

Coral formations are seen in the waters off Pulau Bidong in Terengganu. One area of research carried out by INOS as a Higher Institution Centre of Excellence (HICoE) is to study corals in Malaysian waters with the ultimate aim of creating a Coral Reef Health Index.

MARINE SCIENCE EXCELLENCE

INOS Spearheads Sunda Shelf Research

As Malaysia's leading maritime and marine sciences university, Universiti Malaysia Terengganu (UMT) has a number of research centres focused on advancing research and innovation in these areas. The most celebrated centre is perhaps the Institute of Oceanography and Environment (better known as INOS – the acronym of its Malay name, *Institut Oseanografi dan Sekitaran*).

Originally known as the Marine Science Station at the Faculty of Fisheries and Marine Science at Universiti Pertanian Malaysia (UPM – Agriculture University of Malaysia), it was accorded official status following a recommendation by the Intergovernmental Oceanographic Commission of UNESCO. In July 2012, it was recognised as Malaysia's 7th Higher Institutions Centre of Excellence (HiCoE) in the field of Marine Science by the Ministry of Higher Education – an accolade which has strengthened its mission to become the knowledge leader of the South China Sea.

Below: With UMT having its very own sea-going vessel – the RV Discovery – INOS researchers are able to conduct *in situ* studies of marine life and conditions.

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Collecting and testing water samples enables INOS researchers from the Marine Environmental Processes (MEP) team to determine current circulation, chemical composition and the nutrient cycle of the sea.

A researcher measures a Green Turtle on a beach at Pulau Redang where INOS's Sea Turtle Research Unit (SEATRU) has its research station.

Otherwise known as 'sea cows', dugongs are among the endangered mammals studied by the Marine Mammal Research Group (MMRG) of INOS as part of its Marine Endangered Species (MES) programme.

HICoE Scope

As a HICoE, INOS's research programme is focused on the oceanic health and sustainability of the South China Sea through the assessment of endangered marine species, oceanic process and governance. In order to carry this out, three niche areas have been set up to deal with Marine Environmental Processes (MEP), Marine Endangered Species (MES), and Governance. The first focuses on habitat dynamics, biogeochemistry and productivity, while the second on the biology of the endangered species, as well as on their interaction with humans, and ecology. Last but not least, Governance covers areas such as conservation and protection of species and habitat.

In line with UMT's efforts to become the champion of the Sunda Shelf, INOS has identified two areas in which to carry out research – namely the coastal area of Terengganu and the Brunei Bay. The choice of the latter is particularly interesting as the Institute's Deputy

Director Assoc Prof Dr Aidy @ Mohamed Shawal M Muslim explained that the Brunei Bay comes under four different jurisdictions. They are Brunei, Sabah, Sarawak, and the Malaysian Federal government, owing to the presence of Labuan in the area.

From a scientific point of view, the Brunei Bay has rich biodiversity and is the home of a number of species such as the dugong, turtles and dolphins. The same can be said of the Terengganu coast, which is a nesting area for the green turtle and the hawksbill turtle, and – until recently – the leatherback turtle.

Going On The Ground

In order to carry out their work, researchers at INOS need to be hands-on and on-the-ground. This is where UMT's advantage as the only university in the country to have its own ship – the RV Discovery – for scientific cruises comes into play. As Dr Aidy disclosed, each project takes around three years,



and there are two cruises per year thus leading to six cruises every three years. And on each cruise, different research is carried out to allow those scientists involved to gain a better understanding of the South China Sea.

For example, the research carried out on these cruises as part of INOS's HICoE commitments includes 'studying inter-seasonal monsoon current circulation and water characteristics dynamics of the South China Sea', 'biogeochemical study of elements in the South China Sea', and 'study of sea turtles hatchlings'. Other areas of research include coral reefs in the islands off Terengganu, the effects of sea grass distribution and the abundance of dugong population in the Brunei Bay.

