 16 polycyclic aromatic hydrocarbons (PAHs) and 7 polychlorinated biphenyls (PCBs) were analyzed. PAHs are recognized as priority hazardous substances and potential carcinogens, while PCBs are noted for their persistence and non-dioxin-like effects. Results showed caffeine and DEET in all samples, with paracetamol and carbamazepine in some. UV filters and other pharmaceuticals were not detected. The most abundant PAH was Benzo(a)Antracene at most sites, except at Umm Al Quwain beach, where Naftalene was most prevalent in ascidians. Significant PAHs in Dubai sponges included Benzo(a)Pirene, Acenaftilene, and Fenantrene, with similar trends in ascidians. PCB concentrations were mostly below detection limits, except for PCB101 and PCB118 in ascidians from Umm Al Quwain. Our findings emphasize the urgent need to raise awareness about the risks of emerging and persistent contaminants, while promoting the adoption of environmentally-friendly products. Tackling these challenges is essential for achieving sustainable development and safeguarding the Gulf ecosystem in the face of climate change.

S4.04 (Coastal Habitats)

Presenter: McFarlane, C.

Evaluating small cetacean population and anthropogenic threats in the urban waters of Abu Dhabi, United Arab Emirates

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Marine mammal species inhabiting waters near rapidly developing coastal cities, the aim of this study is to examine the population within the urban areas of Abu Dhabi. This study presents findings from a 19-month continuous boat-based survey of the city waters of Abu Dhabi, United Arab Emirates (Nov 2022-Jun 2024). The survey aimed to investigate the occurrence, abundance, and identify preferred areas of small cetaceans within city waters. The boat-based survey covered 1439.8 km of positive navigation and collected population, photo identification, and behavioral data of cetaceans. Additionally, citizen science data supplemented the survey findings. Of the 26 sightings recorded, 24 (92%) were Indian Ocean humpback dolphins (Sousa plumbea), one was Indo-Pacific bottlenose dolphin (Tursiops aduncus), and one was Indo-Pacific finless porpoise (Neophocaena phocaenoides). All 3 species are listed on the IUCN Red List as 'Endangered', 'Near Threatened', and 'Vulnerable', respectively. The data confirmed their regular presence in the city waters, with total sighting and encounter rates of 0.014 and 0.010, respectively, an order of magnitude higher than those observed in neighbouring Dubai waters. Photoidentification data analysis resulted in 159 individuals photographed (Sp=143, Ta=11, Np=5). The Indian Ocean humpback dolphin was the most frequently sighted species, with 15 sightings recorded in inland channels, while other species were only sighted in open waters. In addition to the survey, the public reported 92 sightings, including 68 of humpback dolphins, 23 of bottlenose dolphins, and 1 of killer whales. These findings provide the first detailed assessment of small cetaceans, identify preferred areas and main threats for these species in Abu Dhabi city waters. The outcome of the study will aid at the understanding of important areas for dolphins around Abu Dhabi Island, and understand the interaction around development, in order to put in place conservation measures in protecting these important areas, supporting the conservation of marine mammals in the area.

S4.05 (Coastal Habitats)

Presenter: Natoli, A.

Declining Presence of Small Cetaceans in Dubai's Coastal Waters: Evidence from Eight Years of Surveys and Mitigation Recommendations

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The presence of small cetaceans in coastal waters can remain unnoticed in the absence of scientific baseline data, especially if populations occur at low density. Environmental impact assessments are generally unable to detect these species, involuntarily jeopardizing the implementation of mitigation measures. This study presents findings from two continuous dedicated cetacean surveys conducted eight-year apart, in Dubai highly anthropogenic impacted waters. These surveys employed boat-based transects and photo-identification techniques, citizen science and passive acoustic monitoring (F-Pods). The initial survey (2013-2014) covered a total of 3,211 km of positive navigation and confirmed the consistent presence of three small cetacean species with 9 sightings of Indo-Pacific bottlenose dolphin (Ta, Tursiops aduncus), 8 of Indian Ocean humpback dolphin (Sp, Sousa plumbea), and 3 of Indo-Pacific finless porpoise (Np, Neophocaena phocaenoides). The maximum estimated number of individuals for all species was low (105, 39, and 11 respectively). All species are considered threatened according to the IUCN Red List. The second survey spanned three years (2021, 2022, 2023), covering a total of 10,981 km of positive navigation, but in none of these years were all three species detected concurrently and the maximum number of individuals remained low. Across the two survey periods, the overall sighting rates for all species declined from 0.006 to 0.004, with Sp showing the most significant decline by an order of magnitude (from 0.002 to 0.0002). A total of 283 sightings reported from the public were utilised to complement the data and 1919 days of passive acustic monitoring recording across 3 different locations in Dubai waters. These data identified spatial and temporal important areas/seasons for these species in Dubai waters, the most endangered species among the three and main threats that hampers its survival. It also suggests potential mitigation strategies to support preserving this essential species.

