VOYAGES of DISCOVERY

Exploring the Sunda Shelf with Universiti Malaysia Terengganu

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Maritime Archaeology
in Bidong Island Waters, Terengganu

ULIK MAYANG
Heritage of Terengganu

THE JELLY BEANS
of the sea

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The sea has become the primary source of life for people around the world since pre-civilisation. Humans started exploring the coastline searching for food and soon realised that more resources could be found further in the ocean as well as new lands. Boats and later ships were developed, allowing the wonder of the sea to be revealed, flourishing the civilisation and empire. The enchantment of the sea has made people realise that the ocean is much more than a beach, swell, fish and shells. It sparks the sense of eagerness, especially of researchers and scientists in conducting research on the ocean and sharing the discoveries with society.

The sea does not only provide food and resources, but it also develops human strength, intelligence and wisdom. As mentioned in Surah An-Nahl, 14:

It is He who has made the sea subject, that ye may eat thereof flesh that is fresh and tender, and that ye may extract there from ornaments to wear; and thou seest the ships therein that plough the waves, that ye may seek (thus) of the bounty of Allah and that ye may be grateful.

Such a bond between man and the sea is reflected from the remains that can be seen until today. Marine heritage includes not only tangible resources, for example, historic shipwrecks, archaeological site, or living organisms, but also intangible resources such as archival documents, oral and cultural histories or indigenous cultures that dwell, use and have been inspired by the ocean for centuries. These are important to be discovered, recorded, evaluated and managed correctly to protect marine heritage for future generations.

The safeguarding of the maritime heritage means preserving and protecting these significant tangible and intangible resources within the jurisdiction rights of the area. Understanding and establishing an effective conservation programme, activity or research will preserve history, value and diversity of underwater heritage.

Batu Bersurat (inscripted stone), a well-known historical artefact in Terengganu is a primary evidence that the state was once a central hub for traders and sailors all around the world. As a developing coastal heritage city, one of the important agendas for Terengganu's capital, Kuala Terengganu is to enhance the social and economic benefits of marine heritage for the community.

The agenda is supported by researchers from Universiti Malaysia Terengganu (UMT) by developing appropriate methods and approaches, finding solutions and the latest technology to estimate and protect the value of marine heritage, as well as increasing public awareness.

UMT is very committed to discovering new knowledge relating to marine heritage of Malaysia, which is the focus of the current edition of Voyages of Discovery. Research on rich marine natural history is conducted by our qualified taxonomists (who make up a substantial number among Malaysian institutions), and the South China Sea Repository and Reference Centre is recognised as the only marine natural history collection in Malaysia. UMT's position in this area is further strenghtened through collaboration with the Department of National Heritage and UZMA Bhd and UMT's Institute of Oceanography and Environment (INOS), School of Marine and Environmental Sciences, and supported by the Central Laboratory which are working hand in hand on marine archaeological research at Pulau Bidong (Pulau: island), off the coast of Terengganu in the South China Sea. The island houses the UMT Marine Research Station is strategically located at the shipping route of coastal vessels, which make it rich with the evidence of the maritime history of Southeast Asia.

The industrial partnership is one of the strategic pillars for research excellence in UMT. It provides space for UMT to have joint research and knowledge transfer activities with the non-academic bodies. The partnership with Laguna Redang Island Resort since 2005 in logistical support for the conservation of endangered and iconic species benefits both parties and the community. Moreover, several research-oriented workshops and underwater research were conducted with support from the resort. The latest collaborative project between UMT and

Laguna Redang Island Resort is the establishment of coral transplantation site, monitored by both the resort's in-house marine biologist and UMT researchers. The collaboration between Laguna Redang Island Resort and UMT has been elevated to a higher level in 2017 through the Memorandum of Understanding to formalise and recognise the partnership.

UZMA Bhd's partnership with UMT in marine archaeology research is the first of its kind in Malaysia. The five-year partnership offers a golden opportunity for UMT researchers to be a marine archaeology key player in Malaysia and the Southeast Asia region. Through this collaboration, the teams are now working on the formation of a Marine Archaeological Research Laboratory in the main UMT campus and Marine Archaeological Research and Excavation Centre on Pulau Bidong.

UMT's efforts in marine conservation are spearheaded by the Sea Turtle Research Unit (SEATRU). The notable 'Save Turtle Outreach Program' (STOP) is a programme by SEATRU to assist the long-term monitoring, tagging and in-situ egg incubation research and conservation project for sea turtles at Chagar Hutang Turtle Sanctuary, Pulau Redang. The programme is one of the longest volunteerism programmes in UMT and has received an overwhelming response from local and international individuals. Also, SEATRU's Adopt a Turtle programme also gained popularity and created a sense of shared responsibility among the public.

In the regional arena, UMT is the only signatory university from Malaysia with Coral Triangle Initiative on Coral Reefs, Fisheries, and Food Security (CTI – CFF). CTI – CFF is a multilateral partnership formed by the governments of the six Coral Triangle countries in 2009 to sustain marine and coastal resources. Several programmes have been designed and currently implemented, such as, exchange of students and staff, research and development (conducting joint research activities, training and technical resources), and collaborative work through the Collaboration Mechanism and Development for Marine Resources Management in addressing crucial issues of marine biodiversity.

On a broader geographical scope, UMT is an active participant in many IOC-WESTPAC ocean science projects and capacity development programmes. The central player from UMT is INOS, a Centre for Excellence in Higher Education (HiCOE) for marine science recognised by the Ministry of Education. INOS is the first institute recognised as IODE Associated Data Unit (ADU) under Intergovernmental Oceanographic Commission-UNESCO (IOC-UNESCO) and one of the node centres for Ocean Biogeographic Information System (OBIS). Knowledge transfer activities by INOS are also on the international scale. The institute is a member of the Regional Training Centre for Ocean Teacher Global Academy (RTC-OTGA) and a consortium member for TROPIMUNDO Erasmus Mundus Masters Course in Tropical Diversity and Ecosystem under the European Commission. Recently, INOS has signed a Letter of Intent with the National Marine Data and Information Service, China for China-ASEAN Marine Environmental Data Platform and to work on up-scaling the function of UMT Marine Data Platform. These activities and recognitions exhibit essential roles played by UMT in ocean science.

Although the wave of challenges is inevitable, UMT will set its sails ahead to continue discovering new knowledge, applying and disseminating it to the world in the spirit of our motto 'Ocean of Discoveries for Global Sustainability'. UMT is confident that it has the perfect blend to be a global player in marine stewardship and sustainability through quality research, fruitful partnerships and impactful alumni.

Professor Dato' Dr. Nor Aieni Haji Mokhtar
Vice Chancellor
Universiti Malaysia Terengganu

MARITIME ARCHAEOLOGY

In Bidong Island, Terengganu Waters

by:
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Photo by:
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Archaeology refers to a scientific field that examines the culture and the past environment of persons based on remaining material culture and ecofact. The term 'archaeology' is derived from the Greek word 'archailogia' which means 'discourse about ancient things' and was first introduced by Jacques Spon in the 17th century. Due to the long history of human development, various material culture and physical environment evolved, and therefore led to the emergence of various archaeological studies.

Archaeological excavation work of the Bidong Island shipwreck site by UMT staff.

Although archaeology was born from a study on land sites, especially prehistoric times, it did not preclude the emergence of other forms of archaeological studies. For example, underwater archaeology or maritime archaeological studies differ in terms of work, location and cultural remains. However, its basic meaning and purpose remain as the science of studying and reconstructing the past. Underwater archaeology is just a labelling for all archaeological studies conducted at underwater sites or the term for archaeological disciplines with aquatic environments as sites.

In line with some of the maritime archaeological research developments in Malaysia from the early 1990s to 2000s, there is a good reason to plan a maritime archaeological research in Terengganu holistically. An accidental discovery of a shipwreck located in the waters of Pulau Bidong, Terengganu became the catalyst for the idea. The location of the shipwreck is approximately two nautical miles from Pulau Bidong and 30 nautical miles from Kuala Terengganu, at a depth of 18 metres below sea level. The ship's size is approximately 25 metres long and 10 metres wide.

The discovery of this shipwreck known as 'The Bidong Shipwreck' has opened new pages in the history of shipwreck investigation in Malaysia. These include the information on the number of shipwrecks in the South China Sea, the cause of ships sinking, shipbuilding technology and the direction of the ships. The study work on the premises that the shipwreck most likely originated from central Thailand, from Sukhothai, Chonburi or other parts of Thailand based on the artefacts found. It was likely due to weather or technical problems.

A preliminary survey was conducted for almost a week on 'The Bidong Shipwreck', and has resulted in an incredible discovery. The result of this initial analysis found that most artefacts found were made of porcelain and stoneware ceramics originating from Thailand which were known from the 15th to 17th century AD. Specifically, the ceramics are the Sawankhalok type and are believed to have originated from the central and northern regions of Thailand around Sukhothai, Pethaburi and Chonburi.

In addition, other artefacts were also found such as metal tools, ship nails, human and elephant statues and the remains of ship wood. Most of these ceramics were found in large numbers, assumed to be from a merchant ship sailing in the waters of the South China Sea from the Gulf of Siam to Southeast Asia. All the artefacts found on this cargo ship are believed to be traded in the region.

The overall expectation is that there is still an abundance of ceramics and artefacts at the bottom of the ocean and archaeological excavation is urgently needed to avoid loss or damage. However, further study is needed to determine the type, size, shape and name of ship and its sailing whereabouts.

In addition to field studies, a series of site and museum visits, particularly at The National

Museum of Maritime Archeology in Chantaburi, Thailand, the University of Bangkok, Ayuthiya and Sukhothai were also made. The purpose of these visits was to carry out some comparative studies especially on aspects related to the discovery of ceramics and the various artefacts which were found to have similarities with those found in the specified area.

In fact, to this day, no Malaysian has conducted a comprehensive programme or research on maritime archaeology in Malaysia especially on the excavation of shipwrecks. This has only been done by researchers from the west and assisted by some local museum staff. Hence, how long do we need to depend on the external experts to uncover the secrets of the shipwreck's history and heritage in our waters? Names like Sten Sjostrand, Michael Hatcher and Michael Flecker are often referred to as shipwreck's field-experts not only in Malaysia but also in the region.

Sten, for example, has managed to uncover nearly 10 ships in Malaysian waters including Sabah and Sarawak. The shipwreck sites like Turiang wreck, Nanyang wreck, Longquan wreck, Royal Nanhai wreck, Xuande wreck, Singtai wreck, Nassau wreck, Risdam wreck, Diana wreck and Desaru wreck which have been successfully excavated by the researcher. Shipwrecks that were uncovered had valuable artefacts such as ceramics from China, Thailand, Europe and Vietnam, metal products, weapons and others which are priceless. Although there is a 30% concession agreement for the Government of Malaysia and 70% to the companies that operate the project, these are all regarded as still incompatible with what we have been thinking about.

Hence, a drastic move should be taken especially by UMT to highlight its own local experts who can handle maritime archaeological research work in line with the latest holistic archaeological developments. UMT will take the initiative to conduct further research on the artefacts found at the Bidong Island shipwreck site to uncover the history of early trading activities in Malaysian waters. Working together with UZMA Bhd., UMT will establish a Marine Archaeological Research Laboratory at the university and a Marine Archaeological Research Centre and excavation on Bidong Island.

