

Applied Research Center for Environment & Marine Studies

The Research Institute
King Fahd University of Petroleum & Minerals



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FOURTH QUARTER - 2022

ARCEMS NEWSLETTER



TABLE OF CONTENTS

Message from the Director	3	22	FUN IN THE SUN – Social Gathering of ARCEMS Employees and Families
REPORTS & PROPOSALS			
Project Reports Submitted in Fourth Quarter of 2022	5	23	New Staff – New Beginning
Project Proposals Submitted in Fourth Quarter of 2022	6	26	WEEKLY SEMINARS
NEWS AND ACTIVITIES			RESEARCH SPOTLIGHT
Eulogy for Professor Dr. Ajmal Khan	8	30	LENSATIONAL
ARCEMS Preparation for ISO 17025 Accreditation	9	33	SCIENTIFIC ARTICLES
Online workshop – “Applications of Environmental DNA (EDNA) in Marine Biodiversity Assessments”	10	35	Brine Waste Management in Desalination Industry: A Prospective Wealth From Waste
KFUPM–KAUST Collaboration Meeting for Coral Photogrammetry Initiative	12	37	The Adverse Effect of Mercury (Hg) in the Marine Environment
Coral and Seagrass survey at Umlujj	14	38	Isotopes & Their Applications in Environmental Science
Whale Sighting in Marjan Oil Field – Arabian Gulf		39	Present Concern: Impact of Climate Change on Marine Ecosystems
Fire and Safety Training – HSE Department KFUPM	15	41	Acid Rain
Introduction to Flow Cytometry for KFUPM Life Science Students	16	42	Geospatial Big Data
Terrestrial Survey at NEOM		43	Satellite Tracking Technology Elucidates Movement Patterns of Migratory Sea Turtles
Training Program Organized by CEMS for NCW	17	44	Threatened and Endemic Socotra cormorant in the Arabian Gulf
KFUPM–KAUST Conversation Series for the Conservation of the Kingdom’s Marine Environment” Face-to-Face Meeting	18	46	Previous Newsletters
Visitors in ARCEMS	20		Media team
One day workshop Crown-of-Thorns Starfish (COTS) Outbreak			
Fisheries Awareness Program at Al Qateef	21		

MESSAGE FROM THE DIRECTOR

Dear All,

Welcome to the last 2022 edition of the ARCEMS Newsletter. As we end another fascinating year after overcoming the challenges of the Covid-19 Pandemic, the future looks promising and intriguing. When we started this year, our ambition was to have a set of goals and targets which are truly transformative and inclusive. Our ambition level has reached a satisfactory level.

Our strategic partnership with Saudi Aramco, NEOM, and TRDC continues to strengthen as another year passes. We attribute our success to business firms like SAIPEM, McDermott, KBR, Subsea 7, Wood PLC, and Worley Parsons because they have been the backbone of our ongoing research projects. The center takes great pride in its connections to PIF, MEWA, NCEC, NCW, and numerous other governmental organizations.

A few employees left the center, searching for another job or retirement. Still, they have been replaced by fresh, young, energetic, and qualified national and international employees who are proud to be part of the CEMS team. As you are aware, KFUPM is going through a period of transformation; for the first time in the Center's history, we have chosen four female colleagues to join us on our journey in the upcoming year.

Oceans dominate the Earth and significantly influence environmental dynamics and terrestrial ecology. The center is trying to add research capabilities on climate change and modeling. The Center is committed to teaching, research, and service that benefits our nation and the planet.

I would also like to take this opportunity to pay homage to Dr. Syed Ajmal Khan, one of our former senior consultants who passed away in November 2022.

I want to express my profound gratitude for everyone's cooperation and understanding in this respect, which has helped the center reach a new level of success. I also want to acknowledge the constant support and leadership from the Top management of the Research Institute and KFUPM.

This newsletter features some of the Center's news, activities, and research highlights during the fourth quarter of this year.



Sincerely

Dr. Fahad Saleh Mohammed Al-Ismail
Director ARCEMS





REPORTS & PROPOSALS



PROJECT REPORTS SUBMITTED IN THE FOURTH QUARTER OF 2022

ARCEMS is currently executing more than 40 active projects. Most of these projects involve conducting EIA and Environmental monitoring studies at various locations in the Arabian Gulf and the Red Sea. Each one of these projects contains several deliverables, including weekly, progress, interim, yearly, and final reports. The timely submission of all project deliverables has always been a top priority for the Center, and in the fourth quarter of 2022, numerous reports were delivered to the appropriate clients. Following is a list of the final reports prepared and delivered during the fourth quarter of 2022.

REPORT TYPE	PROJECT TITLE	PROJECT TITLE	CLIENT
Survey Report	Consultancy Services to Neom in the Execution of Fast Track Environmental Technical Services, Survey Report on Physical Landform-Food Valley	CEM02669	NEOM
Survey Report	Consultancy Services to Neom in the Execution of Fast Track Environmental Technical Services, Survey Report on Physical Landform-Film Location Zone A	CEM02669	NEOM
Survey Report	Consultancy Services to Neom in the Execution of Fast Track Environmental Technical Services, Survey Report on Physical Landform-Highway 362	CEM02669	NEOM
Survey Report	Consultancy Services to Neom in the Execution of Fast Track Environmental Technical Services, Survey Report on Terrestrial Flora and Fauna-Food Valley	CEM02669	NEOM
Survey Report	Consultancy Services to Neom in the Execution of Fast Track Environmental Technical Services, Survey Report on Terrestrial Flora and Fauna-Film Location Zone A	CEM02669	NEOM
Survey Report	Consultancy Services to Neom in the Execution of Fast Track Environmental Technical Services, Survey Report on Terrestrial Flora and Fauna-Highway 362	CEM02669	NEOM
Survey Report	Consultancy Services to Neom in the Execution of Fast Track Environmental Technical Services, Survey Report on Terrestrial Flora and Fauna-Al Osaila	CEM02669	NEOM
Draft report	Consultancy Services to Neom in the Execution of Fast Track Environmental Technical Services, Survey Report on Terrestrial Flora and Fauna-Hydropower Station	CEM02669	NEOM
Draft report	Consultancy Services to Neom in the Execution of Fast Track Environmental Technical Services, Survey Report on Physical Landform-Hydropower Station	CEM02669	NEOM
Draft report	Assessment and characterization of Coastal and Inland Sabkhas in NEOM, Reconnaissance Survey Report	CEM02753	NEOM
Draft report	Environmental Impact Assessment for the Development of Marjan Gas Lift Facilities (BI-10-14848)	CEM02719	Worley
Draft report	Environmental Impact Assessment for the Safaniyah Development of Offshore Oil and Water Injection Facilities (BI-10-14854)	CEM02720	Worley
Annual Report	Environmental Compliance Monitoring and Post-Construction Monitoring for the Safaniya Marine Channel Dredging Project	CEW02555	Saudi Aramco



PROJECT PROPOSALS SUBMITTED IN THE FOURTH QUARTER OF 2022

In the fourth Quarter of 2022, in addition to project deliverables, CEMS also submitted 19 proposals and participated in a bid to various clients, details of which are listed below in the tabular format.

Proposal No	TITLE	CLIENT
CEM02755	Environmental Impact Assessment for the Installation of Two Jackets and Three Oil Production Deck Modules with Associated Facilities and Replacement of Pipelines in Abu Safah Oil Field (BI-12-22000)	NPCC
CEM02756	Framework convention for analysis of samples and components of Environmental Media	NCEC
CEM02757	Environmental Impact Assessment for the Installation of Three Production Deck Modules and Associated Facilities in the Marjan Oil Field (BI-12-23000)	McDermott
CEM02758	Environmental Impact Assessment for the Installation of One Tie-In Platform, Three Production Deck Modules, Two Trunklines, One Composite Cable, and Associated Facilities in the Marjan Oil Field (BI-12-23000)	McDermott
CEM02759	Environmental Impact Assessment for the Installation of Four Production Deck Modules and Associated Facilities in the Marjan Oil Field (BI-12-23000)	McDermott
CEM02760	Environmental Monitoring for Industrial Effluent Discharge in Jazan Integrated Gasification and Power Facility	Wood
CEM02761	Environmental Impact Assessment for the Installation of Trunklines, Subsea Pipelines and Composite Cables in the Marjan Oil Field (BI-12-23000)	Lamprell
CEM02762	Environmental Impact Assessment for Seabed Rectification Works in Karan Oil Field (BI-12-18000)	McDermott
CEM02763	Greenhouse Gas (GHG) Emission Analytics for the Kingdom of Saudi Arabia	Ministry of Energy
CEM02764	A Study to evaluate the means and equipment of fishing in the Arabian Gulf and the Red Sea	MEWA
CEM02765	Environmental Monitoring for the Upgradation of the Juaymah Crude Oil Terminal During Construction and Post-Construction (BI-10-14244)	NPCC
CEM02766	Studies for Establishing a Biodiversity Protection area (BPA) as Offset Mitigation for the Zuluf Field Development Program	NPCC
CEM02767	Construction-Phase Environmental Monitoring for Zuluf AH Increment Trunklines Package-1 (BI-10-07868 / BI-10-12681)	McDermott
CEM02768	Environmental Impact Assessment for the Installation of 12" Bypass Flexible Pipeline in the Berri Oil Field (BI-12-20000 & BI-12-22000)	SAIPEM
CEM02769	Environmental Impact Assessment for the Installation of Five Jackets in the Marjan and Abu Safah Offshore Field (BI-12-22000)	SAIPEM
CEM02770	Environmental Impact Assessment for the Installation of Two Production Deck Modules and Associated Facilities in Marjan and Abusafah Offshore Field (BI-12-22000)	SAIPEM
CEM02771	Environmental Impact Assessment for the Installation of Platforms, Submarine Pipelines and Cables in Qatif Offshore Field (BI-12-20000)	SAIPEM
CEM02772	Environmental Impact Assessment for the Installation of One Production Deck Module and Associated Facilities in the Abusafah Offshore Field (BI-12-22000).	SAIPEM
CEM02773	Environmental Impact Assessment for the Installation of Two Jackets, Two Production Deck Modules and Associated Facilities in the Abu Safah Offshore Field (BI-12-23000)	LAMPRELL
CEM02774	Environmental Impact Assessment for the Installation of Four Gas Jackets and One Oil Jacket in the Zuluf, Karan, Aribiyah, and Hasbah Offshore Fields (BI-12-23000)	Subsea 7
CEM02775	Environmental Impact Assessment for the Installation of Two Jackets, Two Production Deck Modules and Associated Facilities in the Abu Safah Offshore Field (BI-12-23000)	Subsea 7
CEM02776	Environmental Impact Assessment for the Replacement of a 48-Inch Trunkline in the Zuluf Oil Field (BI-10-16966)	Worley

A stack of rolled-up newspapers is shown diagonally from the bottom left towards the top right. The newspapers have blue covers with the word 'NEWS' printed in large, white, serif capital letters. The top newspaper is in sharp focus, while the others behind it are blurred. The background is a light, neutral color.

NEWS & HIGHLIGHTS

EUOLOGY FOR PROFESSOR Dr. SYED AJMAL KHAN

I first met Professor Ajmal Khan as a student, when I took his Graduate level course, Biostatistics. I vividly remember three things about him when he started delivering his lecture on the first day: his laid-back demeanor, unpretentious clothes, and extraordinary cerebral capacity. I was completely blown away by his incredible memory.

