

International **COASTAL CLEAN-UP** **2020**



Part of Swachhta Action Plan (SAP)

Organized by United Way Mumbai (UWM) and
National Centre for Coastal Research (NCCR), MoES, Chennai



सत्यमेव जयते

GOVERNMENT OF INDIA
MINISTRY OF EARTH SCIENCES

राष्ट्रीय तटीय अनुसंधान केन्द्र (एन सी सी आर)

National Centre for Coastal Research (NCCR)

Coordinators



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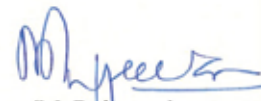
FOREWORD

Plastic plays a substantial role in our life. Mismanagement of abandoned plastics in the form of litter leads to plastic pollution. Predominantly, the litter finds its way to coastal areas and marine environments via land and ocean-based sources. Marine litter is a growing concern and challenge for our planet's environment, enabling acceleration of global warming by altering the carbon dioxide sequestration process in the oceans. In 2015, an article published in "Science" infers that annually 8-13 million metric tons of mismanaged plastics enter the ocean, and a recent report "Breaking the Plastic Wave 2020" estimates that this will increase to 26 million metric tons by 2040.

To combat these issues, we need to create effective policies and awareness among the community. Towards this vision, National Centre for Coastal Research (NCCR) has been working on International Coastal Clean-up Day activities since 2016, together with many governmental and non-governmental institutions through a Citizen Science approach, across coastal states and islands.

Due to the COVID pandemic situation this year (2020), United Way Mumbai, an NGO based at Mumbai and the National Centre for Coastal Research joined through digital platforms to create awareness among students, researchers, scientists, public and other stakeholders instead of manual fieldwork. To promote the continuous efforts for International Coastal Clean-up (ICC) activities, webinar lecture sessions were conducted on marine litter by experts over a period of four days; a national photography competition was held; and a research paper competition was conducted on the theme "Marine pollution and Coastal Conservation" involving participants at international level. The events extended across one month. The major issues focused on marine litter and micro plastics and their impact on biodiversity, countermeasures and strategies that need to be initiated.

I am happy to see that the activities were well planned, and received much attention from a large number of participants. I hope the report summarizing the activities as part of International Coastal Clean Up (ICC) day celebration is a novel way to involve future activities and program.



(M. Rajeevan)

FOREWORD

United Way Mumbai has been working dedicatedly to improve lives, for the past 18 years with a mission to advance the common good by bringing together the various stakeholders of our community including corporates, individuals, government institutions and NGOs. Based on our communities' needs, we have identified 6 cause categories, which form the focus of our work – Education, Income, Health, Environment, Public Safety and Social Inclusion.

We have been actively involved in clean-up activities and have worked closely with the Municipal Corporation of Greater Mumbai (MCGM) on spreading civic awareness. Through our Project Clean Shores Mumbai, we strive to enhance the overall cleanliness and waste management of the city's beaches and contribute towards the mitigation of marine pollution and conservation of the marine ecosystem through strategic and sustained interventions, enabled by a public-private partnership.

This year on International Coastal Cleanup Day, United Way Mumbai had arranged several events in collaboration with the National Centre for Coastal Research (NCCR), Ministry of Earth Sciences Government of India, to raise awareness on marine pollution and encourage young researchers and citizens to adopt sustainable lifestyle and better waste management practices. Keeping the current COVID19 pandemic restrictions in mind, all the events were conducted via online platforms. Around 7500 people participated- not just from India but from other countries too, and were sensitized on issues critical for coastal and ocean cleanup. The enthusiastic involvement of the participants ensured all the events were very successful and could carry a clear message on the significance of coastal cleanup.

This report highlights the details of activities conducted on the occasion of International Coastal Cleanup Day, and I would like to thank NCCR for supporting us in these endeavors. Your belief in our work keeps us motivated to continue and scale up our efforts to spread the message of the relevance of coastal and ocean clean up among all the constituents we interact with. We hope this will create a positive impact on our coasts and oceans in the years to come.



Jayanti Shukla

CEO United Way Mumbai

Report on Observance of International Coastal Cleanup Day 2020 as a part of Swacchta Action Plan (SAP) organized by United Way Mumbai (UWM) and National Centre for Coastal Research (NCCR), MoES, Chennai.

“Without water, our planet would be one of the billions of lifeless rocks floating endlessly in the vastness of the inky-black void”— Fabien Cousteau

Introduction

The oceans are the lungs of our planet; provide oxygen for breathing, a major source of food and medicine, and a critical part of the biosphere. We know that the 3/4th part of our whole earth are full of water; it is our responsibility to save our ocean and marine life from the danger of global warming. India has a long coastline of 7,517 km, contributing to ecological richness, biodiversity and economy. Every year thousand tons of garbage composed of plastics, glass, metals, sanitary, clothes etc. reach the oceans and plastics contribute a major portion (~ 60%) of the total garbage that finds its pathway to the ocean every year. Recently, a number of studies have reported an increase in the number of killings of marine animals (birds, turtles, mammals etc.,) due to plastic ingestion and strangling by abandoned (ghost) fishing nets.

International Coastal Cleanup (ICC) Day takes place on the third Saturday in September every year and is one of the largest one-day volunteer events in the world with an aim to combat the global solid waste problem, including the problem of marine debris, and raise awareness among the citizens about the same. ICC got its start in 1986 when Linda Maraniss met Kathy O'Hara while working for Ocean Conservancy. O'Hara had just completed a report called *Plastics in the Ocean: More Than a Litter Problem*. The two of them reached out to other ocean-lovers and organized a Cleanup for Ocean Conservancy. The first Cleanup consisted of 2,800 volunteers. Since that time, the Cleanup has grown into an international event in more than 100 countries.

This year the ICC Day celebrated on 19th September 2020. The United Way Mumbai in collaboration with National Centre for Coastal Research (NCCR), Ministry of Earth Science, Government of India had arranged several events to raise awareness about marine pollution with special emphasis on marine plastic pollution and to encourage young researchers and citizens. Starting from 16th September, a total of four events were organized under this observation day. Keeping the current COVID19 pandemic restrictions in mind, all the events were conducted on digital platforms of United Way Mumbai. All the activities were promoted on our various social media platforms and also reached via emails and messages to the schools, colleges, and other respected participants. A registration link was provided for each competition for participants to register for the competition.

