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Revolutionizing Coral Reef Surveys:

INOS's Advanced Techniques

TOMSY2022: Building Synergy between Academia, Industry, & Government

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Collaboration for Progress: Hidrokinetik's Partnership with INOS

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Diving into the Depths of Malaysia's Luconia Shoal National Park

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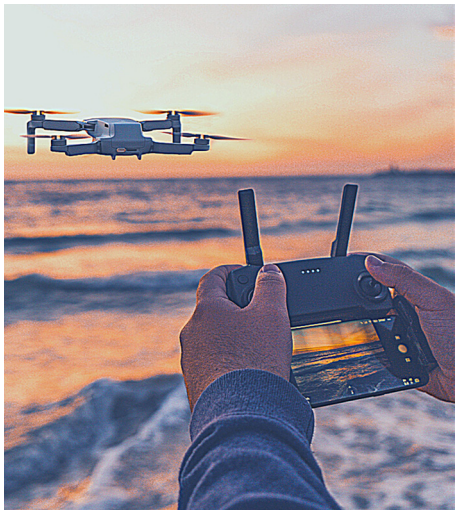
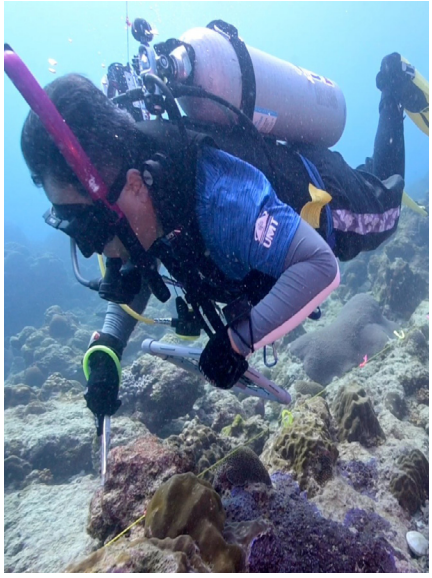
Revolutionizing Coral Reef Surveys:

INOS's Advanced Techniques

Written by:
Zainudin Bachok & Siti Tafzilmeriam Sheikh Abdul Kadir





Field surveys at reef ecosystems involve SCUBA diving, as well as the use of innovative techniques such as coral video transects (CVT), stereo-fish underwater video (Stereo-FUV), multi-beam echo sounders (MBES), drones, and USBL underwater positioning. Omic technology, fatty acid markers, stable isotopes, and DNA methods are used to analyze living tissues. To enhance this research, INOS also maintains well-maintained coral microcosm systems providing opportunities to perform global change simulations under controlled conditions.

INOS has also contributed significantly to the coral reef research community by developing a new survey method using digital waterproof cameras. This affordable and more user-friendly method has been officially recognized as the most efficient survey method in Malaysia. INOS also works closely with the Marine Parks to produce new indexing systems to measure and monitor coral health, which is now being used nationwide as a baseline assessment of coral community structure crucial for identifying reef areas susceptible to stress conditions.

To efficiently manage and protect large-scale reef ecosystems, studies on their ecological communities require a satellite or airborne images with excellent spatial resolution. Significant time and resources in collecting data, mapping and monitoring vast ocean areas can be saved through the use of drones - they provide better spatial, temporal, and radiometric resolution than any airborne or satellite platform.

All information is mapped through GIS approaches, which create, manage, analyze, and categorize all data types. Maps of different layers, such as coral reef and associated organisms distribution maps, detailed bathymetry and seafloor maps are produced. Location data is integrated with all types of d escriptive information to help understand patterns.

Director's Note :

SCIENTIFIC JOURNEY WITH IMPACTFUL OUTCOME

WE WANT TO ANNOUNCE OUR FIRST START-UP COMPANY, OCEAN HYDRO SDN. BHD.

All praise is to Allah, and may peace and blessings be upon Rasulullah.

Each year is an opportunity for us to perform our best to answer critical needs of our nations relating to the ocean and marine environment. 2023 will be another step for INOS as we pursue for a stronger network with various stakeholders. Our new multi-user lab will allow various faculties, industries and communities (citizen scientists) to co-design their scientific journey with a more impactful outcome. This will complement our new strategic approach, where we focus on merging research with innovation and technology across several vital aspects, from ocean prediction to marine conservation.