After going to the library and consulting a number of different textbooks a week later, every member of the class, including myself, concluded that the information presented in Dr. Ajmal Khan's lectures could not have been taken from a single textbook but rather represented a compilation of information taken from several different textbooks. His one-hour lecture was equivalent to 100 library hours. Dr. Ajmal took care to include even the tiniest of details in the neatly written overhead projectors (OHP) he used in his lectures, details that even those with keen and sharp minds would have missed.



Dr. Manikandan K.P
Research Scientist-II



Late : Dr. Syed Ajmal Khan

Dr. Ajmal was a voracious reader, and back then, when the internet was not very reliable, he was the only source of information and insight. His courses were seldom noisy, but there was a fierce race among the students to see who could take the most notes during his lectures. My admiration for Dr. Ajmal Khan never faded even after completing my Ph.D. When the Center for Marine and Environmental Studies (CEMS) was looking for a senior consultant who could compile the section reports of EIA, I had no hesitation to suggest Dr. Ajmal Khan to our management. When it came to Dr. Ajmal Khan's candidacy, there were no lingering doubts, and he ended up serving the CEMS for longer than a year.

Due to his advanced age, Dr. Ajmal Khan was required to resign from his position at the Center. Most of my colleagues and I cherish the days we spent with Dr. Ajmal Khan, in high regard, particularly the Friday morning breakfasts we shared with him. I can still vividly recall the phone call from my coworker that I got in the early hours of November 15, 2022, informing me that a legendary figure has passed away.

The entire world, they have lost a legendary Marine Scientist with a brilliant mind. However, for a select few of us, including my colleagues, and myself we have lost a guiding light, assisting us in every challenge on both a scientific and psychological level.

I see his compassion towards students reflected in the professors he guided, and I see his drive for a diverse, intense, and exciting education in the students who live throughout the world. May his soul rest in peace.

ARCEMS PREPARATION FOR ISO 17025 ACCREDITATION



Dr. Ahsan Shemsi
Research Scientist-II

ISO 17025 is a single international quality standard required for testing and calibration laboratories. This standard is obtained by following a set of commands, and specific procedures, maintaining proper documentation and records of analysis, and applying for accreditation through an authorized organization. The accreditation is the independent third-party evaluation of a conformity assessment body against a recognized standard, conveying a formal demonstration of its impartiality and competence to carry out specific conformity assessment tasks.

The laboratory which possesses this certificate is competent to perform specific tests whose results are internationally acceptable and reliable, and are produced with extreme confidentiality and impartiality following standards and operating procedures. Applied Research Center for Environment and Marine Studies (ARCEMS) is preparing its team to obtain this certificate through a consultation body to perform contaminants analysis of soil, sediment, wastewater, seawater, and biological samples. The scope of analysis of ARCEMS labs has been finalized. These tests are performed following APHA, EPA and laboratory-developed methods. The ARCEMS team was given overall awareness training through a workshop on November 1, 2022. A gap analysis of the available infrastructure, documents, and materials was conducted. Preparation of required documentation and bridging of the gap is in progress. An internal audit will be conducted according to ISO 17025 guidelines to show the conformity of these tests to acquire certification before appearing for accreditation.



Glimpses of ISO 17025 awareness training

ONLINE WORKSHOP - "APPLICATIONS OF ENVIRONMENTAL DNA (eDNA) IN MARINE BIODIVERSITY ASSESSMENTS"

Marine biodiversity surveys are the basis of any study that explores the effects of natural or anthropogenic stresses on an ecosystem. Biodiversity surveys used to be very time-intensive, requiring substantial taxonomic expertise for species identification. However, recently Environmental DNA (eDNA) metabarcoding has emerged as an alternative to bioassessments requiring considerably less time and taxonomic expertise. eDNA is genetic material originating from, e.g., the skin, urine, or feces of animals, which is shed in the environment, in this case, water or sediments. eDNA can be analyzed using standard molecular techniques, and the results can be compared against ever-growing global databases of genetic information to identify the organisms in an ecosystem.



Dr. Joydas Thadickal
Research Scientist-I

Only a limited number of eDNA-based monitoring studies have been conducted in the Arabian Gulf. This workshop served as a platform for researchers and environmental managers to discuss adopting the eDNA method for biodiversity assessments.

 **Speakers**





Dr. Saja A. Fakhraldeen
KISR, Kuwait



Dr. Radhouan Ben-Hamadou
Qatar University, Qatar



Dr. Jayanath Gopi
Mahatma Gandhi University, India



Dr. Imen Saadaoui
Qatar University, Qatar



Dr. Joseph DiBattista
Australian Museum Research Institute, Australia



Dr. Anastasija Zalko
Cawthron Institute, New Zealand



Dr. Thadickal V. Joydas
KFUPM, KSA



Dr. Eva A. Martinez
The Red Sea Development Company, KSA

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There were eight talks from subject experts from Kuwait, Qatar, India, Australia, New Zealand and Saudi Arabia. Talks covered the general introduction to eDNA, its best practices on sampling, preservation and pre-sequencing sample quality verification, seawater and sediment eDNA, and applications for identifying and studying invasive species. CEMS scientists talked about implementing eDNA research in the Saudi waters of the Arabian Gulf.

Schedule Day 1 (October 24, 2022)		
08:00 - 08:10	Welcome address	Dr. Fahad Al-Juwail
08:10 - 08:15	Introductory remarks by the moderator	Dr. Manikandan K.P
08:20 - 08:50	Generating the first spatiotemporal profile of marine bacteria and archaea in the unique waters of the Northwest Arabian Gulf using a shotgun metagenomics approach	Dr. Saja A. Fakhraldien
08:55 - 09:25	Investigation of spatial and seasonal microbiome dynamics in Scleractinian corals in the Arabian Gulf: An eDNA approach	Dr. Radhwan Ben-Hamadou
09:30 - 10:00	Microbial metabarcoding for assessment of biodiversity in benthic communities	Dr. Jayanth Gopi
10:00 - 10:10	Break	
10:10 - 10:15	Introductory remarks by the moderator	Dr. Mohamed Ashraf
10:20 - 10:50	eDNA for the assessment of the desalination impact on the marine biodiversity	Dr. Imen Saidani
10:55 - 11:25	eDNA - bioinformatics analysis challenges	Dr. Omer Alkhazali

Schedule Day 2 (October 25, 2022)		
08:15 - 08:20	Introductory remarks by the moderator	Dr. Manikandan Seerangan
08:25 - 08:55	Best practices in eDNA sampling, preservation, and pre-sequencing sample quality verification	Dr. Joseph DiBattista
09:00 - 09:30	Towards optimisation of molecular surveillance for marine biosecurity	Dr. Anastasia Zeko
09:30 - 09:40	Break	
09:40 - 09:45	Introductory remarks by the moderator	Dr. Sivasankar R
09:50 - 10:20	The implementation of eDNA research in the Saudi waters of the Arabian Gulf	Dr. Thadukul V. Joydas
10:25 - 10:55	Are we ready to adopt bacteria biotic indices using DNA metabarcoding into routine marine monitoring programs?	Dr. Eva Martinez
11:00 - 11:15	Concluding remarks	Dr. Rameel Manjia

170 participants from various parts of the world were actively involved in the workshop. The workshop started at 8 am and ended at 11:30 am both days.



KFUPM-KAUST COLLABORATION MEETING FOR CORAL PHOTOGRAMMETRY INITIATIVE



Dr. Rommel Hilot Manjea
Research Scientist -II

In furtherance of the KFUPM-KAUST Conversation Series for the Conservation of the Kingdom's Marine Environment, the collaboration teams from KFUPM and KAUST held a virtual meeting last October 27, 2022 to discuss the first major collaboration topic entitled "Building coral photogrammetry capabilities using Structure-from-motion (SfM) technology". The KAUST team was led by Dr. Francesca Benzoni, the associate director of the KAUST Red Sea Research Center, together with Dr. Fabio Marchese, Marta Ezeta Watts, Natalie Dunn, Brian Nieuwenhuis, Megan Nolan, Pauline Faulkenberg. The KFUPM team was comprised of scientists from ARCEMS (Dr. Rommel Maneja, Dr. Thadickal Joydas, Dr. Manikandan K.P., Dr. Surya Tiwari, Mr. Reynaldo Lindo, and Mr. Ace Vincent B. Flandez), CPG-Remote Sensing Group (Mr. Jarvis Cline, Mr. Mutaz Aljafari), and CPG-Geosciences (Dr. Korhan Ayranci).

KFUPM – KAUST Conversation Series for the Conservation of the Kingdom's Marine Environment



Applied Research Center for
Environment and Marine Studies



Red Sea
Research Center



Habitat and Benthic
Biodiversity

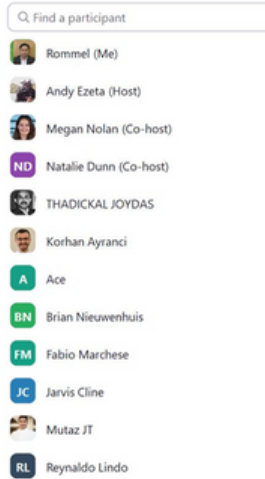
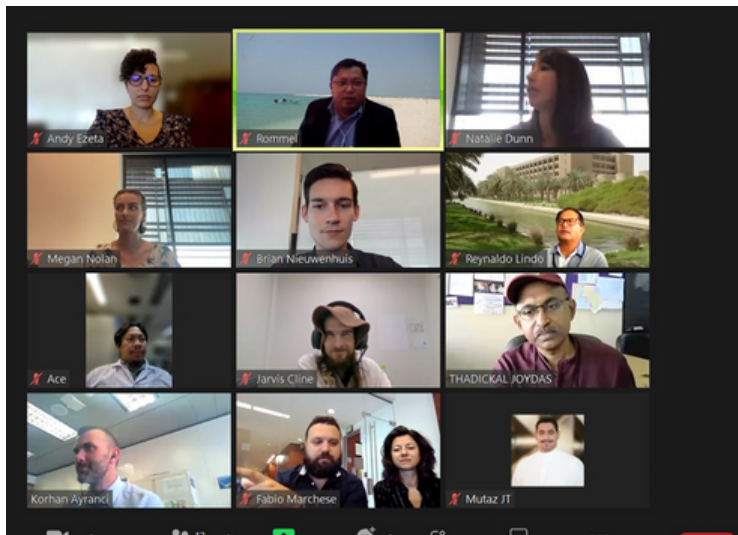


INTEGRATED
OCEAN
PROCESSES

Outline

1. Detection and monitoring of benthic change using Structure-from-Motion (SfM)
2. Benthic habitat mapping
3. Coral growth measurement using 3d models
4. Unmanned Aerial Vehicle (UAV) - based SfM and habitat mapping
5. Predictive spatial models for deep-sea habitats
6. Equipment and software expertise





3. Coral growth measurement using 3d models

Marta Andrea Ezeta Watts, PI: Prof. Francesca Benzoni, Co supervisor: Dr. Fabio Marchese

Current status:

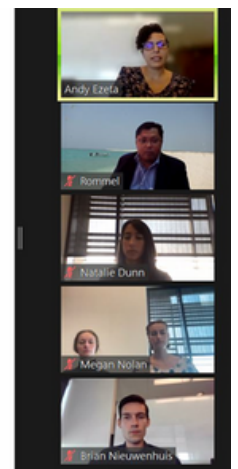
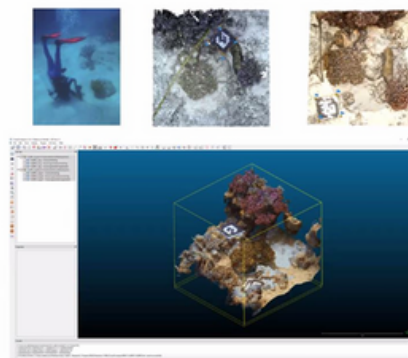
Using the SfM technique, we model 30 *Pocillopora* colonies to measure their growth rate in a year

