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A sea of vibrant fans

Tranquil Earth

The School of Biological Sciences, Universiti Sains Malaysia

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Editorial

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From the **Dean**

Welcome to the first issue of Bio-Bulletin 2015. Year 2014 has proved to be a productive and successful one for us at the School of Biological Sciences as we obtained the highest marks in Key performance Index KPI within USM. After so many years of being one of the top performing school, we finally reach the summit last year. I would like to thank all the academic, administrative and technical staff of the School for their selfless and continuous support towards the success of the School.

In expanding of international linkages, we have signed two Memorandum of Understandings (MoU), one with the South China Sea Institute of Oceanology, China and the second was with Tomsk State University, Russia. These MoUs will strengthen our research and human training in areas of Marine and Ecological Studies.

In this Bio-Bulletin issue I would like to congratulate Dr. Amirul Al-Ashraf Abdullah who was recently promoted to full Professorship. Congratulation also is accorded to Dr. Sreeramanan for being promoted to Associate Professor. Sadly, in the month of April 2015, Cik Rogayah, our clerical staff in charge of postgraduate studies passed away after a short illness. All of us at the School are sadden by her sudden passing.

The School is also experiencing the retirement of many of our technical staff who have served the university for more than 25 years. We truly appreciate their long productive years spent in USM and wish them well. On another note, many young academics have joined our School recently. Surely this is an exciting time for new research in many areas within life science and technology.

I hope you enjoy reading this issue of Bio-Bulletin. Best wishes.

Associate Professor Ahmad Sofiman Othman
Dean, School of Biological Sciences

From the **Editor-in-Chief**

Welcome to the first edition of Bio-Bulletin 2015!

I am filling in the role of Chief Editor (Prof Ng Wing Keong was away on sabbatical leave) for this issue. Apologies for the delay, this issue was supposed to come out early February. However, due to some unfortunate circumstances, we've had to postponed it to a May/June publication.

I'd like to thank the editorial members and also the authors for their time and contribution to Bio-Bulletin. The theme for this issue is the tranquil earth. The cover picture is an eerily calm and tranquil setting of the deep sea. Credits go to Dr Mahadi for his superb underwater photography skills.

We have an assortment of articles for this issue. Kudos to our chief editor who manages to contribute an article during his sabbatical leave. I hope you enjoy Bio-Bulletin.

Keep sending in the articles! See you in the next issue.

Dr. Nik Fadzly N Rosely
Acting Editor-in-Chief
School of Biological Sciences

Bioresources of Tanjung Pura

MANGROVE ECOSYSTEM: At A Glance

Amir Shah Ruddin Md Sah, Zarul Hazrin Hashim, OnRizal, Tauffiq Siddiq and Mashhor Mansor

Mangrove ecosystems are important for coastal fishery activity as this area plays important roles as a nursery ground for fishes. There are three major factors concerning the nursery role: trophic resources, water turbidity, and structural diversity. The concentration of nutrients due to freshwater in-flow, nutrient trapping, tidal mixing and environmental modulation are the main factors for the high primary productivity. This is the base of a food web where zooplankton, mysids and shrimps provide abundant and diversified trophic resources to fish post-larvae and juveniles. Turbidity reduces the perception distance of predators and increases the escape rate, and thus increasing the survival of young fish. Diversity and structural complexity are due to shallowness of the estuarine habitats that provides multiple spatial and trophic niches favourable for juveniles.

Therefore, it is important to safe guard mangrove ecosystem that is rich with aquatic bio-resource. An intensive study on the bio-resource of Tanjung Pura, Medan mangrove ecosystem was carried out from 9 June 2010 to 15 June 2010.

Seven sampling points were identified and chosen during the survey. The sampling stations were Sg Ular, Kuala Canggang, Lapangan, Nibong Hangus, Paloh Gantang, Paloh Ular and Pulau Cabang Tiga. Gillnets of various sizes were used in the survey. A total of 30 fish species, 5 shrimp species and one species of shoehorse comprising 666 specimens were collected and recorded during the survey. Paloh Gantang recorded the highest species number with 19 species followed by Lapangan (18 species), Sg Ular (13 species), Kuala Canggang and Pulau Cabang Tiga (12 species), Paloh Ular (10 species) and lastly Nibong Hangus (9 species) (Table 1). Gelama janggut (*Panna micronodon*), duri goh (*Arius maculatus*) and kasai (*Thryssa* sp.) were the most caught fishes. Udang putih (*Penaeus merguensis*) followed by udang kunyit (*Metapenaeus ensis*) and udang

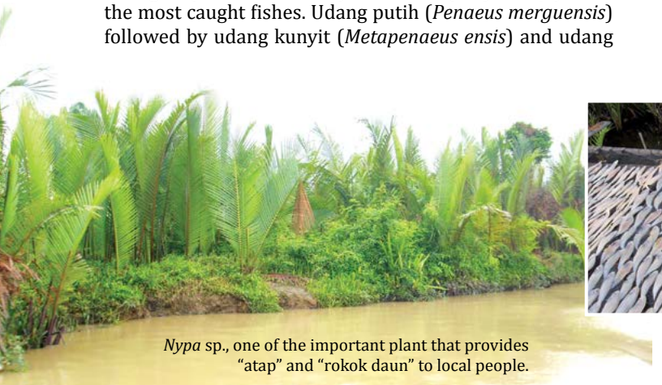
Author (on the right) with Zarul Hazrin and OnRizal waiting ferry at Pematang Buloh Jetty

harimau (*P. monodon*) were the first three dominant shrimp species caught during the survey. The number of species recorded in this survey is low compared to the previous study done by Giesen and Sukotjo in 1991 (51 species were recorded). This could be attributed to the differences in sampling methods and locations. Based on personal observation, this mangrove area had been critically disturbed by human activities when compared to the previous study. The slight reduction of species number may be due to changes in mangrove habitats, over exploitation and uncontrolled fishing activities. Many studies had shown that there are correlation between shrimp catch rate with the size of mangrove areas. Reclamation of mangrove areas for other agricultural and aquaculture activities will reduce the total number of shrimp. A long term monitoring study should be carried out to get more details on Tanjung Pura fisheries status along with the changes of its surrounding environments.

Therefore, mangrove conservation needs to be included within the framework of estuarine management and rehabilitation as part of fisheries management based on ecosystem together with the introduction of community based fisheries management.

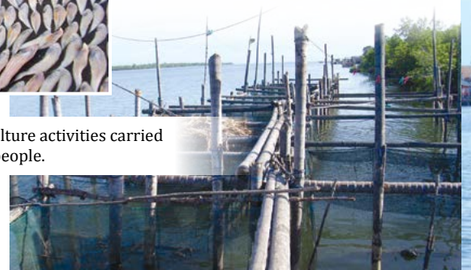
Family	Species	Sg Ular	Kuala Canggang	Lapangan	Nibong Hangus	Paloh Gantang	Paloh Ular	Pulau Cabang Tiga
Ariidae	*Arius thalassinus*	-	+	+	-	+	-	-
	Ketengus typus	-	-	+	-	-	-	-
	Arius maculatus	-	+	+	-	+	+	-
	Arius tenuispinis	-	+	+	-	-	+	+
Chandidae	*Ambasis* sp.	+	-	-	-	-	-	-
Clupeidae	*Sardinella* sp.	-	-	-	-	+	-	-
Dasyatidae	*Dasyatis zurgei*	-	-	-	-	-	-	+
Drepanidae	*Drepane punctata*	-	-	+	+	-	-	-
Eleotridae	*Eleotris fusca*	-	-	-	-	-	+	-
Engraulidae	*Stolephorus commersoni*	+	-	+	-	+	-	+
	Thryssa sp.	-	+	+	+	+	-	+
Gobbidae	*Glossogobius giuris*	-	+	-	+	-	+	-
	Periopthalmus sp.	+	-	+	+	+	-	-
Haemulidae	*Pomadasys kaakan*	+	-	+	-	-	-	+
Leionagthidae	*Secutor* sp.	-	-	-	+	-	-	+
	Leionagthus sp.	+	-	-	+	+	-	+
Limulidae	*Limulus polyphemus*	-	-	-	-	-	+	-
Lutjanidae	*Lutjanus russelli*	-	-	-	-	+	-	-
Mugilidae	*Valamugil* sp.	+	-	-	-	-	-	-
	Mugil sp.	+	-	-	-	+	-	-
Mullidae	*Upenues vittatus*	-	+	+	+	-	-	+
Odontodactylidae	*Odontodactylus scyllarus*	-	+	+	-	+	+	-
Palaemonidae	*Macrobrachium rosenbergii*	+	-	-	-	+	-	-
	M.lanchesteri	-	-	-	-	+	-	-
Panaeidae	*Penaeus monodon*	+	+	+	+	+	+	+
	Metapenaeus ensis	-	+	+	-	+	+	+
	Penaeus mergeunsis	+	+	+	+	+	+	+
Scaenidae	*Jonius carruta*	+	+	+	-	+	+	-
	Panna microdon	-	-	+	-	+	-	-
Scathophagidae	*Scatophagus argus*	-	+	-	-	+	-	-
Scorpaenidae	*Scorpaenopsis gibbosa*	-	-	+	-	+	-	+
Siganidae	*Siganus javus*	-	-	+	-	-	-	-
Syngnathidae	*Doryichthys boaja*	+	-	-	-	-	-	-
Tetraodotidae	*Chelonodon nigroviridis*	+	-	-	-	-	-	-
		13	12	18	9	19	10	12

Notes: + = present; - = absent



Nypa sp., one of the important plant that provides "atap" and "rokok daun" to local people.

One of the main local product - various species of dry fish.



Some aquaculture activities carried out by local people.

Floating village at Pulau Cabang Tiga.

Amir Shah Ruddin Md Sah is a senior lecturer and researcher with 15 years experience in wetland ecosystem focusing on fish biodiversity and freshwater ecology.

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APES & MONKEYS:
Can we draw a line between them?

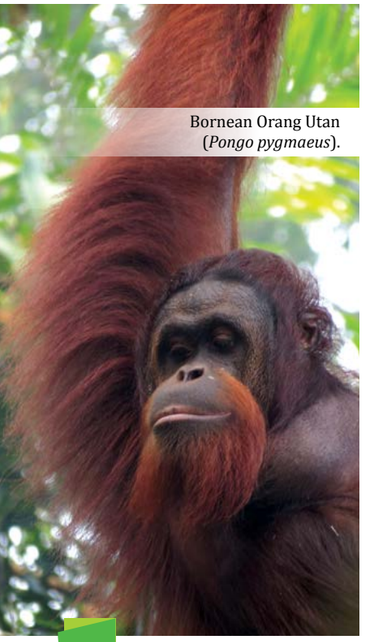
Orang Utan swing from tree to tree.

Infant of Orang Utan was seen clinging to its mother.

Aini Hasanah binti Abd Mutalib, Muhammad Zaki b Zainol, Salniza Akmar binti Kamaruszaman

Apes and monkeys might belong to the order "Primata", but what is the line that separates them? Some might argue that both apes and monkeys are the same, since the common names are often interchangeable, especially in local language use. For example in Malay we call all primates without tails "beruk" but this does blur our understanding of the differences between apes and monkeys. The taxonomic work based on genetic techniques done over the years showed that both animal groups belong to different families. The work also emphasised the clear differences in genetic lineage, which are manifested in their morphological traits.

While all monkeys do possess an external tail (although in some species like the Black-crested macaque *Macaca nigra* it is so short an rudimentary that it is not visible) all apes are lack of this morphological feature. Also apes do have longer arms than legs and broader backs, while monkeys have shorter arms or arms equal in length to their own legs. In some species, intelligence levels of apes and monkeys might be different too. Monkeys are said to have more similar brain capacity and capabilities to primitive prosimians (such as lemurs, lorises and tarsiers). Great apes appear to be more similar to humans and some ape species such as Orang Utan, genetically possess more than 95% match with humans.



Bornean Orang Utan (*Pongo pygmaeus*).

An experiment done in United Kingdom tested the performances of primates in three tasks, which are memory task, transposition task and support task. Species tested were all four great apes (bonobo, gorilla, Orang Utan and chimpanzee) and three monkey species (spider monkeys and long-tailed monkeys). This study found that there is "no clear-cut distinction between cognitive skills of monkeys and apes." To conclude, we can say that comparison between these two families is still understudied. Some questions are still left unanswered, and further thorough research might be required.

Thomas leaf monkey (*Presbytis thomasi*).

Great apes comprise gorillas, bonobo, chimpanzee and Orang Utan, while two lesser apes consist of siamangs and gibbons. There are more monkeys on the lists, such as langurs, baboons, capuchin monkeys, macaques, colobus monkeys, marmosets, and tamarins found in Asia, Africa Central and South America. Malaysia is home to many species of old world monkeys and apes that might not be found in other countries. For examples, *Macaca nemestrina* (Southern pig-tailed macaque), *Macaca fuscularis* (Long-tailed macaque), *Presbytis chrysomelas* (Bornean banded langur) and many more.

Interestingly, some primate species are endemic to Malaysia, especifically to Borneo. During our visit to Sabah last December 2014, we had the opportunity to see an endangered primate species, which was *Pongo pygmaeus morio* (Northeast Bornean Orang Utan). Our trip had started off with the visit to the Sepilok Orang-utan Rehabilitation Center (SORC). This centre is authorized and managed by Department of Wildlife, Sabah.

SORC is surrounded by 700 metres long trail (covered by rainforest), and located within the Kabili-Sepilok

USM Orang Utan researchers with En Sailun Aris.

Reserve Forest. The estimated number of *P.p.morio* in this rehabilitation center is 200 indviduals. Before we started the tour, we were advised to leave our bags in the locker provided. This is to prevent any unwanted attacks from the wild Orang Utan. The Orang Utans are non-captive and free-ranging and they tend to behave aggressively towards visitors with bags, thinking that there was food inside the bags.

Before we proceeded to the feeding site, Mr Sailun, the person-in-charge of this rehabilitation centre brought us to visit the Outdoor Nursing Building. Here, we saw a bunch of young Orang Utans who were trained at a play structures located outdoors. The viewing platform was in front of the Orang Utans' play area. This amenity could make SORC an excellent ecotourism site. After that, we went to watch the feeding process. During the feeding time, we witnessed four Orang Utans, one carrying an infant was eating on the feeding platform. A few *Macaca* sp were observed eating with the Orang Utans. On the way back, we followed a young Orang Utan which was walking on the trail side. That particular Orang Utan was following a ranger who carried a full basket of fruits. After 40 seconds, it disappeared under the trail platform. A few seconds later, we noticed another Orang Utan was doing the same as the earlier Orang Utan was doing.