S4.06 (Coastal Habitats)

Presenter: Cerri, F.

Mangrove Resilience in the Gulf: Phytochemical Insights into Avicennia marina Under Extreme Environmental Conditions

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Mangroves are salt-tolerant woody plants that grow in intertidal regions. Avicennia marina is the dominant mangrove species along the Gulf Coast, where it contributes significantly to the health and biodiversity of aquatic ecosystems. Increasing pressures from climate change make the resilience of A. marina crucial to sustainable environmental management. A. marina shows remarkable resilience to extreme environmental conditions, and this ability has led researchers to study its phytochemical profile and therapeutic potential. However, in the Gulf, where it faces high temperature and high salinity waters, studies on the phytochemistry of this species are limited. Since the chemical composition of plants is influenced by geographical, environmental and climatic conditions, A. marina could produce unique secondary metabolites to cope with these stresses. This study aimed to analyse the phytochemical profile of the leaves, roots, and seeds of A. marina. Samples collected from the Al Zorah mangrove forest were extracted with a hydroalcoholic solution and qualitative analyses of the extracts were performed by electrospray ionisation-coupled liquid chromatography and high-resolution mass spectrometry. The molecules identified, some never before characterised in mangroves, include flavonoids, iridoid glycosides, and triterpene saponins. These molecules aid A. marina's response to abiotic stresses such as salinity fluctuations, high temperatures, and high UV radiation. Furthermore, from a bioprospecting perspective, the plant extracts were

tested for antioxidant and anti-cancer activity, with the root extracts showing the most promising results. This highlights the need to preserve these mangroves, also because of their role as a source of promising natural compounds. By extending this phytochemical work to the analysis of differences between healthy and stressed mangroves, potential stress indicators can be identified. This knowledge would be very valuable for practical applications in plant management and conservation strategies, directly contributing to the resilience and health of aquatic ecosystems in the context of climate change.

S4.07 (Coastal Habitats)

Presenter: El-Tarabily, K.

Enhancing the growth of Avicennia marina in the United Arab Emirates through the utilization of consortium of rhizosphere-competent actinobacteria displaying several plant growth-promoting characteristics

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The coastline of the UAE is mostly covered by grey mangroves, scientifically known as Avicennia marina. Despite mangroves' important role as coastal protectors, little is known about the replanting efforts that have increased their cover in the Arabian Gulf and the United Arab Emirates. Plant growth-promoting actinobacteria (PGPA) were examined for their ability to create plant growth regulators and improve mangrove development when subjected to seawater irrigation. These bacteria were isolated from mangrove rhizosphere sediments in the United Arab Emirates. Out of nine actinobacterial isolates tested in a naturally competitive in vitro setting, Streptomyces coelicoflavus (Sc) demonstrated the highest phosphorus-solubilizing activity. Auxins, polyamines (PAs), and 1-aminocyclopropane-1-carboxylic acid (ACC) deaminase were generated by S. polychromogenes (Sp), S. bacillaris (Sb), and S. ferrugineus (Sf), respectively. The dry biomass of mangrove shoots (43.2-74.0%) and roots (40.8-75.9%) was greatly enhanced by sediment inoculation with individual isolates. However, when plants were irrigated with seawater, the control group experienced a lower increase in dry weight of shoots (82.1%) and roots (81.6%) compared to the Sc/Sp/Sb/Sf consortium of isolates. Our greenhouse tests showed that plant tissues inoculated with Sc/Sp/Sb/Sf had considerably higher levels of photosynthetic pigments, in planta auxins, and PAs, and lower levels of ACC. This was further demonstrated by the fact that plants treated with the combination of isolates had a maximum velocity of rubisco carboxylation (Vcmax) that was four times higher than the control group. If this work is accurate, it is the first to disclose the use of culturable halotolerant, rhizosphere-competent PGPA from salty and arid ecosystems, either alone or in combination, to encourage mangrove development in extreme environments like the Arabian shore.