Strategic Partnerships

In recognition of the importance of keeping data, and in line with its commitments as a HICoE, INOS has also developed and maintains a marine

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THE DIRECTOR SPEAKS



Prof Dr Mohd Lokman bin Husain has not only led INOS to become one of the few HICoE's in Malaysia but was also its founding director.

Next Page: Movers of INOS: Prof Dr Lokman welcoming Principal University Officers led by Vice-Chancellor Prof Dato Dr Ibrahim Komoo (third from right) during an official visit.

As a Higher Institute Centre of Excellence (HICoE), INOS is recognised as the premier research centre for marine science in Malaysia. It is an accolade which was not easily earned, nor is it easily maintained, as the Director of INOS – Prof Dr Mohd Lokman bin Husain – explained. It would not be wrong to say that the challenge of obtaining and then retaining this honour has helped make INOS a positive example to follow.

Prof Lokman is one person who knows full well the arduous process it took to reach the

standards expected of a HICoE. Not only was he the first Director of INOS when the Institute received that name in 2001, but was also from 2006 to 2010 the Director of the Research Management Centre (RMC) at UMT. It was in this capacity that Prof Lokman and his team at the RMC started a mini-audit of UMT's research centres to determine if any then met the criteria to be named HICoEs.

While none qualified then, the exercise enabled UMT to better understand how to enhance their research centres so that they could become HICoEs.

In a fortunate development, Prof Lokman made a return to INOS as Director during the time when it was bidding for HICoE status, and his past experience ensured he understood what was needed for a successful application.

While the records will indicate that the formal process took around two years, Prof Lokman revealed that the two years was just the final stage. As he explained "The difficult part is not in knowing where you want to go, because the framework from the Ministry is already there, but in getting to where you want to go." As the evidence shows, INOS has managed to do just that.

For Prof Lokman, the advantages of being a HICoE are many. In terms of funding alone, the HICoE status entitles INOS to a grant of RM3 million per year for three years. Incidentally,

INOS is subjected to an audit every six months to ensure that it is keeping to the criteria of the accolade, both financially and in its performance.

In many ways, one of the main challenges of being a HICoE is the need to ensure that research carried out is not just academic in value but will also have a national impact at the very least. It is not just a matter of research for research's sake anymore. In addition, as the Director of INOS quite succinctly puts it, "We need to be at the cutting edge of technology and we need to be innovative."

Another achievement of INOS is that it has managed to build links with relevant Malaysian agencies as well as international bodies and research centres. For instance, it has hosted a number of international conferences and workshops, including one organised by the

International Atomic Energy Agency (IAEA) and the Malaysian Nuclear Agency on ocean sampling. These international collaborations are helping to enhance INOS's position in the international arena.

At the end of the day, this fits into the vision that Prof Lokman has for INOS. As he told *Voyages of Discovery*, "We (INOS) need to go beyond our shores. We need to go big into the region. The Vice-Chancellor (Prof Emeritus Dato' Dr Ibrahim Komoo) has given us a lot of encouragement and we need to strategise ourselves to achieve this."

After all, being named a HICoE was just the beginning, and the entire team at INOS, from its Director to its most junior staff, knows that the Institute cannot live on past glories but will always need to strive to be one step ahead, as its reputation deserves it to be.



SCIENTIFIC CRUISES

One of the focus areas of INOS as a HICoE is Marine Environmental Processes (MEP), which encompasses studies on biogeochemistry, ocean dynamics, and productivity, and involves the understanding of current circulation, chemical compounds and nutrient cycles. The research carried out is particularly important to the HICoE programme, and the information gathered is compiled into a database which is then utilised by the Marine Endangered Species (MES) programme and Governance team.

In order to carry out its work, the MEP team at INOS conduct oceanographic cruises. While similar cruises of the South China Sea are undertaken by other research centres, the geographical scope of the INOS cruises makes them unique. This is because while the bulk of sampling stations are located in the waters south of mainland China and west of the Philippines, the Sunda Shelf is relatively unexplored. This gives INOS an advantage as UMT aims to be a champion of Sunda Shelf marine research.