HICOE FLAGSHIP

We are also excited about our new research program under the HICOE flagship, which will continue to bring us forward towards the frontier in Malaysia's marine research. Coastal resilience, marine conservation, and ocean governance will be the robust framework covering mangroves to the coral reefs, ocean prediction, and societal impacts.

We want to announce our first start-up company, Ocean Hydro Sdn. Bhd. that would serve the industrial and national needs in ocean data solutions through our innovative in-house products of ocean forecast and prediction.

We look forward to the future, implementing our new strategic framework to boldly explore our “unknown” oceans for the benefit of the nation.

TOMSY2022:

Building Synergy between Academia, Industry, and Government

Written by: **Azida Abdullah**

How to measure the success of a scientific conference? If based on the crowd, it would be hard to dispute the success of the 3rd Tropical Ocean and Marine Sciences International Symposium (TOMSY2022) held at UMT Conference Centre (UMTCC) from 6-7 November 2022 and organized by INOS. Drawing more than a hundred this year, participants have watched this biannual scientific event, which began in 2018, grow with the participation of industry partners and marine science communities, such as Hydrokinetik Technologies Sdn. Bhd., Marine Coastal and Delta Sustainability for Southeast Asia (MARE), Institute of Oceanography and Maritime Studies (INOCEM) of IIUM, and UNIKL Lumut.

As the leading university in marine science in Malaysia, collaboration with local industries serves as a great platform to enhance UMT's presence in becoming more relevant in marine-related industry. This aligns with UMT's niche area to boost scientific research by applying advanced technology to fulfil industrial needs.

The MARE project, co-funded by the Erasmus+ Programme of the European Union, aims to provide support to academicians in Asian higher education institutions (HEIs) to design and implement new and improvised syllabus of courses related to the marine environment and sustainability. The project highlights the issue as the marine ecosystem and sustainability have become an environmental governance challenge in the Asian partner countries.

The 3rd TOMSY2022 serves as a platform to share knowledge in marine scientific research with the theme "Ocean Research for a Sustainable Future', which is relevant to the global agenda of achieving a sustainable and healthy ocean, as advocated by SDG14 and the UN Ocean Decade. TOMSY2022 has provided a high-impact research discourse that can be further translated or transformed into scientific-based management measures to achieve the global goal of a healthy ocean for a healthy planet.

The event began with a keynote speech by Prof. Dr Biswajeet Pradhan, the Director of the Centre for Advanced Modelling and Geospatial Information Systems (CAMGIS) of the University of Technology Sydney, Australia. Prof Pradhan highlighted on the rapidly attention-gaining machine learning and spatial intelligence application. Due to their promising results, less time are comparatively spent on getting reliable data than the more laborious manual monitoring.

The conference was followed by the plenary talk by Dr Salvatore Aricò from UNESCO's Natural Sciences Sector, which discussed the challenges in bridging science to policy implementation.

He deliberated on how the scientific community and policymakers may collaborate to facilitate science-based advice for implementing the SDGs.

While the other two plenary speakers are Prof. Shing Yip (Joe) Lee from The Chinese University of Hong Kong with his talk entitled; 'Mangrove Microphytobenthos – A Neglected Driver of Estuarine Trophodynamics', and Prof. Dr Wan Izatul Asma Binti Wan Talaat, the Head of Centre for Ocean Governance of INOS, entitled; 'The Role of Ocean Governance in Translating Science into Policies – Accelerating the National Delivery to the Ocean Decade'.

On behalf of the organizing committee, we would like to thank all participants for joining us. We hope they experienced a deep dive into marine research topics while creating good synergy between the academia, industry and government.

Collaboration for Progress:

Hidrokinetik's Partnership with INOS

Visit to Hidrokinetik Sdn. Bhd. laboratory.

Written by: **Azizi Ali**

In recent years, the Hidrokinetik Group has established itself as a leading player in providing hydrographic and geophysical surveys, marine engineering, and technical consultancy services in South-East Asia. The company began in 2013 with the establishment of Temasek Engineering, a specialist in marine sonar and telecommunication equipment. Since then, it has continued to expand, forming Temasek Allied Engineering in 2016 and Temasek Hidroteknik Sdn Bhd in 2018, which provides comprehensive hydrographic and geophysical survey services. In 2019, Hidrokinetik Technologies Sdn Bhd was established to focus on the design, development, and manufacture of autonomous unmanned surface vessels (USVs). Together, Temasek Hidroteknik Sdn Bhd and Hidrokinetik Technologies Sdn Bhd constitute an effective dynamic duo, offering expertise, equipment, and innovative solutions to clients' project needs.

