PULAU SIBU SCIENTIFIC EXPEDITION: CONNECTING THE LAND AND THE SEA FOR BIODIVERSITY MANAGEMENT OF A MARINE PARK ISLAND

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The Department of Marine Parks Malaysia (JTLM) and Universiti Malaysia Terengganu (UMT) have a long history in marine based collaborations. Recently, in recognizing the need for integrated knowledge on both the marine and terrestrial components of our marine park islands in ensuring a holistic understanding of the island ecosystems for its effective management, a new path was paved by the two institutions by agreeing to jointly organize a scientific expedition in Pulau Sibu, Johor. The aim of this expedition was to document the species, ecosystems and livelihoods on the island, with a focus on its coastal and terrestrial zones. Its secondary aim was contribute sufficient content for the publication of a book on Pulau Sibu's biodiversity. This first "from land to the sea" scientific expedition under JTLM's banner was successfully organized from 21 to 25 July 2017. The collaboration was a commendable effort that added value to the biodiversity profile of the marine park island via scientific records of the uniqueness and connectivity between species, ecosystems and livelihoods on the island and contributed towards developing a trans-disciplinary research framework in a marine park ecosystem.

Keywords: *Pulau Sibu, island biodiversity, land to sea research integration, marine park management .*

INTRODUCTION

Even before Wallace made his famous observation in the islands of the Malay Archipelago 150 years ago, islands have already been an interesting study site for biological scientists (Harris 1984). Its niche profile as the place where the land meets the sea makes them ecotones, warranting them far more scientific attention than what they have so far been given (Gillis 2014). Since the signing of the Memorandum of Understanding between Universiti Malaysia Terengganu (UMT) and the Department of Marine Parks Malaysia (JTLM) in 2013, many marine based collaborations have been successfully undertaken together by the partner organisations. In 2017, during a meeting between UMT's Institute of Tropical Biodiversity and Sustainable Development (IBTPL, formerly known as the Kenyir Research Institute) and the JTLM on 10 January 2017, it was agreed that the two institutions will jointly organize a

scientific expedition in Pulau Sibu, Johor towards documenting the species, ecosystems and livelihoods on the island, with a focus on its coastal and terrestrial zones. Indeed, the Malaysian marine park islands are complex socio-ecological sites, and the JTLM realizes the need to also integrate the knowledge on the terrestrial components of their biodiversity in ensuring a holistic understanding of the island ecosystems for its effective management.

In general, there are a variety of ecosystems found on Pulau Sibu, i.e Mangrove, Peat, Heath, Coastal and finally Hill Forests (Turner, 1993); which may reveal interesting links with species and livelihoods. Based on the observations made and information gathered during the reconnaissance survey in April 2017, a one week scientific expedition was recommend to cover four terrestrial sites on the island. Also included were number of marine-based studies.

The event, with its “Species, Ecosystems and Livelihoods” theme was also meant to increase local community support for sustainable marine park management through sharing of the scientific knowledge on the island biodiversity for creating sustainable alternative livelihood opportunities. Hence, in the final evening, a presentation of photos and videos taken during the expedition was made to representatives of the village. During the session, relevant findings were shared with them, inviting them to also share any relevant input or information with the expedition team.

SCIENTIFIC EXPEDITION PROGRAM AND METHODS

The expedition was carried out 21 until 25 July 2017 to cover a number of research topics for the Pulau Sibu scientific expedition. It brought together 25 researchers from UMT and another 9 researchers from other research institutions such as the International Islamic University of Malaysia, Universiti Malaya, the Forest Research Institute of Malaysia, and the Wildlife Department as well as 18 expedition coordinating and support team members from JTLM. En Nazirul Amin, a P. Sibu based project staff from Reef Check also assisted the team on the expedition (see Appendix 1).

UMT's initial literature reviews on Pulau Sibu revealed that there were already some scientific records on the flora and fauna of Pulau Sibu. Therefore, all participating researchers were requested to conduct a thorough library research on their respective topics prior to the expedition to establish current knowledge. In so doing, the expedition could be, where possible, focused on updating the checklist based on prior records.