Artefacts and ceramics found during archaeological excavation work on the Bidong Island shipwreck site.

Marine Taxonomy @ UMT

by:
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School of Marine and Environmental Science, UMT

Heavenly located in a marine biodiversity hotspot, Malaysia is blessed with the presence of various species of marine organisms within its territory. To understand the functions of the sea life in the ecosystem, one must begin by knowing the names of species. For this, Universiti Malaysia Terengganu (UMT) has been focusing on the marine taxonomy that serves as fundamental information in order to embark on future fascinating research journeys that will bring benefits to humankind. Voyages of Discovery delves into the marine taxonomy with UMT to figure out the importance of naming the species for the future generation.

What is in the Name?

Imagine that you are currently diving along the coral reef, surrounded by thousands of fishes, snails, bivalves and wormlike creatures of different colours, shapes and sizes. Some of the fish are completely different from each other, and the same goes for other organisms. How would you differentiate them? What would you call them to differentiate each of the living forms? Would it be a fish with an ugly face or a fish with a yellow spot? A spikey snail?

Organisms can be taxonomically grouped together for identification. The taxonomic groupings can be ranked according to similarity or dissimilarity of external morphologies and with the help of recent technology, DNA. At present, the widely accepted taxonomic ranks start from the kingdom, phylum, class, family, genus to species. At the lowest taxonomic hierarchy, a species means an organism that has unique characters different from others either from external characters (morphology) or at the genetic (DNA) level. An individual from a certain species can only breed with others from the same species because of their similar characteristics.

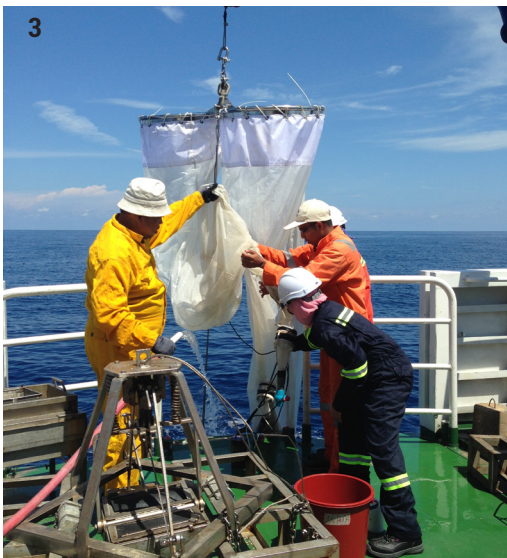
Naming a species, undoubtedly, is an important business. Every living thing in this world functions and contributes to the equilibrium of the ecosystem. Apparently, some organisms are very beneficial to human as food source as well as medicine which help to improve our living conditions. Interestingly, organisms' behaviours, reactions and needs vary between species even if they belong to the same genus or family. Hence, each species needs to be uniquely named as a prerequisite to avoid any refutation of scientific studies that report on these taxa or their components. Once a species has a name with proper description that distinguishes it from other organisms, all ecological functions can be understood and linked. Identified species will facilitate the estimation of diversity in an area, subsequently to be used towards planning of conservation, environmental protection from alien species, pollution, food security, drug discovery and industrial applications.

The science of discovering, describing, classifying and naming organisms is called taxonomy, or also

***Figure 1**: The UMT ichthyologists are looking at the fish collection from Pulau Bidong, one of the major research sites and location of UMT marine research station. Some of the fish collection at RRC can be traced back from the early 1980s. From the left: Dr. Seah Ying Giat, Dr. Tun Nurul Aimi and Siti Tafzilmeriam.*

***Figure 2**: Looking for marine worms (polychaete) within rotten Nypa plant is tedious but rewarding. The students under the supervision of Dr. Yusof Shuaib are working on the possible new species wich have potential application in aquaculture.*

***Figure 3**: From mangroves in Setiu Wetlands to the offshore waters within Malaysian Economic Exclusive Zone (EEZ), UMT taxonomists are working to catalogue marine organisms. This Bongo Net hauled millions of zooplankton including pelagic tunicate from family Saplidae, Dr. Nurul Huda's (in blue coverall) focused organism.*



known as biological systematics. It is one of the oldest biological disciplines in the world. Unfortunately, the number of taxonomists is declining rapidly around the globe as more biologists are keen towards other biological subjects.

Lead the Way in Marine Taxonomy

Malaysia is a country with close association with the marine environment. The country has a total of 4,675 km of coastlines covering Peninsular Malaysia, Sabah and Sarawak. Not surprisingly, Malaysians are among the top fish consumers in the world, and the coral reef ecosystems in Malaysia are known to be among the most beautiful in the world.

Although Malaysia is globally known as a hotspot for marine biodiversity, many organisms below its sea surface are still unknown, waiting to be discovered. This is unfortunate as there is so much potential from our underwater wealth which is not fully utilised yet. Due to this, the effects on stressors of the marine environment are not well understood. At the moment, it is regretful to note that the number of marine taxonomic researchers in Malaysia is very low compared to other maritime nations. That being said, luckily UMT is now home to a large concentration of Malaysian marine taxonomists. As a marine-focused university, UMT's views on the taxonomic research of marine organisms are imperative. As part of its strategic plan, several young academics are trained at both local and overseas universities in taxonomy focusing on several marine organisms. At the same time, UMT hires senior professors in taxonomy to function as mentors to young taxonomists. At present, UMT is proud to have 10 taxonomists focusing on fish (3), mollusc (1), polychaete (2), chordate (1), crustacean (2) and myxozoa (1). The focus on organisms by UMT taxonomists is not by coincidence, in fact, these marine taxa are chosen because of their important roles in the ecosystem and possible effects on humans.

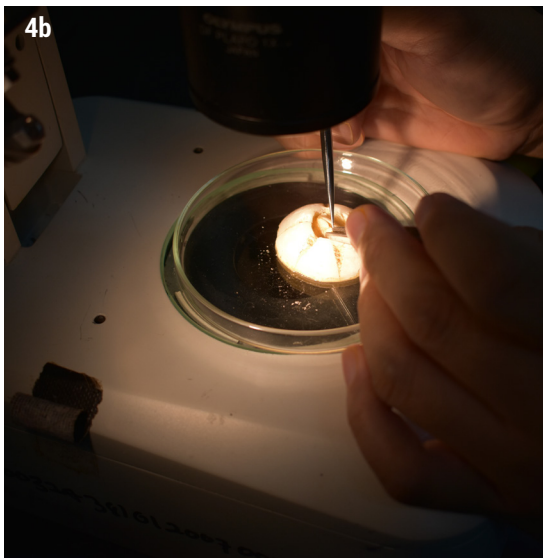
Taxonomically, fish, a major vertebrate is less diverse compared to invertebrates, but is the main and relatively cheap source of protein.

***Figure 4a**: Dr. Muhammad Hafiz Borkhanuddin is looking at the endoparasite that was found on the sea turtle carapace.*

***Figure 4b**: The sea turtle can be infected with a vast diversity of parasites, including barnacles. On the positive side, the presence of the parasite, in this case, barnacle observed by Dr. Muhammad Hafiz can provide useful information on the foraging ground of the sea turtle and its migratory route.*

***Figure 5**: For taxonomists, holotype specimen is very important because the description of a species is based on it. The South China Sea Repository and Reference Centre (RRC) is responsible as a keeper to a number of holotype specimens including the two specimens hold by RRC curator, Mrs Azwarina Azmi and Prof. Dr. Othman Hj Ross, UMT's prominent copepodologist.*


4a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8

The identification of fish species that have commercial value is needed for sustainable harvest. At the same time, roles of other identified fishes in the ecosystem services need to be recognised. For these, our renowned scientists, Dr. Seah Ying Giat, Dr. Tun Nurul Aimi and Siti Tafzilmeriam are cooperating to identify economically and ecologically significant fishes in the Setiu Wetlands and the South China Sea. Dr. Seah focuses on the 'croakers' (Sciaenidae), Dr. Tun Nurul Aimi specialises in 'scads and jack mackerel' (Carangidae) while Siti Tafzilmeriam is an expert on the 'mullet' (Mugilidae) from the coastal waters.

However, identifying the fishes is just a tip of the iceberg, whereas relating the species that supports or threatens the fish population and diversity is deemed important in pursuit of better management of the resources. To help solve this issue, Prof. Dr. Othman Hj Ross and Dr. Nurul Huda Ahmad Ishak are both working hard to identify zooplanktons that serve as food for the fish. Apart from that, Dr. Nurul Huda is also identifying pelagic chordate known as salps and doliolids. Concurrently, Dr. Muhammad Hafiz Borkhanuddin and Dr. Melissa Beata Martin are conducting research on the parasites that are deteriorating the fish health as well as other aquatic organisms including turtle and other invertebrates. Dr. Muhammad Hafiz is working on the parasitic metazoan in fish turtles while Dr. Melissa is vigorously identifying parasitic crustaceans that are affecting the fish.

Interestingly, snails (Gastropoda) are a possible indicator of climate change. It is also a known fact that sensitivity to elevated temperature due to climate change is different among species. That is why in order to attain the best results of her study, our well trained thermal-biologist, Dr. Nursalwa Baharuddin had to meticulously identify intertidal snails found at rocky shores and estuaries in her effort to select suitable samples for her experiment. This required Dr. Nursalwa (fondly known as Dr. Wawa) to acquire taxonomic skills for identification. While doing so, it is no surprise that she is one of the authors of the book 'Gastropods of Brunei Bay' during her PhD candidature which later led her to continue research on gastropods from the Setiu Wetlands. She aims to identify intertidal snails along the east coast of Peninsular Malaysia, while at the same time find evidence on the effects of climate change on marine snails.

One of the dominant organisms in the marine sediment whose existence is often ignored is the marine worm from class Polychaeta. The worms can be found in all marine habitats from the coastal area to the deep ocean. Polychaetes play essential roles in the ecosystem in the trophic level (food web), reef formation, bioremediation and erosion, bio-indicator, fishing baits, broodstock feed, and fascinating

***Figure 6**: Collaborative research is crucial in taxonomic research because it provides access to valuable resources including human power, expertise, financial and even permit. These advantages allow UMT ichthyologists, Dr. Seah Ying Giat and Dr. Tun Nurul Aimi together with fish scientists from Taiwan, Japan and Malaysia to conduct an expedition in east Malaysia (Sabah and Sarawak).*

***Figure 7**: International network does not limit the research only in Malaysian waters. It has even opened up opportunities to conduct research or participate in research expedition abroad. Dr. Izwandy Idris (in black hoodie) participated in the deep sea expedition east of Australia in 2017. The expedition gave him exposure to deep-sea polychaetes which are different from shallow and tropical species.*

***Figure 8**: The major unit supporting the marine taxonomic research at UMT is the South China Sea Repository and Reference Centre (RRC). Established in 2004, RRC has more than 20,000 marine collection including flora, fauna, geology and genomics. The Centre is run by seven staff (seen in the picture with UMT taxonomists) and is the only natural history collection in Malaysia that has marine curator (Mrs Azwarina Azmi Ramasamy– far left)*

The primary drivers of marine taxonomic research at UMT. From the left: Dr. Nursalwa Baharuddin, Dr. Nurul Huda Ahmad Ishak, Dr. Melissa Beata Martin, Dr. Tun Nurul Aimi, Mat Jaafar, Dr. Seah Ying Giat, Prof. Dr. Othman Hj Ross, Siti Tafzilmeriam, Dr. Yusof Shuaib Ibrahim and Dr. Izwandy Idris. The research is also supported by experienced laboratory staff like Mr. Che Mohd Zan Husin (far right). Absent is Dr. Muhammad Hafiz Borkhanuddin.