From the observation, we could see that the visitors consisted of foreigners and local people (Sabahan), and from various age groups. The rehabilitation centre is surrounded by trees of the rainforest. The trees are varied in sizes up to hundred meters tall. The Orang Utan nest can be found on as low as 5-6 meter trees and possible to use a pole to snap a close picture of the nest. The tree canopies were very close to each other. The ranger sat at the feeding platform and fed the Orang Utan with fruits such as banana and cucumber. There were times such as the fruiting season when the Orang Utan prefer to forage in the forest than coming to the feeding platform to eat. During the feeding time, there were two female Orang Utans with their babies and other 4 adults Orang Utan sharing the food.

Nest of Orang Utan

The next day, we continue our journey to Labuk Bay proboscis monkey Sanctuary. Labuk Bay proboscis monkey Sanctuary is a mangrove area. There are two platforms, situated quite a distance from each other. These platforms are named Platform A and Platform B. proboscis monkey (scientifically known as *Nasalis larvatus*) is fast and physically strong. The upper abdomen of this monkey species is generally covered with very dull, pale greyish yellow to red-brown coat, except a darker patch on its upper back. Its top of their head looks as if they are wearing a reddish-brown cap, with the rest of the lower head comes in paler colour. The most distinctive morphologies of male proboscis monkey are their vertically erected tails and a large pendulous nose. The pendulous nose serves the purpose of enhancing vocalisation and as organ of resonance during mating call. What a way to cut a dash!

Adult male of proboscis monkey (*Nasalis larvatus*).

Platform A comprised more of this species compared to Platform B. Most of them waited at the nearby area; on the tree or on the ground. proboscis monkey is diurnal, but they are very active in the morning and late afternoon when leaving to sleeping sites and return. These sleeping sites are usually located at the river bank, However, as the day went by, they hide underneath the mangrove trees, as the heat was getting unbearable. The infant sometime stays with the surrogate mother while the biological mother foraged. We observed a group of proboscis family with an alpha male, females and infants. Besides, there was also a group of adult and sub adult male proboscis monkey around that area.

An hour and a half later, we moved to platform B. Here, the platform was built like a wooden house. While waiting for the feeding session, we watched the video about proboscis monkey's life. We observed a total of 12 adults and 3 infants at Platform B, of which the proboscis monkeys were more habituated as they were less shy. We even saw a big male proboscis monkey jump over the viewing platform, which

was more than five meters long and landed at the rooftop! Talking about showing off his skills.

The principle of 'survival of the fittest' best shown during feeding time. Proboscis monkeys competed with each other including the young to grab food. The dominant adult ate a lot compared to the youngs. In contrast to Platform B, the proboscis monkey at Platform A showed exhibiting behaviour. Some of them even sit among the visitors, while others followed or searched for the workers at the basement for food.

We got to see a group of Silvered Langur (*Presbytis cristata*). One of the Langur was holding its orange-

fur baby. We tried to approach the Langurs, but they quickly shied away from us. One of us managed to capture the image of this Silver-banded langur. The adult has silver and dark colour coat, while its infant is orange in colour. This langur species is generally arboreal and diurnal.

Sabah is a part of Malaysia that reflects the richness of biodiversity heritage and natural resources. With many species of primates (let alone other thousands species of animals), the habitats should be protected and restored. Focus on conservation management at the rehabilitation centre must take into account the various factors such as human interaction, physiology, primate behaviour, enrichment and others. Although anthropogenic activities are pressuring the nation, society should be educated on the importance of conserving these animals from being extinct. Losing monkeys and apes from Malaysia could mean losing them from the globe, permanently.

Most proboscis monkey can often be found in mangrove forest, mixed mangrove and nipah forest, and in river-edge forest.

Silvered langur (*Presbytis cristata*) occurs in many kinds of coastal, riverine, and swamp forests, both tall and secondary.

Aini Hasanah binti Abd Mutalib has recently received her MSc degree in Environmental Biology from Universiti Sains Malaysia. Aini is just starting her PhD research on conservation management of Orang Utan rehab centres in Malaysia.

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Salniza Akmar binti Kamaruszaman has recently received her BSc degree in Biology (Zoology) from Universiti Sains Malaysia and currently pursuing her studies in Orang Utan's focusing on the nest and parasitism level in Orang Utan.

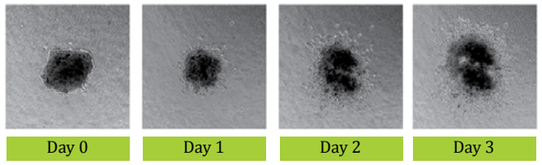
Muhammad Zaki Zainol has recently graduated from Universiti Sains Malaysia with BSc degree in Applied Biology. Currently, he is a MSc candidate in Environmental Biology. His studies include the forest ecology in regards to nesting preferences, feeding behavior and rehab management of Orang Utan (*Pongo pygmaeus*) at Bukit Merah Orang Utan Island and BJ Island, Perak.

Modeling Cancer in *Three-Dimension*

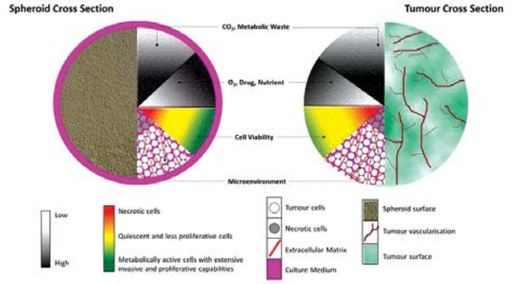
Nethia Mohana Kumaran, Prabu Siva Sankar, Benedict Lian Xhi Siang, Kalaivani Muniandy

The 2-dimensional (2D) cell culture system has been an invaluable model to conduct various assays (e.g. cell migration assays, drug sensitivity assays, apoptosis assays). The assays are easy to conduct, time savvy and economical. The drug sensitivity assays are high-throughput and provide first hand information on whether cancer cells respond to a particular drug. The assays, however, come with their own limitations. The 2D cell culture model lacks the microenvironment that cancer cells encounter *in vivo*. We have to keep in mind that cancer cells to do not live in isolation but maintain as constant crosstalk with the stroma. The constant crosstalk between the cells and stroma enable cancer cells to receive cues/signals to proliferate or invade distant organs. Besides failing to recapitulate the *in vivo* situation, the model also fails to address issues like drug bioavailability.

In vivo models which are superior to 2D assays offer a physiological platform to perform drug assays. In a xenograft model, established cancer cells are implanted into immunodeficient mice. This permits the cells to communicate with the murine stroma, including lymphatic and the vasculature. The interaction between these cells allows us to study the growth behaviour and drug response of human cancer cells *in vivo*. The model, however, utilizes the establishment of cell lines which may have deviated significantly from its original cells due to continous selection in culture. Transplanted cells in mice also undergo strong selection for defective apoptosis. This may lead to poor representation of drug test results generated from xenograft models in clinical trials. Drugs which have demonstrated positive outcome in these models often show opposite results in clinical trials. Morever, tumours do not form in their natural setting and they do not grow in an intact immune system. Xenograft experiments are labour intensive, time consuming and incur a high cost, not to forget, researchers have to deal with issues related to animal ethics.



Growth and Invasion of Nasopharyngeal carcinoma HK1 spheroids into collagen over 3 days.



Similarity of the 3D spheroid with the tumor *in vivo*. The spheroid which is suspended in the medium similarly gains its nourishments as the tumor *in vivo* through its vascularization which is both subject to a concentration gradient to diffusion limitation. This creates a microenvironment, leading to various phenotypes. The necrotic core exists due to the lack of nutrients and accumulation of waste whilst the increasing metabolic activity towards the rim is accounted due to the better diffusion of nutrients and waste. The cells in both situations exist in a three-dimensional conformation with interaction with the extracellular matrix.

The 3-dimensional (3D) spheroid model recapitulates tumour microenvironment and architecture *in vivo*. The model recreates the oxygen/nutrient gradient with a hypoxic zone and a central necrosis, besides allowing interaction between cancer cells and their stroma, when provided. This close resemblance to the situation encountered *in vivo* facilitates more realistic study of cancer growth, invasion and drug response. Utilizing the 3D model is also inexpensive and more efficient as drug sensitivity tests can be conducted in a faster time frame when compared to animal studies. Furthermore, animal usage for drug tests can be reduced. This would speed up drugs coming in for clinical trials from laboratories and accelerate translation from bench to bedside.

Dr. Nethia Mohana Kumaran is a cancer biologist and her research focuses on utilizing the 3-dimensional spheroid model to study the growth, invasion and drug sensitivity of cancer cells. She also utilizes a genetically modified mouse model of melanoma to study the contribution of the apoptosis pathway for melanomagenesis and melanoma drug resistance.

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The *Sabah snake grass* - A medicinal plant with wonders

Phua Qian Yi and Chew Bee Lynn

Sabah snake grass (*Clinacanthus nutans*), locally known as belalai gajah has lately become a popular plant due to its medicinal properties. The Malaysian newspapers and emerging lay testimonies reported that *C. nutans* leaf extracts were used as treatment for cancer and is consumed regularly to suppress cancer progression. The Malaysian Ministry of Agriculture has categorized this plant as one of the main tropical medicinal plants widely researched in the country with hopes to further explore its beneficial properties especially in the area of cancer treatment. Traditional healers particularly in Thailand, Malaysia, Indonesia and China have been utilizing this plant extracts for treating diseases other than cancer. This includes treatment of skin inflammation, insect bites, minor skin diseases and snakebites.

Clinacanthus nutans belongs to the family of Acanthaceae, a small shrub that grows throughout the deciduous forest in South East Asia. The stems are terete and glabrescent, while the leaves have dentate margin ("tooth-like" edges) and the apex is acute and lanceolate in shape. The flowers are usually found at the top of the branches with a dull red and green based corolla. Scientists have attempted to isolate and study the bioactive chemical compounds associated with medicinal properties. They discovered that these compounds were related to chlorophyll a and chlorophyll b. They are 13^2-hydroxy-(13^2S)-chlorophyll b, 13^2-hydroxy-(13^2R)-chlorophyll b, 13^2-hydroxy-(13^2S)-phaeophytin b, 13^2-hydroxy-(13^2R)-phaeophytin b, 13^2-hydroxy-(13^2S)-phaeophytin a, 13^2-hydroxy-(13^2R)-phaeophytin a, purpurin 18 phytylester and phaeophorbide. Five of these were identified as novel compounds.

The medicinal benefits of *Clinacanthus nutans*

Antioxidant activity

The Department of Biotechnology from the Ming Chuan University in Taiwan has proven *Clinacanthus nutans* as a good source of antioxidant. The phytochemical constituents in the extract of *C. nutans* had been proved to have antioxidant activities that can effectively scavenge free radicals as well as inhibit proliferation of cancer cell lines. Excess reactivated oxygen or nitrogen species (RONS) can lead to cancer initiation and progression. RON levels in the cells have to be essentially maintained below the cytotoxic level as this can cause genomic instability due to uncontrolled endogenous antioxidant capacity. Antioxidants function to salvage cells from oxidative stress and prevent them from gradually transforming into cancer cells. Early findings from this investigation indicated that *C. nutans* extracts has the potential to improve oxidation damage and prevent cancer growth advancement.

Anti-Herpes Simplex Virus (HSV)

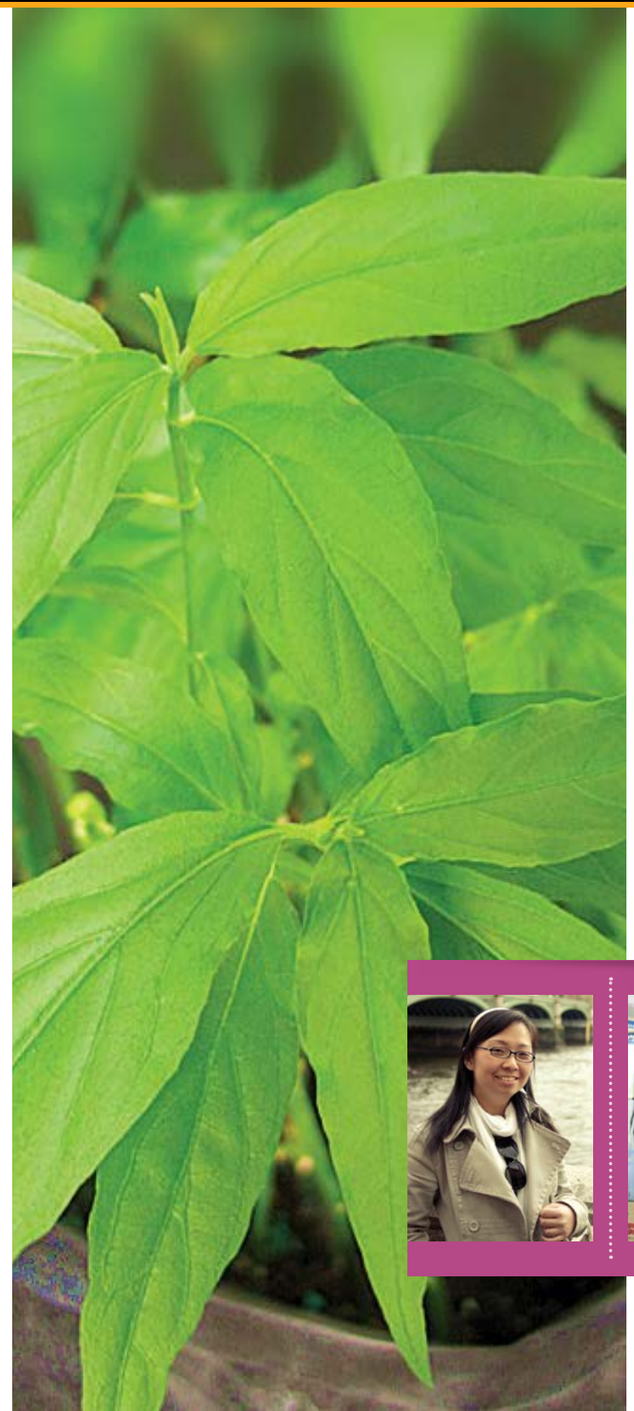
Clinacanthus nutans is traditionally used to treat herpes and viral infection by traditional medicine practitioners. Several researchers have reported the use of creams or gels made using *C. nutans* are useful against genital herpes and varicella-zoster virus (VZV) infection. A scientific study reported that *C. nutans* leaf extracts possessed anti-herpes simplex activity that can inhibit pre-infection and herpes virus activation. Acyclovir, the current anti-herpes drug in the market, can be costly for long-term treatment. Reports revealed that the use of *C. nutans* skin cream showed similar effects as Acyclovir in treating herpes simplex and herpes zoster virus infections. Moreover, it is also able to relieve pain without causing a burning sensation. Hospitals in Thailand have opted for this alternative treatment to replace topical Acyclovir in treating herpes zoster and herpes simplex virus infection.