KEYNOTE

Presenter: Munawar, M.

Transferring North American Great Lakes management experience and skills to the GULF ecosystem: International Cooperation and Agreements

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The North American Great Lakes have a long history of dealing with environmental degradation. Their protection originated with the Boundary Waters Treaty signed in 1909 between the United States and Great Britain (for Canada) supervised by the International Joint Commission that organized revisions in 1972, 1978, 1987, and 2012 committing to the restoration, protection, and use of ecosystem approach (Vallentyne & Beeton, 1988; Vallentyne & Munawar, 1993). The primary focus of 1972 GLWQA was the control of cultural eutrophication by reducing Phosphorus from point and nonpoint sources (Vollenweider et al., 1974). The wide applicability of Vollenweider empirical relationship resulted in regulating sewage treatment plants, reducing phosphates in detergents, and establishing total phosphorus loading targets. A similar approach has been highlighted for the European Union (Dave & Munawar, 2014). Recently Hartig et al. (2019) and Munawar et al. (2020) have suggested the application of Great Lakes technology in the Gulf as well. The Great Lakes research included remediation of sediment contamination which is very relevant due to excessive navigation resulting from oil transport. Any restoration and remediation of the Gulf ecosystem must include physical, chemical and biological monitoring as carried out in the North American Great Lakes. In order to achieve the proposed restoration we need to develop and follow GULF WATER QUALITY AGREEMENT (GWQA) amongst the riparian countries. The GULF Water Quality Agreement could follow the footsteps of research conducted successfully in the North American Great Lakes with modification and adaptation to ecological and political requirements of various stakeholders.
Similarly, monitoring the different fisheries resources will be a necessity too. Sedimentation of oil products or their derivatives may affect the demersal fisheries resources like bottom fish but also many crustacean and mollusk species. Also, the pressure on living non-target species in the bottom ecosystem will be increased, leading to possible ecosystem collapses. Pelagic fisheries resources will undergo pressure from oil products as well. Particularly such products may find their destination in plankton, which is at the basis of any aquatic food web. Other marine litter, like micro and macro plastics, may end up in the food web as well. This happens also in other parts of the world, prone to severe plastic pollution. Various pollution sources may severely reduce the potential of a Blue Growth Initiative or a Blue Economy in the Gulf. The present paper shows examples and recommendations to make better use of the available aquatic resources.

S5.01 (Climate Change)

Presenter: Usman, M.

Space-time analysis of the sea level variability of the Arabian Sea using satellite altimetry data

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As a result of climate change, the sea levels are gradually rising, and it has become a major environmental concern. It creates a serious threat to coastal areas, especially in the Gulf Region, which includes various cities bordering the Arabian Gulf, Red, and Arabian Seas. This phenomenon potentially carries a major influence on the socioeconomics of the area by altering coastal marine ecosystems and posing serious infrastructure sustainability challenges. This research focuses on analyzing the sea-level variability in the Arabian Sea using satellite altimetry data. We conducted a detailed spatiotemporal analysis of all the available satellite altimetry data from 1993 to 2023 along a profile of ~1500 km that runs along the entire length of the Arabian Sea, closer to the coastal areas of the Arabian Peninsula Region. To ensure stationarity, we have decomposed the time series data into seasonal and trend components. We modeled the seasonal components by using the first-order Fourier series. It has provided insight into the seasonal sea level variability along the profile. Also, we observe a variability in the seasonality with maximum peak-to-peak amplitude (-14cm to +11cm) in the south, and as one moves towards the north the seasonal change gradually decreases with a minimum value at the last point located in the north (-6cm to 4cm). For the trend component, we employed the Mann-Kendall Trend Test to assess its significance and modeled it using linear regression. Along the profile, we present results for five points i.e. point 1 located at the southern end of the profile, and point 5 located at the northern end of the profile. The trend at all locations has remained positive, however, we observed significant variability in the sea level rise, as each point indicated a different value (Point 1=0.029±0.003, Point 2=0.036±0.007, Point 3=0.030±0.002, Point 4=0.017±0.01 and Point 5=+0.031 ±0.004 cm/month). This is a foundational study that helps in understanding the sea level variability on detailed seasonal, inter-annual, and long-term scales and will further help to observe the possible teleconnection between the Arabian Sea, Arabian Gulf, and the Red Sea.