- Point clouds – Agisoft Metashape
- Point cloud alignment – CloudCompare

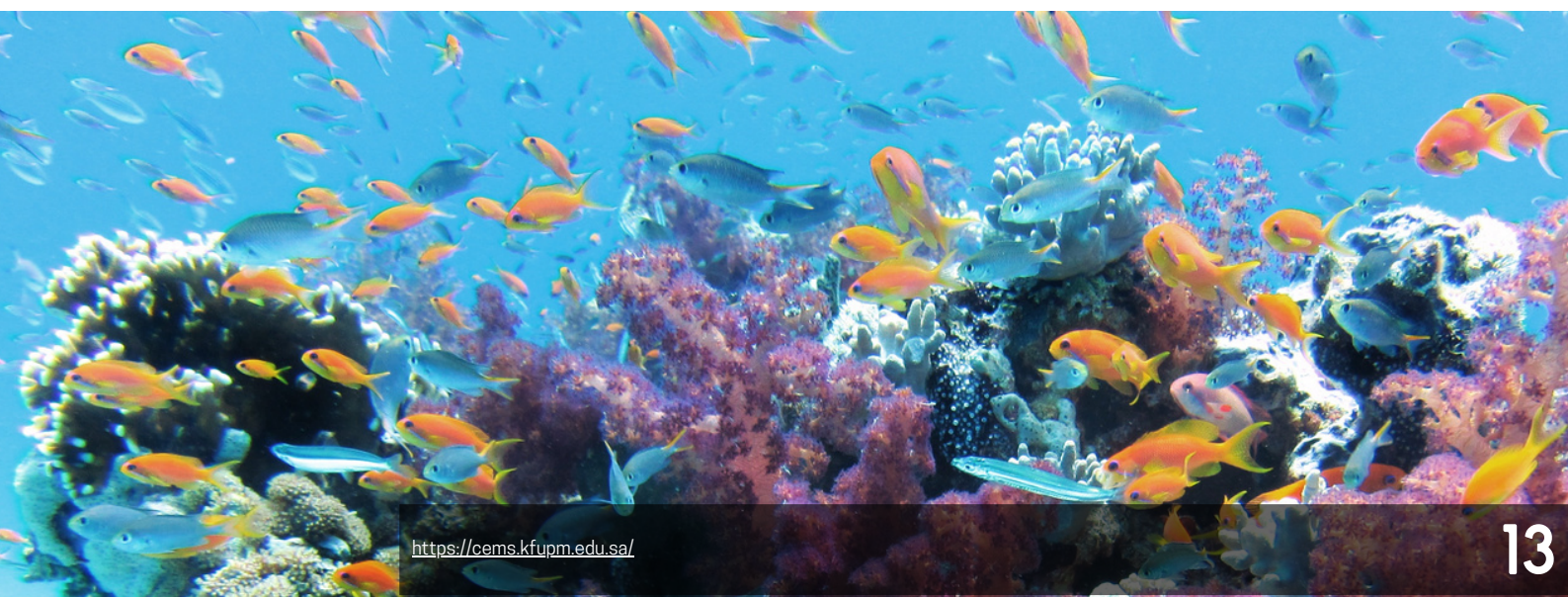
<https://doi.org/10.1111/2041-210X.13388>

Key challenges & future plans:

- Alignment
- 2023 data



Six topics were tackled in the meeting with brief introduction of on-going projects for each topic provided by Ph.D. candidates from the KAUST team. The topics included 1) Detection and monitoring of benthic change using Structure-from-Motion (SfM), 2) Benthic habitat mapping, 3) Coral growth measurement using 3d models, 4) Unmanned Aerial Vehicle (UAV) - based SfM and habitat mapping, 5) Predictive spatial models for deep-sea habitats, 6) Equipment and software expertise. The presentations were followed by intensive discussion by the participants covering technical aspects of Coral Photogrammetry by SfM, including the use of aerial and underwater drones, design of ground control points, underwater image corrections, photogrammetry software, image annotation and classification, supercomputing facilities. The collaboration teams are aiming to build up the capabilities for coral photogrammetry in order to effectively monitor the distribution and status of the marine environment, particularly the coral reef ecosystems.





CORAL AND SEAGRASS SURVEY AT UMLUJJ

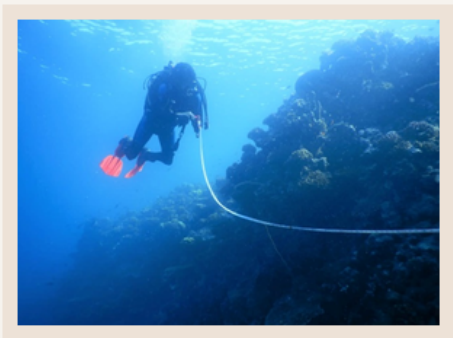


Mr. Thiagarajan Duraisamy
Lab Specialist

Coral and seagrass are two types of marine organisms that play a vital role in the ecosystem. Coral is a type of animal that lives in colonies and forms reefs. Coral reefs are formed by the hard skeletons of coral polyps. These polyps secrete calcium carbonate to form the hard outer layer or skeleton, which acts as protection for the soft inner tissues and polyps.

Seagrasses are flowering plants that grow underwater. They have long leaves with roots underneath them, which they use to absorb nutrients from the water. They also serve as food for small fish and crabs living in seawater near them and provide shelter for other sea animals such as clams and lobsters, who use them to hide from predators.

In connection with the environmental monitoring in Shaybarah and Umluj islands, ARCEMS conducted a comprehensive coral and seagrass surveys, where massive tourism related projects are being developed. The team conducted the survey and assessed the impact of trenching and dredging on the seagrass and corals in the study area.



WHALE SIGHTING IN MARJAN OIL FIELD - ARABIAN GULF

Whales are sentinels of the health of marine environments. They are found in all the world's oceans, from coastal areas to the deep sea. As whales lie at the top of the food pyramid, any decline or increase in their population is an indication of a change in their habitat.



Mr. Premlal Panickan
Scientist -II



One Bryde's whale '*Balenoptera Edani*' was sighted in the Marjan oil field on 05 October 2022 at 5.00 pm. (Location 28.067814° 49.017067°). The animal was observed to be feeding on a shoat of pelagic fishes. Apparently, based on the observation, the length was estimated to be about two meters and it could be a juvenile. The sighting of Bryde's whale has been frequent in Marjan oil field.

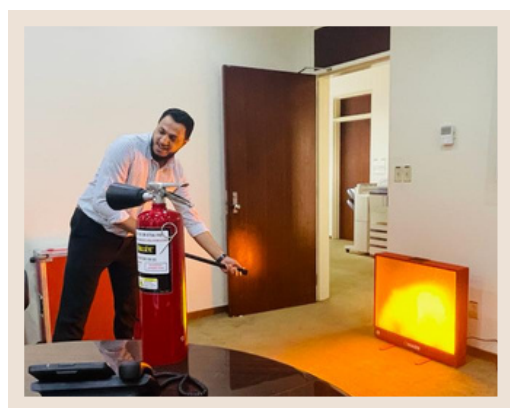
FIRE AND SAFETY TRAINING – HSE DEPARTMENT KFUPM

When it comes to fire safety, the operation of any place can only be safe if operatives are competent. Training features big fires, the risk caused by an accumulation of combustible materials, and what to do in case of a fire with examples from real life shown. The training covers health and safety legislation as well as basic protection topics such as fire precautions, hazardous substances, and personal protective equipment. It is essential for working personnel in any industrial organization when in case of fire, the consequences can destroy equivalent to or more than what hazardous substances could cause. That's why every employer needs to have strict training.



Mr. Premjothi Ravindranathan
Lab Specialist

ARCEMS's attention is drawn to its employees' HSE training requirements. The fire safety training is intended to give employees and scientists the skills and information needed to detect and mitigate possible fire and safety concerns. This course covers a wide range of subjects, including fire danger identification, prevention, control, and evacuation. The safety course addresses the emergency response to hazardous materials such as gases, solids, liquids, or powders. On 14, November 2022, the HSE Department in KFUPM organized a fire and safety training slot at work. The event aimed to create awareness among university staff and create trepidation towards the dooms of fire accidents on campus premises.



KNOW YOUR FIRE EXTINGUISHER COLOUR CODE

Water	Dry powder	Foam	CO ₂ Carbon dioxide	Wet chemical
For use on: • Wood fires • Paper fires • Cloth fires	For use on: • Flammable liquids • Flammable solids	For use on: • Flammable liquids • Flammable solids	For use on: • Flammable liquids • Flammable solids	For use on: • Flammable liquids • Flammable solids
Do not use on: • Flammable gases	Do not use on: • Flammable gases	Do not use on: • Flammable gases	Do not use on: • Flammable gases	Do not use on: • Flammable gases



King Fahd University of Petroleum & Minerals
Environment, Health and
Safety Department

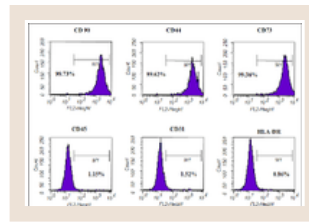
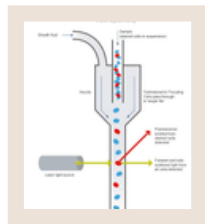
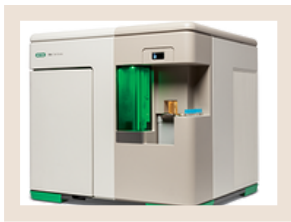


INTRODUCTION TO FLOW CYTOMETRY FOR KFUPM LIFE SCIENCE STUDENTS



Dr. Moritz Heinle
Research Scientist - III

On 4th October 2022, Dr. Moritz Heinle from ARCEMS gave an introduction to flow cytometry for six KFUPM Life Science students that visited the center with Dr. Assad Al-Thukair. Flow cytometry has a wide range of applications in medical and biological sciences. CEMS is using a Sysmex CyFlow Space with autosampler and sorter functions to analyze the smallest phytoplankton, unicellular algae, which cannot be identified with a light microscope.



The students were introduced to the flow cytometer at CEMS and Dr. Moritz gave an overview on the wide range of flow cytometry applications. Following this, the students were led through a number of exemplary phytoplankton analyses to get insight in the practical applications at CEMS. Concluding the session, the students and Dr. Al-Thukair thanked Dr. Moritz for his competent introduction to flow cytometry.

TERRESTRIAL SURVEY AT NEOM

In the last few months, the Terrestrial Team of ARCEMS conducted various types of the survey in NEOM, which included physical landforms, flora, fauna, and soil survey on the first phase November 11-13, 2022, and December 9-13, 2022. IR cameras were deployed in various regions of the Hisma Desert and Foot Hill areas of NEOM to record the animal movement. Moreover, Static Bat recorders were deployed at appropriate places to understand the occurrence of Bat fauna. Additionally, various traps were deployed to capture small rodents to medium-sized mammals. Recently, KFUPM was awarded a new project on the coastal and inland sabkha in NEOM. ARCEMS and CPG team of KFUPM visited though-out the NEOM coast and inland areas to identify the potential sabkha.