The following events were conducted during ICC Week:

1. A week long webinar series by National and International Scientists on the theme of Marine Litter and Coastal conservation
2. A National Panel Discussion on Unmasking the effects of COVID 19 on our oceans
3. A National Photography Competition
4. A Research Paper Competition

Highlights of the Webinar Series

A week-long webinar series was arranged from September 16 to September 19, 2020, every day at 3:00 PM IST on United Way Mumbai's YouTube Channel with an aim to spread awareness about the current issues and encourage young students and researchers to find practical solutions to the current challenges of marine litter and conservation.

We invited national and international professors and scientists from prestigious universities and institutions to deliver expert lectures on marine litter and ongoing research in the field of marine conservation. More than 6000 citizens were encouraged and sensitized through this webinar series about marine conservation.

Day 1 : September 16, 2020

Topic: Micro-plastics : An emerging threat to marine environment & biodiversity

Speaker: Dr. Mahua Saha, Senior Scientist at CSIR-NIO, Goa

Dr. Saha began the session by explaining the role of plastic in the 20th Century's revolution and continued speaking on the consequences with various examples such as gyre of marine debris particles in the Pacific Ocean, sources of waste, and current statistics of India's plastic waste generation where India generates 25940 tons of waste every day which is equal to 9000 Asian elephants.



She had elaborated on her study of Micro-plastics carried out at CSIR-NIO, Goa where they have found an abundance of macro and micro-plastics found along the shoreline of Goa, which was further examined on the basis of its distribution, polymer type, and toxicity of the micro & macro plastics. She also spoke about the water and sediment samples taken from the Mandovi-Zuari Estuary, Goa. Also, they had carried out a study in Ganga & Yamuna River. Some technical aspects were covered regarding the functionality of FTIR microscopy, types of plastic material were found in water and sediment samples. She also mentioned that household products like toothpaste, cosmetics, domestic wastewater, etc, also contain microbeads and microfibers which contribute to marine litter. Lastly, she suggested ways to reduce single-use plastic and eco- friendly alternatives.

Day 2 : September 17, 2020

Topic: Micro-plastics in the Arctic Environment

Speaker: Prof E. V. Ramasamy, Mahatma Gandhi University, Kottayam, Kerala

Prof. Ramasamy started his talk by explaining the geographical area of the Arctic region where he has conducted his research on Microplastics (MPs) and presented a glimpse of the Arctic International research town Ny-Ålesund and 'Himadri' – the Indian research station in a short video which also included the research life in such remote locations.



He also discussed the major issues and the risk involved with ingestion of MPs. Globally, 3561 research papers have been published on MPs but only 34 research papers have been published on the MPs in the Arctic regions. Studies reported from different regions and countries concluded the presence of polymers of plastics (composed of many repeating subunits to form a plastic chain) like Polyvinyl Chloride (PVC), Polypropylene (PP), Polystyrene (PS), Polyamide (PA), Polyethylene terephthalate (PET), and Rayon. Fiber shaped MPs were the most dominant particles reported from different samples (water, sediment, biota, and ice) studied in Arctic. He explained his research at Ny-Ålesund focusing on sampling methods, storage, processing and analysis of the samples for MPs assessment. The results of his study found, High Density Polyethylene (HDPE) as the most abundant type of polymer found in the study area (Ny- Ålesund). Towards the end of his session, he encouraged participants to take an integrated approach to tackle current plastics pollution which will be the best policy for a sustainable environment for future generations.

Day 3 : September 18, 2020

Topic: Marine Litter: Turning the tide, Indo-UK program Marine Litter & Microplastic

Speaker: Mr. Peter Kohler, Senior Marine Litter Scientist

Dr. Danja Hoehn, Scientist at Centre for Environment Fisheries & Aquaculture Science (CEFAS), UK

Mr. Peter started a session with the current global waste generation and its management situation. Currently, 70% of the total waste is being dumped at landfill sites and 12% of which is plastic waste which is problematic as plastic can last up to 10000 years in the environment as a form of micro-plastic.



If the situation continues, there will be a 4% to 8% increase in the disease on coral reefs due to plastic waste which will be also responsible for global economic damage. He also addressed some myths related to plastic such as biodegradable and compostable plastic materials in which he mentioned that to utilize plastic only when it is essential like making heavy machinery, equipment, etc. otherwise for daily usage like take away parcels, water bottles, it could be avoided. Plastic is a complex problem with many pathways therefore we need to focus on redesigning our relationship with our waste and consider it as a resource because it is a major part of our circular economy

where the responsibility of plastic waste management should be shared equally by all the stakeholders.

Dr.Danja continued the session about the Center for Environment Fisheries and Aquaculture Science (Cefas) & Marine Litter Commonwealth Litter Programme (CLiP) where she has shared the work that has been conducted by Cefas about marine litter around the world.

The CLiP is an international programme of Cefas for monitoring and assessing micro and macro plastics data to inform action plans for the host country in the commonwealth. The programme is working in the South Pacific, Caribbean, Asia, and Africa. A team of experts are involved in the



research activities such as types of litter, local & global sources of waste & training local staff. Under CLiP India programme. Two beaches in Pondicherry i.e Auro and Paradise beach were monitored under CLiP programme with NCCR scientists. NCCR has covered more beaches at the east coasts of India. Using the quadrant method various sizes of plastic waste was collected from the beaches. Collected items were further analyzed on the basis of their sizes. She further elaborated that we need a sustainable relationship with plastic. Lastly, Peter encouraged the participants to incorporate the “3R” method to reduce marine litter as behavioral change is one of the most important and promising ways to combat this problem and it starts with us.

Day 4 : September 18, 2020

Topic: Microplastic in the Global Oceans

**Speaker: Prof Bhavani Narayanswamy, Head Deep Sea Ecosystems & Micro-plastic Research
Scottish Association for Marine Science, Scottish Marine Institute, UK.**

Prof. Bhavani Narayanaswamy started her lecture with the composition of plastic and while transferring the nurdles to the factories gets easily spilled which is very less likely to get collected and recycled. These nurdles then show up everywhere in the form of marine litter mostly during the shipping processes.



She gave examples of different plastic products that we use in our daily lives which gave an idea about how much plastic consumption we have on a daily basis. A fully loaded washing machine can release ~596 Million MP/Day even after the treatment. Charleston Harbour alone emits 500 million to 1 billion MP each day from treated effluent. She explained her group's work at places along the wild coastline of Scotland which looks very pristine as no large size plastic waste around the beach but her research found out the presence of MP in the water, sand and molluscs present at the beach. Through her group's research they also found out the presence of MP in the deep sea ocean of the North Atlantic region. Her team also extracted 359 potential MP in benthic invertebrates and acrylic was the most abundant type of polymers with 8 other different types of polymers found. MP present throughout sediment depth studied (10 cm) exceeds the age of plastic production. She had also done research in Svalbard (North of Norway).