UMT conchologist (a scientist working on molluscs) Dr. Nursalwa Baharuddin has been appointed as the Secretary II for the Malacological Society of Southeast Asia, a recognition by regional peers on her work on marine snails.

enough, as potential new protein source for humans. Unfortunately, similar to other marine organisms in this region, numbers of identified polychaetes in Malaysia is relatively low compared to other Southeast Asian countries. In order to work this out, since 2014, our dedicated polychaetologists Dr. Izwandy Idris and Dr. Yusof Shuaib Ibrahim profoundly did their researches to identify polychaetes and relate them with ecology as well as its impact on water pollution. Currently, Dr. Izwandy is investigating the diversity of polychaetes in the estuarine and coastal waters while Dr. Yusof Shuaib focuses on the brackish water polychaetes in the Setiu Wetlands and mangroves. Among the beneficial discoveries made by the UMT team is involving *Marphysa moribidii* which is popularly used by local anglers as bait worms. It has been identified by Dr. Izwandy to have high potential in industrial and medical applications. Aside from that, Dr. Izwandy is also actively working together with other researchers from the School of Fundamental Sciences, and the Institute of Tropical Aquaculture (Akuatrop) of UMT in search of an effective and sustainable application of the polychaete species. At the same time, Dr. Yusof Shuaib works on the effects of micro-plastics on marine organisms particularly affecting polychaetes and its destiny in the marine food web. In addition to all the work mentioned above, the biology and reproductivity of several polychaete species are also being investigated by both researchers in our university's quest to achieve a greater understanding of the ecology of marine habitats.

Collaboration as a Way Forward for Marine Taxonomy

Unlike human population, marine organisms do not recognise political boundaries and they inhabit any habitat that is suitable for them even if it means being located in different countries. On top of that, the number of marine taxa is very large which is why it is impossible to have a taxonomist for each taxon in Malaysia. Hence, in this case, collaboration with taxonomists from other institutions, both local and international is vital.

Realising the importance of collaboration, marine taxonomists at UMT have built up a strong research network with other taxonomists

abroad. Among other institutions and countries are Kagoshima University and Soka University (Japan), Universiti Brunei Darussalam (Brunei), National Museum of Marine Biology and Aquarium (Taiwan), University of Pannonia (Hungary), Australian Museum Research Institute (Australia) and International Islamic University (Malaysia). To achieve the best results out of the collaborative works, we have chosen only the best. Most of the collaborated taxonomists are well known as experts on a specific taxon. Hence, the collaboration provides suitable means for UMT taxonomists to learn more from established taxonomic gurus. That being said, UMT looks forward to collaborate with any institution to carry its taxonomic research to the next level.

Marine Repository as the Collection Centre

The primary entity that supports work in marine taxonomy at UMT is the South China Sea Repository and Reference Centre or also known as RRC. The RRC is a centre positioned within the Institute of Oceanography and Environment (INOS), established in 2004 as Biodiversity Museum and changed to its current name in 2012. At present, RRC has more than 20,000 specimens collected from various locations along the Malaysian coastlines. The collections consist of more than 20,000 marine natural history specimens including animal, plant, geology and genomic specimens. A number of specimen types including holotype have been deposited at RRC. There is also a holotype specimen of Malaysian species repatriated from an overseas collection.

Dr. Nursalwa Baharuddin supervising postgraduate students from Erasmus Mundus TROPIMUNDO programme searching for mangrove gastropods in Setiu Wetlands, approximately 60 km from UMT. Marine taxonomic research requires scientists and students to be in the field not only to collect specimens but also to record environmental data related to the habitat of the species. This information is substantial for species description. UMT has the logistical advantage to access all types of tropical marine systems within a short distance from the university.

As a part of the specimen collection and management, RRC also collaborates with UMT taxonomists as well as international experts to provide training on taxonomy and collection management. Lead by Dr. Izwandy, RRC has being recognised as the centre for marine biodiversity collection in Malaysia and data provider for Malaysia Biodiversity Information System (MyBIS), Malaysia National Oceanographic Data Centre (MyNODC) and Ocean Biogeographic Information System (OBIS). The RRC also has been recognised by the Australian Biological Resources Study (ABRS) as an institution that can be given a loan of biological specimens from any Australian natural history collection for research. UMT is keen for RRC to obtain similar recognition from other countries such as the United Kingdom, USA and Japan in the future.

Besides, the research atmosphere and the support facilities at UMT make it incredibly conducive for marine taxonomic research. Starting with its location facing the South China Sea, the university also has a fleet of boats with sufficient equipment for a quick sampling in nearby islands while the research vessel, RV Discovery is ready for a more extended expedition in Malaysian waters. The support staff, for example, laboratory assistants and assistant to the science officer are also very knowledgeable in certain marine taxa. These people are in turn helping UMT marine taxonomists in conducting sampling and analysis.

The strength of marine taxonomists and the reliable support system in UMT are excellent ingredients to propel UMT as a leader in marine taxonomy research in Malaysia.

Invertebrate is the dominant organism in the marine ecosystem, both in numbers and diversity. A number of identified species are put on display in INOS Gallery as part of knowledge transfer to the public. The marine invertebrate taxonomists verify the displayed species and include new information obtained from their own research to increase the public's awareness and appreciation on Malaysian marine heritage.

Professor Dr. Othman bin Hj Ross

by:
Dr. Izwandy Idris
School of Marine and Environmental Science, UMT

Photo by:
Personal collection of Prof. Dr. Othman Hj Ross

From Coast to Coast

Prof. Dr. Othman bin Hj Ross, a native of Terengganu, was born on 18th February 1948 in Kampung Raja, Besut. He received his education in Besut and Kuala Terengganu before embarking on an impressive academic journey in Kuala Lumpur, the United Kingdom and Australia. Prof. Dr. Othman graduated from Universiti Malaya in 1971 with a Bachelor of Science with Honours in Ecology and obtained a Master of Science degree in 1974 from the University of Strathclyde, Scotland. He did his doctoral programme in marine ecology at the University of Queensland, Australia with a scholarship from the Australian Government under the AIDAB Colombo Plan and was awarded a doctoral degree in 1986.

In his professional life, Prof. Dr. Othman started as a researcher with the Malaysian Agricultural Research and Development Institute (MARDI) for a short period of time. But he was set to be in the world of academia, and this journey began when he was appointed as a tutor at Universiti Kebangsaan Malaysia (UKM) in 1971. From then on Prof Dr Othman became an academician and his name was synonymous with marine ecology and marine biology in UKM where he served for 33 years until he officially retired in 2004 but continued to serve UKM on contract for 10 years till 2014.

Prof. Dr. Othman was promoted as an associate professor in 1989 and as a professor in 1996. He held academic positions which included being the Dean of the School of Environmental and Natural Resources and as a member of the University Senate.

At 70 years old, Prof. Dr. Othman is still actively working on the copepods taxonomy. 'I have stacks of specimen jars containing copepod collected throughout Malaysia, waiting for identification. Passion, is what makes me stay here', he said.

His retirement from UKM did not mark the end of Prof. Dr. Othman's academic career. In fact, it gave him the opportunity to give back to his home state, Terengganu by sharing his knowledge and experience. In January 2015, Universiti Malaysia Terengganu (UMT) appointed him as a professor. He was the head of the Biology and Biodiversity Laboratory, INOS and then was attached to School of Marine and Environmental Sciences (PPSMS) to chair the Marine Science and Marine Biology programmes.

On the national level, Prof. Dr. Othman was appointed a member of the National Mangrove Committee, as the National Principal Investigator for Red-Tides and Soft Bottom Communities under the ASEAN-Australia Cooperative Programme. He also served on a panel of interviewers for the National Science Fund for scholars under the Ministry of Science and Innovation.

Respected Educator and Marine Ecologist

Prof. Dr. Othman has supervised PhD and M.Sc students in the field of marine ecology and taxonomy and even at this stage, he is still doing supervision. Some of his former graduate students are now experts in marine science and are working in various agencies and universities. Some of them have become professors and associate professors. Prof. Dr. Othman has also taught various courses in marine science and scientific communications at both undergraduate and graduate (MSc. coursework) levels.

Although he started out as a marine ecologist, Prof. Dr. Othman is more recognised for his work as a copepod (small crustacean) taxonomist. He has described and given names to 30 crustacean species and published his findings in more than 100 scientific publications. What is more interesting, two genera and 8 species described by Prof. Dr. Othman were named after local places or personalities, for example, genus Klebang (from Klebang, Melaka)

***Figure 1**: In the early 1980s, Prof. Othman was the only Malaysian copepod taxonomist. In his former laboratory at Universiti Kebangsaan Malaysia, Prof. Dr. Othman had the opportunity to describe a number of copepod species new to science.*

***Figure 2**: Prof. Dr. Othman's expertise in copepod taxonomy and ecology attracts collaboration with international scientists who frequently visited his laboratory. One of the international scientist is Prof. Jack Greenwood (far right), who later became his PhD supervisor.*

and species *Labidocera jaafari* (after the UKM Chancellor, the late Tuanku Jaafar, Yang di-Pertuan Besar of Negeri Sembilan).

The quest for knowledge (and perhaps a bit of adventure) in his early days as a scientist led Prof. Dr. Othman to participate in a number of research cruises in Japan, Australia and Malaysia. The cruises in Japan, together with the summer courses that he attended for three consecutive years in Hokkaido, ignited his scientific passion for copepods. He recalled "My earlier research was on fish toxicity studies back in the early 70s when I studied at the University of Strathclyde. However, the change from fish to copepod was influenced by the late Prof. Dr. Motoda from Japan and Dr. David Tranter from CSIRO Australia. Both of them were instructors for the 'Marine Environment' summer courses that attended in Japan. Upon receiving the Colombo Plan Scholarship from the Australian Government to do my PhD, I decided to focus on copepods under the supervision of Prof. Dr. Jack Greenwood, a renowned copepodologist."

The exposure and experience in Japan led to invaluable networking with the Japanese and the seeds of collaboration were sown. In the early 1990s, the professional relationship with Professor Dr. Tatsuki Toda from Soka University was forged which allowed collaboration and cooperation to be expanded and has proven to be fruitful and beneficial to both parties. It has not only resulted in a myriad of scientific publications but also the training of young scientists. Over the years, Prof. Dr. Othman would spend time in various capacities at Soka University, from giving lectures to undergraduates to supervising graduate students. 'I first met Prof. Toda at Prince of Songkhla University, and he expressed the need to collaborate with me in scientific research. From there on, we expanded our collaboration not only in research, but also in the training of young scientists from Japan and Malaysia.