Presently, there are three research programmes under MEP – each under a different discipline. For ocean dynamics, INOS is looking at the ‘temporal current circulation and water characteristics and dynamics’ of the South China Sea. The productivity team are focused on the ‘spatial and temporal variations of phytoplankton biomass and production related to physical and chemical environmental factors’. Then there are the biogeochemistry researchers who are looking at the ‘biogeochemical study of compounds’.



Aside from bi-annual HICoE cruises, INOS also carries out joint cruises with Universiti Kebangsaan Malaysia (UKM – The National University of Malaysia) and the First Institute of Oceanography in China. During such expeditions, the teams conduct field surveys, and collect data either from moored stations or from satellites. This information is also supplied to an Ocean Forecasting System website which is run by UNESCO and the Intergovernmental Oceanographic Commission.

Assoc Prof Dr Suhaimi bin Suratman – the head of the Marine Environmental Process (MEP) programme – supervising the analysis of water samples collected during research cruises.



Above: INOS HICoE Deputy Director Dr Aidy at the INOS Museum where academicians and students contribute by submitting samples from their research work and even leisure time, such as this Ornate Spiny Lobster. Behind him are sediment samplings from the South China Sea which help researchers identify the inhabitants, biodiversity and level of pollution at the specific stations where they were taken.

Right: Their faces shielded from the hot sun, INOS researchers set out to look for elusive sea mammals such as whales and dolphins as part of their research programme.

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spatial database which integrates oceanographic data and serves as a repository centre. By utilising various data acquisition systems such as in-situ sampling, real-time transmission, ocean cruises, sensors, and satellite data as well as databases from around the world, INOS is able to keep up-to-date records.

Furthermore, INOS also has links with strategic partners such as the National Oceanography Directorate (NOD), Astronautic Technology Sdn Bhd (ATSB), the Meteorology Department

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KEEPING TRACK



Above: Dr Saifullah Arifin Jaaman, Head of the Marine Endangered Species Program holding the half jaw of a 16-17-metre long Omura Whale found on the shore at Cherating, Kuantan in 2008.

As a Higher Institute Centre of Excellence (HiCoE) in marine sciences, one of the key focus areas for INOS is the study of endangered mammals that either reside in or transit through the territorial and Exclusive Economic Zones (EEZ) of Malaysian waters. This task is carried out by the Marine Mammal Research Group

(MMRG) of HiCoE INOS – Marine Endangered Species (MES) programme, which is headed by Assoc Prof Dr Saifullah Arifin Jaaman – a specialist in Marine Mammal Science at INOS.

According to Dr Saifullah, the MES has three core research focuses – namely the MMRG, the Coral Research Group (CRG), and the Sea Turtle Research Unit (SEATRU). Speaking further on the MMRG, he revealed that although he is the only researcher permanently attached to the group, there are four other researchers from other faculties in UMT, as well as 10 local and international counterparts.

In many ways, Malaysia's waters are ideal for the study of endangered marine mammals such as dugongs, whales and dolphins. As Dr Saifullah revealed, a total of 27 species of such marine mammals can be found here, and they include the Blue Whale, the Irrawaddy Dolphin and the Orca.

According to Dr Saifullah, the main method of gathering information is through on-site sighting surveys, and the team has set up a research site at the Bay of Brunei using the RV Discovery (UMT's own research vessel). Another means of data acquisition is through aerial sighting where small aircraft are used to get a bird's eye view of the sea.

Aside from that he also hopes that networking with counterparts in the United States and Japan

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will help attract experts in bio-acoustic monitoring to work with the MMRG. With such equipment researchers no longer need to be on-site to carry out studies. Instead they will be able to detect the mammals through sound, thus reducing the need to depend on physical sightings.