The Hidrokinetik Group works closely with INOS and UMT generally on various hydrographic, geophysical survey, and consultancy projects. One notable collaboration with UMT is in the field of ocean solutions through scientific research combining new technology and innovative approach, such as in the excavation of shipwrecks in Bidong Island. These collaborations help to keep the company and students informed of the latest developments and advancements in oceanography and hydrographic technology.

Meanwhile, to support maritime activities and prepare for hazards and disasters, the Malaysian Marine Forecast System (MFAST) has been developed by the First Institute of Oceanography (FIO) and UMT. Unlike the commercial Ocean Forecast Systems (OFS) which often lack accuracy at a local level, MFAST is designed to provide high-resolution forecast data. It is the first OFS in Malaysia to develop high-resolution ocean forecast data based on a wave-tide-circulation coupled model established by the Laboratory of Marine Sciences and Numerical Modelling (MASNUM), FIO.

MFAST provides up to 5 days of forecast data of ocean current, temperature, surface wave and wind between 3 °S – 15 °N and 96 – 123 °E at 3 hours intervals. This comprehensive, continuous, and reliable forecast data can be used for various marine-related activities such as maritime surveillance, navigation, search and rescue operations, recreation, and scientific exploration in the region.

The existence of MFAST has also increased cooperation with Hidrokinetic and other marine-related industries, such as oil and gas companies, who can use the forecasted in their daily operations. The collaboration between Hidrokinetik and INOS is expected to take MFAST further to be widely used unlimited to only the oil and gas industry or government agencies (such as the Fisheries, Meteorology, Marine departments). In recognition of Hidrokinetik's capability and competency in oceanography surveys, a memorandum of agreement was signed to establish a start-up company in the hope of developing innovations in various oceanographic disciplines that meet the needs of the society.


Collaboration MBES survey between INOS and Hydrokinetik for MBES Survey.


MBES system used in collaboration work between INOS and Hydrokinetik.

Industrial collaboration exchange between the Director of INOS and the Director of Hidrokinetik Sdn. Bhd.

Terengganu's Turtle Tourism:

Striking a Balance Between Conservation and Tourism

Written by: **Syamsyahidah Samsol (SEATRU)**

One of the places offering interactions with wildlife is located on the East Coast of Malaysia, Terengganu, which is famously known for sea turtles landing and nesting beaches in Peninsular Malaysia. Terengganu is more accessible to the public with sea turtle watching activities which intrigue local and international tourists to experience once-in-a-lifetime interaction with the sea turtles.

The tourism industry contributes significantly to Malaysia's economic growth due to the abundance of marine resources at beaches and islands that act as the key attractions for Malaysia's coastal recreation tourism (UNTWO, 2018).

Terengganu Turtle Tourism is an ecotourism concept that utilises natural areas to protect environmental resources, preserve biodiversity, and improve local communities' livelihood. Sea turtles are attractive in photogenic ways and relatively human-safe, and their predictable behaviours add credibility as a tourist attraction.

The sea turtles' life cycle is enigmatic, complex, and perplexing to humans to extent of enticing even those who has not been exposed to the natural environmental values. Hence, many are intrigued and interested in having close interactionsl with the iconic animal that makes Terengganu Turtle Tourism a popular and growing tourist activity.

Since the International Union for the Conservation of Nature (IUCN) has classified six out of seven sea turtle species as endangered or critically endangered globally in its IUCN Red List of Threatened Species, turtle-related tourism should be the nation's topmost priority in sustaining ecotourism.

Despite the Terengganu Turtle Tourism helps inflate the local economy tremendously, there are significant threats caused by the interactions of the tourists with the sea turtles that are significantly harmful to the animals. Examples are riding or feeding turtles, disturbance while snorkelling that caused habitat loss and severe injuries due to boat strikes.

Due to these concerning issues, the Sea Turtle Research Unit (SEATRU) of INOS, UMT, has taken the initiative to start assessing the health conditions of the sea turtles roaming Teluk Dalam, located on the northeast of Pulau Redang. This area has been determined as one of the hotspots for swimming, snorkelling and even turtle feeding for the tourist.