S5.02 (Climate Change)

Presenter: Manlik, O.

The Arabian Gulf as a natural laboratory to investigate adaptation to climate change using genetic, genomic and epigenetic approaches

Manlik, O.,[1]* Razali, H.,[1] Behl, A.,[1] Sharma, H.,[1] Alshamsi, M.,[1] Alyeldin, W.,[1] Alam, T.,[1] Edmands, S.,[2] Malik, S.,[1] Almansouri, N.,[3] Muzaffar, S.[1]

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The Arabian Gulf is one of the most extreme marine environments on the planet. Because of its semi-enclosed nature, shallow depth and the hot, arid climate of the region, the waters of the Gulf are characterized by high

temperatures, hypersalinity and low pH. These climatic conditions, which other marine environments are expected to approach under climate-change scenarios, also make the Arabian Gulf a natural laboratory to study adaptation to climate change. In this presentation I will illustrate genetic/genomic and epigenetic approaches used at UAEU to investigate local adaptation to climate change, taking advantage of the extreme conditions in the Gulf. 1.) Genetic approaches: We focus on candidate genes that are selectively adaptive, such as genes of the major histocompatibility complex and toll-like receptors, to compare genetic variants inside and outside the Arabian Gulf. 2.) Genomic approaches: We use genomic sequencing (ddRADseq), to compare genomic regions of locally adapted wildlife (fish, cormorants) to those harbored by populations outside the Gulf. Comparing frequencies of genetic/genomic variants between populations inside and outside the Arabian Gulf, contrasting in climatic conditions, can offer a glimpse into the genetic basis for climate change adaptation. For instance, functional genomic variants that depart from neutrality and show high frequencies inside the Gulf compared to outside in cooler environments could represent genomic regions that are important to adapt to hotter climatic conditions. 3.) Epigenetic approaches: We employ RNA sequencing to identify genes that are active in response to climatic variables. A current project compares gene expression profiles in response to temperature, salinity and pH between locally adapted marine copepods in the Gulf and copepods in cooler, milder regions off North America. With this presentation I hope to convey the unique opportunity the Arabian Gulf presents to study the genetic basis of climate change adaptation.

S5.03 (Climate Change)

Presenter: Usman, M.

A tale of sea level dynamics in the Arabian Gulf

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The Arabian Gulf's level oscillates up and down on a seasonal scale. Some studies claim that the wind has a limited role, while others indicate that the wind has a strong role and controls the cyclic intra-annual movement of the Arabian Gulf. In this research, I use satellite altimetry data. To ensure stationarity and decompose the time series into seasonal and trend components. I model the trend component using linear regression mode and the cyclic component using first-order Fourier series and the simple sine wave function. I compared the two seasonal models and found that a simple sine curve model also explains well the cyclic rise and fall of the Arabian Gulf. There seems to be a phase shift in the direction of the wind, and it correlates with the cyclic rise and fall of the Arabian Gulf.

S5.04 (Climate Change)

Presenter: Sharma, H.