National Panel Discussion on Unmasking the effects of COVID 19 waste on our oceans

Single-use plastic is one of the greatest threats to the environment and over the past few months the COVID-19 pandemic has caused global emergency and has raised social and economic concerns which will also spill over to environmental issues. Wearing surgical face masks, gloves, personal protective equipment (PPE) kits and the frequent disinfection of hands are one of the essential precautions to prevent the spread of COVID 19. This has not only increased the quantity of medical waste but also alters the average density of the Municipal Solid waste crisis around the world particularly in the countries with developing economies and those in transition. Improper disposal and lack of proper waste management will cause huge increases in marine litter and debris into the ocean.

To bring awareness on this crucial topic of plastic pollution, sensitization on the importance of marine conservation and Covid-19 waste management practices, this panel discussion was arranged on 19th September on UWM's YouTube channel where subject experts were invited as a panelist and discussed the problems and solutions to protect our oceans from COVID19 waste. Around 1000 people across the country and abroad were sensitized about waste management of the COVID19 waste.

Event Proceeding:

Ms. Pooja Shinde (Assistant Manager, Community Impact Dept., of United Way Mumbai) welcomed all participants, and introduced Mr. Ajay Govale (Director of Community Impact Dept., United Way Mumbai who opened the event. Mr. Govale opened the session by thanking all the panelists and the audience. He provided the facts of the Covid-19 Medical waste produced in India. He then introduced each of the Panelists, highlighting their involvement in diverse areas of marine conservation and waste management.

Dr. V. Sampath presented facts and figures of the impact of Plastic Pollution on Aquatic animals. He emphasized that the Covid-19 waste should be incinerated as it carries harmful materials which may lead to other diseases. NCCR has been providing guidelines & policy framework to the Ministry of Environment, Forest and Climate Change. He focused on the remediation part and the sustainable long term solution of marine conservation.

Dr. Pravakar Mishra discussed the activities NCCR was involved in 2019 and their upcoming plans. NCCR provides forecasts after monitoring sea water quality, important coastlines which need attention and carrying out studies on micro-plastics found in the rivers and oceans. He put forward the fact of plastic pollution which remains for generations into the oceans. He then spoke of their participation in the beach clean-up drives which they had organized last year on 34 beaches and they found that waste



collected had more than 50% plastic. He provided a viewpoint of the rural and urban people attitude on the usage of plastic waste. Lastly, he talked about low cost floating traps that AlphaMERS have placed in the rivers of Chennai which collects plastic waste before entering into the oceans & how this one initiative can create a huge impact for our whole country.

Pramod Dabrase drew attention to how solid waste management functions and in India 90% of landfills are not technically equipped. He kept on emphasizing that waste should be considered as a resource and the real problem is the usage of single use plastic. He stressed on one important

thing that the Covid-19 waste should be disposed-off in the designated bin as the used PPE kits, masks, gloves, face shields are already infected and it might lead to another pandemic if the present scenario continues. He said that India has enough guidelines so there is no necessity to make more rules but strict actions should be taken for non-followers. We need to facilitate the work of the rag pickers and more support is required of the new infrastructure to deal with a situation like Covid- 19.

Prof. Ramaswamy laid emphasis on the fact that most of our landfills in India are not engineered ones. He explained that plastic when entered into the water bodies gets fragmented into microplastics and ultimately gets into the food chain. Plastics and the microplastics also adsorb chemicals already present in the water bodies on their surface and act as vectors of such chemicals most of them are toxic. There are reports stating the growth of pathogenic microbes over the surface of such plastics and microplastics thus the plastic debris also act as microbial 'hitchhikers'. Lastly, he spoke on the way we manage waste needs to be evolved and strictly Covid-19 waste needs to be incinerated at high temperature as the infected waste may lead to multiple problems.

Dr. Mahua Saha started with explaining that the world was fighting against the usage of single use plastic before 2020 but the Covid-19 had led to the increase in demand of PPE kits, face shields, face masks, gloves, hand sanitizers, etc. She also said that the online purchase utilizes a huge amount of plastic for packaging. She stressed on the fact that micro fibers of plastic absorb chemicals and pathogens tend to grow on it, once it enters into the food chain, it may be fatal. In the end, she said that the developing countries may face a problem of sewage blockage due to irresponsible dumping of PPE kits, face masks, etc.

Rahul Nainani discussed the consequences of waste, people are facing health issues, respiratory issues, skin ailments, etc. He laid attention that we are drowning in our own waste. He had explained that the use of plastic is not bad but the irresponsible disposal creates all the problems. Waste should be thought of as a resource, when a plastic product is designed, it should be in such a way that the end result would be recycled. Towards the end he explained the functioning of his firm Raddi Connect.

An initiative of



Under the aegis of



In collaboration with



NCCR



United Way Mumbai has organized a free week-long webinar series and panel discussion by national and international experts in collaboration with the National Centre for Coastal Research, Ministry of Earth Sciences Gov. of India.

KEY HIGHLIGHTS

- Discussion on global scenario of marine litter & micro-plastic waste in the oceans
- Latest research & technical know-how of Plastic Waste
- COVID19 pandemic and its effect on the oceans
- Eco-friendly alternatives of plastic and solutions to mitigate the marine litter & micro-plastic



This 4 day event was conducted on YouTube where **6300 people participated from all across the world** and were sensitised about marine pollution and importance of conservation

Figure 1 : Image of key highlights of the webinar series & Panel discussion

Mr. Ajay Govale then took over the session, he thanked the panelist for presenting their view points and insights on many essential topics which are crucial to conserve marine environment. The session had opened for questions and answers round.

Q - Are the existing policies of waste management in India comprehensive enough for the Covid- 19? Any amendments are required?

Dr. Mishra answered that policies need to be changed because the usage of plastic has increased. The level of enforcement required for implementation needs to be decided. Dr. Sampath added that disposal policies need to be modified in the context of Covid-19 waste. Dr. Mishra then added more to it that all medical waste should be treated scientifically.

Q - What are the top 2-3 priorities for the municipality to manage waste of Covid-19?