The research activities involve sea turtle capture by rodeo technique, basic external assessment, barnacle removal, weighing and size of body measurements, and blood withdrawal for the health analysis. This initiative also aims to stimulate environmental awareness among tourists and economic growth of the locals while achieving SDG14 – life under water.

Diving into the Depths of Malaysia's Luconia Shoal National Park

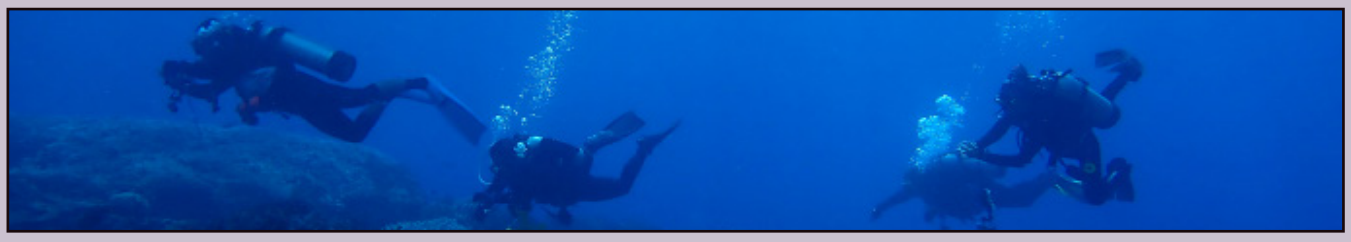
Written by: **Mohd Safuan Che Din**

INOS, UMT had recently completed a consultancy project for Chemsain Konsultant Sdn. Bhd. on the Environmental Impact Assessment (EIA) Study for FDP Sk316 Gas Kasawari CO2 Sequestration Project, Sarawak, assigned by Petronas Cari Gali. The project was carried out at the Luconia Shoal National Park (LSNP), one of Malaysia's largest marine parks, located approximately 180 km from Bintulu, Sarawak.

The LSNP, which was gazetted as a marine national park in 2018, covers an area of approximately 1,011,772 hectares and is known for its diverse coral reef communities, including atolls, reef platforms, and patch reefs. The project was led by Assoc. Prof. Dr Saifullah Arifin Jaaman, who also served as the marine megafauna (MM) survey researcher. Three other researchers were involved in the coral reef communities survey (CRCS); Dr Mohd Safuan Che Din, Prof. Zainudin Bachok, and Dr Lim Chuin Siew.

The project consisted of two major components: a marine megafauna survey, including the assessment of whales, dolphins, porpoises, sea turtles, and seabirds, and a coral reef communities survey (CRCS) which comprised five biological components, including hard coral, soft coral, macroalgae, macro-invertebrates, and reef fish. The survey was conducted using a vessel-based approach and data collection via SCUBA diving techniques. A total of 15 days was required to complete the 326km-transect line for the marine megafauna survey and 18 sampling points for CRCS in Hayes Reef (Terumbu Lang Ngindang), Unknown-K5, and Comus Shoal (Beting Merpati).

The survey was conducted to evaluate the current status of marine fauna and flora in LSNP before implementing the pipeline project of Gas Kasawari proposed by PETRONAS. INOS is proud to have played a role in this important project and looks forward to continuing its work in marine conservation and sustainability.



A Terengganu Native's Quest to Save the Sea Turtles

Written by: **Mohd Uzair Rusli**

The conservation efforts for sea turtles in the country mainly focus on understanding the behaviour and role of these animals in the environment. However, unlike the native daughter of Kuala Terengganu, Dr Long Seh Ling brings a new dimension to sea turtle conservation efforts in this state, which is famous for its history of leatherback turtles. According to Dr Long, to save sea turtles, we not only need to understand the sea turtles, but we also need to understand the communities that are connected to sea turtles. This dimension is crucial because conservation efforts for sea turtles must be inclusive, so it is inappropriate to ignore the livelihood of the local communities.

In the state of Terengganu, sea turtle conservation efforts along the 244 km coast of the state involve beach patrolling method. The system practised for more than half a century has proven to help the government collect sea turtle eggs during the nesting season. This method also brought good returns to the egg collectors at that time.