Anti-inflammatory activity

Clinacanthus nutans was also found to effectively reduce inflammation of the skin and is suitable to be used as skin soothers. The naturally occurring glucosides and flavonoids present in the *C. nutans* extracts were found to effectively inhibit human neutrophil elastase synthesis without the exertion of significant cytotoxic effects where neutrophils function to trigger inflammatory response.

Anti-Dengue virus Type 2 infection

Dengue fever is a mosquito-borne disease caused by the dengue virus that is normally transmitted by *Aedes aegypti.* This disease, if not efficiently treated, could develop into a life-threatening hemorrhagic fever, causing bold plasma leakage, low blood platelet count and external bleeding. Currently, there are no specific vaccines to prevent dengue infection. Only a few compounds are known to have the antiviral effect. *C. nutans* was recently discovered to be able to suppress Dengue virus Type 2 (DV2) replication and post-incubation. The extracts of *C. nutans* help to prevent viral replication by blocking the production of the viral RNA as well as the viral protein and preventing the spread of the virus during infection.



Anti-venom activity

Clinacanthus nutans leaves are commonly used to treat snakebites in Thailand, Vietnam, Indonesia and Malaysia. Leaf extracts are patched externally on the wound for about one week to neutralize the snake venoms. Traditional healers use this practice as an immediate remedy prior to actual treatment with antivenin to prevent systemic toxicity.

At current, testimonials from cancer patients and medical practitioners have revealed the plant's ability to suppress the growth and progression of cancer cells.

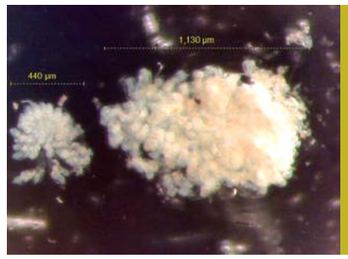
Reports showed that daily consumption of *C. nutans* leaf extracts have been able to prolong the life of cancer patients at critical stages. Herbal companies invented various versions of this medicinal plant in the form of tea bags with flavours and also supplement pills for consumers to purchase. Some consumers prefer to take the fresh herb just as it is. This medicinal herb still requires much research by the pharmaceutical industry to further harness its benefits and potentials especially for the treatment of cancer.

Dr. Chew Bee Lynn is a Senior Lecturer at the School of Biological Sciences, USM and researches on tissue and cell suspension culture in tropical medicinal plants. Phua Qian Yi is her MSc student performing research on the cell suspension of *Clinacanthus nutans* for cancer studies.

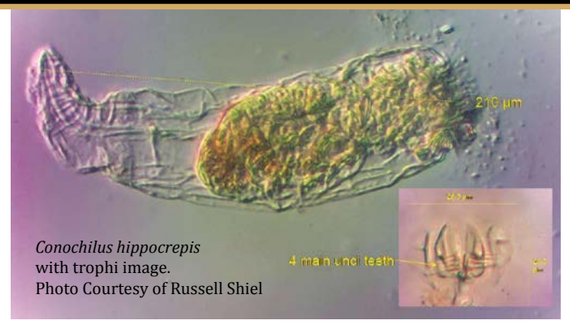
Zooplankton:

Amazing creatures under the microscope

Azma Hanim Ismail



Colonies of *Conochilus hippocrepis*. The smaller colony is juveniles, the larger colony is adults. Photo Courtesy of Russell Shiel.



Conochilus hippocrepis with trophi image. Photo Courtesy of Russell Shiel

Zooplankton are tiny creatures (less than 1 mm long) that can be found in all water bodies, both saline and freshwater. They are the animal form of the planktons that play an important role in aquatic food webs. The only creatures that are lower than them on the food web are the phytoplanktons (plant version of planktons). The zooplanktons are small in size. This feature reduces the number of predators that can feed on them. Furthermore, the generation time of this animal is short thus they rapidly colonise new habitats. These tiny creatures make up a large portion of freshwater zooplanktons and of these the most important groups are the cladocerans, copepods and rotifers. Cladocerans and copepods are tiny crustaceans but some cladocerans species such as *Daphnia* may reach up to 5-6 mm in the absence of fish and can be seen with the naked eye. Rotifers are distinctive animals with most of the species confined solely to freshwater. It is the most abundant metazoans in inland waters but due to its size, rotifers often go unnoticed.

The main source of food of the zooplanktons are the phytoplanktons but some of the larger species are predators and feed on other zooplanktons. Herbivorous zooplanktons consume phytoplanktons and hence directly contribute to the phytoplankton seasonal succession. They play a major role in the maintenance of high phytoplankton species richness in freshwater ecosystem. Consequently, zooplanktons may allow or prevent phytoplankton blooms in inland water bodies.

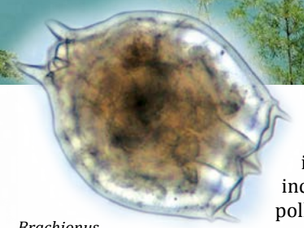
There is scattered literature dealing with global zooplankton distribution. However, due to the vastness of unexplored freshwater bodies and the limited knowledge we have about the zooplankton diversity in Malaysia, I am interested to develop a better understanding on zooplankton population dynamics in various freshwater ecosystem as well as to study the relation between physico-chemical and environmental factors on zooplankton distribution.

Problems and issues on zooplankton identification

There are huge gaps in our understanding of major groups of zooplankton biogeography. The study of zooplankton populations is not a major priority in some large-scale projects. The reasons are partly related to the difficulty in collecting data and species identification leading to fragmented information on the ecology and distribution of this unique organism. There are several inherent problems to the methods of identification. The common problem encountered by researchers working with zooplanktons is some species are difficult to distinguish due to their rare occurrence. Identifying zooplanktons can be challenging, tedious and requires high level of expertise. Moreover, researchers have to spend a lot of time on the microscope during the identification.

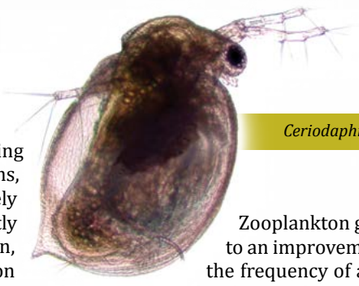
Zooplankton taxonomy is a dynamic science, names of some groups have changed with time. The experts and professionals in this area use a widely-scattered primary literature and published keys that are available in foreign languages with limited access. Furthermore, the available taxonomic keys were created for high level of expertise and such keys are very difficult to be used by the non-experts. Thus, it is difficult for the researchers to accurately identify the animals and only succeed in identifying them at the genus level.

The species are highly variable in size, shape and colour. Hence, a complete database and record of samples from various locations are essential for correct identification as well as to investigate the range of variation occurring in their natural habitats.



Brachionus caudatus

Keratella cochlearis



Ceriodaphnia cf. *quadrangula*

Due to labour-intensive and time-consuming identification and counting of the zooplanktons, the number of samples that can be accurately processed are limited. The reasons are partly related to the difficulty in enumeration, measurement and identification of zooplankton species. For instance, essential anatomical terminology of copepods must be learned in order to ensure accurate species identification. Therefore, some dissection of the body parts are required. For example, to identify the rotifers (<200 µm), the trophi skeleton or jaws are important features of identification. The trophi must be cleared from the tissues to enable positive identification and this process is conducted under the coverslip stage on the compound microscope while keeping the specimen in view. Some non-experts may find it a difficult process as most of the time, the tiny trophi structures are flushed out making it difficult or impossible to identify these small creatures.

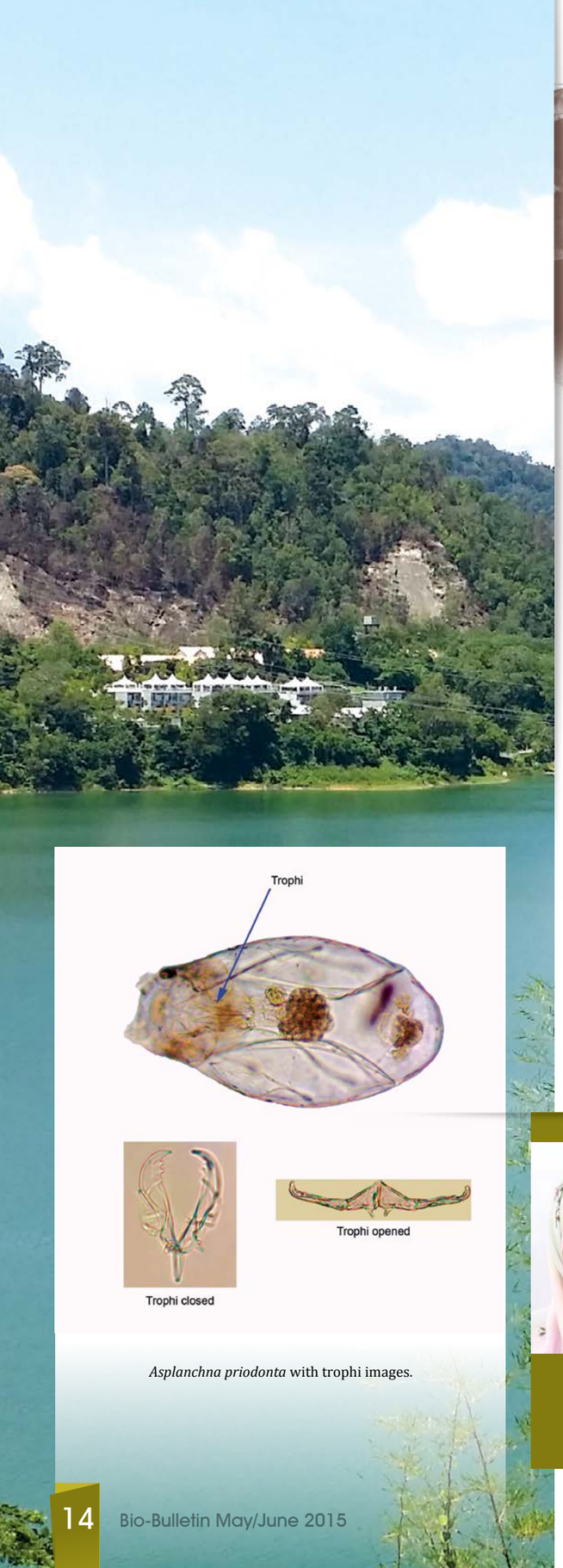
Why do we need to study zooplankton?

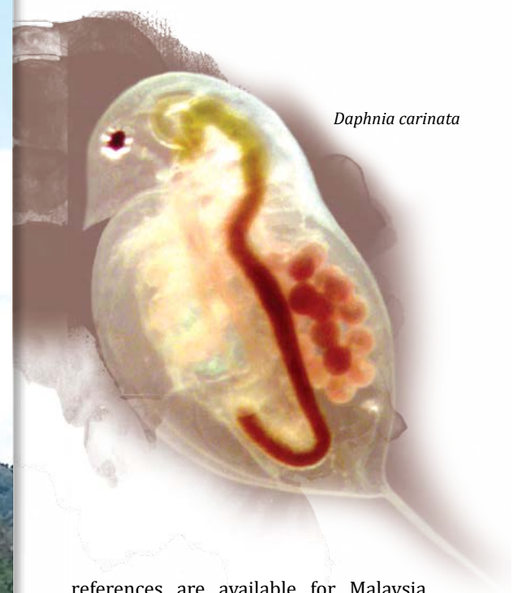
It is important to remember that these unique animals are primary consumers of the phytoplanktons and a vital link in the aquatic food chain. Apart from that, some species of zooplanktons can be indicators of environmental health. Zooplanktons have been used widely as indicators to assess various forms of pollution including acidification, eutrophication, pesticide pollution and algal toxins. These disturbances cause adverse effects including changes in size structure, species composition and abundance.

Zooplankton grazing on phytoplanktons will lead to an improvement of water quality and can reduce the frequency of algal bloom indirectly. A number of studies have indicated the ability of certain zooplankton species to prevent algae bloom which is a crucial global problem.

Carnivorous copepods are excellent biological agents in controlling mosquitoes. Dengue fever is a fatal disease to human caused by the dengue virus transmitted by mosquitos. Utilization of the carnivorous copepods may be better suited for biological control particularly in tropical areas.

Studies on zooplankton taxonomy are extremely important in order to understand their structure and function and for species identification. Species identification allows researchers to recognize species effected from increasing demographic pressure, industrial activities, overfishing of commercial resources, and destruction of natural habitats. It is evident that we know very little of the Malaysian zooplankton diversity as only a few outdated local





Daphnia carinata

references are available for Malaysia. The freshwater ecosystem of the Malaysian region is home to a wide variety of zooplanktons. Without the basic taxonomic and ecological information, we cannot produce meaningful environmental impact assessments on our inland waters, nor understand the complexity of our ecosystems. With this in mind, my goal is to build an interest in the ecology and biodiversity of freshwater zooplanktons.

Calamoecia ampulla with male fifth leg (posterior aspects)

Asplanchna priodonta with trophi images.

Dr. Azma Hanim Ismail is a plankton ecologist that specializes in zooplankton community structure.

Her research focuses on the ecology and biology of freshwater zooplanktons particularly on how physical and biological processes together define zooplankton biogeography, communities and population abundance. Another main branch of her research is zooplankton grazing/feeding at the level of individual organism and community.