Focus Areas

Dr Saifullah further revealed that the MMRG is carrying out two studies in the Bay of Brunei – one which focuses on the abundance and distribution of sea grass and its relation to the population and ecology of dugongs in the area. The other looks at the distribution and abundance of dugongs and in-shore cetaceans (whales, dolphins and porpoises) in the area.

For Assoc Prof Dr Saifullah Arifin Jaaman and the team at the MMRG, the Bay of Brunei is an ideal site for study of marine mammals. This is because, as he pointed out, "It is still a pristine area that is relatively undisturbed by human beings."

Having said that, he admits that this status may not ring true for long as the oil and gas industry is expanding in the area. And that perhaps shows why the work done by the MMRG is of importance, as its research will help us better understand the habits and behaviour of threatened species, and in doing so help find a way for development and conservation to co-exist.

of Malaysia (Met Malaysia), the Mineral and Geosciences Department of Malaysia (JMG), and the Marine Parks Department of Malaysia.

Also, considering that the coast of Terengganu and the Brunei Bay contain deposits of oil and gas, petroleum majors such as Murphy Oil, Petronas Carigali, ExxonMobil and Royal Dutch Shell to name a few, are also supporting INOS in its efforts.

Taking into account the different scope and nature of the various stakeholders involved, INOS has set up a Stakeholders Forum which brings all concerned organisations together. Dr Aidy explained that the forum will allow INOS to obtain feedback on national issues related to maritime and marine sciences, and enable them to support government initiatives by providing scientific solutions.

Below: Dr Behara Satyanarayana who is currently working on collaborations between UMT and Universite libre de Bruxelles (ULB) specialises in the study of mangroves and is pictured here with *Avicennia*, a pneumatophore species of mangrove.



International linkages are also important to INOS, as only by partnering with and benchmarking against other centres of excellence will the institute be able to fulfil its vision and mission. Among its overseas partners are the Australian Maritime College, IFM-GEOMAR in Germany, and the Scripps Institution of Oceanography (SIO) at the University of California in San Diego.

Below, left to right:

Dr Takaomi Arai heads the Marine Database and South China Sea References and Repository Centre which was established to archive research findings and be able to make them available in the future.

Jackie Pearson – from the International and Strategic Partnerships Office at the NOC – briefing Prof Lokman and Dr Aidy about the various scientific expeditions conducted by National Oceanographic Centre.

One of the Autonomous Underwater Vehicles (AUVs) developed by the Marine Autonomous Robotic Systems (MARS) group at NOC which will enable researchers to study deep sea conditions remotely.