Therefore, before amendments to sea turtle regulations were made to ban public and commercial sales, the patrolling beach system certainly needs vigilant research. This issue led Dr Long to work with her supervisor, Associate Professor Dr Jarina Jani, to unravel the causes and effects of changes in sea turtle nesting beach supervision systems.

Born and raised in Kuala Terengganu, Dr Long often heard stories about hawksbill sea turtles from his parents. He still remembers being taken to Rantau Abang as a child, but his generation can no longer see hawksbill sea turtles, which have decreased since the early 1990s.

After completing undergraduate studies at UMT in Conservation and Biodiversity Management, she continued her studies at the University of Exeter in Conservation and Biodiversity. Before returning to Malaysia, she gained experience with the Sea Turtle Conservancy (STC) in Tortuguero, Costa Rica as a research assistant. Although she is from Terengganu with the highest sea turtle population in Peninsular Malaysia, she admits that she had never witnessed sea turtles laying eggs prior to Costa Rica.

In Tortuguero, conservation efforts in place since the 1950s have resulted in almost 300 sea turtles landing along the 8-km beach on one night during the peak of the nesting season. This experience was significant for her to learn about sea turtle nesting monitoring methods. She also witnessed first-hand how the local community could earn a side income through eco-tourism products such as watching sea turtles lay their eggs. To reduce the impact of this eco-tourism activity on nesting turtles, the Turtle Spotter Project was created. Only authorized rangers patrol the beach and inform the tour guides, with tourists in tow. Tour guides are not allowed to crowd the beach with tourists searching for landing turtles, which could disturb the nesting turtles.

This experience of travelling to foreign countries inspired her to start the Turtle Stop Project with Daniel Quilter in Pulau Perhentian. It also motivated her to fight for sea turtle conservation and see the local community's economic development. Coinciding with recent amendment to the Terengganu Turtle Enactment in 2021, Dr Long believes that Terengganu is now more ready to make sea turtle-based tourism a significant attraction.

Dr Long received a Special Director award at the Institute of Oceanography and Environment (INOS) student award ceremony in conjunction with UMT's 20th Convocation on December 10, 2022. This award was significant for her to commemorate the challenges she had to endure while pursuing her Ph.D.

Throughout her doctoral study at INOS, she was blessed that she was surrounded by close friends and researchers who were very supportive. She took advantage of many opportunities to participate in various programs and volunteer in community programs. Dr Long Seh Ling is now serving with Lang Tengah Turtle Watch (LTTW) as a conservation sea turtle project manager in Terengganu state.

Saving Lives with Science:

INOS Experts Assist in Kemaman Search and Rescue

The involvement of three INOS oceanographers in the search and rescue (SAR) operation for a missing child, who was feared to have drowned near the Kuala Kemaman river on 15 November 2022, testifies to the significance of oceanography expertise in critical situations. The three oceanography experts were Shukri Arsad, Che Mohd Kamarul Anuar Che Abdullah and Tan Hock Seng.

The Director of the Terengganu Fire and Rescue Department, Md. Hilman Abd. Rashid acknowledged the necessary service of the oceanography experts from UMT in the SAR operation in order to identify the location of the victim due to the constantly-changing and unpredictable water movement. The river mouth was known to have complex currents with the convergence of seawater and river, making the SAR operation difficult without the knowledge of oceanography expertise.

Oceanography encompasses the ocean's physical, chemical, biological, and geological aspects. It involves the study of ocean currents, waves, tides, and the movement of water masses, which are all crucial in understanding the dynamics of the ocean and the potential dangers it poses. In the case of SAR operation, INOS oceanographers can provide valuable information on the movement of water, which can aid in identifying the victim's location.

Furthermore, the involvement of these oceanography experts in the SAR operation has also highlighted the importance of collaboration in handling critical and emergency situations.

Sunken Ships, Rising Ecosystems:

The Artificial Reef Project in the Waters of Perhentian and Susu Dara Islands

Written by: **Azizi Ali**

Artificial reefs from seized foreign vessels is an innovative idea by repurposing abandoned or seized ships and use them to create new habitats for marine life. These reefs can be created by sinking the vessels in designated areas and allowing coral and other marine organisms to grow on and around them. This helps to improve the local marine ecosystem and provides a new diving and snorkelling destination for tourists.