***Figure 3**: The young Prof. Dr Othman looking for his favourite organism – copepod on board a research vessel off Hokkaido (Japan) waters in 1975.*

***Figure 4**: Prof. Dr. Othman explaining to marine science students on how to use flowmeter, an important equipment in plankton research.*

I was fortunate to receive Teruaki Yoshida as my PhD student at UKM as a result of this collaboration'. (Dr. Teruaki Yoshida currently serves as an Associate Professor at Universiti Malaysia Sabah). Apart from Japan, scientists from neighbouring ASEAN countries have been collaborating with Prof. Dr. Othman until today.

Throughout his academic career, Prof. Dr. Othman received research grants from various sources including the Malaysian Government (IRPA, Science Fund, GUP, OUP and FRGS), Japanese Government (JSPS) and from several corporations (Exxon-Mobil, Doris, Kanto Rika and Nikko Teknos).

A 'Yoda' to the young taxonomic 'Jedi'

One of the tasks given to Prof. Dr. Othman at UMT is mentoring the young lecturers, particularly in the field of taxonomy. He has met and discussed with many young lecturers and given advice on how to excel in their respective fields. As a result, one of his mentees, Dr. Nurul Huda Ahmad Ishak recently published a taxonomic paper on salps from the South China Sea (see Research Paper section). Another mentee, Dr. Izwandy Idris is now the head of South China Sea Repository and Reference Centre which manages marine collections from the South China Sea. Other mentees are also productive not only in research but also in research network, heeding advice from Prof. Dr. Othman.

Prof. Dr. Othman strongly believes that Malaysia needs more marine taxonomists and opined that 'we have many species that have not been described and marine species that are yet to be discovered in Malaysia. Various marine organisms from the sea have the potential to contribute to the discovery of new drugs. The basis of finding the drugs lies primarily on knowing the taxonomy of the species'.

Age is just a number

At the age of 70, Prof. Dr. Othman shows no sign of slowing down with his scientific works. Apart from academic work as a lecturer, programme head (Marine Biology) and a mentor at the School of Marine and Environmental Sciences, Prof. Dr. Othman is also UMT's advisor for the Japan Science Technology Research Partnership Strategy (SATREPS) Continuous Operating System for Microalgae Culture Optimized for Sustainable Tropical Aquaculture (COSMOS). At the national level, he is the head of Malaysia's Plankton Group for Japan Society for the Promotion of Science (JSPS) Core-to-Core Programme.

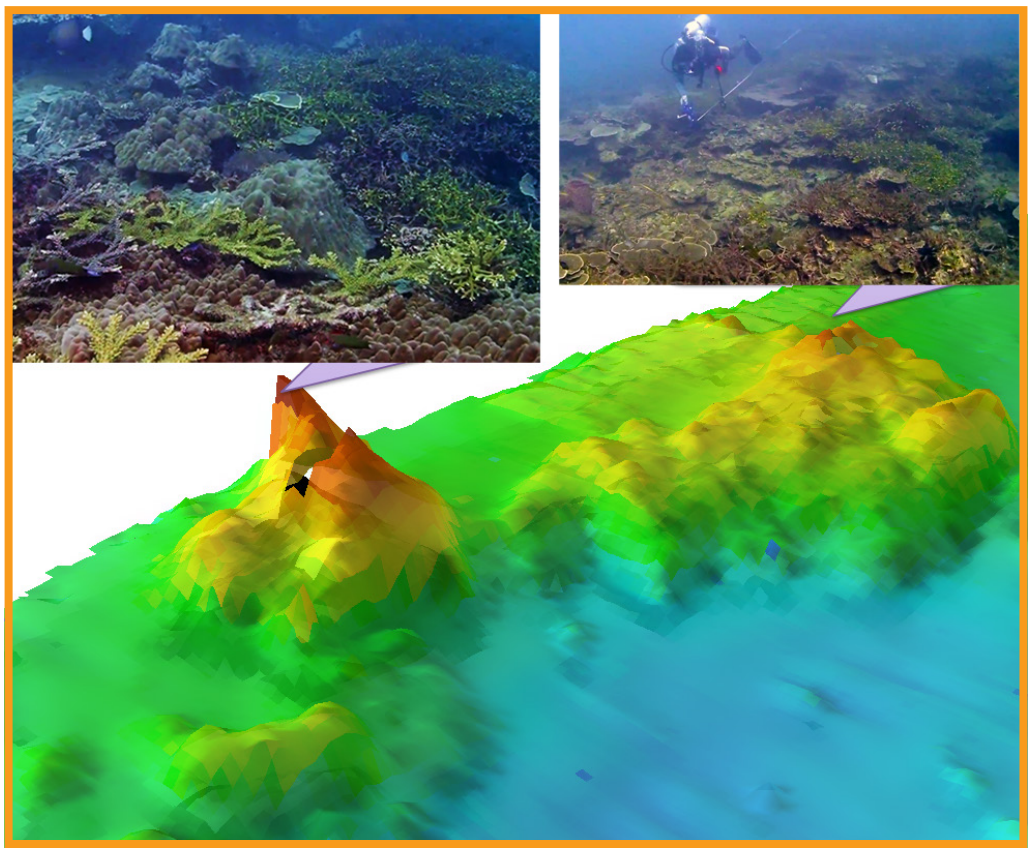
Starting from 2019, Prof. Dr. Othman will spend more of his time on his beloved copepods as he has a plethora of specimens waiting to be described. At the same time, he hopes to continue mentoring young lecturers for them to be able to survive in academia. Academic and research issues such as insufficient research funding and research directions are common for newly appointed academic staff. Thus, Prof. Dr. Othman firmly believes that working together in a group could solve some of the issues. 'Research group is an excellent strategy for sharing financial and research resources to facilitate scientific activities. In this way we can gather researchers working on certain groups of organisms to work together and know the knowledge gap', he added.

Prof. Dr. Othman strongly feels that UMT has all the advantages to become a key player in marine studies. Most marine and maritime related fields are being offered at the undergraduate and post-graduate levels with qualified lecturers. 'Having a campus by the sea is definitely a plus point.' Prof. Dr. Othman quipped.

The Sound of the Seafloor

Paving the Pathway Towards International Visibility with National Oceanography Centre, Southampton

By:
Dr. Khaira Ismail
School of Marine and Environmental Sciences



Multibeam bathymetry data showing the depth of the ocean floor and Coral Video Transect used as groundtruthing material | Photo by INOS

Ocean exploration is an extensive science and the research is too great for any one institution to act alone. University Malaysia Terengganu, as a developing oceanography institute has to embark on an international pursuit in order to grow to be a world-renowned oceanography institute. One of the strategies to make our institute and its capabilities visible worldwide is through collaborations with pioneering institutes in ocean science across the globe. One notable example is the collaboration with the National Oceanography Centre, Southampton (NOCS), one of the world's top oceanographic institutions. They provide the United Kingdom with the national capability needed in order to be a top global player in ocean science. They strive in research from the coast to the deep sea, from fundamental science to the latest ocean measurement technology innovation and they undertake world leading research in large scale oceanography.

The NOC was formed in 1949 and it grew from the work of scientists working at Antarctic whaling stations and the complimentary voyages of Captain Scott's Discovery to study the movement of waves affecting amphibious landing. Fast forward, NOCS was renamed in 2005 by HRH, the Duke of Edinburgh reflecting its prominence and national capability in ocean and earth sciences. As one of their missions is to undertake international linkage for effective translation of new and existing knowledge into demonstrably high societal benefit, a partnership with UMT is mutually valuable for both.

A Platform for Advancement

Having established a research tie back in 2012, the collaboration with UMT continues in 2018 with the focus on seafloor mapping. The focus is to build national capabilities in habitat mapping to support effective ecosystem-based marine spatial management in Malaysia. As explained by Dr. Tim Le Bas, a senior

(Left) Dr. Tim Le Bas of NOCS inspecting the multibeam setup. The multibeam echosounder is mounted on the pole for the survey. (Right) Retrieving sidescan sonar at the end of the survey. | Photo by INOS

scientist in habitat mapping – NOCS could provide the expertise for UMT in order to propose a comprehensive protocol for effective habitat mapping exercise as an onset for a much more elaborate work of habitat mapping in Malaysia. Furthermore, NOCS is at the leading edge in developing ocean measurement technology with the establishment of their Marine Robotics Innovation Centre which is working closely with specialised engineers and industries. This is something that we could benefit from.

In line with this, two NOCS experts in seafloor mapping, Dr. Tim Le Bas and Dr. James Strong visited UMT twice in 2018. The purpose of the first visit in January 2018 was to kick-off the UK's ACCORD project (Addressing Challenges of Coastal Communities through Ocean Research for Developing Economies – Pathways to Impact). Among its specific objectives are to develop and provide novel tools and approaches that improve the ability to quantify and predict the impacts of environmental stress on ecosystem function, identify asset vulnerability and resilience. Additionally, to increase the efficiency and cost-effectiveness of seabed mapping to quantify the potential for exploitation of both living and non-living seafloor resources and identify the processes that underlie the maintenance and sensitivity of those resources.

Habitat Mapping

On their second visit in March 2018, they carried out the plan prepared

***Figure 3**: UMT and NOCS team at the end of the acoustic survey in Pulau Bidong. Clockwise from top left: Mr. Azri Muhamad, Mr. Roslan Latif, Dr. Azizi Ali, Dr. Khaira Ismail, Dr. Tim Le Bas, Dr. James Strong and Mr. Shukri Arsad. | Photo by INOS*

***Figure 4:** Dr. Tim Le Bas (right) supervising the acoustic acquisition work on board. | Photo by INOS*

***Figure 5**: Dr. James Strong verifying the coral growth at different depth for coral reef mapping in Bidong Island. | Photo by Mohd Safuan*

in January during through a two-week collaborative effort of habitat mapping survey in Pulau Bidong. Habitat mapping is a general terminology encompassing maps produced from the acoustic survey of the seabed to mapping a defined biological assemblage or biotopes such as coral reef, sea grass, sea mounts etc. A habitat map is a useful tool to bridge the gap between policy makers and scientists as it is capable of retaining important scientific information without overwhelming a non-scientist audience. The habitat map is a statement of the best estimate of habitat distribution at a point in time of making the best use of the knowledge that is available at the time. Here, we focus on mapping the coral reef occurrence.

The collaborative effort was jointly carried out by Dr. Khaira Ismail from the School of Marine and Environmental Sciences and Dr. Azizi Ali from the Institute of Oceanography and Environment, UMT. Associate Professor Dr. Zainuddin Bachok contributed his extensive knowledge of coral reef occurrence around Pulau Bidong. This knowledge is crucial to validate the capability of the acoustic data acquired for habitat mapping. Dr. James Strong was responsible to tie in the ecological information into the acoustic data working with video and photography data collected during the acoustic survey. It is common in habitat mapping practice to be working with at least 5 different types of data in order to achieve a reliable map. Therefore a well-organised data management will go a long way. Such practice will ease future work especially if the effort is to be carried out extensively at the national level.