Dr. Aarif K Muhammed
Lab Specialist



Flora quadrature survey



Deployment of pitfall trap for reptiles

TRAINING PROGRAM ORGANIZED BY CEMS FOR NCW



Dr. Subhajit Sen
Lab Specialist

ARCEMS, KFUPM has organized a training program for the rangers who are working in the different environmentally protected areas under National Center for Wildlife (NCW), Saudi Arabia. Around 14 delegates from NCW have joined the one-day training program which is part of the PN: CEM02650 titled "Baseline Status of Pollutants in the Uruq Bani Mu'arid Protected Area". KFUPM has conducted a detailed survey to study the pollutants in soil and plant in Uruq Bani Mu'arid Protected Area.

Dust and Noise Survey was conducted in two different seasons and Dust Dispersal Model was executed. Field survey, laboratory analysis, and data analysis provide the present condition of the Bani Muarid Protected Area. As a part of this project, the training program was conducted by four speakers from KFUPM who delivered lectures on various aspects of pollution and biodiversity in the protected area. The main aim to organize this event is to provide guidance and awareness to the rangers to protect biodiversity. The event started with a welcome address from the Project Manager. The major aspects of this talk were biodiversity, pollutant, Air Quality, and Dust Dispersal Model.

أجندة الدورة التدريبية لمنسوبي المركز الوطني لتنمية الحياة الفطرية
9 نوفمبر 2022م - 8:30 صباحاً - 04:30 مساءً

الخطوط العريضة لبرنامج التدريب:

- سيتم تنظيم برنامج تدريب على أساس ما تم استعراضه من النتائج الفكرية، والملاحظات الميدانية، وتحليل البيانات.
- يتكون برنامج التدريب من أربعة موضوعات رئيسية لها علاقة بالتنوع الحيوي في المحميات الطبيعية.

المستهدفون لحضور البرنامج:

برنامج التدريب هو عبارة عن ورشة عمل، وحلقة علمية ينظمه فريق العمل بجامعة الملك فهد للبترول والمعادن مع المركز الوطني لتنمية الحياة الفطرية، بهدف رفع الوعي بأهمية حماية التنوع الحيوي بين الأفراد الذين يعملون في المناطق المحمية أو يعيشون بالقرب منها.

نظرة عامة:

عروق بني معارض هي واحدة من أكبر المحميات الطبيعية في المملكة العربية السعودية، حيث تبلغ مساحتها حوالي (12000 كلم²)، وتأسست بموجب مرسوم ملكي في عام 1995م، لغرض حماية الظواهر الطبيعية لصحراء الربع الخالي، ولتكون موطناً لإعادة إدخال الأنواع الرئيسية لحيوانات شبه الجزيرة العربية، التي انقرضت منها، بما في ذلك المها العربي، وغزال الريم وغيرها.

تقع محمية عروق بني معارض على الحافة الغربية للصحراء الرملية الكبرى في الربع الخالي، جنوب جبل طويق داخل منطقتي الرياض، ونجران في جنوب المملكة، وعلى بعد حوالي (750 كلم) إلى الجنوب من العاصمة الرياض، وأقرب تجمع سكاني كبير للمحمية هي مدينة نجران، والتي تبعد حوالي (200 كلم) إلى الجنوب الغربي، وهناك العديد من القرى المجاورة إلى الشمال الغربي من المحمية مثل: السليل، وادي الدواسر، وسلطانة والخالدة.

حسب الدراسة الفنية للمشروع البحثي، يتم عقد هذه الدورة التدريبية في التوعية البيئية، حيث يتم التركيز فيها بشكل أساسي على العاملين بالمحمية، والكشافات (الجوالين)، لتعزيز معرفتهم بأهمية التنوع الحيوي والحفاظ عليه.

المواضيع الرئيسية للبرنامج التدريبي

د. محمد أبو الريش المحميات الطبيعية والتنوع الحيوي	د. عادل عبده النوعية في السيطرة على الغبار والضوضاء
د. مازن نزال النوعية بالملوثات في المناطق المحمية	د. أوديا جونورو نمذجة تشتت الغبار

الجدول الزمني لفعاليات البرنامج التدريبي

التوقيت	الفعالية
08:30 - 09:00	مؤتمر من الأمن والسلامة
09:00 - 09:30	الكلمة الافتتاحية
09:30 - 09:45	مقدمة
09:45 - 10:00	محمية عروق بني معارض
10:00 - 10:15	التنوع الحيوي
10:15 - 10:30	التنوع
10:30 - 10:45	الخدمات البيئية
10:45 - 11:00	استراحة
11:00 - 11:15	مقدمة المحمية الحيوي والتنوع البيئي والملوثات
11:15 - 11:30	التنوع البيئي: الأسباب وأشكاله وتصنيف التنوع حسب درجته
11:30 - 11:45	تأثير التربة، التضاريس، والظواهر الجيولوجية والتضاريس
11:45 - 12:00	الغذاء، الماء، المناخ، التربة
12:00 - 12:15	تأثيرات التربة والملوثات وأهم مؤشرات تلوث التربة
12:15 - 12:30	طرق استصلاح التربة
12:30 - 12:45	استراحة الغداء
12:45 - 13:00	التنوع الحيوي: الأنواع، وموائل التكاثر، وأهم الطرق والمقاييس
13:00 - 13:15	استراتيجيات الحفاظ، الأنواع، وموائل التكاثر، وأهم الطرق والمقاييس
13:15 - 13:30	إجراءات التفتيش من الملوثات الغبار
13:30 - 13:45	الأنشطة، والتفتيش، والموارد البشرية المسجلة ميدانياً وموالياً
13:45 - 14:00	استراحة
14:00 - 14:15	نوعية الهواء
14:15 - 14:30	تلوث الهواء
14:30 - 14:45	مصادر تلوث الهواء والملوثات في الهواء
14:45 - 15:00	جوانب الأهمية الحيوية التي تلزم على تلوث الهواء - الرياح واستقرار الغلاف الجوي
15:00 - 15:15	أدوات نماذج التشتت
15:15 - 15:30	نموذج CALPUFF
15:30 - 15:45	الكلمة الختامية
15:45 - 16:00	الفرص المتاحة على المتدربين



المركز الوطني
لتنمية الحياة الفطرية
National Center for Wildlife
المملكة العربية السعودية



"KFUPM-KAUST CONVERSATION SERIES FOR THE CONSERVATION OF THE KINGDOM'S MARINE ENVIRONMENT" FACE-TO-FACE MEETING

As part of the effort to further the KFUPM-ARCEMS and KAUST-Red Sea Research Center collaborative program, the two centers are exploring the first collaboration topic entitled "Building coral photogrammetry capabilities for the conservation of coral reef ecosystem." The current topic is part of the broader initiative dubbed the "KFUPM-KAUST Conversation Series for the Conservation of the Kingdom's Marine Environment," which has been initiated by Dr. Abdullah Sultan, the KFUPM Dean for Research, Coordination, and Oversight, and Dr. Suzana Pereira Nunes, the KAUST Vice Provost of Faculty and Academic Affairs.



Dr. Rommel Hilot Manjea
Research Scientist - III

Grabbing the enthusiasm and energy from the first online meeting held last October 27, 2022, the KFUPM-ARCEMS hosted the first face-to-face meeting on "Coral photogrammetry capabilities using Structure-from-Motion (SfM) technology" last December 12-13, 2022, which was participated by a total of 29 participants from four organizations. KFUPM was represented by the Applied Research Center for Environment and Marine Studies (ARCEMS), the College of Petroleum Engineering and Geosciences-Remote Sensing and Digital Services (CPG-RSDS), and the CPG-Geosciences Department, while KAUST was represented by the Red Sea Research Center.

DECEMBER 12 - 13, 2022 MEETING

KFUPM-KAUST CONVERSATION SERIES FOR THE CONSERVATION OF THE KINGDOM'S MARINE ENVIRONMENT

Coral Photogrammetry Capabilities using Structure-from-Motion Technology

Organized by
Applied Research Center for Environment & Marine Studies
Research Institute, KFUPM

DECEMBER 12 - 13, 2022 **Monday, Tuesday 08:30-15:30** **Petroleum Engineering & Geosciences Technology Center Room 007**

+966 (13)-8603232 +966 (13)-8603220 cems@kfupm.edu.sa https://cems.kfupm.edu.sa

Speakers

Dr. Abdullah Sultan
Dean - Research, Coordination and Oversight, KFUPM

Dr. Fahad Al Issawi
Director - ARCEMS, KFUPM

Dr. Francesco Benvenuti
RSC, KAUST

Dr. Thaidar Jordan
Geography, KAUST

Dr. Rommel H. Manjea
Research Scientist, KFUPM

Dr. Karhan Azzam
CPG Geosciences, KFUPM

Dr. Fabio Marchese
RSC, KAUST

Mr. Mazen Al Jafari
CPG Mining, KFUPM

Mr. Brian Newcomer
RSC, KAUST

Mr. Abbas Farooqui
CPG RSDS, KFUPM

Mr. Muhammad Al-Qusabi
CPG RSDS, KFUPM

Mr. Jarvis Elmer
CPG RSDS, KFUPM

Ms. Nozha Duen
RSC, KAUST

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Schedule

Day 1 (DECEMBER 12, 2022) PEGTC, KFUPM Room 007

08:30-08:40	Safety Induction	Safety Officer
08:40-08:50	Welcome Address - CEMS Director	Dr. Fahad Al Issawi
08:50-09:00	Message - Dean - Research, Coordination and Oversight	Dr. Abdullah Sultan
09:00-09:15	Introduction of KAUST Red Sea Research Center	Dr. Francesco Benvenuti
09:15-09:30	Introduction of KFUPM ARCEMS	Dr. Thaidar Jordan
09:30-09:50	BREAK	
09:50-10:20	Detection and monitoring of benthic change and coral growth using SfM	Ms. Nozha Duen
10:20-10:50	Remote sensing, 3D modeling, and state-of-the-art capabilities of KFUPM CPG-RSDS	Mr. Mazen Al Jafari
10:50-11:20	Initialization of ARCEMS coral photogrammetry capabilities	Dr. Rommel H. Manjea
11:20-13:00	LUNCH BREAK	
13:00-13:30	Unmanned aerial vehicle - based SfM and habitat mapping	Mr. Brian Newcomer
13:30-14:00	Combining acoustic and SfM technologies for mapping	Dr. Fabio Marchese
14:00-14:20	BREAK	
14:20-15:30	Scientific Discussions Topic 1: KFUPM scale and type of SfM work Topic 2: Choice and positioning of sites Topic 3: Standardization of field methodology	

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Schedule

Day 2 (DECEMBER 13, 2022) PEGTC, KFUPM Room 007

08:30-08:40	Opening and Welcome to PEGTC	
08:40-09:10	Automated coral detection using deep-learning	Dr. Karhan Azzam
09:10-09:40	Spectral Reflectance Measurement of Coral and Surface Environmental Habitat Mapping	Mr. Abbas Farooqui
09:40-10:00	BREAK	
10:00-10:40	3D modelling and merging 3D models with DEM data	Mr. Muhammad Al-Qusabi
10:40-11:50	Tips and tricks for 3D photogrammetry registration, making GCPs, and hacking geotags	Mr. Jarvis Elmer
11:50-13:00	LUNCH BREAK	
13:00-15:30	Scientific Discussions Topic 4: KAUST and KFUPM equipment Topic 5: Classification methodology Topic 6: Discuss potential training workshop in February 2023	

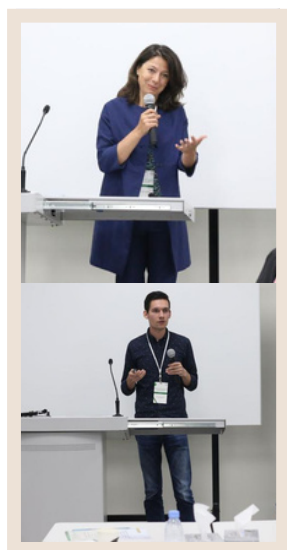
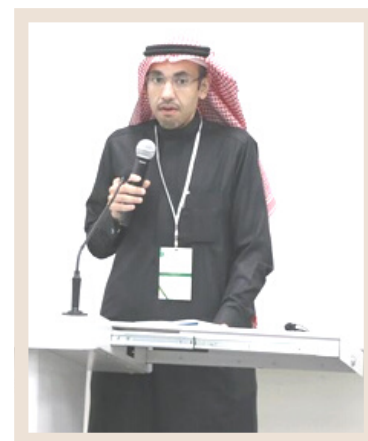
جامعة الملك عبدالعزيز
العلوم والتقنية
King Abdulaziz University of
Science and Technology

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The meeting was designed to promote a more extensive exchange of ideas and research experiences and identify future avenues of collaboration between the institutions.