Identification of Genes Important for Adaptation to Climate Change in a Marine Copepod

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Climate change represents a major threat to marine biodiversity through ocean warming, acidification, and altered salinity, with particularly severe impacts expected in the Arabian Gulf due to its extreme conditions including high temperatures, hypersalinity, and increasing acidity. For marine organisms to persist in a changing climate, requires an adaptive response to these climatic factors. This study aims to identify genes crucial for local adaptation to climate change in the intertidal copepod Tigriopus sp. We will employ an RNA-sequencing approach to assess gene expression in response to climate change variables, specifically temperature, pH, and salinity. To compare gene expression patterns, we cultured Tigriopus californicus from four populations in North America (San Diego, Catalina Island, Santa Cruz, Victoria), each adapted to distinct local climatic conditions, as well as Tigriopus sp. sampled from the Arabian Gulf (Abu Dhabi). Ongoing efforts are focused on resolving the taxonomic identity of the Arabian Gulf Tigriopus species through morphological and phylogenetic analyses. Unlike previous studies that have primarily focused on short-term stressors, this research also investigates the long-term effects of these climatic factors on gene expression across multiple generations. By comparing gene expression between populations adapted to different climates, the study seeks to identify genes essential for adaptation to extreme conditions similar to those in the Arabian Gulf. Given that the Arabian Gulf is representative of extreme climatic conditions that other marine environments are expected to approach under climate-change scenarios, our study will provide insights into local adaptation mechanisms in response to climate change beyond the Gulf.

Poster.01

Presenter: Al-Hazeem, S.

Nontargeted NMR and LC-MS Metabolomics-Based Analysis of Coral and Their Microorganisms Symbionts

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Natural products from the sea are a valuable and diverse source of bioactive compounds with a wide range of applications, including pharmaceuticals, cosmetics, and food additives. These marine-derived compounds are derived from various organisms found in oceans, including microorganisms, algae, corals, and even some species of fish. Soft corals live in an extreme and competitive area are well-known as excellent sources of marine-derived natural products. Among them, members of the genera porites harrisoni, porites lutea, favia pallida and platygyra daedalea and their Microorganisms symbionts are especially attractive targets for marine natural product research. collection of the natural source material, Isolation and fractionation of natural compounds are essential steps in the process of discovering and characterizing bioactive molecules from natural sources. Two powerful techniques used in this process are Liquid Chromatography-Mass Spectrometry (LCMS) and Nuclear Magnetic Resonance (NMR) spectroscopy. Afterwards, a computational approach comprising molecular docking analysis will be performed to understand the binding potentials of selected compounds against diseases. Based on the results, a pharmacophore evaluation study will be also conducted to generate ligand-based feature pharmacophores for the best-performing selected compound.
KEY WORDS: corals; computational; drug design; LC-MS; Kuwait; molecular docking; pharmacophore; virtual screening

Poster.02

Presenter: Alshalan, H.

Evaluation of Belowground Carbon and Microbial Dynamics in Mangrove Forests and their Relationship with Hyperspectral Satellite Data

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Mangroves, woody halophytes distributed along the coasts of tropical and subtropical regions including the intertidal zones of the United Arab Emirates (UAE). The total estimated mangrove area within the UAE is ≈ 136.16 km2 and is dominated by the monospecies Avicennia marina, with varying densities along each of the country's seven Emirates. These ecosystems act as vital carbon sinks, storing significant amounts of blue carbon in their above- and below-ground biomass, while also sequestering a vast amount of carbon into the surrounding sediments. With a direct positive correlation between the mangrove forest density and soil carbon stock, where an increase in mangrove numbers creates a stable environment with nutrient-rich soils that support a thriving microbial community, thus enhancing the soil carbon sink.

This research aims to determine the correlation between the density of mangrove forests across the UAE's coastal areas and the below-ground microbial composition, soil carbon stock, and changes in both the physicochemical and microbiological properties. Methodologically, it involves digitally mapping the UAE's mangrove forests and distinguishing the densities using multispectral satellite imagery, and the belowground mangrove root system's carbon stock and microbial composition will be determined using species-specific allometric equations, field measurements, and through next-generation sequencing respectively.

The findings aim to illustrate the impact of mangrove forest density and the belowground microbial dynamics on the belowground carbon stock of mangrove forests within the UAE's coastal area.

Poster.03

Presenter: Bu-Olayan, A.