Mr. Pramod answered that first and foremost should be the storage of Covid-19 waste at household and then municipal should support with the further proceedings. It is also necessary to orient sanitation workers & safety measurements should be taken because the workers collect all sorts of waste including COVID 19. Existing facilities of bio-medical waste should be evolved. Lastly, Covid-19 bins should be placed so that the COVID 19 waste can be disposed of.

Mr. Govale concluded the session by acknowledging the contributions of the panelists and audience members. He said that the next steps should be to engage more stakeholders to support the right waste management practices and spread awareness regarding saving our oceans from Marine litter and COVID 19 waste. Towards the end of the session, several audience members thanked the UWM, NCCR and panelists for this event and gave their support to efforts to address the crucial issues regarding waste management in the You Tube comment section.

National Photography Competition

Photography is a powerful medium of expression that can be used to communicate strong positive messages about a subject. Therefore, a National photography competition was arranged to inspire the creation and dissemination of such positive imagery, which conveys the beauty and importance of the ocean and humankind's relation and to promote the conservation of marine diversity. The competition was free to enter and open to the Indian Nationals 18 years and above.

The photo competition had three thematic categories open for photographic submissions:

1. Coastlines & Seascapes
2. Human Impact on Oceans
3. Marine Wildlife

The entries were submitted electronically through the google form link which was provided on UWM's social media platforms in accordance with the competition guidelines and subject to the competition rules. **A total of 200 entries** were received under this competition from all across India in all categories.

The primary screening was conducted by Miss Minal Patel, Wildlife photographer, Ph.D. Scholar College of Forestry, ACHF, NAU and the secondary screening was conducted by Sumer Verma (Underwater Photographer). The entries were shortlisted on the basis of originality, composition, technicality, photography ethic and storytelling of the theme under which the photographs were submitted.

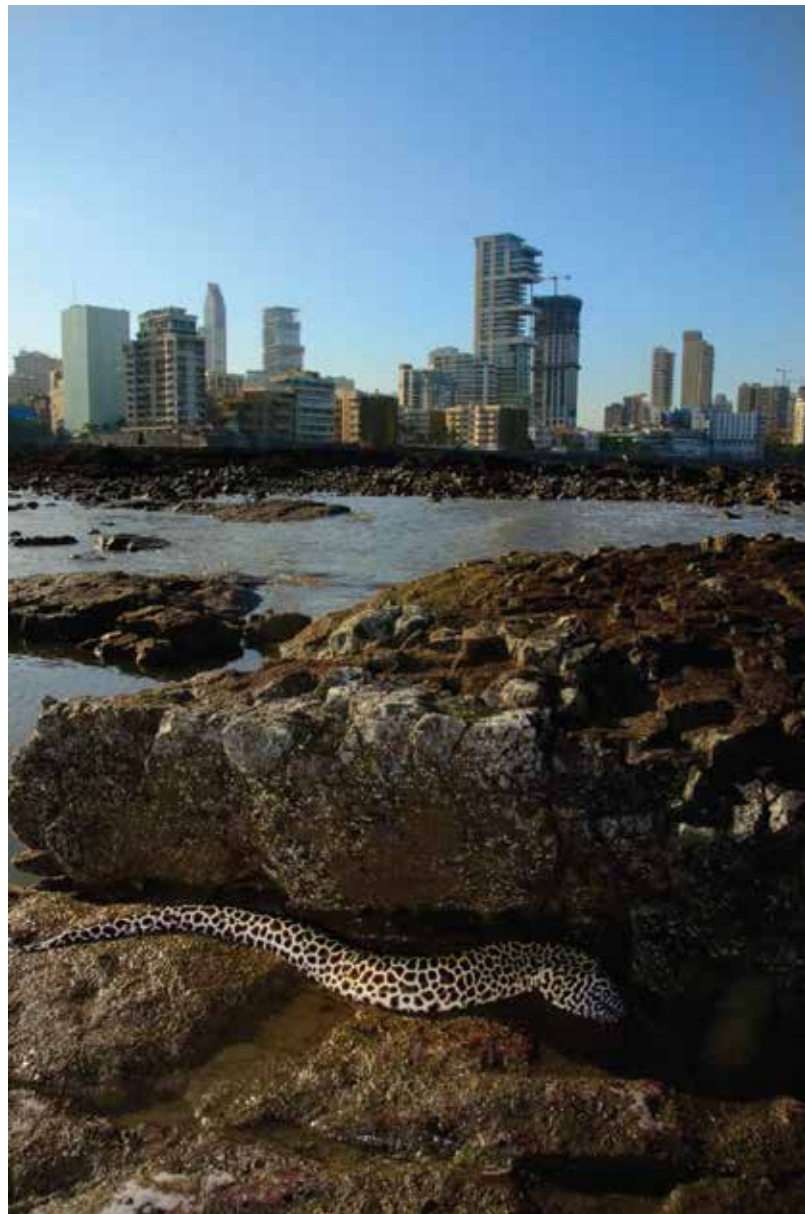
The final winners were declared by Sumer Verma, Dhirtiman Mukherjee and Dr. Parvish Pandya on 30th October 2020 on UWM's social media platforms.

Recognition and diffusion of the winning images and finalists were widely exposed throughout the social media platforms of United Way Mumbai and prizes were delivered to all three winners sponsored by NCCR. Here are the winning photos of each category with their story behind the photograph and our judge's comments on the winning photos.

Winners of National Photography Competition



Mr. Prathamesh Khedwan



FIRST WINNER in the category "**Coastlines & Seascapes**"

Title: "Unusual Cityscape"

He describes his photograph below:

"This image was shot at Mahalaxmi during extremely low tide in the afternoon on 15th March. While searching for nudibranchs and gastropods in intertidal zones, we came across a honeycomb Morey eel - a once in a lifetime experience - stranded in a shallow pool regurgitating his meal. Basically, they come to hunt for crabs and small fish during low tide but this time he got stuck and couldn't get back. Taking a cityscape with this exclusive species was amazing."