Building National Capabilities

As a wrap up of the survey, a brief workshop on data processing and data management was carried out and the recommended operating guideline for habitat mapping was drafted. As Malaysia has one of the most diverse

5

Underwater videography by Dr. Zainuddin Bachok for ground truthing of benthic community. | Photo by Mohd Safuan

habitats in the world, the lack of baseline data makes it complicated to quantify, monitor and effectively manage. A limited number of habitat mapping experts and teams in Malaysia marked UMT as the only university with an experienced team for seafloor surveying for habitat mapping purposes. Such discipline is crucial for Malaysia to fulfil its international obligation for instance, Convention Biological Diversity and Coral Triangle Initiatives. Habitat mapping has never been more urgent for us to fulfil the commitment to conserve 10% of the coastal and marine areas through effective and equitable management.

Beyond the Horizon

In the near future, a workshop on detailed habitat mapping techniques will be next on the agenda for NOCS and UMT and this will be attended by at least three habitat mapping experts from NOCS. Apart from that, an opportunity for a research attachment is being offered by NOCS for UMT staff and students for training in seafloor mapping technology and ocean data management. Additionally, the collaboration is looking to support cross-disciplinary research in ocean sciences. Although the focus is inclined towards habitat mapping, the purpose of a habitat map itself is as a baseline data that is needed in every aspect of oceanography study. It can either be used as main information or as valuable auxiliary data. For instance, through habitat maps we have the capability to map the habitat suitability for marine organisms and its resilience towards certain environmental conditions.

Young Scientist

Dr. Mohd Uzair Rosli

by:
Dr. Nor Omaima Harun
School of Fundamental Sciences

Photo by: Dr. Mohd Uzair Rosli

What drew you to this field and what are the discoveries that have led up to your current work?

My supervisor once said; If you want to be a turtle scientist, there are thousands of turtle scientists. You have to create your own niche area so that you are no longer a follower. So one day I got an idea of integrating my hobbies and study.

In a cycling event, cyclists moving in a big group have termed it as 'social facilitation' and this term is also used for sea turtle hatchlings nest escaping phenomena. Previously, the description of the nest escaping behaviour of turtle hatchlings from their underground nest has been limited to the classic observations made through a glass pane in the early 60s. Since these pioneering studies, researchers have used the term 'social facilitation' to describe the way hatchlings work together to escape the nest. However, no investigation has been done to explore how 'social facilitation' might influence the energy spent, similar to one that has been done for cyclists in cycling events.

From our data, it is estimated that sea turtle hatchlings would use approximately 10% of their reserved energy when digging with at least 60 individuals. However, we are currently working on modelling this energy saving estimation mathematically with other variables such as nest depth, temperature, sediment texture, moisture etc.

Being with SEATRU

As a SEATRU leader, Dr. Uzair is responsible not only for doing scientific research but he is also actively involved in conservation activities. One of the iconic conservation programmes in UMT since 1998 is the SEATRU volunteer programme at Chagar Hutang, Redang Island and this programme has received volunteers from all around the world. It was developed to provide volunteer assistance to the long-term monitoring, tagging and in-situ egg incubation research and conservation project for sea turtles.

Besides that, Dr. Uzair is also one of the technical advisors for *Persatuan Khazanah*

Rakyat Ma'Daerah (MEKAR), an active local community society in Kerteh, Terengganu.

Dr. Uzair has worked in conservation science and holds on to the hope, that more people will work together to protect their own precious natural heritage such as sea turtles, and important marine ecosystems like mangroves for the survival of endangered species and moving towards the development of a sustainable society.

Which is your favourite aspect of your research?

I would say the fact that we are trying to measure something, which is the energy spent by hatchlings while escaping their nest. Thus, I had to start experimenting and most of the time it ended in failure. It does challenge my problem solving skills to the limit.

Why is your area of scientific discovery important (or relevant) for citizens of this country?

This study is crucial for sea turtle conservation worldwide especially their relocating egg clutching practices. In a big group, hatchlings only use 10% of their energy reserve but the smaller group when compared to the smaller, use more than half of their reserve energy. This is related to the egg-splitting clutching practices in sea turtle conservation worldwide. In short, PUT ALL EGGS IN ONE BASKET!

In the animal kingdom, at least 10 different patterns of moving formation have been identified and described with mathematical models. Some of the most remarkable examples of moving formation can be observed in flying bird flocks and fish schools that have been shown to influence speed and reduce

resistance around the adjacent individuals in formation and thus save on the energetic cost of transport.

Share a defining moment in your work as a scientist

I was invited as a Keynote speaker to share our discovery on proofing the long standing theory on 'social facilitation' at The 35th International Sea Turtle Symposium held in 2015 at Mugla, Turkey.

What do you hope to gain from this field?

To enhance national interest in science

Tell me what you like to do when you aren't doing research

Cycling

***Figure 1**: Sharing my research update on investigating sea turtle hatchlings digging behaviour at The 38th International Sea Turtle Symposium in Kobe, Japan.*

***Figure 2**: Participating in a discussion as a visiting scientist at Biosphere Informatics Lab, Graduate School of Informatics, Kyoto University.*

***Figure 3**: Checking a male green turtle carcass stranded at Kampung Pengkalan Atap, Batu Rakit .*

***Figure 4**: Lifting sea turtle carcass to bring back to repository center (INOS, UMT) for further investigation of his cause of death.*

Supporting education hand-in-hand with the industry: Laguna Redang Island Resort

by:
Dr. Mohd Uzair Rusli and Dr. James Tan Chun Hong
School of Marine and Environmental Sciences, UMT

Laguna Redang Island Resort, operated since July 2002 on Redang Island, is one of the famous tourist hotspots in the east coast of Peninsular Malaysia. Apart from operating business on the island, Laguna Redang Island Resort is committed in supporting marine research and educational programmes. Through its commitment, Laguna has allocated a room which has been converted into a wet laboratory for marine research purposes. The lab is a field station upon request which is made available to undergraduates, postgraduates and researchers from UMT. Laguna has supported more than five students doing the Masters programme and over a dozen of undergraduate students on their field trips for the past 15 years. In addition, Laguna has also generously provided complimentary food, accommodation and logistic support for researchers from UMT during the field trips at Redang Island.

Sea Turtle Research Unit (SEATRU) had introduced an outreach programme which is Save our Turtle Outreach Programme

Managing Director, Mr. Toh Seng Lip (in blue) accompanied by Mr. Peter Cheng (General Manager) of Laguna Redang Island Resort receiving a souvenir from Professor Dato` Dr. Nor Aieni Binti Haji Mokhtar, Vice Chancellor of UMT after the Memorandum of Understanding signing ceremony between UMT and Laguna Redang Island Resort in February 2017. (photo credit: James Tan)

Dr. Tan Chun Hong (James) demonstrating coral nubbins settling procedure to volunteers during the coral transplant event at Laguna Redang Island Resort (photo credit: Mohammad Hafiz Borkhanuddin)

(STOP) from 2001 until present. This outreach programme was initiated in order to support the long-term sea turtle conservation programme at Redang Island. STOP comprises several programmes which are the Sea Turtle Volunteer Programme, the Marine Awareness Programme and the Turtle Camps. Sea Turtle Volunteer Programme was developed to provide volunteer assistance to the long-term monitoring, tagging and in-situ egg incubation research and conservation project for sea turtles at Chagar Hutang Turtle Sanctuary, Redang Island. This volunteer programme is open to the public, both local and international, aimed to give the public hands-on experience and knowledge on conserving sea turtles at Chagar Hutang. Since its introduction in 1998, more than 4000 volunteers have participated. Laguna Redang Island Resort gives great help to SEATRU by fully sponsoring ferry transportation for volunteers since 2005 and by making available perishable food for SEATRU to buy since 2012 thus making it much easier for restocking the weekly food supplies.

Apart from the Sea Turtle Volunteer Programme, STOP also started the Marine Awareness Programme in 2012 to increase awareness and understanding on conservation of sea turtles, as well as to promote ocean conservation to the public. This programme offer interesting and interactive activities which includes poster exhibitions, colouring activities for children, sale of merchandise and hatchling release. Information on sea turtles was spread to the public and through this channel members of the public could be inspired to become conservationists and in turn spread the knowledge to others. Children are

also participants of this awareness programme and as a consequence, they are encouraged, at a very young age, to love sea turtles. Laguna Redang Island Resort has become one of the main sponsors since this programme started, by providing ferry transportation, accommodations, food for four days and three nights to the facilitators. In conclusion, sea turtle conservation and outreach programmes (Sea Turtle Volunteer Programme and Marine Awareness Programme) conducted by SEATRU would not have run smoothly and on a long-term basis without the help and support from corporate agencies such as Laguna Redang Island Resort as well as participation and donations from the public.

Local and international audience attended the Marine Conservation and Awareness seminar organised by Laguna Redang Island Resort and The International SeaKeepers Society Asia, supported by researchers from Universiti Malaysia Terengganu and Singapore Reefs. (Photo credit: James Chang Wai Hoong)

Sending off Sea Turtle volunteers through Laguna Ferry service from Shahbandar Jetty. (Photo credit: SEATRU)

Together with UMT, several research-oriented workshops were conducted at the Resort, for example, a coral reproduction training workshop which involved participants from local universities and NGO. Besides, Laguna and UMT frequently organise marine and beach cleanup events in Redang Island. Starting 2018, Laguna has embarked on a new conservation effort. Partnering with UMT, Laguna has set up a coral transplantation site underwater. The transplanted corals (180 nubbins) are monitored by Laguna's in-house Marine Science Officer (ex UMT graduate). The establishment of this site provides an opportunity for researcher from UMT to explore the health of coral reefs in a closely monitored way which further enhanced the collaboration between UMT and Laguna. After more than a decade of collaboration, Universiti Malaysia Terengganu and Laguna Redang Island Resort signed a Memorandum of Understanding on 20 February 2017 to formalise the partnership.