The effect of macroplastics and trace metals in the Kuwait marine environment

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The harmful consequences of trace metals and macroplastics on the marine ecology have been revealed since the pandemic outbreak. Eight distinct coastal locations in Kuwait were selected based on a range of environmental contamination problems, and it was found that these locations included 25 common macroplastics (fragments larger than five millimeters). FTIR examination revealed that these macroplastics matched one of the commonly coded plastics (1–7). Trace metals that were leached from the marine environment, polluted with macroplastic waste, or absorbed by adsorbed biofilm were analyzed using an ICP-MS. Of all the beach sites that were examined, Sulabikhat Bay and Kuwait Towers showed high concentrations of macroplastics, which are additives made of polyethylene and polypropylene. Hydrological factors that carried these macroplastics along these coastlines, including temperature, salinity, pH, dissolved oxygen, and water velocity, reinforced the synergistic effect of pollution. Research indicates that the abundance of waste plastic materials impact tourism, aesthetic appeal, and environmental issues. Therefore, it is recommended that preventive actions be made to minimize, reuse, and replace plastic products to lessen the harmful effects of plastic pollution.

Poster.04

Presenter: El-Serehy, H.

Assemblages of sand-dwelling meiofauna in the interstitial environment of four wetlands northwestern Saudi Arabia with emphasis on their ecological implications as a tool for wetlands ecosystem biomonitoring

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A total of 86 meiofaunal taxa were recorded in the soil samples collected from the Saudi four wetlands. Seven representative meiofaunal groups of testate amoebae (20 taxa); ciliates (11 taxa); nematodes (18 taxa); ostracods

(5 taxa); copepods (15 taxa); oligochaete annelids (3 taxa) and polycheate annelids (14 taxa) were recorded. The assemblage at Wadi Tash (Site 4) was represented by 77 taxa belonging to 60 genera. While the assemblage at Jeb water pool (Site 2) was represented only by 19 taxa belonging to 11 genera. The high meiofaunal assemblage at Wadi Tash was coincided with highest values of organic matter content (4.61±1.3%), calcium carbonate (6.55±1.42%), water holding capacity (34%) and higher chlorophyll a concentration of 0.87 μg/g. The meiofaunal density is influenced by a set of physico-chemical factors of the sediment as well as by the presence of the biogenic structures. The more food availability, their sediment stability, protection from predators, and their habitat complexity increase the density of meiofaunal community in the wetland sediments. The Saudi wetlands have a highly productive ecosystem and their interstitial habitat can be considered a non-metal-polluted area, according to the OME and EPA classification criteria. The ubiquity of meiofauna distribution suggests their important role in the soil food webs and nutrient cycling, and their community structure and specific characteristics appear to be of major importance for soil formation. A full understanding of meiofaunal diversity and physico-chemical parameters helps to inform best practice for improving soil quality as well as conservation practices for sustainable development and management of wetlands. In conclusion, meiofanal diversity serves as an important and sensitive bioindicator for soil quality.

Poster.05

Presenter: Kim, Y.

Vegetation phenology retrievals

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Vegetation phenology, the study of periodic plant life cycle events and their relationship to climate, is crucial for understanding ecosystem dynamics. Understanding vegetation responses to climatic variability is essential for sustainable land management and environmental monitoring. Long-term satellite monitoring provides critical insights into vegetation dynamics. This study addresses the need for such insights by conducting a comprehensive analysis of vegetation dynamics across diverse sites in the United Arab Emirates (UAE), using daily data collected from 2000 to 2023. The study sites were strategically selected to represent various ecological zones, including desert, mountainous regions, islands, and coastal areas, categorized into built-up areas, bare spaces, vegetation, permanent water bodies, and tree cover. The primary objective is to utilize multisource satellite data, including MODIS Combined Terra and Aqua Bidirectional Reflectance Distribution Function (BRDF) and Albedo Product (MCD43), Landsat, and Sentinel imagery, to derive Normalized Difference Vegetation Index (NDVI) values. These NDVI values are then employed to construct time series and identify vegetation phenology metrics, providing insights into long-term vegetation trends and changes over the study period. The methodology involves estimating vegetation phenology metrics such as onset and offset of vegetation growth periods are identified using NDVI time series data. These metrics provide detailed information on the timing of vegetation growth cycles over the study sites, which is essential for understanding how vegetation responds to climatic variability. Findings from this research provide valuable insights for environmental monitoring and sustainable land management in hyper-arid regions of the UAE. The comprehensive analysis of NDVI time series and phenology metrics offers a robust framework for studying ecosystem resilience and adaptation to changing environmental conditions over two decades. This research underscores the importance of long-term monitoring and the integration of multisource data in capturing the complex dynamics of vegetation interactions.