On the part of KFUPM, Dr. Rommel H. Maneja showcased the efforts of ARCEMS scientists together with the support of other KFUPM institutions, such as the CPG-Remote Sensing and Digital Services and CPG-Geoscience Department in building the Coral Photogrammetry capabilities of the center. The CPG-RSDS led by their director, Dr. Mohammed Alfathan, showcased their state-of-the-art photogrammetry, 3D modelling, virtual reality, remote sensing, software development, and aerial drone survey capabilities. Dr. Korhan Ayranci of the CPG-Geosciences Department presented the machine learning and artificial intelligence capabilities of the Dhahran Techno Valley start-up company iGEOS for automated classification of videos and images for coral reef monitoring and geosciences application. The KAUST-RSRC presented the status of the current projects involving the detection and monitoring of benthic change and coral growth using SfM, unmanned aerial vehicle-based SfM and habitat mapping, and combining acoustic-SfM technologies for mapping.



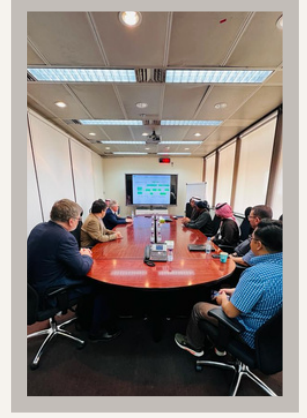
An important component of the meeting was the Scientific Discussions, where participants engaged in open and intensive discussions regarding various topics relevant to the coral photogrammetry topic. The discussion topics included the KFUPM scale and type of SfM work, choice and positioning of sites, standardization of field methodology, KAUST and KFUPM equipment, classification methodology, and identification of workshop topics for the planned workshop in 2023. One of the major outputs of the meeting was the identification of working subgroups that will initiate future online and face-to-face collaborative meetings or workshops, where sharing methodologies, techniques, and problem-hacking/solving will take place.

Scientists among the various institutions will continue to engage and form collaboration networks to utilize the advanced methodologies, equipment, and techniques available in each research group.

VISITORS IN ARCEMS

NEOM University President

Dr. Andreas Cangellaris, the Founding President of NEOM U – NEOM's first university. visited the ARCEMS on 03 October 2022. He was greeted by the Center Director, Dr Fahd Ismail and assisted him to tour the labs of ARCEMS.

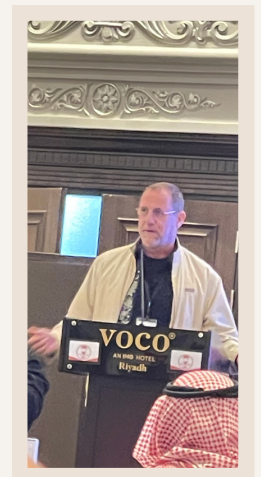


US Embassy

Representatives of the US Embassy also visited the ARCEMS on the 08, November 2022 (9:00 am to 11 am). A meeting was held at the VPRI Conference room, with Dean of Research and Center Directors Dr. Zain Yamani, Dr. Hassan Asiri, Dr. Fahad Al-Ismail, Dr. Sadiq Sait, and Dr. Fahad Al-Sulaiman. After the meeting, the visitors conducted a tour of the laboratories including the labs of ARCEMS.

ONE DAY WORKSHOP CROWN-OF-THORNS STARFISH (COTS) OUTBREAK

Mr. Premlal Panickan and Mr Muaad Al Nuwaira attended the one-day workshop on Crown-of-Thorns Starfish (COTS), Outbreaks Management in Saudi Arabia, organized by National Center for Wildlife. The workshop was held in Voco Riyadh Hotel. The workshop was held under the guidance of Dr. Mohammed Ali Qurban, Executive President, National Center for Wildlife. The presentations were done by world wide experts in ecological management of star fish outbreaks. Dr. Lotfi Rabaoui, Senior Marine Ecologist and Consultant in the National Center for Wildlife moderated the sessions. Many renowned ecologists participated in the workshop.



FISHERIES AWARENESS PROGRAM AT AL QATEEF



Dr. Abudrahiman K.P.
Research Scientist III



Lab Specialist
Research Assistant

On 19 December 2022, the center's fisheries study group held a one-day awareness program for fishermen at Al Qateef. The primary goal of this program was to raise awareness among the fishing community about the importance of protecting the marine environment, including critical fish habitats, in order to ensure a sustainable commercial fishery.

The main point of the awareness class was to convey the implications of illegal fishing, the disposal of plastics and used oil cans, unsanitary fishing practices, unregulated fishing of juveniles and bycatch on the sustainability of the marine environment, as well as the long-term impact on their livelihoods. The main outcomes of the center's fisheries program were clearly explained, and fishermen were asked to take special care to return some of the untargeted species caught while fishing alive. Proper guidelines on good management practices (GMP) onboard were provided, as well as a protocol for managing plastic and other wastes during fishing operations.



FUN IN THE SUN - SOCIAL GATHERING OF ARCEMS EMPLOYEES AND FAMILIES



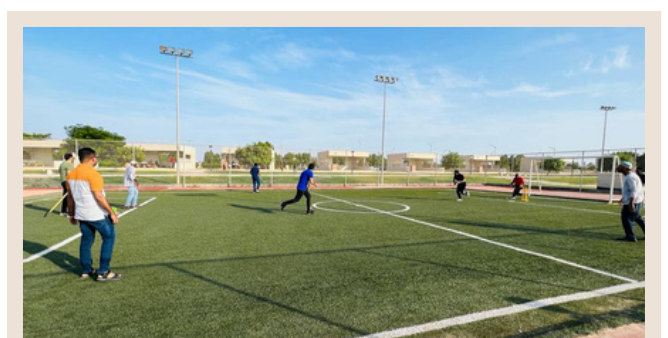
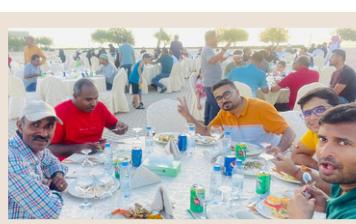
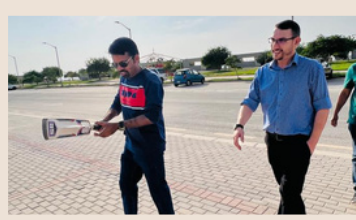
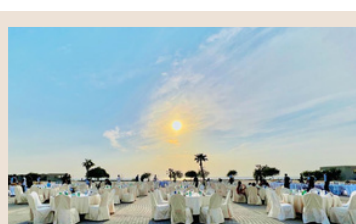
Mr. Mudassir Nayeem Mir
Technical Research Assistant



Mr. Jerin John
Administrative Officer

Some days work is fun but most of the times, it is also quite hectic as you have to keep up with the deadlines and be quick with your work. A family fun day is a fantastic opportunity to foster employee relationships and reward their hard work. It's about everyone enjoying a day out alongside their families and having a great time.

Bringing employees and their families together in a relaxed and informal setting is a great way for them to get to know each other on a deeper level. The Applied Research Center for Environment & Marine Studies (ARCEMS) has conducted a social gathering as part of the ARCEMS 2022 Key Performance Indicator (KPI). The purpose of conducting this gathering was to improve CEMS Researchers morale, and health, and it is the perfect way to increase productivity in our work. The gathering was organized on November 11, 2022, at KFUPM Beach with approximately 130 participants, including families. Several games were organized. The event started from 2:00 pm until late evening. Overall, the event was a success, with everyone enjoying the mild early winter and good food.



NEW STAFF
New Beginning.





Mr. Saleh Nasser Balobaid

Saleh Nasser Balobaid, joined the ARCEMS in October 2022. He holds a diploma in Chemical production from College of Technology, Dammam. He is currently endowed with the responsibility of contaminant analysis in the ECAL lab of CEMS.

Mr. Abdulaziz Mohammed Al-abdullatif

Abdulaziz Mohammed Al-abdullatif, joined the ARCEMS as Research Assistant in October 2022. He has diploma in Industrial Chemistry Technology from Jubail Industrial College (JIC). He has been assigned the responsibility of conducting trace metal analysis in the ECAL lab.



Mr. Jawad Mitham AL Darwish

Jawad Mitham AL Darwish, joined the ARCEMS in July 2022. He holds a diploma in Chemical production from College of Technology, Dammam. He is currently endowed with the responsibility of contaminant analysis of PAH and TPHs in the ECAL lab of CEMS.

Mr. Abdullah Yusuf Ahmed Al Eid

Mr. Abdullah Yusuf Ahmed Al Eid, joined the ARCEMS in September 2022. He holds a diploma in Chemical production from College of Technology, Dammam. He is currently in sample preparation and analysis of biota samples in the ECAL laboratory.



Mr. Omar Hamad Alkhalaf

Mr. Omar Hamad Alkhalaf joined the ARCEMS as Lab Scientist in December 2022. He holds Bachelors in Physics, College of Engineering and Physics, KFUPM, (2016-2021) and Masters in Computational Analytics, KFUPM, College of Computing and Mathematics (2021-2022). He will be working in the CMDA group and will be in the team for Machine learning.



Mr. Mujataba Assa Halal

Mr. Mujataba Assa Halal, joined the ARCEMS in December 2022, as boat mechanic. He will be responsible for driving and maintaining the boats and will also extend his support in logistics as well.

Ms. Najd Abdullah Alhussain

Mrs. Najd Abdullah Alhussain, joined the ARCEMS in September 2022. She holds a Bachelor degree in Applied Chemistry from Imam Abdulrahman Bin Faisal University Dammam. She is currently carrying out trace metals analysis in the ECAL lab of CEMS



Mrs. Fatimah Nabil Alhabib

Ms. Fatimah Nabil Alhabib, joined the ARCEMS in September 2022. She holds a Bachelor degree in Environmental Science - Chemistry from University of Michigan, USA. She is currently carrying out trace metals analysis in the ECAL lab of CEMS.

Ms. Aishah Rashed AlDossary

Ms. Aishah Rashed AlDossary joined the ARCEMS as Research Assistant in November 2022. She holds a Master's degree in Environmental Science.



WELCOME, EVERYONE, WE'RE PROUD THAT YOU CHOSE TO JOIN OUR TEAM. WE WERE THRILLED TO FIND SOMEONE WITH YOUR ABILITIES, IDEAS AND GREAT ATTITUDE."

A large audience of people is seated in a dark room, viewed from behind, looking towards a large, bright white projection screen. The screen displays the text "WEEKLY SEMINARS" in bold green capital letters. The audience is diverse in age and appearance, and the room is dimly lit, with the primary light source being the screen.