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Ecological Observation

on Maninjau Lake and Singkarak Lake, West Sumatra, Indonesia

Muzzalifah Abd Hamid, Siti Norasikin Ismail, Nor Aisyah Omar, Wan Maznah Wan Omar and Mashhor Mansor

The representatives from both USM and LIPI after the signing of MoU on 14th March 2014.

From Left: Dr. Luki Subehi, Prof. Mashhor Mansor, Associate Prof. Dr. Wan Maznah Wan Omar, Associate Professor Dr. Ahmad Sofiman Othman, Dr. Tri Widiyanto, Prof Dr. Iskandar Zulkarnain.

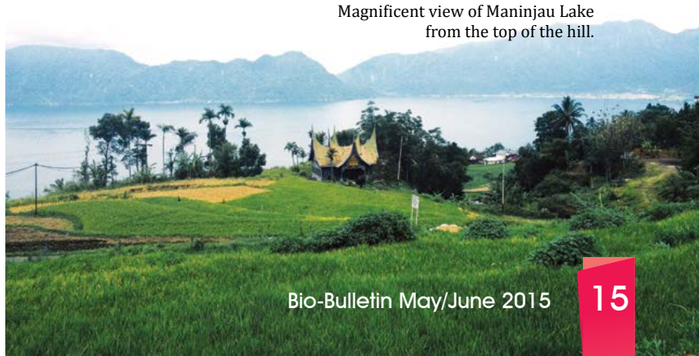
Background

The limnological research team from School of Biological Science (SBS), Universiti Sains Malaysia (USM) were given a golden opportunity to visit two lakes in Indonesia which took place from the 13th to 18th March 2014. Located in West Sumatra, Maninjau Lake (caldera lake) and Singkarak Lake (tectonic lake) were both formed by volcanic eruption. The team conducted observations and initiated the first sampling in these two lakes. This opportunity is an initiative from the collaboration with the Research Centre for Limnology, Indonesian Institute of Sciences (LIPI). The collaboration between USM and LIPI has begun officially as the Memorandum of Understanding (MoU) was signed by both institutes. USM was represented by School of Biological Sciences, led by the dean, Associate Professor Dr. Ahmad Sofiman Othman, while collaboration with LIPI was through the Research Centre for Limnology (RCL), headed by Dr. Tri Widiyanto (Director Research Centre for Limnology, LIPI). The MoU enables all research involving both countries to be conducted with ease. From the collaboration, the teams were aiming to extend the network and make it as a global and international collaboration in terms of limnological studies focusing on biological engineering approaches.

Lake Singkarak is the largest lake in West Sumatra with the surface area of 10, 780 ha while Lake Maninjau has a surface area of 9, 950 ha. Both lakes are the main water sources for local people especially for agriculture and aquaculture activities. However, these lakes function mainly in generating hydroelectric power to West Sumatra and Riau Province.The survey in Maninjau and Singarak Lake was led by the limnology team from LIPI which comprise scientists from different fields: Dr. Luki Subehi (Geo Hydro-Climatologist), Mr. Iwan Ridwansyah (Bathymetric and GIS), Mr. Hendro Wibowo (Hydrology and SWAT Model Analyses), Mr. Fajar Setiawan (Remote Sensing and Water Quality), Mrs Dini Daruati (Chlorophyll and Remote Sensing). The USM team was represented by Associate Professor Dr. Wan Maznah Wan Omar (Biomonitoring and Biological Activities of Algae), Professor Mashhor Mansor (Ecology), Dr. Azma Hanim Ismail (Zooplankton Taxonomist), Onrizal (Mangrove Forest), Nor Aisyah Omar (Water Quality), Siti Norasikin Ismail (Aquatic Macrophyte), Muzzalifah Abd Hamid (Aquaculture and Freshwater Ecology) and Mr. Saadon Zubir (Lab Assistant).

During the survey, we were in awe of the breath-taking views of the lakes. Its luxurious scenery and traditional paddy field, was truly mesmerizing. The lakes were surrounded by mountains and rural placement of the local people. Most of the people who lives around the lakes are Minangkabau. The classic architecture of the houses and buildings in the area shows the value of their heritage which they still honour and keep till this very day.
The locals were also interviewed for a socio-economic survey.

Magnificent view of Maninjau Lake from the top of the hill.



Picturesque sight of Singkarak Lake.

The survey was conducted to obtain a better understanding of their lifestyle and subsistence. Both teams also managed to collect phytoplankton samples from the lakes. Two of researchers were attacked by small brown worms found in the lake also known as "langsing" by the locals while collecting the samples. According to locals, the worms are particularly abundant during rainy season.

Observation on Fish Populations in Maninjau and Singkarak Lake

Maninjau Lake harbours a high abundance of an endemic fish known as Ikan Rinuak (*Psilopsis* sp.). According to the locals, previously, they used to catch the fish amounting to approximately 0.09 ton/day. This fish is famous for delicious dishes which includes Palai Rinuak, Peyek Rinuak, Goreng Rinuak, Gulai Pedas Rinuak and Bakwan Rinuak.

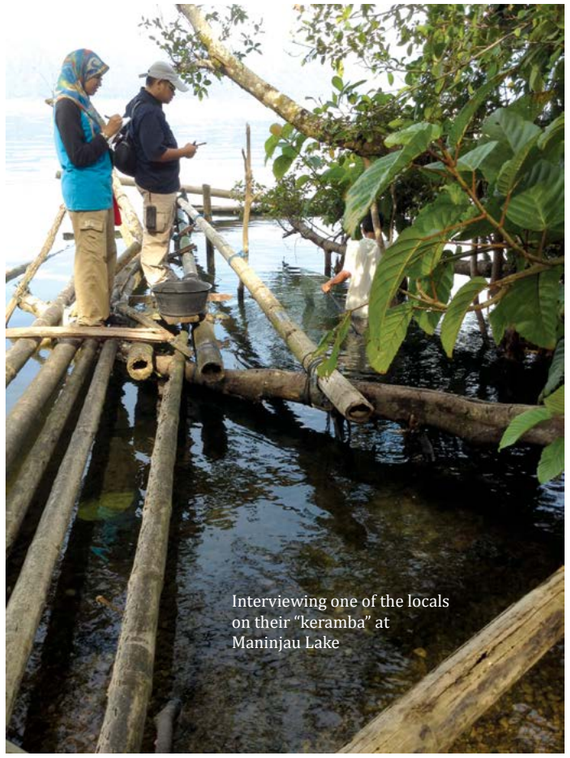
There are approximately 16 000 units of floating net cages ($25m^2$/unit) or known as "karamba" in Lake Maninjau. These cage cultures have been successfully established by local communities. Most of the fishes cultured here includes Ikan Nila, *Oreochromis niloticus* sp. and ikan Mas, *Cyprinus carpio*. The fishes were harvested within four months.

In Singkarak Lake, there is no "keramba' deployed as floating cages could not withstand the gale. Singkarak Lake harbours endemic fish such as ikan Bilih, *Mystacoleucus padangensis* sp., bivalves such as Pensi, *Corbicula sumatrana* sp. and *Corbicula moltkiana* are also common. These economical bivalves are common in muddy and sandy substrate. Generally, the locals were able to make USD 0.44 for every litre of bivalves collected.

Observation on Aquatic Macrophyte

Eichhornia crassipes or also known as water hyacinth is a common invasive species found at these two surveyed area. *E. crassipes* has a luxuriant growth by performing an extremely rapid multiplication, often forming dense mats at the water surface. This free floating plant species is

Floating cage cultures or "karamba" around the edge of the Maninjau lake shores.



Interviewing one of the locals on their "keramba" at Maninjau Lake

considered as the top noxious aquatic weed in Southeast Asia. Although *E. crassipes* is a noxious weed, the plant has been utilised in cage cultures as refuge sites for juvenile fishes.

Another common aquatic plant in Singkarak is rumput jeramon, *Potamogeton zizii*. This endemic submerged aquatic plant can grow up to 4 meters in height from the bottom of the lake to the surface. The plants are food for most of the fish species, especially Ikan Bilih, *Mystacoleucus padangensis*. In addition, *Mimosa pigra* was also recorded along the lake shores and banks of rice fields. *M. pigra* was introduced to Southeast Asia and it favours wet tropical climate. It does not appear to grow preferentially in any one soil type, but it is most commonly found in floodplains and river banks in soils ranging from black cracking clays throughout sandy clays to coarse siliceous river sand.

Observation on Phytoplankton

Plankton is one of the biological components that influences the ecological function of the lake water. In addition, water quality of a lake is determined based on the biological, physical and chemical components in its ecosystem. In Maninjau Lake, few studies were previously conducted to study the distribution of phytoplankton in temporal and spatial scales. It is vital to carry out research on water quality and phytoplankton in order to mitigate problems such as blooming of algae and weed infestation.

Samples were collected from different points at the littoral zone of the lakes. Forty litre of water was filtered through a 30 µm mesh-size Wisconsin plankton net to collect the

Filtering fourty litres of lake water through a net for phytoplankton samples.

Streaking 'live' phytoplankton samples on media for culture purposes.

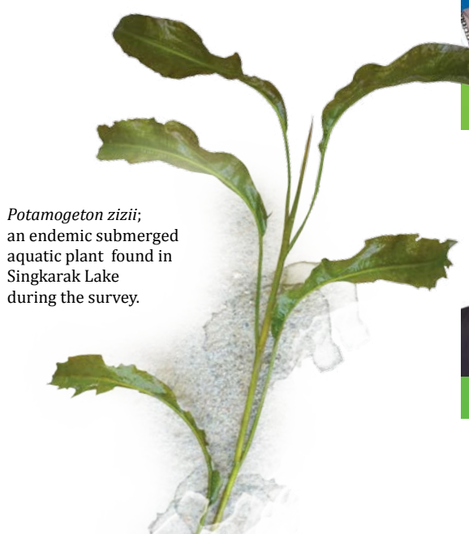
phytoplankton sample below the surface. Lugol's solution was used to preserve the samples. Live samples were also collected and cultured on agar media (BBM and BG-II). All phytoplankton samples were then shipped to USM for further species identification in the laboratory.

Conclusion

The MoU between the institutions is a great starting point to ignite further collaborations. This joint effort affirms our objective in bridging the knowledge gaps between our expertises to solve environmental problems especially relating to limnological studies. Therefore, this network should be established as a long-term cooperation.

Acknowledgements

Special thanks to USM for sponsoring this research trip through RUI grants led by Dr. Wan Maznah, Professor Mashhor Mansor, and Dr. Azma Hanim. We greatly acknowledge the members and delegates from the Research Centre for Limnology, Indonesian Institute of Sciences (LIPI) for the eagerness to cooperate with the research team of School of Biological Sciences, USM.



Potamogeton zizii; an endemic submerged aquatic plant found in Singkarak Lake during the survey.

Muzzalifah Abd Hamid is currently a Ph.D candidate in Environmental Biology focusing on aquaculture and its impacts on lake ecosystem. She completed her M.Sc and Bachelor degree in Environmental Biology at Universiti Sains Malaysia with specialization on freshwater fish community.

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Nor Aisyah Omar is currently a M.Sc candidate in Environmental Biology focusing on the water quality and morphology of Temengor Lake. She completed her Bachelor degree in Agrobiology at Universiti Sains Malaysia with specialization on fungal diseases on local fruits.

Siti Norasikin Ismail is a Ph.D candidate in Environmental Biology focusing on the aquatic vegetation and lake ecosystem. She received her Bachelors Degree in Agrobiology and Masters Degree in Environmental Sciences from Universiti Sains Malaysia.

Mashhor Mansor is an Ecology and Botany professor at School of Biological Sciences, USM. He has contributed in publishing many articles especially regarding scientific research related to ecology and botany.

Eggplant and its benefits to the human health

Lee Ze Hong & Chew Bee Lynn

The eggplant or aubergine (*Solanum melongena* L.), better known as 'terung' locally, is a famous non-tuberous vegetable crop grown in various tropical and temperate regions of the world. It is called the eggplant or commonly referred to as aubergine in United Kingdom due to its egg-shaped fruits. This crop is believed to originate from the North East of India and Burma and was brought over to be cultivated in northern Thailand, Laos, Vietnam and Southwest of China. The earliest documentation of eggplants was found in the Sanskrit literature written about 2000 years ago, suggesting the existence of the eggplant as an important and popular crop in ancient India.

The eggplant is generally divided into three main categories which are egg-shaped (*S. melongena* var. *esculentum*), dwarf-shaped (*S. melongena* var. *depressum*) and long slender shaped (*S. melongena* var. *serpentium*). The normal height of an eggplant ranged between 0.5 and 1.0 meters, but some varieties can grow up to 3.0 meters in height. The optimum growth and fruiting temperature of eggplant falls in the range of 21˚C to 30˚C in tropical conditions. The flowers of eggplant are purplish, reddish or white in colour, while the fruits are in either globular or long shape, with purplish, whitish or greenish colour (unripen fruits) or brown or yellow colour (ripen fruits). According to the data of Food and Agriculture Organization of United Nations, the world production of eggplant gained a record of 49,418,212.00 tonnes with the yield of 264,643.47 kg/ha in year 2013 with Asia being the main producer of eggplant with 92.9% of world production concentrated in this region.

The flavor and the nutrients of the eggplant

The eggplant flesh is rich in vitamins and minerals (particularly iron), making it a good source of nutrients for the human diet. The flavor of the eggplant has been described as interesting to the human palette. Raw eggplant would taste a little bitter with a hint of smoky flavor and this flavor could be stronger in over matured fruits. This distinctive flavor of the eggplant make this vegetable desirable to the human diet and due to its ability to absorb other stronger flavors from other ingredients, it is used in various cuisines around the world. The vegetarians include eggplant as an essential ingredient in their cooking.

The eggplant flesh is rich in a variety of nutrients and coupled with high levels of dietary fibers and low level of calories and fats. In 100g edible portion of eggplant, 92.7% of the content is water, while the rest are carbohydrates (4.0%), proteins (1.4%), fibers (1.3%), fats (0.3%), and vitamins and trace metals. The examples of vitamins that can be found in an eggplant are vitamin C, thiamine, niacin, riboflavin, vitamin B-6, vitamin K, folate and choline. Eggplants also contain a lot of minerals such as potassium, phosphorus, calcium, iron, magnesium, sodium, zinc, manganese and copper which are important to the human health.