Poster.06

Presenter: Kim, Y.

Multi-year monitoring of soil salinity and biological soil crusts in hyper-arid ecosystems using satellite remote sensing.

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Detecting and mapping soil salinity and biological soil crusts (comprising cyanobacteria, lichens) is vital for ecosystem productivity, sustainable land management, and ecological restoration in arid regions. This research integrates satellite imagery and ground-based data to map soil salinity and biological soil crusts in the UAE. Landsat 8 satellite data from 2018 to 2023 were used. The methodology includes preprocessing and radiometric corrections of satellite imagery, followed by spectral indices computations like the Normalized Difference Salinity Index (NDSI) and Normalized Difference Vegetation Index (NDVI). The Biological Soil Crust Index (BSCI) was applied to identify BSCs. A supervised classification algorithm was used for both soil salinity and biological soil crust mapping. The study results show multi-year 30-m soil salinity maps with 80% accuracy, providing insights into the spatial distribution and temporal variations of salinization and biological soil crust distribution across various land cover types in the UAE, including coastal, urban, agricultural, and desert regions. The presence of biological soil crusts was compared with climate factors such as temperature and precipitation, which are crucial for their formation and persistence. The results also showed linkages between biological soil crusts and heterotrophic respiration derived from Soil Moisture Active Passive (SMAP) L4_SM products. Additionally, the analysis examined the correlation between annual salinity levels and climate constraints. Comparisons were made between the spatial and temporal patterns of soil salinity and BSC maps. This approach provided deeper insights into the interactions between soil salinity and biological crusts and their relationships with climatic variables. This study underscores the effectiveness of satellite remote sensing, specifically Landsat 8 imagery, in monitoring soil salinity and BSCs in arid environments. The findings offer valuable information for land management practices and highlight the need for continued monitoring to mitigate salinity and promote the conservation of biological soil crusts in arid regions.

Poster.07

Presenter: Kumar, A.

Influence of microplastic types on carbon dioxide flux from mangrove sediments

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Tidal wetlands including mangrove ecosystems are among highly productive on our planet. Globally, mangrove ecosystems are located in tropical and subtropical coasts and alone contributes an average of 200 Tg carbon year-1

to net primary productivity. A considerable proportion of this carbon enter the mangrove sediments making them important C sinks to mitigate global climate change. However, the presence of microplastics in these ecosystems can significantly alter sedimentary carbon sinks including CO2 emissions from mangrove sediments. Our research investigates how three different types of commonly occurring microplastics in mangrove sediments affect total CO2 emissions. A control was established without microplastic addition. Each treatment was replicated five times. We hypothesize that the different type of microplastic pollution distinctly affect CO2 emissions from sediments via potentially altering microbial activity thereby impacting the overall carbon cycling in mangrove ecosystems. The experiment is currently underway, with preliminary findings indicating differences in CO2 emissions across the treatments. Detailed results and implications for understanding the impact of microplastics on carbon dynamics in mangrove sediments will be presented at the conference.

Poster.08

Presenter: Mousa, M.

Digital Herbarium for the Flora of United Arab Emirates: Database for plant conservation, biodiversity and sustainability

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Herbarium database and digitization of herbarium specimens includes the capturing of data and images and storing them in a digital format. Considerable progress has been made in the creation of digital assets from herbarium collections as well as in the dissemination of this information. The digitization process allows for collections to be queried and analyzed in ways not previously possible and enables virtual access to those unable to visit the collections in person.
The collected informations about the history of plants in the last forty years will be used in future research for comparing the preserved samples and freshly collected samples to assess the climate changes, pollution, DNA sequencing and any other morphological and genetical variations
National herbarium at UAE University were started in 1989. The herbarium has own code (ABDH) and registered in the Index Herbariorum. Approximately 15,000 herbarium specimens of vascular plants from UAE different habitat. Herbarium specimens are being digitized using ObjectScan 1600, according to the international standards, at 600 dpi, with a barcode, 24-color scale and spatial scale bar. Images and metadata are stored in the database using software (BRAHMS, Oxford University)

Poster.09

Presenter: Mousa, M.