WEEKLY SEMINARS

Genomic and Metabolomic Approaches for Discovering New Drug Candidates from the Marine Environment



October 05, 2022

Dr. T.P Sajeewan
Associate Professor in Marine Biotechnology
UGC-Raman Fellow (UTSW, Dallas, USA)
National Centre for Aquatic Animal Health
Cochin University of Science and Technology, Kerala, India

Abstract

Marine bioprospecting, also known as marine natural products research, is concerned with exploring and exploiting the rich biological and chemical diversity found in marine organisms. The marine ecosystem is diverse, dynamic, and inhabited by organisms possessing unique chemical compounds. Recent trends indicating that humans and animals are developing resistance to existing drugs have spurred the search for new drugs from marine organisms. Despite the overwhelming number of natural products and their derivatives approved by the FDA, most of the pharmaceutical industry has reduced its reliance on natural product-based drug discovery programs due to the high rediscovery rates. However, the recent innovations in genomics and metabolomics help to overcome this redundancy and thus facilitate the discovery of novel drug candidates from the marine environment.

CEMS 2022 Third Quarters KPIs: Targets and Achievements



October 12, 2022

Mr. Humayun Baig M.
Engineer-II, CEMS, KFUPM-RI

Background:

CEMS prepared 24 KPIs for the year 2022 based on the well established five strategic objectives. These KPIs resulted through a collective effort of different CEMS research groups. On April 25th, 2022, CEMS conducted its first workshop, to discuss the quarterly targets and achievements. KPIs targets of third quarter and the related achievements will be shown and discussed during this workshop.

Objectives:

To discuss KPI targets vs. achievement of KPIs with group leaders
To investigate potential reasons for mismatch between target KPIs and achievement

Agenda:

Introductory Speech: CEMS Director, Dr. Fahad Al-Ismael
CEMS KPIs: Moderated by Mr. Humayun Baig with participation of the Center Director and Group Leaders
Closing Remarks: CEMS Director Dr. Fahad Al-Ismael

Heavy Metal Contamination in Environmental samples: Analysis using Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES)



Mr. Muhammed Kabeer Korakkottil
Lab Specialist

November 02, 2022

Abstract

Inductively coupled plasma optical emission spectrometry (ICP-OES), is an analytical technique used to determine certain elements in a sample. It is a type of emission spectroscopy that works on the principle that excited atoms and ions can produce electromagnetic radiation at wavelengths characteristic of a particular element. As an electron returns from a higher energy level to a lower energy level, usually to the ground state, it emits light of a very specific wavelength and the intensity of this light or radiation will be proportional to the concentration of that particular element.

Rapid industrialization during the last hundred years resulted in the exploitation of the Earth's natural resources and led to the major problem of environmental pollution. Heavy metals are well-known environmental pollutants because of their toxicity, persistence in the environment, and bio-accumulative nature. Nowadays, there has been an increasing ecological and global public health concern associated with environmental contamination by these metals. Heavy metals are found everywhere in nature, so understanding their behavior and interaction with organisms, particularly fishes, a major source of protein for human consumption, is of great socioeconomic importance. Therefore, assessing heavy metals in various environmental samples is necessary to safeguard the environment and human health.

Eddy Covariance, a Direct Flux Measurement Tool for Monitoring Greenhouse Gases, Evapotranspiration, and Heat



Dr. Frank Griessbaum
Sr. Application Scientist, Environmental
LI-COR Biosciences, Bad Homburg, Germany

November 16, 2022

Abstract

We all are familiar with automated weather stations. Less known are similarly looking flux stations, which in addition to weather parameters, directly measure emissions and uptakes of gases, water vapor, and heat in and out of the air. These have over 700 presently active locations, and since the 1970s, had over 2100 locations across the globe.

These stations are used for precise and continuous half-hourly measurements of CO₂ and CH₄ sequestration and emission rates, evaporative water losses, and the amounts of heat emanating from the natural and anthropogenic areas into the atmospheric air.

In this presentation, we provide a short introduction to the Eddy Covariance theory, the importance of the flux footprint concept for a proper measurement design, as well as an overview of application examples from environmental, agricultural, and industrial (Carbon capture and sequestration/storage, landfill) to urban.

Uncovering Environmental and Human Microbiome with Metagenomics

Dr. Sharif Matouq Ahmed Hala
Noor DX Diagnostics and Discovery



December 08, 2022

Abstract

There is an increasing demand for accurate and fast metagenome classifiers that can identify not only bacteria but all members of a microbial community.

Next Generation Sequencing (NGS) offers an exclusive glimpse at biological agents (bacteria, archaea, viruses, fungi, protists, helminths, etc.) present in clinically relevant samples (as an isolated organism or as a mixed community or body fluids) at strain levels that traditional microbiological methods could not identify. Epidemiological association studies on the presence of pathogens in such samples are considered to be of great benefit to the community and also to build a compendium of circulating pathogens and monitor them for their presence and spread in the hospital or in other environments. The use of metagenomics for the identification of microbiomes would open a new world of identification.

Capabilities of Acoustic Doppler Current Profiler (ADCP) in Marine Research

Mr. Ketil Horn
Principle Sales Engineer, Nortek AS



December 15, 2022

Abstract

Nortek will present the Signature series Acoustic Doppler Current Profiler (ADCP), which is the world's most advanced line of acoustic Doppler current profilers. Features that offer unique possibilities to researchers, like wave measurements, turbulence measurements, and near boundary measurements, will be highlighted. Further, particular focus will be given to the unique combination of current profiles, waves and echo-sounding images and to the integrated AHRS when ADCPs are used in surface buoys.



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Elasmobranchs of the western Arabian Gulf: Diversity, status, and implications for conservation



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Framework of Big Data and Deep Learning for Simultaneously Solving Space Allocation and Signal Timing Problem

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Research output: Contribution to journal > Article > peer-review

Spatiotemporal grid-based crash prediction—application of a transparent deep hybrid modeling framework

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Research output: Contribution to journal > Article > peer-review

Article

Analysis of Climate Change Impacts on the Food System Security of Saudi Arabia

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Article

A Critical, Temporal Analysis of Saudi Arabia's Initiatives for Greenhouse Gas Emissions Reduction in the Energy Sector

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Predicting the travel mode choice with interpretable machine learning techniques: A comparative study

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Mr. Premlal Panickan



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SCIENTIFIC ARTICLES

BRINE WASTE MANAGEMENT IN DESALINATION INDUSTRY: A PROSPECTIVE WEALTH FROM WASTE

The desalination of salt water has become unstoppable due to dwindling freshwater sources, population growth, and new advances in desalination technology. As many nations increase their desalination capacity, they must also deal with the associated waste (brine). The brine contains salt and other important chemicals derived from the source industries. However, desalination is often expensive, restricting its popularity in many countries. As a result, creating valuable products from brine seems to be a sustainable way out of this stalemate. On the one hand, the extraction of valuable chemicals from brine will make the resultant solution less toxic and can be safely discharged or reused.



Dr. Adeola Akeem Akinpelu
Scientist -II

On the other hand, it will generate more income, thereby reducing the overall cost of the desalination process. Brine management has evolved into three perspectives over the years: water, mineral, and energy recovery. Water recovery is made using either the MLD or ZLD methods. The membrane-based technologies that are applicable for MLD are RO, OARO, and HPRO for MLD (HPRO). Minerals can be extracted from brine in various ways.

Membrane distillation and electrodialysis are examples of these processes. Other technologies being researched to recover energy from brine include reverse electrodialysis (RED) and capacitive mixing (CAPMIX). As seen in table 1, different countries are at various stages of brine usage. Mineral and energy recovery from brine has made great progress in the United States, the Netherlands, and China.

Table 1: Comparative study of the use of brine by different countries

COUNTRY	AMOUNT OF BRINE (M ³ /DAY)	WATER RECOVERY	MINERAL RECOVERY	ENERGY RECOVERY
Saudi Arabia	31.55million	ZLD	Magnesium (Mg), Calcium (Ca), Sodium Chloride (NaCl), Bromine (Br), Lithium (Li), Potassium (K), and Sulfate (SO ₄ ²⁻)	Pressure Exchanger
USA	5.28million	HPRO, ZLD, FO, VSEP, OARO	NaCl, HCl, HNO ₃ , H ₂ SO ₄ NaOH, KOH, Li	Pressure Exchanger, CAPMIX, Gas to the liquid process by US Navy
Netherland		ZLD	sulphate salts, sodium bicarbonate, NaCl	Osmotic pressure, Reverse Electro Dialysis (RED) Capacitive Mixing (CAPMIX)
China	1,785,000	ZLD	Li, NaCl, Magnesium (Mg), Calcium (Ca), Sodium Chloride	Pressure Exchanger

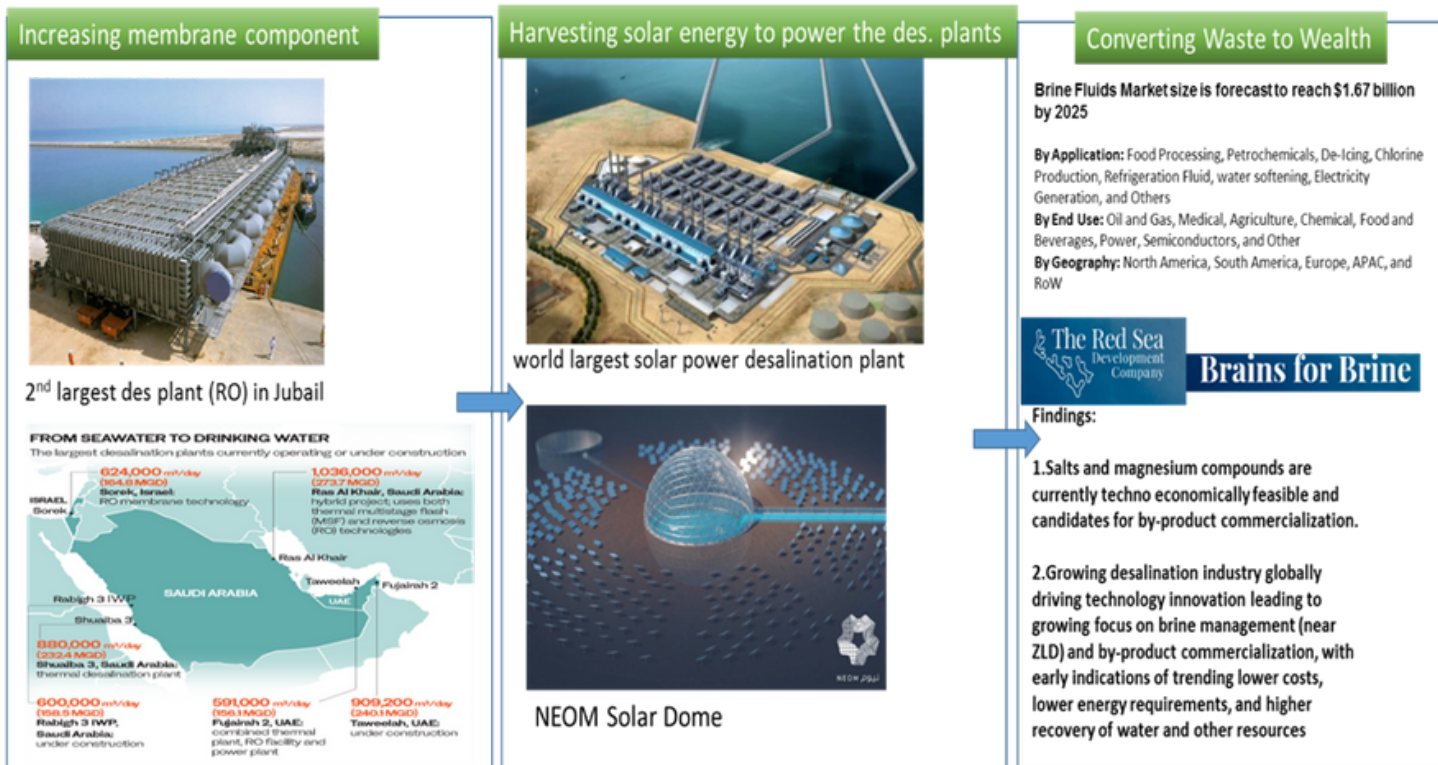


Figure 1: Progress in the use of brine in Saudi Arabia

While Saudi Arabia, the world's largest brine producer, has made some significant gains in the recovery of salt, the recovery of some other essential minerals is still in the pilot stage.