The medicinal benefits of the eggplant

The use of eggplant as medicine was practiced in India and its medicinal properties are described in the Medieval Arabic Texts. Modern studies revealed the role of eggplant in treating several diseases such as diabetes, arthritis, asthma and bronchitis. The main health benefits of an eggplant are contributed by its high fiber content and low carbohydrate level, which can aid in weight loss and reduce the risk of cardiovascular diseases. Phytochemicals such as anthocyanin belonging to the flavonoid group and other existing phenolic compounds found in the eggplant flesh provide various medicinal properties to the human health. The active anthocyanin compound abundantly found on the skin of the eggplant, known as nasunin, has been reported to inhibit lipid peroxidation which prevents the production of free radicals in human body as a result of excessive iron accumulation thus inhibiting blood cholesterol peroxidation and cellular damage. Nasunin was reported to be a potential bioactive compound to reduce the risk of heart disease and cancer. The consumption of nasunin also helps to protect joints and prevent arthritis.

Eggplant extracts were found to be enriched in phenolic compounds that have abilities in inhibiting the angiotensin I-converting enzyme (ACE) enzyme, leading to control glucose absorption and reducing the risk of hypertension. Chlorogenic acid found in the eggplant flesh was discovered to have antioxidant activity, hepatoprotective effect and anti-inflammatory which can prevent cancer. Various sources have proven that eggplant has many health benefits coupled with medicinal properties that can prevent many health problems. Its consumption should therefore be encouraged in our daily diet.

Minerals	Value per 100g	Vitamins	Value per 100g
Calcium	9mg	Vitamin C	2.2mg
Iron	0.23mg	Thiamine	0.039mg
Magnesium	14mg	Niacin	0.649mg
Phosphorus	24mg	Riboflavin	0.037mg
Sodium	229mg	Vitamin B-6	0.084mg
Zinc	0.16mg	Folate	22µg
Copper	0.081mg	Choline	6.9mg
Manganese	0.232mg	Vitamin K	3.5µg

Data obtained from National Nutrient Database for Standard Reference Release 27, USDA

Dr. Chew Bee Lynn is a Senior Lecturer in the School of Biological Sciences, USM and is researching on the generation of transgenic plants particularly in the *Solanaceae* species for nutrient enhancement. Lee Ze Hong is her M.Sc student performing research on the transformation of novel genes in eggplant (*Solanum melongena*).

A *Sea of* *Vibrant Fans*

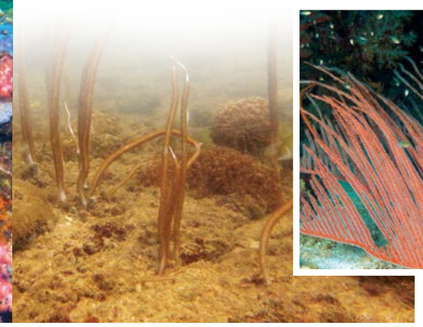
Mahadi Mohammad

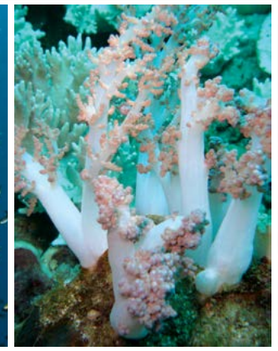
Coral reefs can be found in both shallow and deep waters and are classified into two general categories, hard and soft.

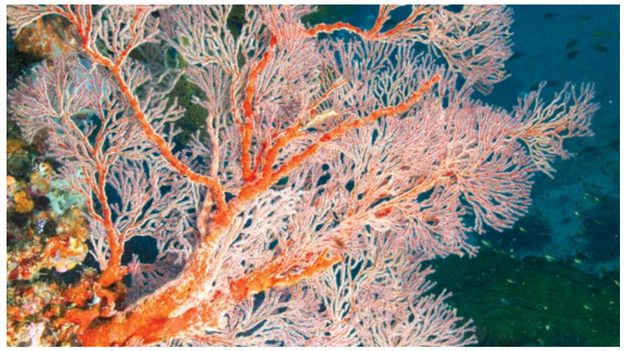
Soft coral and gorgonian (sea fans) are animals grouped under the scientific subclass Octocorallia. Their distinguishing characteristic is the eight tentacled polyps (hence octo-coral). Soft coral and gorgonian are corals that do not produce calcium carbonate skeletons. Hence, they are neither reef-building corals nor do they lay new foundation for future reefs. Instead, they contain spiney skeletal elements called sclerites. Aside from their scientific utility in species identification, sclerites provide soft corals some degree of support and give their flesh a spiky, grainy texture that deters predators such as fishes and other benthos.

Gorgonian, better known as sea fans or sea whips, are an order of sessile colonial cnidarian found throughout the oceans of the world, especially in the tropics. Individual tiny polyps form a colony, are normally erect, flattened, branching or reminiscent of a fan. Others may be whiplike, bushy, or even encrusting. A colony can be several feet high and across but only a few inches thick. They may be brightly coloured, often purple, red, or yellow.

Gorgonians come in a wide range of hues and account for many of the beautiful splashes of color on the reefs for example violet, yellow orange and even blood-red. Gorgonians feed on tiny plankton by expanding their tentacle into the surrounding water where their prey can wander into their waiting "arms". Gorgonians orient themselves to the prevailing surge or current for maximum polyps exposure. This is why in a particular location, all sea fans could be found facing the same direction. The tentacles of the polyps bear stinging nematocysts which immobilize the prey. The tentacles then draw the prey to the mouth at the centre of the polyp. Fortunately, stings of the gorgonian polyps are not felt by divers. Gorgonians act as hosts for many other animals in several different ways. Oysters and sponges, for examples, often attach to their branches and use them as anchors. Basket stars, brittlestars, and feather stars climb tall on gorgonians for more advantageous feeding positions. Gorgonians make up a large part of what are called coral gardens.







The future of soft coral communities in tropical waters may literally be melting away because of episodic bleaching events, which have been caused by global warming. Unlike hard corals, tiny skeletons made of calcium carbonate of the dead soft corals contribute minutely to reef build up. This translated to least conservation and research effort as compared to the hard corals. Soft corals would likely vanish or become extinct in response to environmental stress such as ocean acidification, before they are even discovered. Continuous damage to coral reefs due to bleaching and other stressors may affect the ocean food webs and can subsequently drive the extinction of reef fishes and other benthos.

We have now undeniably missed the boat in discovering key pharmaceutical compound that could be derived from soft corals. There is an enormous gap in our knowledge on soft corals of the reef environment, and with the current rate of extinction, we have already lost certain species forever.

Dr. Mahadi Mohammad is a marine biologist. His research focuses on coral reef resilience and climate change.

UNDERGRADUATE Partnership Program with

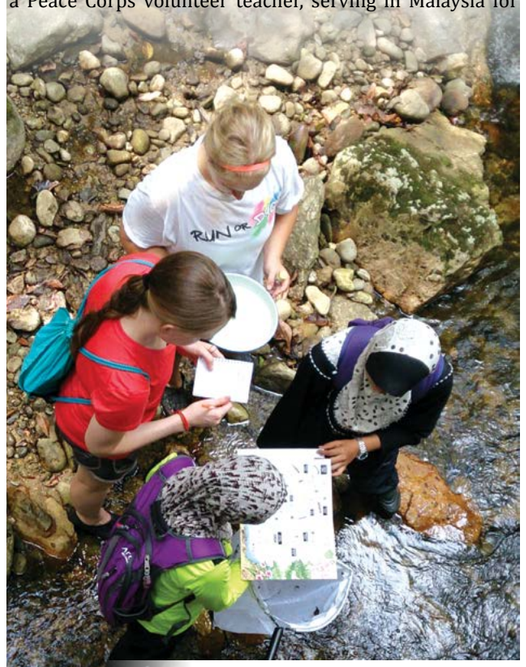
Gustavus Adolphus College

Semester in Malaysia: Living Diversity

Nurul Salmi Abdul Latip

The start of Semester II this academic year saw a newly launched program between USM and Gustavus Adolphus College (GAC) of Minnesota, United States. The program, named, *Semester in Malaysia: Living Diversity*, was designed as a study abroad program to provide students of GAC, a liberal arts institution, opportunities to immerse themselves in a different country in as many different ways as possible. Malaysia, with our rich ethnics, culture, religions, languages, food, and biodiversity became their best candidate!

The initiation of the program came with two previous visits by faculty members of GAC and Carolyn O'Grady, director of the College's Center for International and Cultural Education (CICE) in 2012. This first Spring 2014 Semester in Malaysia program was led by Professor Steve Mellema and Shirley Mellema. Steve first encountered Malaysia as a Peace Corps volunteer teacher, serving in Malaysia for almost six years. He spent three of those years in Pasir Puteh, Kelantan and speaks fluent Kelantanese. Since joining the Gustavus faculty in 1986, he has spent two sabbatical leaves teaching at USM, including six months as a Fulbright Fellow in 2002-03. Shirley also worked for the Peace Corps in Malaysia, helping to train newly arrived American volunteers. The Mellemas also act as the students' cross-cultural liaisons for this program.



Lenggong-Aquatic insect sampling trip.

Perlis rainforest trip.

Perlis-Night herping.

This specially customized program for the College's involves the participation of four schools on the USM main campus, one being the School of Biological Sciences. GAC students spent a whole semester from 17 February till 30 May 2014. Students registered the program under GAC's respective course codes which included four courses, i.e., Malay Language and Culture; Religions of Malaysia; Tropical Ecology; and The Malaysian Experience: Living Diversity. The initial program brought over twelve GAC students with different course backgrounds, science and non-science, all of whom has been selected from a competitive application of over 50 students.

Under the program, School of Biological Sciences offers Tropical Ecology which was designed for non-Biology majors in content. The program emphasises on field-based experiential learning where field trips were conducted to expose students to the wealth of diversity that makes Malaysia a most unique tropical classroom. The course aimed to introduce students to the study of tropical biodiversity, ecology, and conservation biology so that students will develop an appreciation for diversity of life and the intricate interactions of different organisms in different tropical ecosystems in Malaysia. At the same time, students could develop an understanding of the factors controlling biodiversity and human influences on biodiversity and be able to discuss a realistic perspective of the challenges to conservation in a rapidly developing biodiversity hotspot country such as Malaysia. Four main ecosystems became the focal point for the course, i.e., the rainforest, mangrove, freshwater and marine, where ecology is the integrating concept for all.

Redang reef trip.

Through the Tropical Ecology program, students get to experience the complexity and beauty of these biologically diverse and threatened ecosystems in Malaysia. Course activities included lectures, hands-on exercises, participatory learning and discussions. Field studies comprised at least 60% of the student contact hours while the rest are in more formal settings. Students underwent diverse range of experiences from observing Orang Utan, to counting bats, exploring the intricacies of a mangrove forest, chasing aquatic insects, to doing a reef health check and sleeping with turtles! Places visited include Perlis State Park, Perlis; the mangroves of Merbok, Kedah and Matang, Perak; Lenggong valley and Sungai Perak, Perak; Kota Bharu, Kelantan and Pulau Redang, Terengganu. For evaluations, students are required to complete various forms of continuous assessments. These included presentations, individual and group work, essays, test, field journal and a final term paper, all graded by a group of lecturers from the School.

The Tropical Ecology component offers the GAC students a broader global perspective in terms of biodiversity conservation, issues and challenges in a rapidly developing tropical country and strives for students to acquire transformative study abroad experiences through field-based learning and research. Study abroad programs such as this certainly offer some of the most exciting and academically enriching opportunities for the first batch of GAC undergraduates. The Malaysian experience - exposure to a new geography and environment, cultures, languages and ideas, certainly offered some of the most exciting and academically enriching opportunities for the first batch of GAC undergraduates.

Merbok-Fish cage culture.

Merbok-mangrove crab.

Makan time.

Dr. Nurul Salmi Abdul Latip primary interest lies in environmental ecology with emphasis on conservation and management of environmentally sensitive areas; sustainability; ecological literacy. She coordinates undergraduate international field programs with University of Victoria, Canada and Gustavus Adolphus College, USA.

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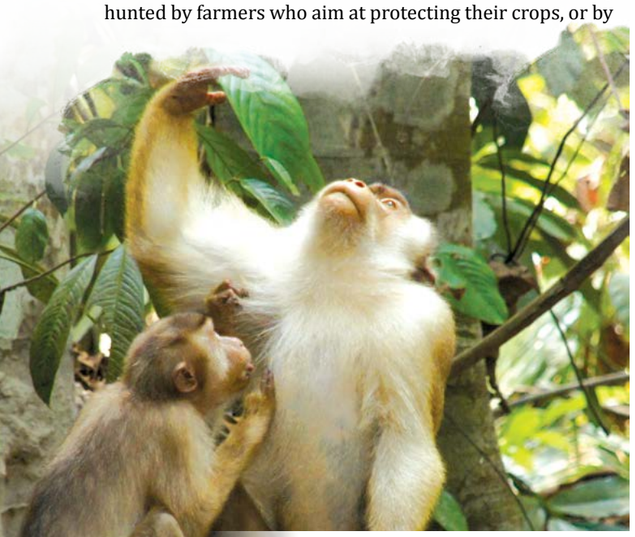
The *Macaca nemestrina Project* - *Strengthening the profile of primate studies at USM*

Nadine Ruppert

The southern pig-tailed macaque (*Macaca nemestrina*), or locally known as "beruk", is one of twelve primate species of Peninsular Malaysia. Hardly any studies have been conducted on these primates in the wild. Unlike its more opportunistic and cheeky cousin, the long-tailed macaque ("kera", *Macaca fascicularis*), Pigtails are usually not found in urban areas but need an intact forest habitat to strive. Ongoing deforestation thus puts pressure on their populations and they have been declared "vulnerable" by IUCN. Because of its mainly terrestrial and thus rather stealthy behaviour, and its ability to silently retreat into the forest and blend in with the dense forest vegetation, this elusive primate has long since gained the reputation that it cannot be habituated.