Effect of climate change on soil seed bank diversity of UAE

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The first study in the history of the Gulf countries, aims at collection of soil seed bank the entire flora of United Arab Emirates, with multiple populations sampled, as well as to build up comprehensive herbarium collections for the region. Field work to collect seeds and herbarium specimens has been underway in UAE since 2010, with a series of joint collection trips. So far, more than 2000 vouchered soil seed collections have been made, representing more than 600 species. Although total seed quantity is important, the genetic representativeness of the collection is a more important indicator of the value of a collection for recovery purposes.
Plants species found in the UAE are adapted to several environmental stresses, such as salinity and high temperature that can reach up to 50°C during summers. In the UAE, approximately 600 plant species have been recorded from diverse habitats. Many of the plants of the UAE that cannot tolerate the very harsh temperatures in summers are present on the top of the high mountains. If the global warming process has already started, the temperatures would increase, even at the top of these mountains, and consequently many of these plants could become extinct. Therefore, seed banking is an important step towards safeguarding plant biodiversity in the region.

Poster.10

Presenter: Muzaffar, S.

On the response of sea surface temperature to dust storms in the Arabian Gulf

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The Arabian Gulf, connected to the northern Indian Ocean by a narrow strait, is an inverse estuary for which surface heating and evaporation is the primary mechanism for the formation of (warm salty) bottom water. Frequent dust storms in the atmosphere over the Gulf reflect solar insolation and are known to cause significant variation of surface radiative forcing in the Gulf. Previous studies have noted that the climatological shortwave radiation should be reduced to account for the effect of dust aerosols (e.g., Johns et al., 2003; Lorenz et al. 2020). In this study, by combining satellite SST, in-situ SST collected by biologging devices attached to cormorants and a series of numerical experiments with different shortwave radiative forcings (with and without dust) from the MERRA-2 hourly reanalysis product, we investigate the shorter timescale response of sea surface temperature (SST) of the Arabian Gulf to the dust aerosol concentration over the Gulf. The model results suggest that higher dust concentration during each storm decreases the gulf-averaged daily SST by about 0.8 °C maximum, by reducing shortwave radiation. The SST decreases rapidly during periods of high dust concentration and restores more slowly after storms. The correlation between dust concentration and SST anomalies is also captured in both satellite SST observation and in situ biologging SST data. The SST response to the dust-induced forcing is finally generalized and interpreted by applying a linearized forcing-response model. By fitting the numerical results to the linearized model, we found that the response time of the SST to the variation of shortwave radiation is about 13 days, whereas typical dust storm durations are 6-15 days. This study enhances our understanding of the surface ocean's

response to atmospheric processes in coastal and estuarine regions by utilizing improved air-sea fluxes, and biologging and satellite observations.

Poster.11

Presenter: Usman, M.

Satellite gravimetry observations on the state of groundwater level variability in the Arabian Peninsula Region and the associated socio-economic sustainability challenges

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Groundwater is an important resource for the Arabian Peninsula Region. The population increase, rise in agricultural activities, and GCC countries' inclination towards economic diversification and tourism promotion have heightened the freshwater demand. As a result of climate change and varying weather patterns, the situation has become more complicated. Due to arid conditions, recharge is mostly less than withdrawal which consequently results in underground water level decline with time. In the research, we have used Gravity Recovery and Climate Experiment (GRACE/GRACE-FO) MASCON solutions and Global Precipitation Measurement Mission's rainfall data to observe the Equivalent Water Thickness (EWT) and rainfall patterns in this region for the past two decades. The results indicate that in Saudi Arabia the water level is declining nearly at a linear rate and the linear regression model fits well with the data (R2 value, the coefficient of determination, for different cities of Saudi Arabia is greater than equal to 0.95). Also, in the recent data, one can see the higher seasonal amplitudes that are indicative of greater fluctuations in EWT data in recent times. Furthermore, the UAE cities (Dubai and Al-Ain) and Oman's Masqat also indicate a declining trend. If water mining continues at the same pace, this important resource can become a rare commodity. Limited water supply can likely become a limiting factor for further social, agricultural, and industrial development. That's why major reviews and shifts are necessary in the current policies related to water resource management and conservation.

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