Mr. Satyabrata Mishra

FIRST WINNER in the category "**Marine Wildlife**"

Title: "The pain to attain motherhood"

He describes his photograph below:

Olive Ridley turtles are exciting and fascinating, always. So many questions are unsolved. Why do they come to the same place, in mass? How do they dig a hole in the sand with help of flippers; how do the tiny hatchlings come out from the 1.5 feet dip hole and how do the hatchlings know the direction of the sea? In this photo, a mother Olive Ridley turtle is digging a pit to lay eggs with help of her flippers in Rushikulya river basin, Odisha state, India



Mr. Udayan Shankar Pal

FIRST WINNER in the category "**Human Impact on Oceans**"

Title: "Kaali"

He describes his photograph below:

Kulasai Dasara is the grand festival of 300-year-old Kulasai Mutharammam Temple which is located at Kulasekharapatnam in Tamil Nadu. It is estimated that around 2.5 Million [25Lakhs] devotees visited the temple in the 2018 celebrations. According to practice, thousands of devotees wearing artificial hands to depict Goddess Kaali have bath in the sea after offering their prayer to the temple. Then they throw those artificial hands mainly made of plastic into the sea or nearby beaches. Local kids collect these hands for recycling. In this photograph, the boy was joyous for getting such two hands where I was happy that at least a pair of hands is going away from sea & helping the sea not being polluted by one more piece of plastic waste.

Research Paper Competition

Research paper competition was announced on the theme of Marine Pollution and Coastal Conservation on 22nd September 2020 on UWM's social media platform and a total of **32** national and international researchers participated. The competition was divided into two levels. In the first level, NCCR has screened the abstracts received from the participants and selected entries for the final round. The final round took place on **28th & 29th October 2020** on Zoom Application. The 15 selected participants including two International participants were divided

into two groups and were notified to present their research paper into presentation format on their scheduled day. Each participant was given 12 minutes to present their research paper and 3 minutes were dedicated for questions from the judges. Two international participants were given "Letter of Appreciation" enlightening their research activities and not included in judging the best paper award.

The final rounds were judged by Dr. V Sampath, Scientist- G & Advisor to MoES (Rtd), Former Director, NCCR & Dr. D. Mohan, Scientist F (Retd) National Centre for Coastal Research (NCCR). Results were declared on 2nd November 2020 on UWM's social media platform.

Honorable Judges of National Research Paper Competition



Dr. V. Sampath
Scientist G & Former Director



Dr. D Mohan
Scientist F (Retd), NCCR, MoES

Research Paper Competition Finalists and Winners



FIRST WINNER
Dhanusha Kawalkar,
Coimbatore

Coastal Karst Landforms: Tacit Geological Structures In India



SECOND WINNER
Soumya K, Kerala

Risk Assessment Of Biofilm Forming Bacteria On Plastic Debris From Popular Beaches Of Kerala



THIRD WINNER
Shiva Shankar, Andaman

Risk Assessment Of Andaman And Nicobar Islands In Response To Future Climate Change Eventualities



Shivali Deshmukh,
Aurangabad

Identification of Danger Zone And Damages of Kolhapur District Using Gis And Remote Sensing Technique



Pattanathu Rahman,
United Kingdom

Biosurfactants And Biocatalyst - Their Applications For Degrading Plastics In Ocean



Nivetha Janani,
Puducherry

The Gulf Of Kachchh Turbid Reefs Sheltering The Corals Under Climate Related - Temperature Stress



Jayita Bhattacharya,
Kolkata

Can Oceanic Fouling Be A Stress On Human Health?



Jazi Minimo, Phillipines

Ontogenetic Development Corollary In Dosage Variations Of Salmon Gonadotropin-Releasing Hormone To Silver Therapon (Leiopotherapon Plumbeus) Embryo



Shrestha Debnath,
Kolkata

Marine Pollution Impact, Prevention, Control Towards Sustainability



Pallavi Tyagi, Mumbai

Flood Risk, Mangrove Ecosystem and Coastal Megacities: To Assess the adaptation benefits of Mangrove Ecosystem to Urban flood Risk in the H/E ward of Mumbai



Subham Mahapatra,
Odisha

A study of Bycatch of Molluscs



Athira M, Kerela

Flood Resilience With Respect To Climate Change: Case Study Of Kuttyadi, Kozhikode District, Kerala

Research poster of First Winner: Dhanusha Kawalkar



Coastal Karst Landforms: tacit geological structures in India

Dhanusha J Kawalkar, Senior Research Biologist, Shirish S Manchi, Principal Scientist

Division of Conservation Ecology
Salim Ali Centre for Ornithology and Natural History
(Centre of Excellence under the Ministry of Environment, Forest and Climate Change, Government of India)

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ABSTRACT

Coastal karst landforms are the erosional and depositional structures of the limestone exposed along coastlines. As part of endogenous, the karst landforms depict the tectono-stratigraphic potential of a region. Most of these karst landforms are a resource to several unique coastal flora and fauna and have several critical geological applications. In paleo-environmental interpretation, tracking climate change, recognition of past catastrophic events, analysis of sea-level fluctuations, studies of biologic community interactions, and identifying geology karst landforms are India's geologically diverse coastline of 7518 km (estimated) and 5422.8 km (documented) stretches. Recently, we surveyed the coastal region of Interview Island (12°54'17"N and 92°42'31"E) of the Andaman and Nicobar Islands in the Bay of Bengal to document the diversity of the coastal karst landforms. It is the only single limestone island identified from India. Of the diverse array of coastal karst landforms known worldwide, we encountered karst on Interview Island. The coastal karst landforms include caves and patterns of erosion, uplift and subsidence patterns of the shoreline. The sea caves with unique flora and fauna of karst fresh-water lenses can be used to assess past and present sea-level positions. The Phylloids and limestone outcrops are unique microhabitats for the flora and fauna that occur on the exposed limestone at the coast. Bio-constructions such as corals and coral reefs are the sedimentary structures in the bio-mineralized marine taxa. These bio-constructions serve as natural monuments and habitats for the exceptional life at the coast. Therefore, we identify Interview Island as a tectono-stratigraphic potential area with diverse coastal karst landforms. Further, comprehending the geological and biological indicators and place of information by various karst landforms can allow us to assess natural events or geological events on the Indian coast. Furthermore, recognize the tectono-stratigraphic potential of coastal landscapes of the country.