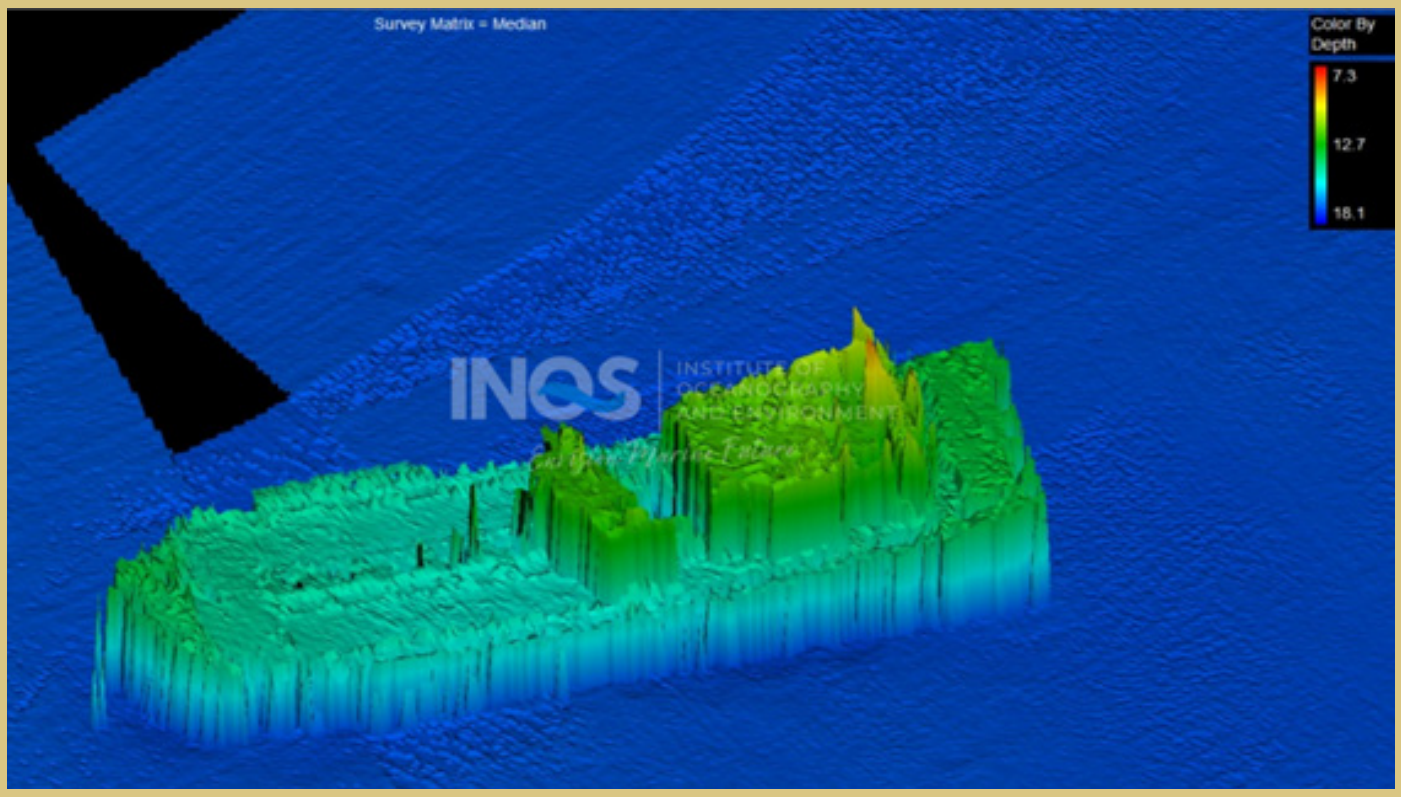
Additionally, seizing vessels can deter illegal fishing and smuggling operations, as the sunken ships can act as physical barriers. Therefore, creating artificial reefs from seized foreign vessels can provide a win-win solution for both the environment and the local economy.

That is why INOS and the Southeast Asian Marine Resource Institute (ISMAT) are working on a mapping project of seized vessels in the waters of the Perhentian and Susu Dara Islands.

Dr. Azizi Ali leads this project from the Ocean Mapping and Geospatial Research Group, INOS and Mr. Muhammad Amirullah from ISMAT. The mapping were conducted using a multi-beam system from July 3rd to 7th, 2022.

This project was aimed to determine the status of seized vessels anchored as artificial reefs from 2020 to 2021. INOS was responsible for carrying out the mapping.