Benchmarking With The Best

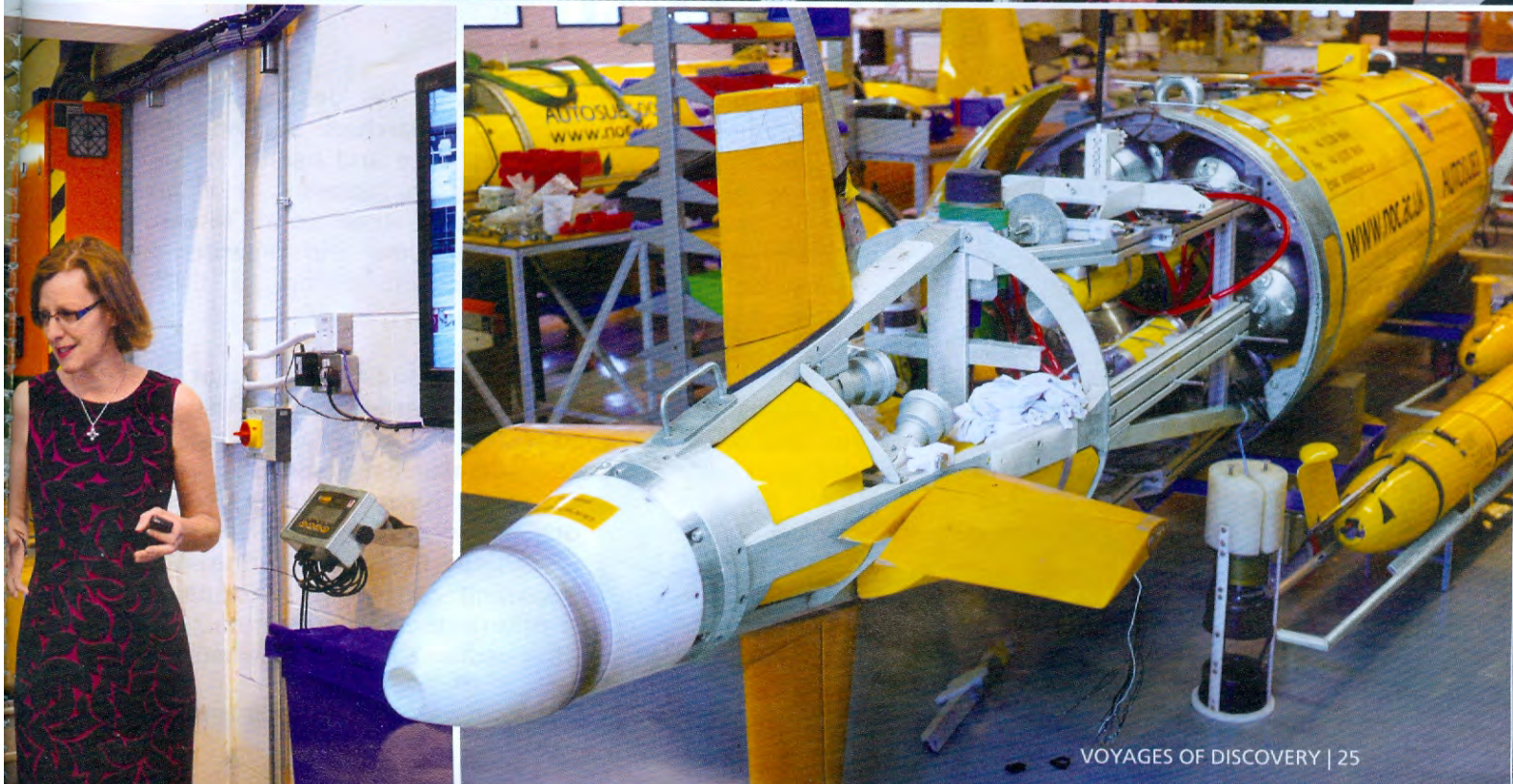
Just last year in June, UMT also signed a Memorandum of Understanding (MoU) with the UK's National Oceanography Centre (NOC) and the University of Southampton (UoS) which hosts the NOC. According to Dr Aidy, the NOC will be INOS's benchmarking partner, and this is a significant development as the UK centre is one that is highly regarded and well-recognised.

That being said, this is a win-win partnership, as the University of Southampton – having recently opened a branch campus in Malaysia – stands to benefit from its links with INOS and UMT as a whole. However, it needs to be noted that the primary reason why such a prestigious organisation as the NOC chooses to link up with INOS

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Teams from UMT INOS, UoS and NOC during the signing of the MOU between UMT, the NOC and the UoS. (From left to right) Jacky Wood – Head of the International and Strategic Partnerships Office (ISPO) NOC, Idham Khalil – UoS postgraduate student and UMT lecturer, Karen Arnold – Regional Director, International Office UoS, Assoc. Prof Dr Aidy @ Mohamed Shawal M Muslim – Deputy Director (HICoE) INOS, Prof Dr Mohd Lokman Husain - Director, INOS, Prof Ian Wright – Director of Science and Technology, NOC, Dr Louise Darroch from the British Oceanographic Data Centre, NOC, Jackie Pearson – Manager Marine Coordination, ISPO, NOC and Prof Adrian New – Head of Marine Systems Modelling, NOC.