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INTRODUCTION

Erosion of limestones and geomorphic evolution of exo-karsts (exposed karst surface) is usually associated with the process of calcium carbonate dissolution. These exo-karsts on marine coastlines are characterized by a tremendous range of rock textures and structures (Tabatabai and Klemm, 2013). Erosional and depositional textures, structures and the cohesiveness of these mosaic of landscapes, have several important applications. All over the world these structures are utilized for their high potential in paleo-environmental interpretation, tracking climate change, recognition of past catastrophic events, analysis of sea level fluctuations, studies of biologic community interactions, and even research in planetary geology (Tabatabai and Klemm, 2013). The Andaman arc has a long history of tectonic events (Epachi et al., 1979) because of its location in the proximity to a subduction zone west to Indonesian Archipelago (Awasthi et al., 2013; Kunt et al., 2010; Rajendran et al., 2007). The most recent tsunami of December 2004 following the mega-earthquake Mw 9.3 in the region caused around 2.8 meters of land uplift in the northern part of the Andaman arc (Bandyopadhyay and Carter, 2017). The Andaman Islands have episodic uplift and subsidence (Awasthi et al., 2013). As a result, on few islands such as Interview Island and Little Andaman Island, coral terraces are exposed above sea level (Bandyopadhyay and Carter, 2017). Further, we attempted to document the coastal karst landforms on Interview Island.

METHODS AND MATERIALS

The observations, concerning coastal karst forms, discussed here are island located in the North and Middle Andaman district (Fig. 1, 12°56'17"N and 92°42'31"E). Interview Island is a westernmost island of the island group and has an area of 131.4 sq. km (Murthy, 2007; Fig. 1). The Interview Island is the only identified carbonate island from India (Kawalkar and Manchi 2020). Being part of the North and Middle Andaman Islands, Interview Island had an uplift of around 2 meters during the mega-earthquake in December 2004 (Rajendran et al., 2007). The island belongs to the Archipelago series comprising of soft limestone formed of coral, soft calcareous sandstones and soft white clay with occasional bands of conglomerates and shell (Murthy, 2007). Interview Island harbors the oldest and best-developed series of terraces. The island coast was surveyed by the engine dingy and on foot as per the accessibility, to document the coastal karst landforms.

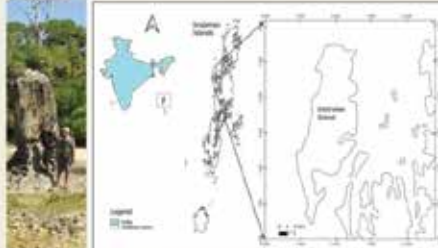


Figure 1. The geographic location of Interview Island in the Andaman Islands, India




Figure 2. Coastal Karst Landforms of the Interview Island (a) Phylloids (b) Bio-constructions - Corals, Giant Clam (c) Sea cave (d) Limestone outcrops on the phylloids (e) Coastal terrace




Figure 3. Coastal Karst Landforms of the Interview Island

RESULTS

We identified six types of coastal karst landforms on the coast of Interview Island namely, 1) Phylloids, 2) Limestone outcrops, 3) Bio-constructions, 4) Coastal Karst, 5) Coastal caves and 6) Coastal terrace.




Figure 4. Limestone outcrop on the west coast of Interview Island, Andaman and Nicobar Islands

DISCUSSION

Based on the findings of the past studies and during our recent visits, we scored the exposed limestone on the West and East coastline. These coasts have an array of eogenetic coastal karst features depicting diversity of rock surfaces and textures.

- **Phylloids** - They are jagged forms having penetrating holes which is mostly the result of action of micro-organisms i.e. cyanobacteria (Fig. 2a).
- **Limestone outcrops** - It is exposed bedrock because of the isostatic movements during last glacial period. They signify the past tectonic movements (Fig. 4).
- **Bio-constructions** - These landforms are very unique to the coastal landscape. Their geomorphology is mostly driven by the organisms such as gastropods. They are known to occur both in shallow and deep waters. E.g. Coral reefs, stromatolites, algal reefs (Fig. 2b,c,d).
- **Coastal Karst** - commonly found structure is the eogenetic rocks (younger than 1000 million years) are near to surface are found in tropical regions of the world. These forms usually occur as ridges, irregular pits and points (Fig. 3a).
- **Coastal terrace** - usually referred to as horizontal or inclined raised beach formed due to uplifts or coastal erosion. Interview Island is known for its best and well-developed terraces. Also, the recent tsunami of 2004 resulted in the 2m uplift of the Interview Island (Awasthi et al., 2013). Further, these terraces are repositories of past geologic events and sea level fluctuations (Fig. 2e).
- **Coastal caves** - It is a type of a pseudokarst and generally formed due to wave action. Coastal caves occur only on the rocky coast. They are of three types namely, (1) Sea caves (2) Flank-margin caves, (3) Littoral caves. The coastal caves are the indicators of fresh-water lenses (past and present) and major repositories of the paleo-environmental conditions. They also function as the habitats for coastal flora and fauna (Fig. 2c).

CONCLUSIONS

It is the first ever documentation of coastal karst forms in India. Understanding the diversity of coastal karst landforms and their significance we believe that the Interview Island has high tectono-stratigraphic potential. Further, comprehending the geological and biological indicators and place of information by various karst landforms can allow us to assess several secrets of geological events on the Indian coast.

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Research poster of Second Winner: Soumya K



Risk assessment of biofilm forming bacteria on plastic debris from popular beaches of Kerala

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ABSTRACT

Increasing marine litter, especially plastics, besides being recalcitrant material offers an ideal substratum for the development of bacteria and long term dissemination for microorganisms. Spread of antibiotic resistant bacteria is of great concern as for us human health is concerned. In the present study we have characterized biofilm forming bacteria on plastic debris from the popular beaches of Kerala and carried out the risk assessment of the isolates in terms of their antibiotic resistance. Plastic samples were collected using three methods such as Big Microplastic Suction Method (BMSM), Random Microplastic Assessment Project (RAMAP) and Marine Strategy Framework Directive (MSFD). A total of 208 bacterial strains were isolated from different types of plastics, polypropylene ropes, EPS sheets etc. Preliminary characterization of the bacteria revealed that most of them were Gram positive. Scanning electron microscopy images revealed the direct attachment of bacteria onto plastic samples collected from beaches, which is further confirmed by biochemical tests to determine the biofilm forming ability of the bacteria. Most of them had the ability to form biofilm. Fourteen bacterial isolates which showed the ability to form biofilms were tested by Kirby-Bauer method to determine the prevalence of resistance against 14 different antibiotics used in human therapy. Results revealed that the following percentage of isolates were resistant to various antibiotics: ampicillin (33.33%), cefazolin (26.67%), Colistin (16.67%), Cephalothin (16.67%), Ciprofloxacin (6.67%), Trimethoprim (13.33%) and Chloramphenicol (6.67%). None of the isolates were resistant to streptomycin, co-trimoxazole, ciprofloxacin, cefepime, gentamicin and tetracycline. The present study highlights that bacteria being a threat to marine flora, the plastic debris as beaches and coastal environments offer an ideal substratum for long distance dissemination of biofilm forming multi drug resistant bacteria which pose considerable threat to humans who frequent the popular beaches for recreation.