The kingdom is currently harvesting abundant solar energy to power the distillation plants and distillate the saline water, as captured in figure 1. Moreso, the new thinking is to extract valuable compounds from the resultant brine.



THE ADVERSE EFFECT OF MERCURY (Hg) IN THE MARINE ENVIRONMENT



Dr. Venkata chandra Akruthahi
Lab Specialist

Mercury (Hg) is a poisonous element that is abundant in nature and has been introduced as a contaminant in the environment. It shows a profound influence on public health and the surrounding wildlife environment. It exists in various chemical forms, such as elemental Hg and Hg+2 inorganic and organic complexes. The severity of the contamination and risk assessment can be estimated based on the form of mercury present in the environment and its sources. Various geochemical and ecological processes control the different Hg chemical structures in the environment.

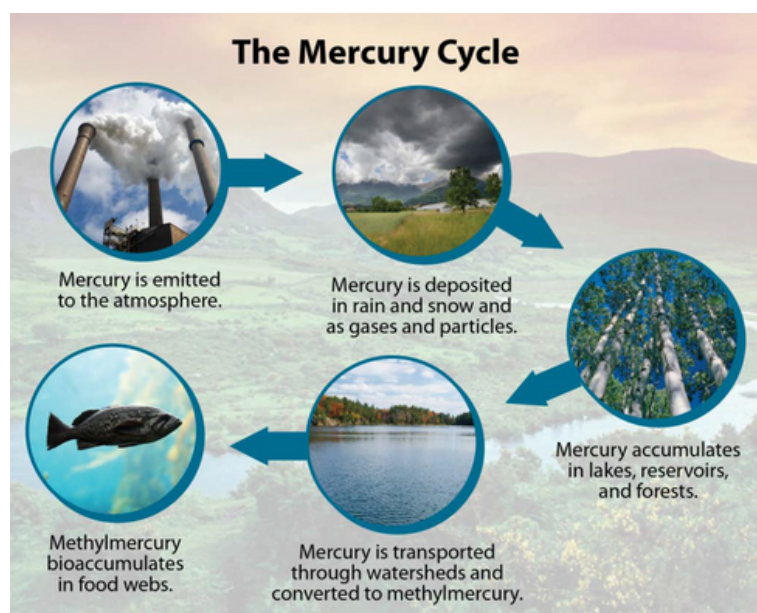
Among all the forms, methyl mercury ($\text{CH}^3 \text{Hg}$) is the most toxic chemical form. Mercury methylation and its bioaccumulation are critical processes in the marine food web and its trophic transfer. In the marine environment, under the influence of anaerobic sulfate-reducing bacteria, inorganic mercury is converted to methylated mercury. When compared to low seawater concentrations, fish may bio-concentrate $\text{CH}^3 \text{Hg}$ up to 106-fold. The people who eat mercury-contaminated seafood have a variety of health problems. Exposure to methylmercury most commonly occurs when people eat kinds of fish. This exposure can adversely affect unborn infants' growing brains and nervous systems. These systems may be more vulnerable to methylmercury than the brains and nervous systems of adults. Children exposed to methylmercury while they are in the womb can have impacts to their cognitive thinking, memory, attention, language, fine motor skills, and visual spatial skills.

Adverse effects of methylmercury

Methyl mercury damages the Immune system, Nervous system, Genetic and enzymatic system and Slowing down embryo development.

The Clean Water Act (CWA)

Under section 304(a) of the Clean Water Act, the United States Environmental Protection Agency (EPA) established a fish tissue threshold for $\text{CH}^3 \text{Hg}$ of 0.3 Microgram per gram ($\mu\text{g/g}$) to protect human health



Schematic diagram of mercury contamination processes in the environment

<https://webcam.srs.fs.fed.us/impacts/mercury/index.shtml>

ISOTOPES & THEIR APPLICATIONS IN ENVIRONMENTAL SCIENCE

Isotopes are atoms of the same element with the same number of protons but can vary in mass depending on the number of neutrons. They share almost the same chemical properties. These atom varieties are called isotopes. For example, as shown in Figure 1, Hydrogen is an element with different isotopes. It has three naturally occurring isotopes- ^1H , ^2H , and ^3H . Hydrogen-1, or protium, is the most prevalent hydrogen isotope, accounting for 99.98% hydrogen atoms, and has no neutrons. Hydrogen-2 (Deuterium) and Hydrogen-3 (Tritium) have one and two neutrons, respectively.



Mr. Mohammed Asif
Scientist - II

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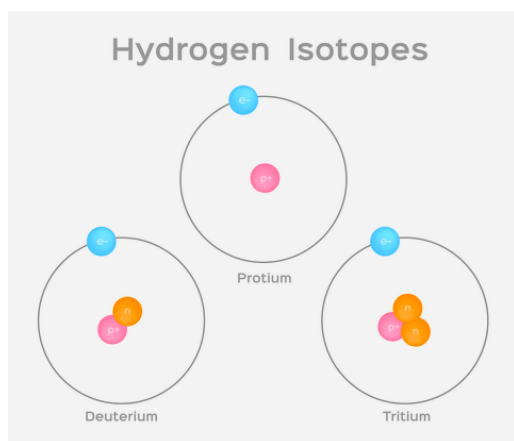


Figure 1: Hydrogen isotopes. (Image: Isotope Basics/ NIDC)

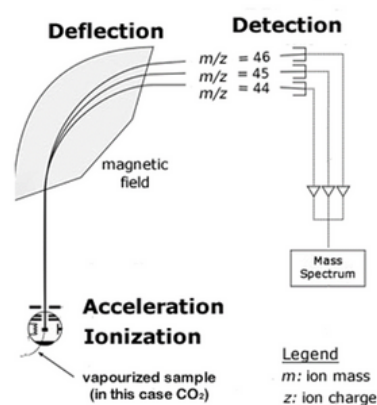


Figure 2: Isotope-ratio mass spectrometry (IRMS)

The relative abundance of each isotope can be determined using mass spectrometry. Isotope-ratio mass spectrometry (IRMS) is a specialization of mass spectrometry in which mass spectrometric methods are used to measure the relative abundance of isotopes in a given sample. Traditional measurements of water isotopes have been achieved using magnetic sector isotope ratio mass spectrometry. A mass spectrometer ionizes atoms and molecules with a high-energy electron beam and then deflects the ions through a magnetic field based on their mass-to-charge ratios. Typical measurements target hydrogen, carbon, nitrogen, and oxygen analyses.

Isotope analysis provides a powerful tool for tackling many environmental issues. Environmental isotopes are a subset of isotopes, both stable and radioactive. They are primarily used as tracers to see how things move around within the ocean-atmosphere system, within terrestrial biomes, within the Earth's surface. The subtle changes in the concentration or type of isotopes can be accurately measured and compared to reconstruct an accurate climate history. This data can also be used to study the complex interactions between the sun, atmosphere, oceans, and biosphere, which together influence climate.

PRESENT CONCERN: IMPACT OF CLIMATE CHANGE ON MARINE ECOSYSTEMS



Dr. Priya Brata Das
Lab Specialist

Around the world, we have witnessed irregular patterns of climatic events and unprecedented extreme weather actions. That is the reason for continuous anthropogenic activities which disturbs the earth's climate. Worlds reputed scientific organizations urge that emission of carbon dioxide and other greenhouse gases is responsible for long-term climate change. Among all the communities and ecosystems, marine ecology is a significant aspect to be affected by climate change.

The higher emission of greenhouse gases will lead to air and water temperature warming, seasonal shifts in species, coral bleaching, sea level rise, coastal inundation, coastal erosion, harmful algal blooms, hypoxic zones, new marine diseases, loss of marine mammals, changes in the level of precipitation and fishery declines. Further extreme events such as droughts, floods, and storms can affect marine habitats and the species community living in them (Figure 1).

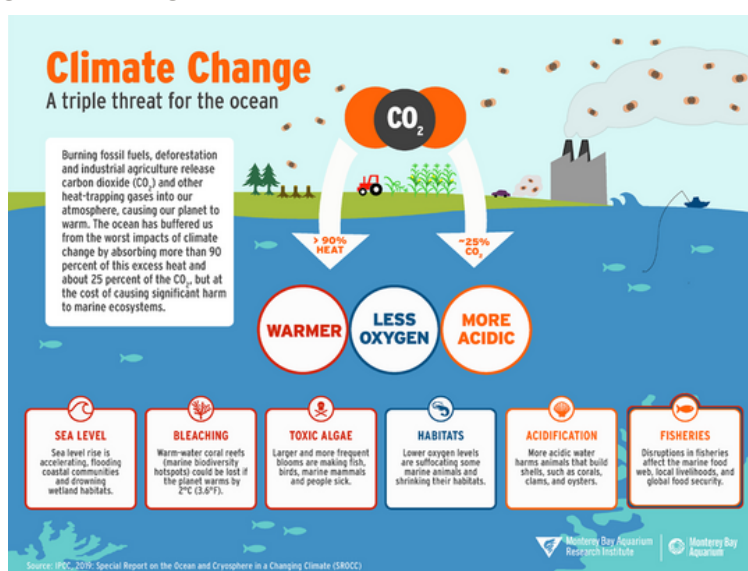


Figure 1: Represents the impacts of climate change on marine health (source: IPCC 2019, special report on the ocean and cryosphere in a changing climate)

This indicates that global climate change alarms the scientific fraternity to think about its impacts on the biotic and abiotic environment to live in harmony, protection of our marine ecosystems is quite essential. A significant reduction of greenhouse gas emissions is the overall solution for the ocean and climate change.

The Paris Agreement 2016 needs attention and action to prevent the adverse effects of climate change at international, national, local, and community levels around the world. One of the important actions, such as blue carbon, is the advanced method for long-term carbon sequestration and storage. Blue carbon is nothing but capturing of carbon dioxide by the world's ocean and coastal ecosystems. Concurrently health of the ocean should be maintained properly by avoiding the threats that occur in the marine environment. With the reduction of stresses from superfluous human activities, the flexibility of marine species and ecosystems can be increased. This is the way we can work on sustainable development of marine health and its immune system by eradicating or reducing the numerous negative effects from which it suffers. Proper restoration of marine biota/species such as mangroves, seagrass meadows, corals, kelp forests, fisheries, and all marine life will keep the marine ecosystem healthy and acts as a safeguard to reduce the impacts of climate change on the living entity.

ACID RAIN

Acid rain has been considered one of the major environmental threats since the 19th century. It forms both natural and man-made conditions. It is caused by a chemical reaction that begins when compounds like sulfur dioxide and nitrogen oxides are released into the air. These substances can rise very high into the atmosphere, mixing and reacting with water, oxygen, and other chemicals to form more acidic pollutants, known as acid rain. Sulfur dioxide and nitrogen oxides dissolve easily in water and can be carried very far by the wind.