CORAL RESEARCH GROUP

Among the oldest ecosystems in the world, coral reefs are not just beautiful to behold but also play an important role in supporting marine life and local communities, in addition to boosting tourism and protecting the shoreline. In Malaysia, off the coast of the state of Terengganu is an abundance of coral, much of it located around offshore islands in designated marine parks. While the corals are being preserved, research on them is lacking.

According to Assoc Prof Dr Zainudin Bachok – the head

of the Coral Research Group (CRG) of the HiCOE INOS Marine Endangered Species (MES) programme – the lack of personnel is one of the reasons for this as the Department of Marine Parks Malaysia has only one research officer. Another problem is that research was previously done on an independent basis and when the principal researcher had concluded his or her study, there was little to no effort made to systematically disseminate or continue it.

The CRG addresses these problems. Not only does it

provide a dedicated team of researchers studying the resilience and health of coral reefs in Malaysia, it also ensures that coral research is ongoing and regarded as important owing to INOS's status as a HiCoE.

Dr Zainudin hopes that the work carried out by the CRG will be used to develop the Corals Reef Health Index. "Such an index will assist stakeholders such as the Department of Marine Parks and other interested parties in the classification and sustainable management of

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through UMT, is because the Institute of Oceanography and Environment is seen as being worthy of such a link.

The MoU acknowledges the mutual benefits that scientific and technological collaboration can bring to all parties, and the shared desire to develop academic cooperation in research. Under its provisions, both the NOC and INOS are committed to seeking ways to further develop joint research activities in the field of oceanography and marine technology.

Further forms of cooperation include organising and promoting joint-lectures, workshops, and/or conferences with "the aim of leading to the development

of joint proposals for marine scientific and technological research, relevant scientific instrument development, and fieldwork." Also, exchange visits between each campus by researchers and students are encouraged in order to broaden knowledge and expertise.

Dr Aidy also revealed that in November 2013, a team from the NOC and the University of Southampton will be visiting INOS to look at the programmes and work out ways to benchmark activities. Furthermore, a lecturer from the University of Southampton will also be seconded to help the INOS team with the equipment on the RV Discovery.

Previous page: Aside from being visually stunning, corals also act as natural defences for coastal areas thus making their conservation a matter of great importance.

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Right: Assoc Prof Dr Zainudin Bachok's (left) field of research includes the study of corals. Here he is inspecting a specimen held by a colleague.

reefs. For instance, with the index, they will know where to focus their resources, and not spend so much on dying reefs while ensuring that those with greater changes are given priority. Therefore, limited resources can be utilised with optimum results.



CONSERVING THE TURTLES

One of the important roles that Terengganu plays in marine ecology is that it is a nesting area for a number of sea turtle species such as the Green Turtle and Hawksbill Turtle. There is also the Leatherback Turtle which lays its eggs in the sand of Rantau Abang beach. However, of late the number of Leatherbacks nesting has been negligible leading to concern that it is on the brink of extinction. Such an alarming possibility only serves to highlight the importance of sea turtle conservation, and this mission is championed by the Sea Turtle Research Unit (SEATRU) of the HICoE INOS Marine Endangered Species (MES) Programme, led by Dr Juanita Joseph.

SEATRU was founded in 1993 by two UMT lecturers – Prof Dr Chan Eng Heng and Assoc Prof Liew Hock Chark – and its establishment was spurred by the shocking decline in the number of turtle eggs harvested by egg collectors. Whereas in the

1970s, turtle eggs would fill the brim of the collectors' boats, by the 1990s the amount collected had diminished considerably. It was proof of one thing – the sea turtles had to be protected.

In 2009, SEATRU was placed under the auspices of INOS. Speaking on that, Dr Juanita said, "It was a good decision because it has helped us a lot. In terms of research, being part of INOS has enabled us to tap into its resources and equipment. Furthermore, being part of INOS has helped us in funding, especially in view of it being a HICoE."