Key words: Marine litter, biofilms, antibiotic resistance

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INTRODUCTION

- The oceans provide important and valuable resources such as food, energy and water
- Changes in the marine ecosystem caused by anthropogenic influences such as plastic pollution can have a dramatic impact on global scale
- Macro (>25mm), meso (5mm-25mm) and microplastics (1mm -25mm) offer an ideal substratum for attachment for biofilm forming bacteria facilitating long distance transport of plastic associated bacterial flora
- Developing economies such as India are highly populated and subjected to high degree of environmental pollution
- Pathogen diversity (part of total biodiversity) is very high in the tropical regions such as India
- Beaches are popular tourist destinations and often subjected to serious plastic pollution
- Potentially pathogenic bacteria attached to the plastic surfaces might get disseminated to pristine environments elsewhere and cause health hazards in such environments

METHODS AND MATERIALS



Figure 1. Methods used for collection of plastic samples



Figure 2. Microbial colonies on plastic surface - Polypropylene rope



Figure 3. Bacterial colonies on Agar plate



Figure 4. Gram positive rod bacteria



Figure 5. Mixture plate with biofilm forming bacteria

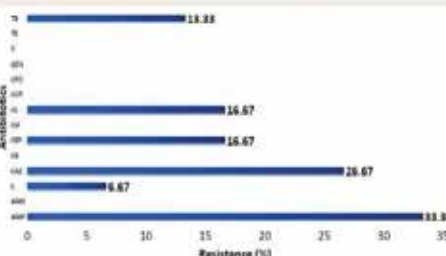


Chart 2. Prevalence of antibiotic resistance among bacteria isolated from plastics on the beaches

RESULTS

- A total of 108 isolates were obtained from different types of plastics with different colony and morphological characteristics. Most of them were Gram positive bacteria (Figure 4)
- The images of Scanning Electron Microscopy revealed the presence of bacterial biofilm associated at different types of plastics like polypropylene rope, secondary plastic HDPE, EPS ball and secondary plastic polythene bag (Figure 2)
- Some of the bacteria had the ability to form biofilm. Around 13.11 % of them were Strong biofilm producers (Figure 5 & Chart 1)
- Highest prevalence of antibiotic resistance was observed among isolates for ampicillin (33.33%) (Chart 2)

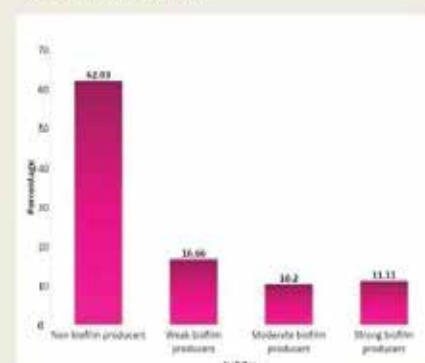


Chart 1. Percentage incidence of biofilm forming bacteria isolated from plastics at various stations

DISCUSSION

- The study was focused on bacterial flora associated with the macro, meso and micro plastics from the popular beaches of Kerala. The scanning electron microscopy images revealed the direct attachment of bacteria onto plastic samples collected from beaches. Most of them were Gram positive organisms.
- Antibiotic resistance observed among isolates against ampicillin (33.33%), Cefazolin (26.67%), Colistin (16.67%), Cephalothin (16.67%), Trimethoprim (13.33%) and Chloramphenicol (6.67%) and totally susceptible against amoxicillin, co-trimoxazole, ciprofloxacin, cefepime, carbapenem, gentamicin and tetracycline (Chart 2)
- Future recommendations:
 - Profiling of bacterial assemblages from plastics using high-throughput amplicon sequencing (16S rRNA Microbial community analysis)
 - Conduct study to understand the survival of plastic borne pathogens in the marine environment using microcosms
 - Delineate the molecular mechanisms of drug resistance and virulence among the plastic associated bacteria

CONCLUSIONS

- Scanning Electron Microscopy (SEM) analysis and other analysis revealed the presence of rich bacterial flora on encountered plastics at different beaches
- Some of them had the ability to form biofilm and shown resistance to antibiotics like ampicillin, cefazolin, colistin, cephalothin etc.
- It highlights the role of plastic as a novel and potential route of dispersal of MDR pathogens and their antibiotic - resistance genes in the marine environment, having impacts on animal and human health, until their final interaction with the human food chain

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Research poster of Third Winner: Shiva Shankar

Risk assessment of Andaman and Nicobar Islands in response to future climate change eventualities

ABSTRACT

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INTRODUCTION

Andaman and Nicobar Islands (ANI's) is the maritime island territory of India in the Bay of Bengal sandwiched between the peninsular India and Myanmar, speeding like a broken necklace trending in a north-south direction with a geographical extent of 8293 Sqkm (Figure 1). Bounded by the coordinates (92° to 94° East and 6° to 14° North), it is an archipelago with > 500 islands/islets, stretching over 700 km. They are closer to the Indonesian landmass than to mainland India (1200 km), with the southernmost island (Great Nicobar) only 150 km from Sumatra and the northernmost landfall (Dieloul, North Andaman), 190 km south of West Myanmar.

Disaster Vulnerability checklist

- ✓ Cyclones.
- ✓ Floods.
- ✓ Droughts.
- ✓ Land degradation.
- ✓ Runoff.
- ✓ Soil erosion.
- ✓ Shallow landslides.
- ✓ Epidemics.
- ✓ Earthquakes.
- ✓ Volcanism.
- ✓ Tsunami, and
- ✓ Storm surge.

Meteorological Profile

Zone: Tropical
Temperature: 24 °C to 28 °C
Relative Humidity: 80%
Monsoon: South West Monsoon (May to September, 76.36%), North East Monsoon (October- December, 22%)
Rainfall: 3500mm/ year
Rain Days: 143

Objective: Demarcation of vulnerable zones of ANI's to sea level rise due to climate change as Very high, High, Moderate and Safe

METHODS AND MATERIALS

The following materials were used to comprehend the objective of the study. Landsat satellite data products via, P134R050, P134R051, P134R052, P134R053, P134R054, P134R055, P133R051, P133R052, P133R053, P133R054, P133R055 were downloaded from www.earthexplorer.usgs.gov. ASTER-GDEM was downloaded from www.earthexplorer.usgs.gov and geology map was procured from geological Survey of India. All the aforementioned materials were processed in ArcGIS Desktop 10.5 using the methodology (Figure 2). All the inputs and outputs were projected and transformed to UTM Zone: 46 North, WGS84 datum.