Pig-tailed macaques live in multi-male multi-female groups that can consist of up to 80 individuals. Although sometimes found near agricultural lands, these species prefer pristine primary forests of altitudes up to 2000 m. While males leave their birth group upon adolescence, females stay within their group throughout their life and their hierarchy is organized in strict matrilines. Pigtails are mainly frugivorous and adapted to foraging on the ground. In rural areas they can sometimes be stealthy crop raiders who sneak silently into gardens or plantations one at a time, with a male acting as a lookout and giving alarm calls if humans arrive. Many groups are often being hunted by farmers who aim at protecting their crops, or by



Barbie grooming Vince 'the prince'.

Emma with newborn.

people seeking their meat for culinary purposes. In some areas of the Malay Peninsula, farmers also train pig-tailed macaques to harvest coconuts or other fruits (e.g. *petai*) from cultivated trees.

I began to study Pigtails during the field work for my PhD in 2012, and with the start of the "*Macaca nemestrina* Project" (MNeP, *www.macaca-nemestrina.org*) the course was set to study the biology, behaviour and ecology of this charismatic primate species in more detail. MNeP is a collaboration between Bio School USM and the German Primate Centre (Deutsches Primatenzentrum DPZ, *www.dpz.eu*). The two institutions have signed a Memorandum of Agreement in May 2013 and Dr Antje Engelhardt (DPZ), who is head of the junior research group "Primate Sexual Selection" and founder of the "*Macaca nigra* Project" (*www.macaca-nigra.org*) in Tangkoko National Park North-Sulawesi, acts as scientific advisor and co-researcher for MNeP.

MNeP is the first long-term programme on southern pig-tailed macaques that is aimed at studying habituated animals in their natural habitat. At the Segari Melintang Forest Reserve, Perak, one group of Pigtails has since been habituated successfully and is being followed by observers daily. A second group is soon to be habituated.

Since April 2013 until April 2014 scan and GPS data on three adult males, three females and three subadults were collected. This data describes the group's daily foraging patterns, walking distances, home range area, time spent in different strata of the forest, time spent in the rain forest vs. surrounding oil palm plantations, and daily time spent on different behaviours, e.g. locomotion, feeding, grooming etc. The data in detail is currently reviewed for publication. To this date, the group consists of 18 adult females, 6 adult males and around 15 subadults, including infants. They use a home range area of 1.5 km^2 with a core area of 0.8 km^2, their daily walking distance ranges between 1.5-3.5 km and they spend an average of 2 hours daily (of a total of around 10-11 hours daily foraging time) in oil palm plantations that surround the forest.

Grooming session.

Data sampling methods have now switched from scan data to focal animal sampling. Here, a focal animal is being followed for several hours daily and its exact behaviour is recorded every minute. This more elaborate method allows analyzing for various aspects of the individual's behavioural repertoire, its interaction with other group members and the social structure of the group.

Another field of interest that will be tackled soon is the use of oil palm plantations as additional foraging grounds. It was shown that the group visits the surrounding plantation daily, so it is interesting to study to which degree they use oil palm fruits as a component of their diet. Preliminary observations suggest that oil palm contributes to around 25% of their overall diet. However, the actual intake of ripe oil palm fruits (and thus fruits of market value) is rather low compared to the intake of overripe fruits that had already fallen to the ground. In many areas of the Peninsular and elsewhere, Pigtails are commonly hunted by oil palm farmers who want to protect their crops. An important opportunity of this study is to create awareness amongst farmers and act towards conservation of this vulnerable primate species. Although, Pigtails might like to "hang around" in people's plantations, the actual harm and monetary loss they cause to the overall harvest might be rather negligible. The Rufford Foundation (London UK) is contributing funding to this important aspect of Pigtail conservation efforts. Here, I would also like to express my gratitude to the more than 20 volunteers from all over the world who have been helping to do the fieldwork for this project since the start-up.

Sunny feeding on oil palm fruits.

With the *Macaca nemestrina* Project, the School of Biological Sciences has gained a new, interesting and versatile research project that enhances the School's international profile and expedites the discipline of primatology in Malaysia.

Dr Nadine Ruppert is a new lecturer at School of Biological Sciences and initiated the "*Macaca nemestrina* Project" in 2012 as part of her PhD thesis. She is a zoologist who studies the role of mammals in tropical forest ecosystems. Dealing with mammals as seed dispersers of rattan palms during her PhD studies, she recently put her focus on local primates and expanded her expertise in primate behaviour and ecology.

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Liana:

A Forgotten Plant

Rahmad Zakaria, Mohamad Syafiq bin Mohd Johari and
Amzar Helmy bin Abdul Rahim

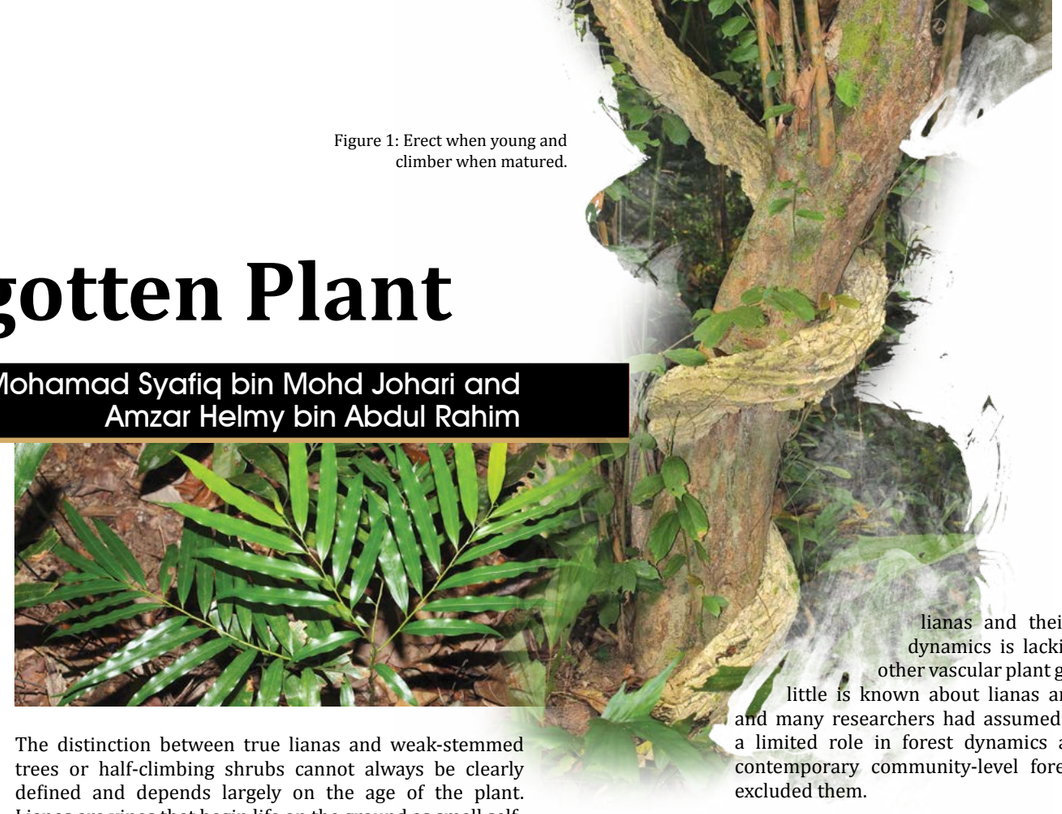

Figure 1: Erect when young and climber when matured.

Figure 2: Top Left (tendrils), bottom left (hook), Bottom right (twinning).

Figure 4: Another species of parasite, *Rhizanthes infanticida* growing on liana.

What is liana?

Liana is a name for any climbing plant that is rooted on the ground. The term is most often used for the woody vines that form a characteristic part of tropical rain-forest vegetation; they are sometimes also called bush ropes or simple vines. Lianas in Peninsular Malaysia constitute more than 1000 species from 75 families with various types/shapes of fruits and flowers depending on their family. Although lianas are found in every climate where there are trees to support them, they are most abundant and luxuriant in the tropics, where rapid growth to reach the light is an advantage in the dense forest vegetation.

The term "liana" is not a proper taxonomic grouping, but rather a description of the way the plant grows and behaves – much like "tree" or "shrub". Lianas may come from many different plant families, for example, rattans. Lianas often ascend and descend on more than one tree. A climbing palm was once measured at over 210 m long; a length of over 60 m is not unusual for many other types of liana. One way to distinguish lianas from trees and shrubs is based on the bole/trunk stiffness. Trees and shrubs have young twigs and smaller branches which are quite flexible and older growth such as trunks and large branches are stiffer. A liana on the other hand, often has stiff young parts (juvenile and seedling) but older/matured growth is more flexible (Figure 1).

The distinction between true lianas and weak-stemmed trees or half-climbing shrubs cannot always be clearly defined and depends largely on the age of the plant. Lianas are vines that begin life on the ground as small self-supporting (erect) shrubs and later rely on other plants (host) to reach the light-rich environment on the upper canopy and emergent. Because lianas use the architecture of other plants (host) for support, they devote relatively little to structural support and instead allocate more resources to leaf production and stem/root elongation for rapid growth. They are rooted to the ground throughout their lives (unlike parasites, epiphytes and hemiepiphytes), they take nothing from the tree except support.

Specifically, liana attached to the trees by different climbing mechanisms depending on species (Figure 2). Lianas have a variety of adaptations for attaching themselves to their host and climb towards the forest canopy. These adaptations include stem twining, clasping tendrils arising from stem, leaf and branch modifications, thorns and spikes that attach the liana to its host, downward-pointing adhesive hairs, and adhesive, adventitious roots. The relative proportion of lianas with different climbing mechanisms might be directly influenced by the successional stage or disturbance regime of the forest.

Some parasitic plant grows on liana. One of the most famous liana plants invaded by the parasitic plant is from the genus *Tetrastigma*. *Rafflesia* is an endophytic holoparasite, which lack leaves and stems. They parasitize on a specific number of *Tetrastigma* (i.e., members of the grapevine family, Vitaceae) hosts, on which they rely exclusively for their nutrition (Figure 3). *Rhizanthes* (quite rare compared to *Rafflesia*) is also a parasite growing on *Tetrastigma*. It is identified by the earthstar shape with 14-16 pointed lobes (Figure 4).

Ecological value

The current understanding of the ecology of lianas and their role in forest dynamics is lacking compared to other vascular plant groups. Relatively little is known about lianas and their ecology and many researchers had assumed that lianas play a limited role in forest dynamics and hence most contemporary community-level forest studies have excluded them.

Lianas play an important role in forest dynamics including suppressing tree regeneration, increasing tree mortality, providing a valuable food source for animals, and physically linking trees together, thereby providing canopy-to-canopy access for arboreal animals. Lianas are important for animals in tropical forests, because they connect from one tree to the next tree, and provide a lot of resources. They thrive well in dry season, flowering and producing fruits all year long, providing a source of food for other organisms.

Furthermore, lianas contribute to overall plant diversity in tropical forests (especially in and around light gaps and forest edges where lianas are abundant due to the increased availability of light). Up to 30% of plant species are liana in a tropical forest. With their high photosynthetic production and sizable biomass, lianas also make a significant contribution to carbon sequestration and transpiration. Liana have high canopy:stem ratio, extremely long and wide vessel elements, and very deep root systems (able to tap the water deep in the ground) lianas also have high sap flow and transpiration rates compared with trees. Experiments in Panamanian forest showed that lianas are able to transpire well throughout the dry season. During dry seasons, nearly all lianas remained evergreen whereas many of the woody trees shed their leaves.

Figure 3: Pride of Parasite, *Rafflesia kerri* found growing on liana, *Tetrastigma* sp.

Economical value

Most economic activity of tropical forests are timber based products. However, a large numbers of liana species provide a large variety of non-timber products that are used by millions of people around the world. These include all wild animal and plant products that are harvested from natural and planted forests. Liana species constitute a very important group of non-timber forest products.

Lianas are used in many different ways such as for medicinal purpose, edible fruits, and domestic purpose. The principle uses of lianas are for: medicine, food and domestic purposes such as fuel wood, rope making, furniture etc. In Malaysia, lianas are important in remote areas where regular "modern" western medicines and various other products are not easily available and accessible. However, in some regions, the knowledge of these useful plants is disappearing more rapidly than the plants themselves. If no efforts are made to maintain and study both the biological and cultural diversity, a potential resource of new medicines for human disease, food products for international trade, and indigenous management systems will vanish together with the forests.

Dr Rahmad Zakaria is a senior botanist with special interest in woody plants, climbers such as lianas and also mistletoes.

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Establishing *Research Collaborations* with Australian institutions

Ng Wing Keong

As I write this article, my sabbatical leave of nine months will soon be over. Apart from taking a much needed break from routine academic duties at Universiti Sains Malaysia, my time was spent attending and speaking at conferences, evaluating and monitoring Technofund projects at the Ministry of Science, Technology and Innovation (MOSTI) and a sponsored visit to Australia. One of the highlights of my sabbatical leave was a visit to Brisbane (Queensland) and Hobart (Tasmania), fully sponsored by the Sir Frederick McMaster Visiting Fellowship administered by the Commonwealth Scientific and Industrial Research Organization (CSIRO).

A friendly local wildlife at the Lone Pine Koala Sanctuary, Brisbane.

McMaster Visiting Fellow

McMaster Fellowships are available to distinguished overseas scientists working in CSIRO priority areas directly related to veterinary science or agriculture. Nominations for a Fellowship are made by the Chief of the host CSIRO Division. According to their stipulated requirements, "a Visiting Fellow should be a leader in a research discipline, or experienced in directing research or developing research policy at an institutional, national or international level." A Visiting Fellow is expected to undertake a "review and make recommendations on a specific area of research, or a program of public lectures and high level discussions on research policy and management, or other activities approved by the Selection Committee."

During my stay in Australia, visits were made to the CSIRO laboratories at the Ecosciences Precint at Dutton Park, CSIRO Bribie Island Research Center, Ridley Aqua-Feed Pty Ltd at Narangba Queensland, CSIRO laboratories in Hobart, Institute for Marine and Antarctic Studies (IMAS) at the Hobart Waterfront and the IMAS/University of Tasmania (UTAS) Fisheries and Aquaculture Centre at Taroona, Tasmania.

CSIRO Brisbane is housed within the Ecosciences Precint in a highly modern glass building at Dutton Park. Modern laboratories with a full range of sophisticated equipment are available for use by researchers.

Dr. Brett Glencross (arms folded) with his team at CSIRO Bribie Island Research Center which houses the fish and shrimp culture facilities of CSIRO.