Together with UMT, Laguna Redang Island Resort established a coral transplantation project to provide a great platform for marine awareness and educational opportunity. (Photo credit: Putri Asma Megat Yusop)

ULIK MAYANG
Heritage of Terengganu

by Dato' Assoc. Prof. Dr. Noraien Mansor

Origins of Ulik Mayang

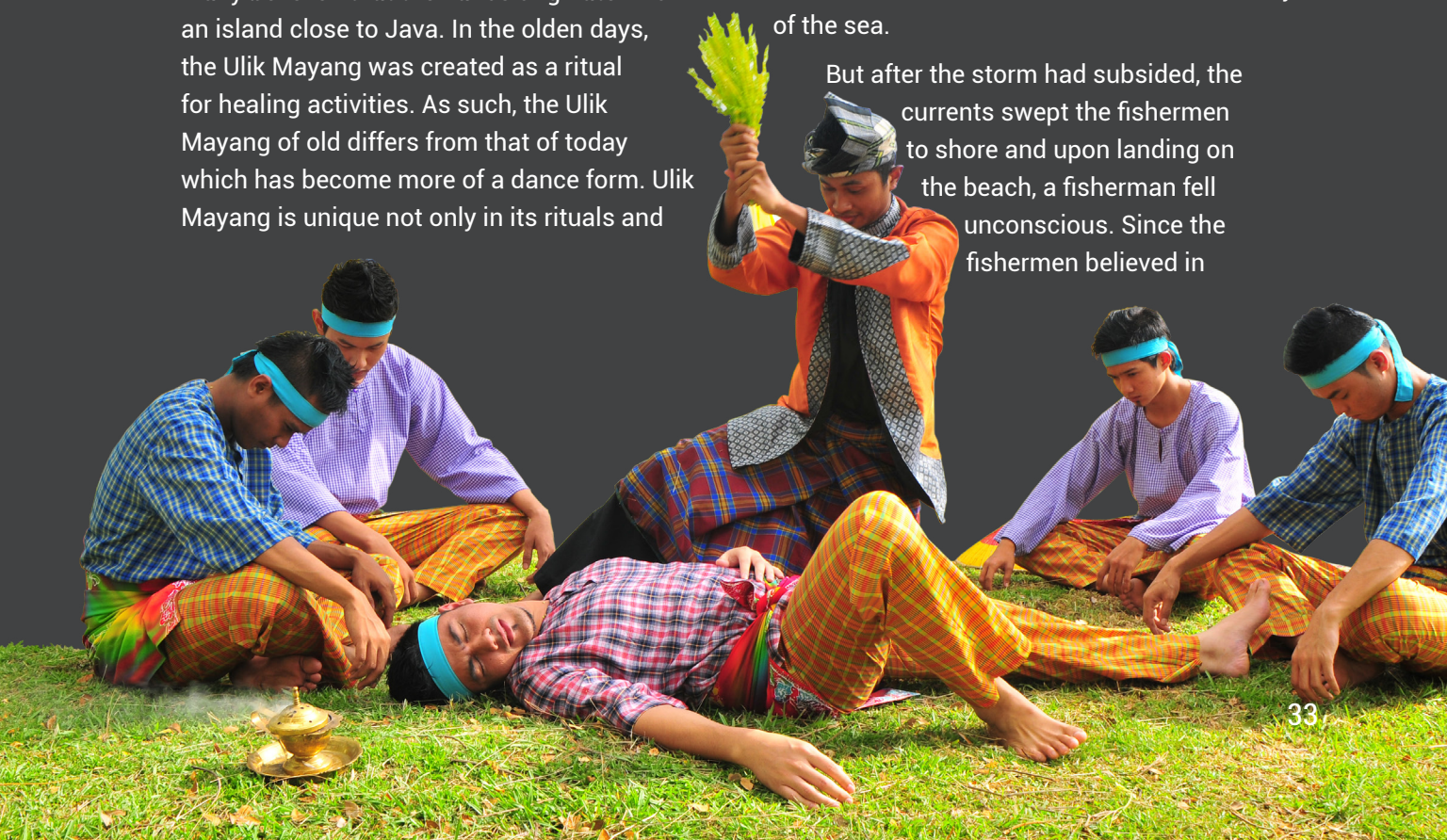
In pre-Islamic times, coastal communities who believed in the existence of life forces in the natural environment such as spirits and mystics used dances as a means of communication with ancestral spirits. The Terengganu community, which is deeply synonymous with coastal living, is no exception to such activities. They created complete rituals in the form of dance movements, giving rise to the creation of the Ulik Mayang dance which has become a famous image in the state.

According to history, the Ulik Mayang dance existed during the reign of Sultan Umar (1839-1870) who was originally from Java. Many believed that the dance originated from an island close to Java. In the olden days, the Ulik Mayang was created as a ritual for healing activities. As such, the Ulik Mayang of old differs from that of today which has become more of a dance form. Ulik Mayang is unique not only in its rituals and beliefs, but also in its lyrics, costumes, musical instruments, and the reason behind its creation.

The strength of the Ulik Mayang dance lies in the lyrics that were sung during the performance which contain elements of worship used by the shaman or traditional healer to cure ailments. Today, the lyrics of the Ulik Mayang song have been amended to comply with the teachings of Islam.

There are various versions of the Ulik Mayang legend. It is believed that the dance was an outcome subsequent to a trip out to sea by a group of fishermen. In the middle of the sea, they were caught in a storm, and their boat rocked by strong waves. As a result, all the fishermen were thrown overboard at the mercy of the sea.

But after the storm had subsided, the currents swept the fishermen to shore and upon landing on the beach, a fisherman fell unconscious. Since the fishermen believed in



animism, spirits, and the mystical, they enlisted the help of a shaman to treat the unconscious fisherman. A few of them suspected that the soul of the unconscious fisherman was lost in another world, leaving his body lying on the beach.

After chanting a spell, the shaman discovered that the fisherman had been bewitched by the spirit of the sea. In this instance, the spirit of the sea was a princess in another realm. According to legend, the princess was testing all the fishermen but only one fell under her spell. The unconscious fisherman was believed to have been trapped and his soul wandering in the realm of the bunian (supernatural).

While the shaman was battling with the princess to try and bring the fisherman's soul back to the real world, the princess called five of her sisters to her aid. As the battle became increasingly intense, the Seventh princess appeared, to whom the shaman appealed to restore the fisherman's soul. Realising her siblings' mischief, the princess commanded the fight to stop, saying:

"Aku tahu asal usulmu",

"Biarlah yang laut pulang ke laut dan yang darat pulang ke darat".

Thus, with the help of the seventh princess, the battle ended but on condition that the princesses be served with coloured rice (yellow glutinous rice) in a ceremony to appease (by feeding) the bunian.

Although there are different versions of the origin of Ulik Mayang, the tale and chronological order of events about a group of fishermen being washed ashore with one of them not regaining consciousness remain the same. With the advent of Islam, the use of invocations during the healing ceremony was the subject of contention among religious scholars as they believed that these verses contained elements of shirk (worshipping other than god) and superstition. The spread of superstitious beliefs and elements of shirk had to be curbed to ensure the smooth development of Islam in society. Today, the Ulik Mayang dance is the modified version of the original and is performed purely as an art form as there were too many elements in the original Ulik Mayang that went against the teachings of Islam.

Dance Concept

In terms of performance, the current Ulik Mayang dance is very different from its original form. Originally, the Ulik Mayang was performed as a healing ritual whereas today, the dance has become an art form. The mantras used in Ulik Mayang of today are different from those of the past as they have undergone a change in the length of the spell. The original mantra was

lengthy and became the subject of contention, resulting in the removal of "seru mayang" as it was clearly invocation of a supernatural entity. At that time, the palm blossom still had healing and artistic functions. The original mantra, also known as the Ulik Mayang healing mantra, was still being recited.

In the 1980s, Ulik Mayang went through a gloomy phase when the authorities banned the use of the original spell in Ulik Mayang. Debates ensued as the mantra was deemed to contravene the teachings of Islam as it had the element of invoking that which was considered superstitious. The music was also the creator's idea because in the original performance, there was no music and only the spell was recited during the healing ritual. As such, the current version of the Ulik Mayang came about from the imagination of its creator who turned the spell into a song.

Today, the Ulik Mayang dance has been completely transformed into a performing art and it has become the icon of art for the state of Terengganu. Although it has undergone a transformation, it has retained the original concept of the seven princesses, the shaman or traditional healer, the bewitched fisherman, and the character that helped healed the victim. This original concept, a symbol of the Ulik Mayang dance, is not contrary to Islamic teachings.

Ulik Mayang begins with the performers standing in a circle, the size of which depends on the number of performers. A performer sits in the middle of the circle, holding a palm blossom, and another is the lead singer ('adi') in the ensemble. The dance performance starts with three male dancers lying in an unconsciousness state while another holds a palm blossom. A background singer sings the Ulik Mayang song summoning the Second Princess. Upon the appearance of the Second Princess dancing behind the male performer, the voice thereafter summons the Fourth, the Sixth and the Seventh Princesses. When the Seventh Princess appears, the song to drive and send away the spirits is sung. Overall, the Ulik Mayang dance involves 11 performers consisting of four men and seven women.

Equipment and Costume

Palm Blossom

The main item in the Ulik Mayang dance is the areca nut palm blossom that is used by the shaman or traditional healer during the performance. Its main purpose is to invoke the spirit of the blossom and as such, it bears significant meaning in the Ulik Mayang dance. Therefore, the areca nut palm blossom is used in the Ulik Mayang dance until today.

Musical Instruments

Unlike the Ulik Mayang of the past which does not use musical instruments, the modern version of the Ulik Mayang dance is accompanied by various musical instruments. In line with the changes made by Ulik Mayang practitioners, musical instruments were added to inject new life into the art form. The musical instruments create an immersive atmosphere and rouse the spirit of the seven princesses. These instruments include the accordion, viola, small/large rebana or silat drum, guitar, and gong.

Costume

According to several cultural experts in Terengganu and those involved in the Ulik Mayang performances, there is no special costume for the dancers. The Ulik Mayang costume is inspired by and reflects the beauty of a princess. Originally, the dancers were dressed based on the gamelan costume which comprises a short top worn with gold embroidered *sarong* to symbolise the high stature of a princess. The dancer who plays the part of a princess wears a yellow shawl, an inlaid belt, and a crown on her head. The dress is yellow, green, and red, which have specific symbolic meaning in the customs of the Malays. The male dancers who play the roles of the shaman and fishermen are dressed like fishermen when they go out to sea.

Myths and Beliefs

The Ulik Mayang dance has its own myths and beliefs common in Terengganu society. When discussing the aspect of beliefs in the Ulik Mayang dance, we cannot but mention the mystical elements and myths of the time before Ulik Mayang was altered to its present form. In the olden days before the advent of Islam, the local communities believed in animism. Basically, Ulik Mayang relates

to rituals for a spiritual and physical life, such as creating gestures featured in the performance.

The Terengganu community, in particular, performed this dance as a healing ceremony together with ailments of a shaman, also known as peduan. This was a normal practice of the community in pre-Islamic times. During the process of treating the illness, the shaman or peduan would perform certain rituals such as summoning the spirit of the sea. An important belief with respect to the Ulik Mayang, which became a symbol and myth in the community, was the existence of the seven princesses who appeared during the ceremony. Therefore, it is not surprising that the seven princesses are still depicted in the Ulik Mayang dance even after its alteration made by its practitioners.

The effectiveness of the ritual was tested with a mantra recited by the shaman or peduan. A number of important factors determined the effectiveness of the mantra, namely faith and confidence, purity, attitude, atmosphere of the location, and the items used. In the past, the Ulik Mayang mantra was used widely until it was banned following the arrival of Islam since enlisting the help of a supernatural entity which considered a form of superstition.

Another belief was the offering of the yellow glutinous rice after an Ulik Mayang ceremony as a token of gratitude to the seven princesses. The yellow glutinous rice has its own significance in a ceremony. Before the advent of Islam, this was an important part of the Ulik Mayang ceremony but today, the yellow glutinous rice is served as a delicacy at most ceremonies such as tahlil prayers, weddings, and formal functions or presented as a gift to guests.

The present Ulik Mayang dance also features the seven princesses. The dance creator visualises the princesses to create their attire and accessories. According to folklore, the seven princesses were siblings with the eldest being the most intelligent for she was able to resolve the battle between the shaman and her six sisters. Based on the current version, the Ulik Mayang comprises seven beautiful princesses who are central to the imagination of the dance creator.

Today, some people still believe in the strange events that occurred during the Ulik Mayang process or matters related to it. For example, incidents of hysteria during the performance of the Ulik Mayang dance are often published in the mass media. These mystical incidents will continue to revolve around the Ulik Mayang ceremony for even before the advent of Islam, it involved the invocation of supernatural entities or spirits. Therefore, it is not surprising that Ulik Mayang was once banned by the Terengganu State Government for its superstitious elements that violated the teachings of Islam.