Figure 2. Map of Study Area



Figure 2. Map showing vulnerable zones of Abdis for sea level rise due to climate change



Figure 2. Methodology



Figure 4. Map showing coastal villages of South Andaman vulnerable to sea level rise due to climate change

		North & Middle Andaman District		Total Pop	
South Andaman Island District	Total Pop	Aus Island	2	Neelbar District	Total Pop
		Baratang Island	5086		
		Carbor Island			
Flat Bay Island	5	East Island **	2	Car Nicobar Island	17842
Havelock Island	6335	Intervale Island	13	Chowra Island	1279
Little Andaman Island	18823	Land Fall Island *	6	Kanaka Island	3668
Neil Island	3646	Middle Andaman Island	25771	Namany Island	1370
North Bay Island	347	North Passage Island	3	Great Nicobar Island	8946
South Andaman Island	29907	North Andaman Island	42342	Kalchul Island	2065
		Port Blair Island	26	St. Michael Island	261
		Long Island	1351	Phule Mhew Island	30
North Sentinel Island	15	South Island	60	Tilang Chong Island	88
		Stewart Island	2		
Total	238342	Strait Island	89	Total	36842
		Total	75732		

Table 1. Human Inhabited Islands of AOTs as per 2001 census of India

RESULTS

ANI's being a cradle of multi-disasters is also vulnerable to sea-level rise due to climate change. Out of >500 islands only 31 are inhabited by human being. According to 2011 census of India more than half of the islands population is residing in south Andaman, around Port Blair (Table 1).

vulnerable zones of ANI's to sea level raise due to climate change is depicted in figure 3. Also, village-wise vulnerable zones of densely populated south Andaman is illustrated in figure 4.

DISCUSSION

ANI's (notified as seismic zone V) are at the closest proximity of subduction zone of Indo-Australian plate and Eurasian plate. The Indo-Australian plate moves at 15±3mm/year in the NE direction (Mallik et al. 2019). The NE-moving Indo-Australian Plate currently subducts beneath the Eurasian Plate. The subduction rate varies from 5.7, 5.0 and 3.9 cm/year in Java, Sumatra and near the Andaman Island, respectively (McCarthy, 2009).

26th Dec 2004 mega tsunamigenic earthquake resulted in the rupturing the Andaman-Sunda plate 4300Km (with an average rupture speed of 2.5 to 3 km/s) in about 8 to 10 minutes. Resulting in up to ~6 m of bottom subsidence and ~10 m of uplift parallel to the rupture and about 100-150 km wide across the subduction area (Malik et al. 2019).

The landmass subsided zones (~1.5m) of south Andaman (Shiva Shankar et al. 2019) are vulnerable to sea level rise due to climate change (Table 2).

SNo	Village name	Area (Ha)	SNo	Village name	Area (Ha)
1	Chidiyatapuri	27.83	15	Ograbraj	32.4
2	Manjeri	11.13	16	Spigheht	136.5
3	Wandoor	28.89	17	Garacharma	27.7
4	Choudhari	12.52	18	Dolligunj	30.4
5	Portmout	3.82	19	Minne Bay	1.3
6	Hobdipur	6.21	20	Ward XVII	80.5
7	Balu Ghat	11.19	21	Nayasarhar	1
8	Mohwa Dera	20.83	22	Bimbilatan	84.5
9	Tinur	19.43	23	Taylerabad	51.5
10	Bamboo Flat	46.11	24	Muslim Basti	16.3
11	Mathura	6.27	25	Kanyaspuram	49
12	Narmanahar	15.77	26	Govindapuram	46.4
13	Dundas Point	9.91	27	Stewardgunji	5.5
14	Mitha Khari	111.48	28	Wimberlygunji	

Table 2. Coastal villages of South Andaman fairly vulnerable to sea level rise due to climate change

CONCLUSIONS

The landmass subsided regions of ANI's are more vulnerable to sea level rise due to climate change. Since the subsided zones are presently 1.5m below the mean sea level. Moreover, Land reclamation from the subsided zones are on the rise in south Andaman since it is in private ownership. More than 50% of the islands population is residing in Port Blair, South Andaman and it is most vulnerable to submerge in the eventuality of sea level rise due to climate change. Further, sea level rise due to climate change will trigger biological disasters like out break of vector borne diseases via., Malaria, Dengue, Chikangunya, etc.

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Conclusion:

Around 7000 participants were sensitized and made aware of the current trends in the field of marine and micro-plastic research. All the activities received a positive response and feedback across the globe. United Way Mumbai is thankful to NCCR for this opportunity of collaboration and we look forward to more fruitful collaborations in the future.

All the online webinars you can find here

Topics	Youtube Links
Microplastics: An emerging threat to marine environment & biodiversity by Dr. Mahua Saha	https://youtu.be/aFsqecuCRPk
Microplastics in the Arctic Environment by Prof E. V. Ramasamy	https://youtu.be/uq0312nVaw8
Marine Litter – Turning the tide & Indo-UK program on Marine Litter & Micro-plastic by Mr. Peter Kohler & Dr. Danja Hoehn	https://youtu.be/3sKVmcSq3nc
Micro-plastic in the Global Oceans by Prof. Bhavani Narayanswamy	https://youtu.be/iYqp3_iOx8A
Panel Discussion on Unmasking the effects of COVID 19 waste on our oceans	https://youtu.be/xWwevhi5rS4

Semi-Finalist in “Marine Wildlife” Category



Mass Gathering
by Souvik Mukherjee

The Wondering Crab
by Abhishekh Parichha



Recycled Homes
by Abinaya Kalyanasundaram

Mesmerizing Coral Polyps Galaxea sp.
by Dr. Sudhanshu Dixit



Semi-Finalist in “Human Impact on Oceans” Category



Sorry

by Chandru Manickavasagam

Hooked

by Shinto K Anto



Alien Shore

by Arnab Chattopadhyay

Semi-Finalist in “Coastline & Seascapes” Category



The Magic of Bioluminescence
by Tushar Lad

Chasing Tides
by Nikhil Thomas



Waves
by Udayan Shankar Pal



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