Two official seminars, one at CSIRO Brisbane and another at IMAS, were conducted which was open to the public and aquaculture/aquafeed industries. The topic of my seminar was "*The journey from research concept to commercialization of a functional feed additive for aquaculture*". From concept to commercialization, the presentation highlighted the 10-year journey it took to develop an innovative functional feed additive for farmed fish and shrimp feeds. The journey from getting a research idea, obtaining funding, developing laboratory proof of concept, construction of a pilot plant, field testing of the prototype product, promotional activities and ultimately the commercialization of the feed additive was shared together with all the associated excitement and challenges faced along the way. Researchers and the public benefited from understanding the whole process of commercializing a research product developed in a university. Personal experiences shared may also help policy makers in governmental and research institutions to formulate policies, funding and management plans to help researchers in their quest to commercialize research findings. The important role played by private companies and fish/shrimp farmers in collaborating with researchers was also highlighted in this presentation. The seminar was well received and very timely to CSIRO and IMAS/UTAS research scientists as many are currently involved in research projects that are linked to industry partners and have just been or in the process of being commercialized.

The highly impressive building of the Institute for Marine and Antarctic Studies (IMAS) at the University of Tasmania (UTAS) was recently established to usher in a new era in Australian marine and Antarctic research and education.

A typical Australian lunch of 'fish and chips' at a restaurant opposite IMAS. Professor Chris Carter (left) and Dr. Peter Nichols are seated at the far end of the table.

Information shared during the ensuing discussions was mutually beneficial. Over the period of my visit, opportunities were also available for informal discussions and exchange of ideas with CSIRO and IMAS researchers, technicians and industry groups on this subject matter of commercializing research findings and products.

A day was set aside for me to give research and academic input to three PhD students currently attached to CSIRO Brisbane. Each student gave a presentation of their current research project and discussions were held to address any issues or questions they have in conducting their research. The research projects were related to amino acid and fatty acid nutrition in barramundi as well as a breeding project for tiger shrimp. A comprehensive discussion on the use of molecular biology techniques was given by Dr. Nick Wade (Research Scientist, CSIRO Brisbane) in his laboratory which was highly informative.

Opportunities for research collaborations

A series of high level discussions on research initiatives, policies and potential collaborative efforts on novel functional feed additives, feed ingredients and other aquaculture-related topics were undertaken. Discussions held with Dr. Nigel Preston (Program Director, Integrated Sustainable Aquaculture Production, Agriculture Flagship) included his vision and future research plans for the group in aquaculture-related research. His active involvement with shrimp breeding work in Asia and feral tilapia genetics research in Africa may open up future possibilities for collaborative work of mutual interest. Discussions held with Dr. Brett Glencross (Senior Principal Research Scientist, CSIRO Brisbane) especially on the use of Novacq™, a novel feed additive developed at CSIRO, may have implications for future work in evaluating the product in Malaysia. Discussions were also held with Dr. Peter Nichols (Senior Principal Research Scientist, CSIRO Hobart) on the use in aquafeeds of omega-3 fatty acid enriched canola oil extracted from genetically-modified plants, an area of our mutual interest in lipid biochemistry. Another relevant research topic discussed with Professor Chris Carter (Head, Fisheries and Aquaculture Centre, IMAS) was on developing lobster culture technologies.

A factory visit to Ridley AgriProducts Pty Ltd, which is a major producer of marine fish and shrimp feeds in Australia, based in Queensland.

A chance meeting with Prof. Siti Azizah (with sunglasses) and Dr. Khairun Yahya at the Queen Street Mall in Brisbane.

The industry partner linked to this lobster project currently has a grow-out farm based in Malaysia and the potential for further collaborative research work between IMAS and Universiti Sains Malaysia (USM) in the culture of this crustacean species was discussed.

Ridley AgriProducts Pty Ltd, through a visit to the aquafeed factory arranged by Dr. Brett Glencross, has expressed interest in the laboratory evaluation of Novacq™ at USM with locally farmed tropical species. Dr. Matthew Briggs (Technical Project Manager) was present at my seminar and he has also expressed interest in testing the novel functional feed additive, Orgacids™-AQUA, developed by USM for shrimp feeds, most probably facilitated through their close research collaboration with CSIRO. Located in Asia where more than 85% of the global aquaculture production takes place, USM is uniquely positioned to be a strategic alliance. This visit sponsored by the McMaster Fellowship is important not only in terms of the valuable exchange of ideas and information, but also important in developing mutual understanding and friendships which in my opinion are equally important in the establishment of any successful collaborative links. The contacts made are therefore invaluable in any future collaborative research efforts with Australian institutions.

Concluding remarks

I arrived in Brisbane on a Saturday and on Sunday went out to the city center to purchase some groceries. While walking along Queen Street Mall, I heard someone talking in a familiar sounding voice and when I turned around, there she was, Professor Siti Azizah Mohd. Nor! Prof. Siti was with her husband and Dr. Khairun Yahya. Prof. Siti and Dr. Khairun are colleagues from the School of Biological Sciences in USM and the odds of meeting them at the exact same location in Australia at the exact same day and time is mind boggling to say the least. It was encouraging to find out that they were in Brisbane to establish research collaborations with Griffith University in the area of mangrove ecosystems and conservation. Unfortunately, due to our respective busy schedules, there were no opportunities to meet further while in Brisbane. As a researcher, I feel that it is important to constantly expand our network of collaborative research efforts and to form linkages with other researchers and institutions of good scientific reputation so that we can remain at the cutting edge of research. I am glad that I am not alone in such a quest for research excellence and relevance.

Ng Wing Keong is a Professor of Aquaculture Nutrition. He has specialized interests in developing new lipid and protein ingredients as well as functional additives in the feeds of commercially farmed fish and shrimp to enhance sustainability and profitability of aquaculture.

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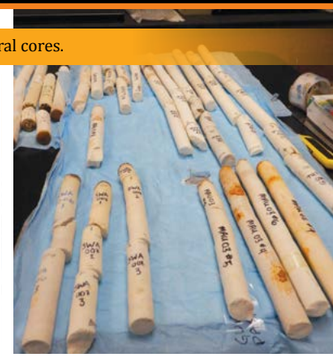
Summer of a Lifetime

Quek Yew Aun

Anne Cohen, my supervisor.

Leaving for the US.



Coral cores.

It was the summer of a lifetime. Last year (July to August, 2014), I spent my summer in Woods Hole Oceanographic Institute (WHOI). This article is my attempt at sharing the experiences and hopefully inspire young biologists from Malaysia to visit faraway places, learn their research culture and bring the good values back home where we truly belong. WHOI conducts an amazing program every summer called Summer Student Fellowships (SSF) where budding marine scientists from around the world could apply to join.

Fellows are granted full funding, lodging and get to go aboard the R/V Tioga which is a real life research vessel from which WHOI launches their sophisticated equipment. Without much thought, I applied for the SSF. In the process, I had to contact a researcher from WHOI itself to increase my chances of admission. I looked through the directory and emailed the people who work in marine biology or anyone close to the field that I was interested in and stumbled across the name Anne Cohen, my supervisor to-be. She replied my email and promised to look up my profile if I was accepted to the program. After weeks of waiting, I didn't get in. My heart was crushed. That distant dream seemed more and more impossible. As a consolation, the admission people did mention that my file ranked highly in the screening process and that I would be an alternative if anyone turned down the offer.

A week later, Anne emailed me. I have to admit it was a pleasant surprise. Out of nowhere, she asked about my application and whether I got into the program or not. When I replied with the news, she did all she can to try to take me in as her guest student instead. I intended to seize this opportunity wholeheartedly. I was to receive lodging and a stipend from Anne while transport to WHOI was paid for by my own expenses. With the visa and paperwork completed, there I was on the cheapest flight to Boston Logan Airport, the beginning of the experience that literally changed my life. The young Malaysian student who has never left Mother Asia now flying through 2 continents in just over a day.

WHOI is located in the town of Woods Hole, a tourist destination in Cape Cod where people would take the ferry to world renowned Martha's Vineyard. In the olden days, WHOI was located solely in the small village but since their expansion, WHOI is now divided into 'The Village' and the Quisset Campus. Most labs are located in Quisset Campus, about 7 minutes away by van from 'The Village'. When I was there, my dormitory or 'The Barn' was located in 'The Village' while the lab I was working, in Quisset Campus. When you think of WHOI, you almost always imagine fancy labs in tall buildings and people in lab coats. Well, the place was the exact opposite. There you have people doing cutting edge research living in quaint cottages by the sea.

Since I was a guest student, I lived in 'The Barn' which was an actual barn before being converted to a dormitory for students. My roommate was a Brazilian oceanography masters student, Andre Palocsy while there were other students from China, England, Argentina and India. I was greeted on my first day by Liz, one of Anne's final year graduate students that took the liberty of showing me around.

The next day, I got down to business immediately. Anne wasn't back from her latest field trip yet so I was assigned to her research assistant, Katherine who showed me the techniques in coral core analysis. Anne's reasearch group conducts coral skeletons studies. Hermatypic corals lay down calcareous skeleton by converting the calcium and carbonate ions in seawater to calcium carbonate. How much a coral lays down a year is very much dependent on the environmental conditions at that time. Hence by knowing the calcification rate in a year, we can get a better idea about the conditions in that particular year. For example, during the El Nino years of 1998-1999, there was a decrease in the extension rate which is visible for many coral cores in the Pacific from massive bleaching events.

In the lab, the coral cores were already extracted from remote places in the Carribean and Pacific. My work involved analyzing these cores. Initially, I cleaned the cores, dried them, put them together and CT scanned them to get the skeleton images, similar to what a doctor would do to someone with broken bones. Tom, one of Anne's genius graduate students created a MATLAB script that could analyse the calcification rates simply by marking the yearly bands. I used this on a daily basis to work on a set of corals from Guam, Maug, Tutuila and Swairns which were all US territories in the Pacific Ocean. I compared the calcification rates with data from NOAA like El Nino and Pacific Decadal Oscillation effects and mixed layer depth. Towards the end of my guest studentship, I worked on coral dissepiments which was something even more amazing. One of the problems faced by coral scientists is where exactly to draw a line from year to year in terms of extension. It is theorized that corals grow a horizontal layer called a dissepiment every month and hence it would make sense to have 12 dissepiments for a year. In Tom's work, he marked the coral dissepiments using Adobe Illustrator and superimposed it on a 'theoretical year' scanned by the CT. It turns out that one year might have more than 12 dissepiments. This is totally new frontline science and it was an amazing feeling to be part of it.

One of the concepts that I found interesting during my time at WHOI was the free propagation of knowledge. The thirst for knowledge is so ingrained in their culture. A very good illustration of this is the Friday Night public lecture by the Marine Biological Lab (MBL). Every Friday night, a distinguished guest in any field of science would be invited for an hour long talk to the public. It is there you would see old uncle and aunties, barely able to walk but coming in with walking sticks and hearing aids around their necks just to listen to these speakers. The speakers were from a wide range too! One week you had the paleontologist that discovered Ichthyostega (the missing link between fish and amphibians) while the next would be the person who discovered the dangers of bisphenol A in plastics and campaigned against the use of it. I feel that these weekly lectures can be practised back home, especially starting from here in the well-educated Penang society.

All work and no play indeed make Jack a dull boy. Thankfully, it was the World Cup season and it was a blessing to have Brazilians and Argentinians in the Barn. Football is their national sport but the only difference was that both countries have teams in the World Cup. Other than that, I experienced my first 4th of July (America's Independence Day) with fireworks, a parade and free watermelon! In Woods Hole, the ride to and from Quisset campus was always something to look forward to. Going there in the misty morning on the dedicated bike path would always spark encounters with wild rabbits and sometimes deer if you're lucky. Here the balance between nature and human beings is emphasized at all times. In mid-summer, late nights at Quisset would be rewarded with fireflies along the Shining Sea bikeway.

Birthday in Boston.

The affable characters of the WHOI lab.

I had the coolest supervisor ever. She was ever so supportive and wanted me to get the most out of my experience. Hari Raya came and I learned of a Malaysian open house in Washington D.C. The Malaysian in me wanted to go so bad and so happened that a friend of mine who studies in Iowa knew someone from Boston who was going. After an online introduction, blessings from Anne, I was in a car with total strangers, whisked 6 states away into the capital of USA! It was then I met my Boston family, Ashbir, Anis and Hasanah; the UiTM interns, Nik the recently graduated IBM employee and Hakim, the Boston University engineering student. Despite not being a Malay Muslim who celebrated Hari Raya, the Malaysians there welcomed me with open arms. I slept over at a Malay family's house, fasted with them and even stayed for 2 nights in an uztaz's house in Washington D.C. It was an adventure to last a lifetime. A week later, I celebrated my birthday with this newfound family of mine in a foreign land. It is indeed amazing how welcoming people are, and how tight knit Malaysians are overseas.

Being a marine biology student, it was amazing to visit two of the largest aquariums in the USA for free! I visited the New England Aquarium on my 22nd birthday! The visits changed my perceptions of aquariums/zoos in general. Initially to the naked eye, they might seem like it is solely a money making business. However, some of these facilities support conservation efforts all around the world. For example, Shedd Aquarium has been a leader in seahorse conservation and all their seahorses on exhibit have been bred in captivity.

My travels have also brought me interesting experiences. One of which is sleeping over at airports to catch cheaper flights. Odd hours often offer more affordable travel options so a wanderlust student on a shoestring budget has to make sacrifices. I promised to visit the students from Gustavus College, who were a group of exchange students back at USM before taking 4 connecting flights in 2 days all the way back to Malaysia. Before leaving for Minnesota, I hugged Anne for the last time during my stay. I thanked her for the wonderful thing she has done for me and wished her well in her research. It was a big moment in my life. I said my goodbyes to all the members of the Cohen Lab as well (Liz, Hannah, Tom, Katherine, Alice, Amanda, Cailan and Dan) and left WHOI with a heavy heart, wondering when will I ever return to this place that changed my life forever.

Back in Malaysia I felt very overwhelmed yet hungry for more. I encourage everyone especially the School of Biological Science to go out there and make Malaysia proud!

Quek Yew Aun is an aspiring marine biologist currently in his final year studies at School of Biological Sciences, USM. He is an active student and has been involved in a lot of conservation projects.