For the terrestrial survey, four trails were suggested (see Figure 1):

- Northern trail
- Two Southern trails (the mapped trail in Figure 1 is divided into two parts that meets in the highest peak of Pulau Sibu, each starting from opposing directions, i.e one from south to north and the other from north to south).
- North-western trail from the western coast going eastward towards the hills

Northern Trail | Southern Trail (2 parts) | North-western Trail (new)

Figure 1. Terrestrial trails on Pulau Sibu

During the expedition, there were also three research teams that covered the marine component of Pulau Sibu biodiversity. Already familiar with the area due to former or current research projects, the teams from Universiti Malaya and the International Islamic University of Malaysia selected their study sites based on their respective study objectives. As for the sea bird survey, the researcher was allowed to also cover the three out laying islands a little further south-east, i.e Pulau Tokong Gantang, Pulau Tokong Chondong and Pulau Tokong Belalai. However, the timing of the expedition

did not coincide well with the sea bird nesting season. This component was therefore deferred to a later date.

The findings of the expedition, including the former component were shared during the one day Pulau Sibu Scientific Expedition 2017 Seminar on November 2017 in Universiti Malaysia Terengganu. The papers presented at the seminar are currently being edited for publication as seminar proceedings by the Institute of Tropical Biodiversity and Sustainable Development, UMT.

SUMMARY OF FINDINGS

During the expedition, members of the expedition were encouraged to share their first hand findings and insights with the rest of the expedition team at the end of each day. This created an opportunity for the whole team to be exposed to the other elements studied during the expedition, which promoted inter-disciplinarity that is most valuable for biodiversity conservation. Later in November, each research team presented their scientific report at the Pulau Sibu Scientific Expedition 2017. Their key findings are reported in Table 1.

Table 1. Reported key findings of the Pulau Sibu Scientific Expedition 2017

Reported topics	***Key findings***
Exploring the potential of Pulau Sibu as Tongkat Ali (*Eurycoma longifolia*) Sanctuary for conservation and local community livelihood (Mohd Jani, Badrul Zaman, N.S.A & Abdullah, N.S)	*E. longifolia* is highly abundant in the wild and can also be found in the village. However, it is not used by the local community, although harvesting by non-locals has been reported prior to the gazettement of the island as a marine park. Their omnipresence creates opportunity to promoting is as a "Green-Gold Sanctuary". There is a good indication of local community readiness to participate in *E. Longifolia*-based ecotourism; due to their past involvement in kelong related tourism as well as the presence of local nature guides and local-owned tourism facilities (restaurants and chalets).
Human-Wild boar Conflict in Pulau Sibu (Mohd Jani, J, Jamalludin, A & Azmi, N.A)	Wildboar presence detected everywhere in the wild, and were interestingly a common sight in the local villages. Reportedly absent until a decade ago, its abundance is perceived as a social and economic menace. The local villagers however would rather not get directly involved in managing the conflict, preferring to take defensive to passif measures due to socio-cultural aspect of their relationship with the species. Households that do take offensive measures are found to be successful in keeping the conflict at bay.