Mr. Muaad A. Al Nuwairah
Research Assistant

As a result, the two compounds can travel long distances and become part of the rain, sleet, snow, and fog we experience on certain days. The effect of acidification has been sighted worldwide, such as deleterious ecological effects and accumulation of toxic heavy metals in soil and oceans, biodiversity loss, including corals and shellfish, and degradation of fisheries and growth of plants. Typical acid rain has a pH value of 4.0. A decrease in pH values from 5.0 to 4.0 means that the acidity is ten times.

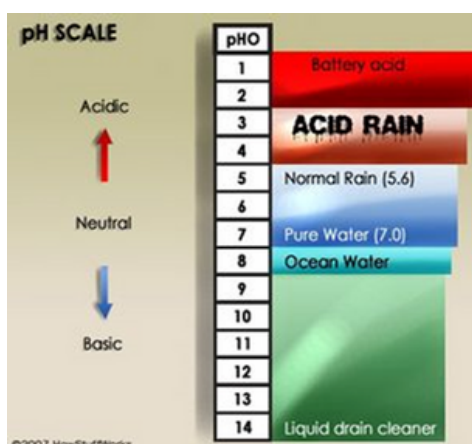


Figure 1: Rang of Acid rains

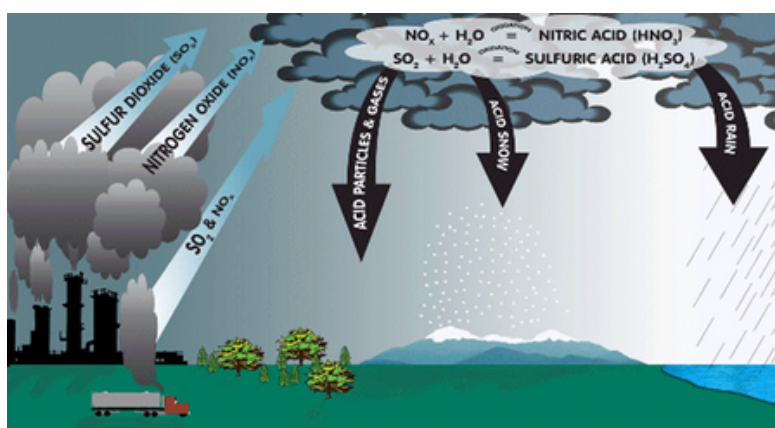


Figure 2: Forms Acid rain particles and their return from the atmosphere

The acid substance returns to the earth in one of two forms:

1. Wet: falls as acid rains, fog, snow, and cold vapor.
2. Dry: falls as acid particles.

Human activities are the leading cause of acid rain. Over the past few decades, humans have released so many different chemicals into the air that they have changed the mix of gases in the atmosphere. Power plants release the majority of sulfur dioxide and much nitrogen oxides when they burn fossil fuels, such as coal, to produce electricity. In addition, the exhaust from cars, trucks, and buses releases nitrogen oxides and sulfur dioxide into the air. These pollutants cause acid rain.

Acid rain affects nearly everything. A United States Environmental Protection Agency (EPA) study showed that acid rain is particularly hard on trees and changes the composition of soil and bodies of water, making them uninhabitable for local animals and plants. Acidification of lakes and streams can lead to the death of aquatic life, such as trout and seabass. It can leach heavy metals like mercury out of the soil causing toxic levels to build up in the fish we eat. It can additionally deteriorate limestone and marble buildings and monuments, like gravestones.



Dr. Syed Masiur Rahman
Research Scientist -II

GEOSPATIAL BIG DATA

People often use the words "volume," "velocity," and "diversity" to describe "big data." Big Data is a term for very large amounts of data that come from sensors, business transactions, social media, and online publications, among other places.

We are supposed to be in the middle of an "exaflood" of 10^{15} bytes of data, or to be "drinking from a firehose." International standard prefixes have already been made for the numbers 10^{18} (peta), 10^{21} (zetta), and 10^{24} (yotta), but it looks like more may be needed soon.

Data is also getting easier to find, and we have gotten used to getting real-time updates on airplane movements and traffic jams on our phones through apps. Big data has a lot of different kinds of information because there are so many possible sources for a given problem, and it is hard to combine them all into a single, reliable answer.

When Landsat started working in the early 1970s, it made a lot more data than could be easily stored or even looked at. This meant that special high-capacity tape drives had to be made. Even though processing speed and storage space have come a long way, our ability to collect geographic data is still orders of magnitude greater than our ability to inspect, interpret, analyze, or make sense of it.



The fact that GIS is becoming easier for people to use is making it clearer how important identified places are as the basis for global information and personal communication. In recent years, there has been a lot of interest in the idea of a spatial technology in which named places, not coordinates, are the most important parts of knowledge. Many things get a lot harder, like figuring out where you are and how far away something is. But it becomes much easier to do other things, like share what you know and make sketch maps to help others.

Many of the new data sources that are making people interested in "big data" come from social media and crowdsourcing. At the same time, the general public is eagerly using GIS tools that were once only available to professionals, such as tools for navigating, making maps, and finding places of interest. GIS tools are now being made available as apps for smartphones, moved to the cloud, and made much easier to use than they were in the past.



SATELLITE TRACKING TECHNOLOGY ELUCIDATES MOVEMENT PATTERNS OF MIGRATORY SEA TURTLES

The use of modern satellite telemetry allows ecologists to monitor the movement and behavior of animals on unprecedented spatial and temporal scales (Hofman et al., 2019). Coupled with satellite transmitters, the ARGOS satellite system has been widely used in wildlife telemetry to track marine and terrestrial vertebrates (Yasuda and Arai, 2005). In general, wildlife researchers conduct satellite telemetry to study predator-prey interactions, foraging behavior, activity patterns, movement patterns, migratory routes, habitat preferences and other aspects of animal behavior (Hofman et al., 2019).



Dr. Rommel Hilot Manjea
Research Scientist -III

The performance of satellite telemetry programs is dependent on several factors, including environmental characteristics of the study area, species traits, transmitter unit specifications, satellite configuration, etc. (Hofman et al., 2019). The performance of satellite telemetry applications has improved over time, based on an analysis of over 3,000 satellite transmitters used in 167 projects to study 62 terrestrial species worldwide (Hofman et al., 2019).

Satellite telemetry has been extensively used to investigate long-term and large-scale movements of many migratory species, including sea turtles (Metz et al., 2020; Casale et al., 2012). Tracking data can also be used to protect critical habitats and to ensure the recovery of threatened and endangered species (Metz et al., 2020). Turtle tagging involves attaching a special piece of tracking equipment, called a Platform Terminal Transmitter (PTT), to a sea turtle's carapace. Figure 1 shows a graphical description of satellite tagging from Carter et al. (2016). The PTT on the carapace sends messages to a satellite when the turtle comes to the surface to breathe. The location of the turtle can then be plotted on a map using the message received from the satellite. Existing technology either uses an Argos-derived location from a Doppler-shift in frequencies between the transmitter and low-orbiting polar Argos satellites or with Fastloc® GPS technology (Carter et al., 2016).

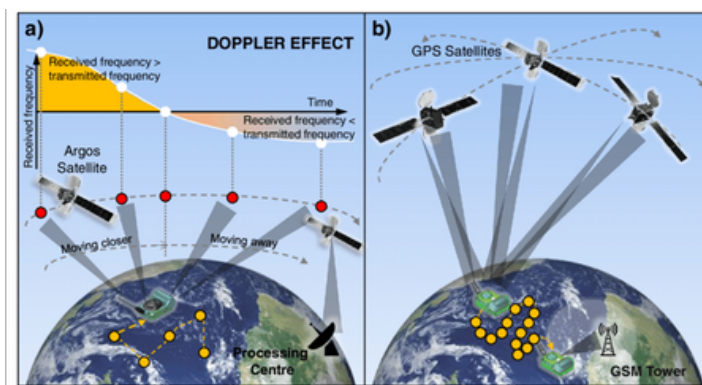


Figure 1. Satellite telemetry location detection and transmission methods. (a) Argos satellite tags, and (b) GPS-GSM phone tags. Yellow dots represent locations where the tag is at the surface and a location fix is derived. From Carter et al. (2016).

While underwater, electric current flow between two metal contact points in the satellite transmitter attached to the sea turtle. During this time, the transmitter will not send signals to the satellites. However, when the turtle comes to the surface to breathe, one or both of the metal contact points will come out of the water and the electric circuit will no longer be able to run between the contact points. At this time, the PTT will start sending signals to the NOAA satellites. Argos receivers onboard the NOAA environmental satellites orbiting the poles provide full global coverage (www.conserveturtles.org). When transmissions are received, the location of the transmitter will then be calculated and accuracy determined according to five different location classes.

THREATENED AND ENDEMIC SOCOTRA CORMORANT IN THE ARABIAN GULF

Seabirds form important components of marine ecosystems, serves as top predators that indicate long-term stability through feeding interactions. Many species of seabirds reside within the Arabian Gulf, although their role in this marine system is not well characterized. The Socotra cormorant (*Phalacrocorax nigrogularis*) is a threatened species of cormorant that is endemic to the Persian Gulf and the south-east coast of the Arabian Peninsula.



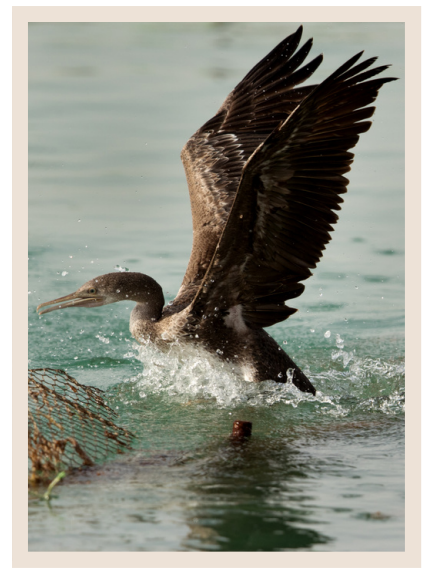
Dr. Aarif K Muhammed
Lab Specialist



Mr. Goutham S Subbusamy
Lab Specialist

They breed on Islands in the Arabian Gulf, where they are common. There are no inland records of this species in the Kingdom. The species has a restricted range spanning from the Arabian Gulf, the Gulf of Oman and south into the Gulf of Aden.

Socotra Cormorants have historically nested on a number of islands in Kuwait, Saudi Arabia, Bahrain, Qatar, the UAE and Iran. Many of these colonies have dwindled as a result of disturbance, degradation, or outright destruction of nesting islands due to oil exploration activities. Nesting is no longer reported from Kuwait and Iran although non-breeding birds continue to disperse throughout the Arabian Gulf. Currently, three islands in Saudi Arabia (in the Gulf of Salwa), one island in Bahrain, one island in Qatar and up to 11 islands in the United Arab Emirates support the entire breeding population within the Arabian Gulf.



Socotra cormorant (*Phalacrocorax nigrogularis*)

This species is listed as Vulnerable because it has a small range, which is suspected to be undergoing a continuous and rapid decline, largely because of infrastructure and residential development, disturbance at its nesting colonies, exploitation, and marine oil pollution. No studies were undertaken on the ecology, habitat use pattern and local movements of the Socotra Cormorants in Saudi Arabia. Therefore, detailed studies need to be carried out on this species to get clear pictures of eco-sociobiology from the Kingdom.



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The only way forward, if we are going to improve the quality of the environment, is to get everybody involved.

””

Richard Rogers

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