Closing

Today, the original Ulik Mayang has been altered by Terengganu art practitioners by excluding all superstitious elements that are contrary to Islam. Even the lyrics of the Ulik Mayang song have been revised to adapt to the dance concept. The lyrics no longer contain spells, which are prohibited by Islam, to adapt to the current situation. Its dance form and characters are also the result of the creative imagination of practitioners of the art to produce Ulik Mayang as a traditional Malaysian dance. To date, the Ulik Mayang dance continues to thrive for the benefit of the present and future generations.

THE JELLY BEANS of the sea

by:
Dr. Izwandy Idris
School of Marine and Environmental Sciences, UMT

Photo by:
Dr. Nurul Huda Ahmad Ishak
School of Marine and Environmental Sciences, UMT

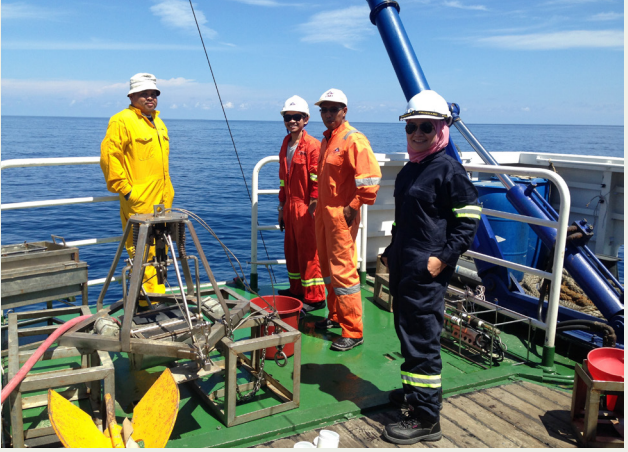
Dr. Nurul Huda Ahmad Ishak with slippery and slimy salp on her hand.

The paper co-authored by Nurul Huda Ahmad Ishak, Nur Aliah Adam and Zaleha Kassim is focused on a group of gelatinous zooplankton taxa (salps) which have been studied for more than 200 years. Salp is a group of important marine organisms that are notoriously difficult to work on due to their fragility, sporadic abundance fluctuations and complex life cycles. Their hardly predictable and intermittent occurrence in various parts of the oceans has been a major challenge to obtain information on their ecology. Ideally, because of their occasional though sometimes dominant abundance, numerous cruises per year at short intervals is required, but which at most times, is unfortunately infeasible.

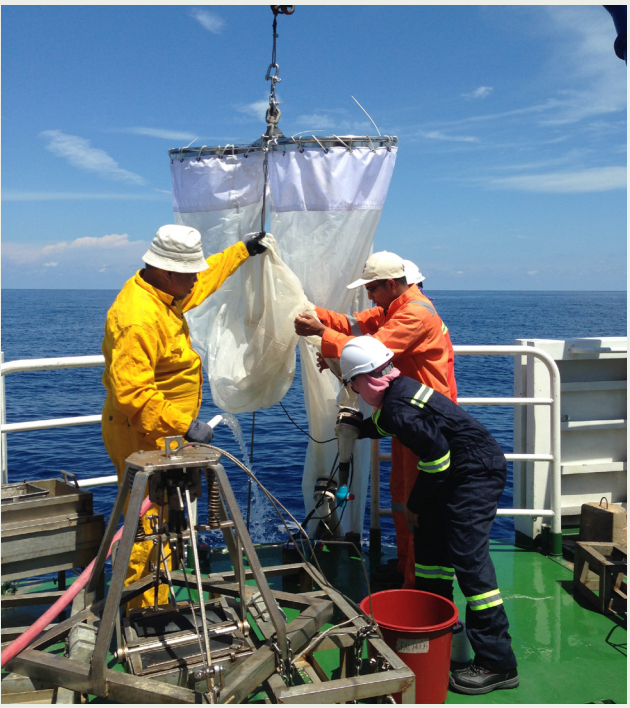
What is salp?

Salps are barrel-shaped, soft-bodied planktonic tunicate belonging to phylum Chordata. Most tunicates have two openings, anterior and posterior, projecting from the other. They are plankton feeders and live by drawing seawater through their bodies. You might be surprised that tunicates are actually more similar to humans compared to other invertebrates. One clue that tunicates are related to vertebrates is they have a nerve cord down its back similar to the nerve cord found inside the vertebrates.

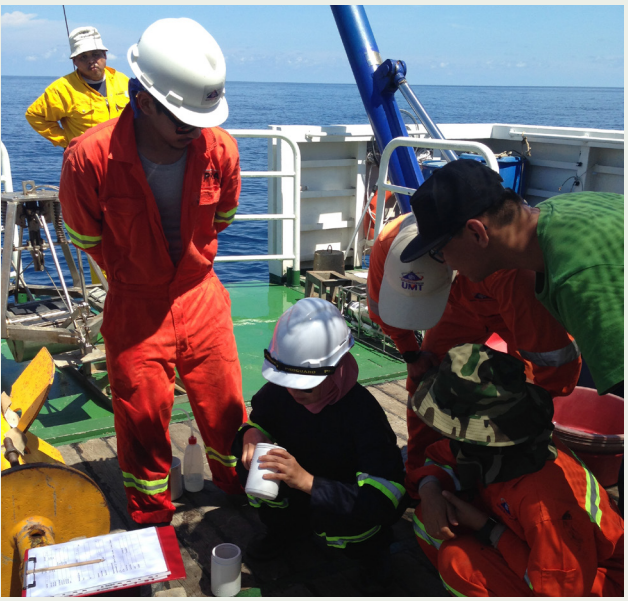
These wobbly-jelly salps may increase abundantly as oceans become warmer because of changing climate.



With INOS team members during scientific cruise expedition in 2017.



Collecting zooplankton using Bongo net



Observing zooplankton live samples while on board.

Why does taxonomy on Salp matter?

This frequently asked question, the basis of many discussions, is that we should be doing more work on salps to determine their role impacting marine ecosystem, although very few marine scientists have taken on the challenge. While biodiversity is being lost as a consequence of climate change and anthropogenic activities, action must be taken to combat this trend. But how can we decide where to establish the protected areas? What are we protecting? How do we conserve and sustainably use the biological diversity resources if we don't know the biological diversity that we have?

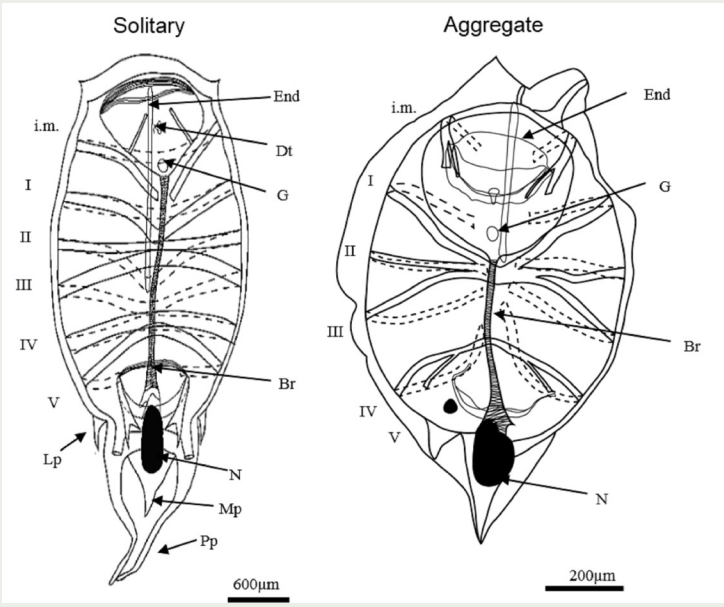
On the other hand, taxonomy provides basic understanding about the components of biodiversity of an ecosystem. However, incorrect identifications can impede ecological studies. What is more, possible species misidentification could affect evaluations of population status and distribution, leading to inaccurate reporting and incorrect conservation decision-making!

Salp blooms around the world

Environmental and climate changes in the ocean trigger the growth of salps over copepods, the latter of which are vital food source for fish juveniles and other sea creatures. Salp's physiology is strongly coupled to temperature. When the physical and biological condition meet their preferences, they will 'clone' themselves with remarkable speed and dominate the ecosystem, which can comprise around 80% of zooplankton abundance under bloom conditions.

Several salp blooms have been reported in numerous locations all over the world and the blooms are increasing in number at a global scale. Malaysia makes no exception. Recent bloom events of salps have been recorded in Malaysian waters (Pulau Kapas in August 2017 and Mersing, Johor in April 2018). Due to insufficient knowledge to evaluate the ecological impact of salp blooms, we have difficulty in predicting their response to environmental change. Since taxonomic study is a fundamental basis for all disciplines of science (especially biology and ecology), the authors therefore commit themselves to work on the taxonomic studies on salps in Malaysia.

Salp.



Drawing of Thalia rhomboides (Quoy & Gaimard, 1824). Left, solitary; Right, aggregate zooid. Ap., atrial palp; Br, branchial septum; Dt., dorsal tubercle; End, endostyle; G, ganglion, i.m., intermediate muscle; Lp. lateral projection, ; Mp., medioventral projection; N, nucleus ; o.m., oral musculature; Pp., posterior projection.

First taxonomic report on salps in Malaysia

The marine pelagic tunicates of family Salpidae Lahille, 1888 present in the coastal waters of Terengganu was studied for the first time. Samples were collected from April to July 2016 using a 200µm Bongo net; hauled vertically from a stationary vessel; and preserved in 5% buffered formaldehyde. A total of 4 species under this family were found, observed and identified: *Thalia rhomboides* (Quoy and Gaimard 1824); *Thalia sibogae* (van Soest 1973); *Weelia cylindrica* (Cuvier 1804) and *Brooksia rostrata* (Traustedt 1893). All species were identified as new records in Malaysian waters. The description on morphological characteristics and a key to the solitary and aggregation of the recorded species is added. The distribution was analysed from 18 sampling stations in Terengganu waters including Pulau Bidong, Pulau Yu and Pulau Kapas. The collected data was then compiled with previous available global literature on the distribution and occurrence of these four species, consequently updating the biodiversity of Malaysian fauna and its worldwide biogeography distribution. Not only is the taxonomic report on salps the first from Malaysia but also it is a publication from the first author's research grant Research Acculturation Grant Scheme (RAGS).

DR. MELISSA BEATA MARTIN

by:
Dr. Izwandy Idris
School of Marine and Environmental Sciences, UMT

Photo by:
Personal Collection of
Dr. Melissa Beata Martin

A walk in the magical museum…

Imagine yourself waking up to a simple Australian flat near the beach, and the burst of reds, pinks and yellows of the morning sunrise welcomes your day. You work in a museum that is a 5-minute drive away, but instead you cycle for a good 20 minutes to absorb the fresh sea breeze and say your morning greeting "G'day mate" to friendly strangers. At the museum's back of house (where ALL the magic happens), you start at your workbench, looking at heaps of crustacean specimens, searching for any morphological differences. You come across a "likely new species", but before you get all excited, you go back and forth looking at old literature, some dating as far back as the 1880s, just to find clues of simple descriptions or figures if the possible "new" specimen has already been described. Worst-case scenario, you would have to get a loan of the original specimen (a.k.a "holotype") just to verify the sample you have before possibly being reported, or the chance of describing a new species! Before you know it, the day ends at the museum. As you walk back home enjoying the splendid view of the beach, you look forward to another day of resolving the mystery of crustacean species.