SEATRU is conducting two types of research as part of INOS being a HICoE – namely studying sea turtles at their foraging grounds in the Bay of Brunei, and also observing sea turtle hatchlings during their 'lost years'. These will help add to the understanding of these great marine creatures which are very much part of the natural heritage – not just Malaysia's but also the region as whole.

In addition, SEATRU conducts turtle conservation activities in Pulau Redang (Redang Island) which is a nesting ground for both the Green Turtle and Hawksbill Turtle and set up a project site at Chagar Hutang

beach in 1993. According to Dr Juanita, the SEATRU team perform long-term tagging and monitoring, as well as genetics study, satellite tracking, photo-identification, and RFID tagging of sea turtles at Chagar Hutang, as well as at two other nesting areas – Mak Kepit and Mak Simpan.

Since 2005, all nesting beaches on Pulau Redang have been declared sanctuaries – a victory of sorts for SEATRU as it had been pushing for that from the state government since the unit's formation. All in all, 7,206 nests have been protected and more than 450,000 turtle hatchlings have been born since 1993.

While there has been progress, Dr Juanita Joseph believes that more can be and should be done to help conserve the sea turtles, and she expressed concern over activities such as poaching and selling turtle eggs, not just in Terengganu but throughout the country as well. Thanks to financial support from both the state government and other interested parties such as resort operators in the area – particularly Berjaya, and the extra boost that comes from being part of INOS, SEATRU's efforts to protect the sea turtles look promising indeed.

Next page: Dr Juanita Joseph – the head of SEATRU – holding a preserved Hawksbill turtle which had been recovered from poachers. The illegal hunting of Hawksbills is particularly rampant owing to their shells being prized for jewellery pieces.



ESTABLISHING GOVERNANCE

One of the aims of INOS as a HICoE is to set up a Legislative Administrative and Policy (LAP) framework, and this is headed by Assoc Prof Dr Wan Izatul Asma Wan Talaa. According to her, good governance starts with having good policy, and therefore the research she and her team are carrying out aims to develop effective systems to sustainably maintain endangered marine life.

For Dr Wan Izatul, the main problem lies in the absence of a National Ocean Policy. She revealed that while there are laws governing different aspects, they lack cohesion with one another. For example, when it comes to endangered marine species such as coral, sea turtles, and marine mammals, the present legislation is archaic and does not conform to the Convention on Biological Diversity (CBD) to which Malaysia is a signatory.

Therefore, on the 17th of June, the LAP team at INOS hosted a Stakeholder's Forum, bringing together different interested

parties – Ministries, government departments, and NGOs. According to Dr Wan Izatul, "We presented our aims and we asked them to contribute their views, so that we could find a comprehensive approach."

Dr Wan Izatul is of the view that it is very important for both scientists and legal experts (such as herself) to work together to develop the LAP, stating that "We cannot work in isolation."

Incidentally, this ties in with one of the aims of INOS in the field of governance and administration, which is to look at ways of forging cooperation between the different littoral states in the South China Sea. "This cannot be about our boundaries anymore. We share the sea, the ocean, and we should all play a part. The environment is beyond borders," Dr Wan Izatul concludes firmly.



A lawyer by training, Assoc Prof Dr Wan Izatul Asma Wan Talaa – the head of the Legislative, Administrative and Policy (LAP) – believes that international cooperation is vital for the creation of comprehensive policies for better governance of the ocean.

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As Malaysia's Higher Institute Centre of Excellence for Marine Sciences, INOS has the task of spearheading the nation's efforts in maritime and marine research and study. There is still much to learn about the country's coasts and waters, and definitely Malaysia's rich marine ecosystem has a lot to offer. Thanks to the Institute of Oceanography and Environment at Universiti Malaysia Terengganu, the world will soon know more about the Sunda Shelf and the wealth of opportunities and possibilities it possesses.

Dr Saifullah inspecting
a beached whale off the
coast of Terengganu.