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IMTGT for IMT-GT

Dr Aileen presented token to Plenary Speaker - Prof Abd Wahab A Rahman.

Group photo.

Plenary Speakers - Left Dr Apridar - Right Emeritus Prof Yong Hoi Sen.

Plenary Speaker- Dr Perapong Tekasakul.

Passing of batton USM to PSU.

Foong Swee Yeok

The Regional IMT-GT UNINET Conference was back for its 9th time, and hosted by USM for the 4th time in Penang from 3rd-5th November 2014. A total of around 150 esteemed academicians and researchers from four countries gathered to discuss critical topics on Biodiversity, Environment & Conservation, Biotechnology & Food technology, Biomedical & Health Science, Pharmaceutical & Natural Resources and Agriculture.

With the theme "Integrated Multidisciplinary & Transboundary Research for Global Transformation", the focus of the conference is on the trans-disciplinary intensive researches especially among the young scientists in this region.

The energized hosts and participants had once again turned the biennial event into a very inspiring meeting. The conference started with the plenary speech by the prestige Merdeka Award (2010) for Outstanding Scholastic Achiever, Emeritus Professor Dr. Yong Hoi Sen. Professor Yong offered a broad and comprehensive discussion on the role of cytogenetic data in differentiation of cryptic species. As a scientist working in one of the world's richest nations in terms of genetic resources, Professor Yong proficiently drew discussions based on his works on various species, from nematode parasites, stingless bees, fruit flies, odonates, crab-eating frogs to rats!

The conference second plenary speaker was Prince of Songkla University's Vice President for Research System and Graduate Studies, Associate Professor Dr. Perapong Tekasakul. Dr. Perapong had pinpointed important roles play by university researchers and how many mechanisms can be devised to maximize a country's economic potential. The importance of having close collaborations among universities in ASEAN region has been indicated by Dr. Perapong as the way forward.

Another imminent plenary speaker was the Rector of Malikussaleh Univeristy, Aceh, Indonesia, Dr. Apridar. In recognition of the importance of marine and coastal economy, Dr. Apridar urged for the establishment of Asia-Pacific Research Center for Coastal Community Development. Again, Dr. Apridar stressed that collaborative research lead by regional universities should be employed to improve the livelihood of fisherman and to safeguard marine countries.

The organising committee was also very honoured to have Professor Abd. Wahab A. Rahman to present a plenary speech. Professor Abd. Wahab, currently attached to the School of Food Science and Technology, Universiti Malaysia Terengganu, is well known among the scientists in IMT-GT as he was actively involved and led many IMT-GT conferences as organizer. In his talk, Professor Abd. Wahab identified the major scientific achievements and challenges facing in scavenging chickens farming in Malaysia.

Besides the plenary session, on the agenda were short paper sessions, poster sessions, welcome dinner & icebreaker reception and a cultural night dinner that was sponsored by the Vice Chancellor of Universiti Sains Malaysia. A total of 80 oral presentations and 43 poster presentations were successfully presented in this two days conference.

Overall, it has been an exciting gathering of so much new interdisciplinary science from so many participants especially the young scientists from this region. The IMT-GT once again served well in strengthening future regional collaboration and networking, a tradition to continue through concentrated efforts among the three hosting countries.

Baton has been passed to Prince of Songkla University for the next round of conference. See you all at the 10th IMT-GT UNINET Conference 2016 in Thailand, at the Prince of Songkla University!

Acknowledgements

The 9th IMT-GT UNINET Conference committee would like to thank the continuous support from the co-organizers of Prince of Songkhla University and Universitas Sumatera Utara. The success of the conference represents the cumulative effort of many, especially the local organizing team led by the Chairman, Assoc. Prof. Ahmad Sofiman Othman and Deputy Chairman, Assoc. Prof. Aileen Tan Shau Hwai.

Dr Foong Swee Yeok

"My research interests are concerned with the nutrient fluxes, productivity and restoration ecology of the mangrove ecosystem. I also aim at progressing the use of palynology technique to study the abundance, variety and transportation of pollen in coastal ecosystem".

Email: *foong_sy@yahoo.com*

Change Your Life.

Study Abroad in Japan–

Nara Institute of Science and Technology

Studying abroad can be a very valuable experience, but will it be different from pursuing graduate studies in one of our best universities in the country - Universiti Sains Malaysia (USM)? Let us share some of our experiences here in Japan, specifically in the Graduate School of Biological Sciences, Nara Institute of Science and Technology (NAIST).

Among the major differences is the size of the university, number of students as well as courses offered. USM is a full-fledged research university, which offers courses ranging from the Sciences to Arts for both undergraduate and postgraduate levels to approximately 30,000 students. On the other hand, NAIST is only focusing on three major sciences, namely Information Sciences, Biological Sciences and Materials Sciences. Only master's and doctoral program are available in NAIST with around 1,000 students in total.

What does this means? Graduate students here are more closely supervised because the lecturers here are less occupied with other duties related to undergraduate teaching.

Since the main part of the graduate studies is research, let's talk about the research at NAIST.

In terms of research environment, NAIST has created a very research friendly environment where everything is set up to support researchers. What strategies did they employ?

1. **Accessibility to scientific equipment**
   It is extremely easy to have access to any equipment at NAIST. For instance, to use a common fluorescence microscope, students just need to reserve the microscope by writing their names in the reservation book and the equipment can be self-operated. Furthermore, all the equipment are available **24 hours** except during maintenance periods. **Lesser procedures required resulting in higher efficiency in conducting experiments**.

2. **Support system**
   a. **Administration**
   The administration team in the school will try their best to take care of official matters from documentation, reimbursement, residential registration to international collaboration agreements. Generally, all the administration works will be done in the shortest time possible without any hassle. Besides being efficient, **the staff are highly motivated and willing to assist students**. With that, students can focus on their research instead of wasting time on tedious paper works.

   b. **Mentor-student system**
   In Japan, the mentor-student system can be found at all levels of education as well as sports clubs, informal or social organizations. Although we might have different experiences with different mentors, most of the students find this system very useful and practical. Although principal investigators/-lecturers at NAIST are relatively less occupied, they are still not available all the time because of their other duties. Hence, **mentor-student system allows students to be closely supervised in terms of experimental matters and data analysis**.

   c. **Self-development-Progress reports/ Journal Clubs/ Seminars**
   This might be different in every laboratory, but most of the **students are required to participate in weekly journal clubs** (note: some of the journal clubs might be using Japanese as medium), meeting with Principal investigators at regular basis (from weekly to monthly depending on the laboratory system), International Bio-seminars which is compulsory for students to attend and submit reports to earn credits. Depending on availability, students can also participate in an one month internship program, which includes **critical thinking training and a lab-stay in the University of California, Davis**.

   d. **Library**
   Being a Japanese university, the collection of English books is not sufficient for international students. However, **requesting for book purchase is extremely easy**. Through submitting online book request form, the book will be available for borrowing in merely one month.

   e. **Emailing system**
   NAIST webmail system is very convenient too. Students and staff receive all information through this email system. The information ranges from maintenance notice, seminar reminders, changes in lecture schedules to emergency warnings. This is possible partly because **every student will have a personal computer provided in the lab**.

3. **Laboratory**
   Due to the small number of students, most of the professors will have their own lab. Every student also has their own experiment bench and a desk. Hence, it is very convenient to carry out experiments with a proper place for data analysis.

4. **Research materials**
   Here, there is no requirement on checking the price before ordering chemicals or equipment. All students just have to write down the product name and amount in an 'ordering list' which the suppliers will check every day. Normally, the items will arrive within few days. This ordering system ensures the 'smoothness' of the experiments.

5. **Maintenance**
   Campus wide maintenance is done routinely in order to prevent machine break down and lengthen the lifespan of equipment. For instance, there will be annual inspection and maintenance on the electricity supply. In terms of laboratories, pipettes as well as other machines will also be checked regularly.

All these factors contribute to the research friendly environment in NAIST. Most of the research interests in NAIST are of very fundamental science while studies done in USM are generally skewed towards applied sciences.

Group photo of most of the Malaysian students and their families. This photo was taken during Malaysian student welcome party 2014.

O.K.! That's for research. How about life in Japan?

Communication barrier is the first and major obstacle here. Although Japanese language is not required in the school/ lab, everyone speak Japanese outside the campus. Hence, most of the students are also studying Japanese language apart from their busy schedules. It is not easy but most of the international students are able to communicate in simple Japanese after few years.

Another issue would be food. Malaysia is a food paradise, with a lot of choices and relatively cheap. Here, meals are one of the major expenses and it costs way more than what we pay in Malaysia. So, students normally cook for themselves, as it is cheaper and convenient. Compared to Malaysia, it is also difficult to look for Halal food for Muslim students. Do not be disheartened! Halal food can still be purchased through online store or some specific supermarkets.

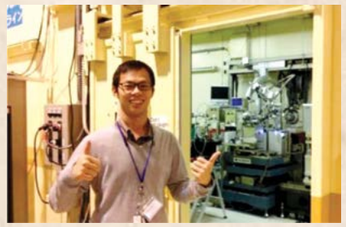
Jumping out from the comfort zone we built up for years in Malaysia and explore into a completely new world is exciting yet worrying. It takes time for us to adapt and learn new cultures in a foreign country. Hence, in a good way, students will spend a lot more time in the lab as we have less commitments here than Malaysia and able to be fully focused on research in well equipped facilities and amazing supportive system.

For those who are interested to study abroad in NAIST.....

The application is opened to USM students around end of every year. Two to four applicants from USM who meet the qualifications will be selected by NAIST to join the pre-internship program. Announcement and application information can also be found on website below:

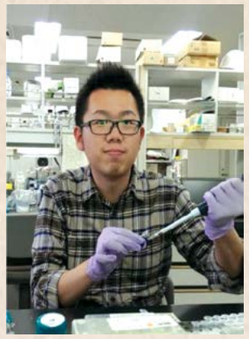
http://www.naist.jp/en/international_students/index.html

For further information, please contact Prof. Dr. K. Sudesh Kumar at 04-653 4367 or email to *ksudesh@usm.my*



Chek Min Fey
D1 (Structural Biology) Prof. Toshio Hakoshima
Lab homepage: *http://bsw3.naist.jp/hako/*
M.Sc (Molecular Biology) Prof. Mohd. Razip Samian

"Thanks for the good basic and logical thinking training by my professors and labmates back in USM. It helps me advance faster here in Japan!"



Chia Kim Hou
D1 (Cell Signaling) Prof. Kaz Shiozaki
Lab homepage: *http://bsw3.naist.jp/shiozaki/?cate=206*
M.Sc (Microbiology) Prof. Sudesh Kumar

"NAIST provides good research environment and opportunities for students to improve themselves, I am glad to pursue my study here. I have learned a lot during my 6 years study in USM, without these great experiences, I would not be here now. Thank you!"

Wong Kah Loon
D1 (Gene expression regulation) Prof. Yasumasa Bessho
Lab homepage: *http://bsw3.naist.jp/bessho/*
M.Sc. (Molecular Biology) Prof. Alexander Chong

"Although it can be tough to study aboard, it really opened my scope of views about science. I am glad I got the chance to do my PhD here. Thanks for those who help me all the while especially my former supervisor and labmates in USM. Looking forward to meet more USM students in Japan"

Nurhezreen Md Iqbal
D1 (Systems Biology) Prof. Hirotada Mori
Lab homepage: *http://ecoli.naist.jp/Lab/joomla/index.php/jp/*
M.Sc (Industrial Microbiology)
Prof. Dr. Amirul Al-Ashraf Abdullah

"Thank you USM for a fulfilling and valuable learning experience. I am now starting a new adventure at NAIST and hope it will be just as exciting"

Suzianti Iskandar Vijaya
Research Student (Microbial Molecular Genetics)
Lab homepage: *http://bsw3.naist.jp/maki/*
Prof Hisaji Maki
M.Sc (Plant Pathology) Assoc. Prof. Dr. Latiffah Zakaria

"My research experiences at USM have given me great insights and transformed me into the young researcher that I am today. Being able to study in NAIST is a great opportunity for me to experience a new research environment that will help me evolve to be a world class researcher"

Nur Ayunie Zulkepli
D1 (Molecular Signal Transduction) Prof. Hiroshi Itoh
Lab homepage: *http://bsw3.naist.jp/itoh/*
M.Sc (Molecular Biology) Dr. Azman Seeni

"I really loved my time at USM and being able to study in NAIST is a great experience. I got to meet people from various backgrounds and learn about their cultures, countries and traditions. I am really looking forward to the following three years of my course!

Bio-Bulletin

A publication of the School of Biological Sciences, Universiti Sains Malaysia

AUTHORS' GUIDELINES

We, the Editorial Team, would like to invite you to contribute short articles (about 1000-1500 words; 2 to 3 pages of text) for the twice yearly issue of the magazine, the *Bio-Bulletin*, on any biological sciences topic of your interest.

Articles should include at least 3 to 4 good quality color pictures (digital images) along with any tables and figures that can enhance understanding of the subject matter. All figures and tables should be placed at the end of the article, one per page. Photos should be sent as separate jpg or tif files (not embedded within the text). Photos and graphics are very essential to illustrate articles published in *Bio-Bulletin* and should be at the highest resolution possible.

Literature citations are not needed nor encouraged in your article. Please include complete contact information of all authors (designation, email address, affiliation) but the number of authors for each article should not be more than five. Please include a digital photo (face only) of the corresponding author as a separate jpg file. Include a short write-up (not more than 5 sentences) on your area of expertise at the end of your article. There is no fixed text format for submitted articles as all formatting and editing will be done by the Editorial Team.

When adapting your published scientific journal manuscripts for *Bio-Bulletin*, please try to summarize and reword the article using terminology easily comprehensible by the general public. You may include an Author's note at the end of the article giving the full paper citation upon which your article in *Bio-Bulletin* was based so that interested readers can refer to your published paper for more information.

On behalf of the Editorial Team, we thank you for considering this request, and we look forward to receiving your article contributions to *Bio-Bulletin*.

Editor-in-Chief,
Professor Ng Wing Keong, *FASc*

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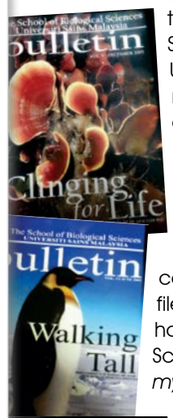

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