Dr. Melissa Martin: The story of her taxonomic life

This was the typical work of Dr. Melissa Beata Martin at the Museum of Tropical Queensland (MTQ) in Townsville, Australia. She graduated from the University of Tasmania (UTAS), Australia under the supervision of Prof. Barbara Nowak (main supervisor at UTAS) and Dr. Niel Bruce, who was a senior scientist at MTQ during Melissa's PhD candidature. She worked on the taxonomy and phylogeny of parasitic isopods, a type of crustacean exclusively parasitic on marine, freshwater and brackish fishes. The parasitic isopods that Melissa worked on are from the family Cymothoidae, with almost 400 species in the family.

Taxonomy and phylogeny were not entirely the clear straight path that Melissa had all figured out. Graduating as a marine biologist from Universiti Malaysia Terengganu (UMT), she conducted her final year project for her bachelor's degree on marine parasites from the *dwarf whipray Himantura walga*. It was there that she decided to pursue her interest in parasitology, and from then on Melissa's correspondence with Prof. Nowak took place. The initial proposal was to come up with a project on resolving the conspecificity of the former parasitic isopod *Ceratothoa imbricata* on two of the more important commercial fish species in Australia, the Atlantic salmon Salmo salar and the striped trumpeter Latris lineata. Digging deeper into the root of the matter, both realised that the project at hand was bigger than expected, because the parasitic *Ceratothoa imbricata* was a complex species that was of debate between taxonomists and researchers alike, but was never resolved. Once Dr. Bruce stepped into the scene, not only was a strong team formed, but also Melissa's PhD journey would never be the same again.

Soaring upwards… with networks and awards

Melissa's love for museums and taxonomy (particularly for an interesting group of organisms) began to gather much attention when she received a Geddes Postgraduate Fellowship to visit the Australian Museum in Sydney. There, she worked under the supervision of Dr. Stephen Keable and studied the collections of hundreds of cymothoid specimens collected from all around Australia. The outcome of this travel was not only fruitful for her research, but provided the chance to meet renowned researchers such as Dr. Shane Ahyong, Dr. Jim Lowry and Dr. Mark McGrouther; and was even invited to write her first blog with the Australian Museum entitled "Ouch! An isopod grabbed my tongue". More people (particularly non-researchers) were more curious about the tongue-biting parasites and

Melissa with a scavenging giant isopod (Bathynomus spp.) from the family Cirolanidae (left), a cousin of the parasitic isopod from the family Cymothoidae (right), where her research revolves around.

Melissa examining a preserved flying fish in the Ichthyology Collection at the Australian Museum, Sydney. © Mark McGrouther.

were keen on sending more collected specimens to the museum to get them identified!

Being an active member of the Australian Society of Parasitology (ASP), Melissa was also very blessed to have received numerous ASP Student Conference Travel Grants to deliver her results, and also received a Researcher Exchange, Travel and Training Award to visit the lab in RMIT Bundoora, Melbourne under Dr. Nathan Bott. The University of Tasmania was a great platform to provide her a travel award to Cape Town, South Africa for an approximately 2-week workshop on Molecular Mining of Archival Samples with the British Association, University of Cape Town, and the Marine Research Institute of Cape Town. This also provided her the opportunity to collaborate with other cymothoid experts namely, Prof. Nico Smit and Dr. Kerry Hadfield.

Since working as a senior lecturer at UMT, Melissa has continued to spread her wings to enhance her taxonomic skills. In the past two years, she was one of the few selected candidates to attend the Basics of Taxonomy Workshop held at the Sven Lovén Centre for Marine Sciences, Kristineberg, Sweden (thanks to the funding of the Royal Swedish Academy of Sciences and UMT's travel grant). In addition to enhancing her taxonomic skills with scientific illustrations and e-Taxonomy and biodiversity informatics tools; she has met wonderful coordinators (Dr. Matz Berggren, Dr. Charles Oliver Coleman, Prof. Tomas Cedhagen) and friends in the making.

In 2017, Melissa struck her luck once again where she was sponsored by WESTPAC, IOC and LIPI to attend a training course on Molecular Taxonomy based on Single DNA Barcoding and Metabarcoding, which was held at the IOC Regional Training and Research Center on Marine Biodiversity and Ecosystem Health, Jakarta. This training course was designed to develop the capacity of member states in the Western Pacific involved in molecular taxonomy of marine organisms. This course exposed her to important people in the field of taxonomy, barcoding, metagenomics and phylogeography.

Melissa was one of the selected early career researchers who participated in the training course Basics of Taxonomy co-funded by the Royal Swedish Academy of Sciences from 10-21 October 2016.

Why is taxonomy important: a taxonomist's plea

Melissa's work on taxonomy was one that was daunting and highly underestimated. In all her years as a marine biologist, taxonomy was simply seen as referring to a pictorial guide and comparing one picture to another (or a tangible specimen). However, there is more than meets the eye.

"Identification is merely a small aspect of systematics. In fact, taxonomy is more like CSI" says Melissa. "Prior to understanding the specimen you have beforehand, you need to do ample research not only on the anatomy of the specimen to be able to identify, but you need to know every aspect of its ecology."

Taxonomy forms the fundamental knowledge of biological sciences. Its aims are to discriminate closely related species and further illustrate evolution, equivalent to that of a passport. Most scientists would rather skip straight towards the advancements of "fingerprint recognition" (a.k.a molecular systematics) due to the hassle of observing minute phenotypic details of an organism. Taxonomy does not work that way, because you cannot put a name to something you do not quite know well. This is why classical taxonomy, together with molecular approaches (e.g. genomics, next generation sequencing, phylogenetics, phylogeography) could greatly enhance the comprehension of a study subject. To a great extent, taxonomy could be a matter of life and death if not applied wisely. This is especially important to discriminate things like edible fungi and vegetation from toxic ones in the wild should one need to survive.

In helping to grasp the vast biodiversity in this world, taxonomy is important to speedily identify and classify an entity of interest. Once this is established, one can further investigate the status of a study subject and its ecological importance. In relation to the parasitic isopods that Melissa deals with she not only needs to look into the morphology of the cymothoid parasite which is an important aspect to study, but she also needs to investigate facts like: Does the parasite attach to a specific part of the body (e.g. gills, fins, mouth)? Is it a specific freshwater or marine isopod species? Does the isopod parasitise all kinds of fishes or a specific fish species (or even genus, family)? Is it of tropical or temperate distribution? The lists go on and on, and imagine applying that knowledge on nearly 400 species, just so one does not accidentally name a specimen twice!

Melissa with other participants and coordinators of the molecular workshop in Jakarta.

Working hard pays off, even if it up to 11 at night in a lab at LIPI.

"Naming a new species is the fun and easy part! But if you find papers that read "Review of..." or "Revision of..." and the toughest bit, "Monograph of...", you'd want to salute the fellow author and the team for such contributions. Since my PhD journey, I have had a deeper and greater respect for all taxonomists worldwide"

Melissa's research while studying as a PhD candidate was exclusively on reviewing buccal-attaching isopods parasitic to fishes from Australian waters. On top of the publication of reviews and new species, her research has helped address issues of fish host specificity, cymothoid distribution locally and worldwide, and potential species of aquaculture concern. This account has helped raise the platform for further research to elucidate the ecological and economical roles and impact of these parasitic isopods.

What's next for Melissa?

Melissa's core interest is systematics which includes the classical taxonomy and studying morphological and molecular phylogeny. Since coming back to Malaysia, she has broaden her research to reviewing not only parasitic isopods from fishes, but working on a wider range of marine isopods and other crustaceans of ecological importance, parasite composition of marine organisms and further understanding of the symbiotic relationships of associated organisms on invertebrates, such as sponges.

She has been recently invited to collaborate with Dr. Albert Chakona whose work spans on fields of ecology, phylogeography, historical biogeography, systematics and conservation. Her research attachment at SAIAB will be working on the taxonomic revision of endemic stream fishes of South Africa. On a more regional basis, she hopes that her contribution (together with other local taxonomists) towards RRC will form a formidable taxonomic task force with Dr. Izwandy Idris so as to create an accessible and reliable marine biodiversity database.

On top of securing grants and postgraduate students, Melissa realises the importance of transferring fundamental knowledge to the public domain. She hopes that her attempts through school programmes will help create awareness of the importance of taxonomy and marine ecology and inspire the younger generation that taxonomy is not boring, but it can help save lives!

Melissa's interest has expanded into studying epibionts associated to organisms

Melissa sorting invertebrate species of commercial importance and trash value during her SEAFDEC expeditions off the coast of Terengganu

Sharif Shahin

by:
Norfatehah Abdullah Sani
Centre for Fundamental and Liberal Education

Brief Background

The excellent achiever featured in this volume is a PhD candidate at UMT, specialising in Aquaculture. He is Sharif Shahin, from Ann Arbor, Michigan USA. Before coming to UMT to do his master and doctorate degree programmes, he had worked in various fields, including constructions, robotics, and biological research. Although he spends most of his time conducting his PhD research, he still enjoys fishing and basketball during his leisure time.

Education Background

Sharif received his Associate Degree in Robotics at Washtenaw Community College and continued his Bachelor's Degree in Biology at Eastern Michigan University. After graduating, he decided to further his studies doing the master and doctorate degree programmes in aquaculture at Universiti Malaysia Terengganu (UMT). He has a keen interest in plankton, and for his Master's Degree, he collected, identified, isolated, and cultured several species of microalgae from the wild and subsequently produced a highly concentrated and viable algae paste.

Current Research / Project

For his PhD research, he worked on Par larvae culture of Cephalopods and began to look at the potential of amphipods as an alternative feed resource for aquaculture. He has identified and

Amphipods that are potentially excellent live food for nursery phase of various aquaculture species. Beside Sharif, are mud crab larvae rearing tanks.

documented the complete life history of a new Gammarid amphipod and *Gammarus* sp. and able to determine its preferred culture substrate.

In addition to his own research, he provided guidance to two students through the successful completion of their final year projects and he has been involved with strategic planning of a new joint shellfish research laboratory between UMT and Shantou University. His contributions included among others, that of an in-house editor and proofreader at the institute.

Sharif has high regards for his supervisor, Professor Mohd Ikhwanuddin who is an excellent supervisor and knowledgeable especially in his field of study yet humble at the same time. In any situation, his supervisor is understanding and helpful in assisting Sharif with his research. His supervisor treats everyone with the utmost respect and care, as well as always providing great opportunities and support to the students.

For Sharif, Universiti Malaysia Terengganu is a scenic tropical seaside campus, strategically designed to facilitate marine exploration and discovery. There are professional personnel to assist and accessibility to advanced laboratories and facilities have made it an ideal place to conduct research related to any marine science. At UMT, he enjoys the peaceful and beautiful environment and appreciate a kind and generous community around him.

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