This is an important project to ensure that the waters of the Perhentian and Susu Dara Islands remain healthy and preserved for future generations. We hope that the results of this project will provide the insight needed to take the necessary actions to protect our marine environment.



Marine Research Management Course 2022:

A Catalyst for Change

The Marine Research Management Course 2022 was a great success. The course held on the 23rd September 2022 was attended by naval officers from the Royal Malaysian Navy.

Throughout the course, participants had the opportunity to learn about the latest techniques and technologies used in marine research and best practices for managing and leading research teams. They could also work on real-world research projects under the guidance of experienced marine researchers, which allowed them to apply what they learned in a practical setting.

One of the most valuable aspects of the course was the opportunity for participants to link with other professionals in the field and learned from the experiences of seasoned marine researchers. This provided valuable insights into the challenges and opportunities of working in the marine research field and helped participants develop a broader understanding of the industry.

Overall, the Marine Research Management Course 2022 was a great success and provided participants with valuable skills and knowledge in marine research management. We are excited to see the impact this training would have on the participants' careers and the marine research industry as a whole. We look forward to hosting similar events in the future.

INOS Staff Lead Innovative Drone Course for Agriculture

The Basic Course of UAV (Drone) Control in Agriculture, organized and attended by staff from the Faculty of Fisheries and Food Sciences, UMT was held on August 16-17, 2022, at the Satellite Oceanography & Marine Informatics Laboratory INOS. Staff from INOS served as facilitators during the two-day course, which emphasized the introduction of drone control, drone flight laws, and image processing.

The use of drones in agriculture have rapidly increased in recent years, as they offer a cost-effective and efficient way to collect data and monitor crops. The course aimed to provide participants with a comprehensive understanding of the basics in drone control, including safety procedures, navigation, and basic troubleshooting.

Participants also had the opportunity to learn about the laws and regulations governing drone flight and how to obtain the necessary licenses and permits for agricultural drone operations. The participants also gained knowledge about image processing, which is crucial for extracting useful information from images and videos captured by drones.

The course also included hands-on training sessions, where participants could operate drones and practise image processing techniques using real-world data. These sessions provided valuable practical experience and helped participants to develop the necessary skills to effectively operate drones in an agricultural setting.

In a nutshell, the Basic Course of UAV (Drone) Control in Agriculture was a great success by providing participants with a solid foundation in drone control, related laws and regulations and image processing. We are excited to see the impact this training will have on the the agricultural industry and look forward to hosting similar events in the future.

Ortho-Images like Never Before

The viva examination for the Masters of Science program has ended, and we are excited to announce that Nurul Hidayah Binti Mat Zaki (P4709) has successfully defended her thesis. Her thesis topic was "Assessing Optimal UAV-Data Pre-Processing Workflows for Quality Ortho-Image Generation to Support Coral Reef Mapping."

Coral reefs are facing increasing threats from human activities, and the use of unmanned aerial vehicles (UAVs) in coral reef mapping has become increasingly popular as they provide a cost-effective and efficient way to collect data and monitor coral reefs. However, the data collected by UAVs need to be pre-processed before they can be used for coral reef mapping.

Nurul Hidayah's thesis aimed to evaluate different UAV-data pre-processing workflows to determine the best for generating high-quality ortho-images that can be used for coral reef mapping. By assessing different workflows, her thesis contributed to the coral reef mapping and conservation field.

We are proud of Nurul Hidayah's achievement and the impact it will have in coral reef mapping. We wish her all the best in her future endeavours and look forward to the publication out of her thesis.

INOS Class of 2022 Celebrates Success

INOS graduation ceremony for the class of 2022 was an emotional and unforgettable event. The ceremony was held on 10 December 2022 at INOS Seminar Room.

The ceremony was attended by the graduating students, their families, friends, and INOS staff. It was a proud moment for the graduands as they received their scrolls and were recognized for their hard work and dedication throughout their studies.

Two postgraduate students were selected for INOS awards: Mohd Nasir Bin Mohamad (Best Student Award) and Dr. Long Seh Ling (Director's Special Award).

During the ceremony, the graduands had the opportunity to reflect on their journey and the experiences they gained throughout the program. They also had the chance to express their gratitude towards their families, friends, and the staff for the support they received throughout their studies.

On behalf of the INOS family, we wish them all the best in their future endeavours and look forward to hearing about their continued success.

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