Reported topics	***Key findings***
Feral Animals And Their Impact on The Biodiversity, Ecosystem And Sustainability Of Pulau Sibu (Hassan Basri, H, Zahidin, M.A., Mahmood, F, Parlan, M.F. & Abdullah, M.T.)	A total area of 4737m^2 was identified as damaged or disturbed survey sites. At Trail 1, 21 disturbed sites were found (522m^2) while Trail 2 has only 14. However the most affected area was the village with a total accumulated disturbed area of 3314 meter square for 16 sites. Majority of the damage causes by feral animal was on soil structure. 43.14% of the damage was type 2 damage followed by type 3 damage with 31.37% from the total of 51 sites assessed. Type 5 damage only covered 2% from the total assessed site.
Coastal Sandy Beach and Coastal Forest of Pulau Sibu (Mohd Salim, J., Salam, R & Pesiu, E)	A total of 48 families with 83 species of plants were recorded along the coastal sandy beach and coastal forest of Pulau Sibu, excluding in the coastal hill forest. The most abundant species recorded is from the Fabaceae family with 11 species. Most of the families are only represented by only one species, indicating high diversity of coastal vegetation. This is also indicates they are more vulnerable to species loss when their habitat become exposed to unrecoverable environmental degradation or experienced extreme disturbance, except for those that have a rigorous regenerating potential via seeds or vegetative parts.
Checklist of Mangrove Plants and Its Distribution on Pulau Sibu (Shahruddin, R., Salam, R., Cheo, J.Y. & Hakim, M)	A total of 9 families of mangrove plants was found, which comprised of 6 genera and 23 species. Rhizophoraceae was the speciose family, with 8 species in total, including 2 hybrids. In general, the mangroves on Pulau Sibu is important since most of the exclusive species can be found here, which a rare situation compared to other mangrove areas. The mangrove forests on Pulau Sibu occur in patches, which at the north, centre and south of the island. However, the patches were only can be found at the western side of the island. This could be because of the shelter-effect provided between the island and mainland compared to the east side that exposed to the South China Sea. It is suggested that active action should be taken to conserve the mangrove forest on this island. Activity such as thorough distribution mapping can be done to monitor this precious forest.
Diversity of Macrofungi at Pulau Sibu (Mohamad, A & Abdullah, N.S. & Lee, S.Y.)	This study was the first attempt to discover macrofungal diversity in Pulau Sibu, Johor. Overall, there were 28 genera of macrofungi recorded in three study sites of Pulau Sibu. 39 species were recorded in Southern trail while 29 species for Northern trail. Several common species were also found within Twinbeach resort area. The most common species found in this island were of family Polyporaceae, which mostly consist of perennial woody fungi.
Diversity of Insects of Pulau Sibu (Azmi, W.A., Hussain M.H., Mohd Hatta, M.F. & Mat Saaidin, M.F.)	A rich collection of 173 individuals belonging to 12 orders and 35 species from 24 families of insects were successfully identified. Hymenoptera (ants, bees and wasps) were found to be more abundant than other groups of insects. Formicidae (ants) made up the most dominant family collected, followed by Apidae (bees) and Vespidae (wasps). The other well represented insect orders were Odonata (dragonflies and damselflies), Hemiptera (bugs), Isoptera (termites), Orthoptera (grasshoppers and leafhoppers) and Lepidoptera (butterflies and moths). Smaller numbers of species of Diptera (flies), Coleoptera (beetles), Homoptera (cicadas), Phasmatodea (stick insect), Blattaria (cockroaches) and Mantodea (praying mantid) were also collected. *Solenopsis* sp*., Oecoephylla smaragdina* and *Coptotermes* sp. were found to be the most abundant species recorded in this study.

Reported topics	***Key findings***
Diversity of Herpetofauna of Pulau Sibu (Badli Shah, B. H., Ahmad, M.F., & Ahmad, A)	A total of 114 individuals of amphibians and reptiles was collected, with with five of additional records of species in this island. Village areas record the higher species richness and diversity index values compared to Trail 1 and Trail 2, which resulted from the differences in terms of landscape condition and habitat suitability. The number of species that has been recorded so far in Pulau Sibu was 29, with five of additional records from the current study such as *Duttaphrynus melanostictus*, *Kaloula pulchra*, *Polypedates discantus*, *Malayophyton reticulatus* and *Cuora amboinensis*.
Diversity of Fish of Pulau Sibu (Mohd Naser, M.A. & Ahmad, A)	Inland fishes of Pulau Sibu, Johor is reported for the first time with the record of three species namely *Periophthalmus variabilis*, *Pseudogobius melanostictus* and *Ophiocara porocephala*. The three species, all of which were marine associated species were found in the remnant water bodies closed to the sea. Poor species richness could be related to the scarcity of the permanent inland water on the island.
Diversity of Birds of Pulau Sibu David, G., Mamat, M.A. & Abdullah, M.T)	A total of 12 individuals from 5 species representing 3 families were caught through mist-netting method. The most frequently caught species is Pycnonotus plumosus (Olive-winged Bulbul) with a total of 7 individuals. For the direct observation method, a total of 153 individuals from 25 species representing 16 families were recorded where the most observed species was the Acridotheres tristis (Common Myna) with a total of 28 individuals.
Diversity of flowering plants in P. Sibu (May Yunoh, S.H & Atan, A)	In general, only a few families and species were flowering and fruiting in most areas visited. However, good field observation and collection were made, including a new species record to Pulau Sibu, *Knema globularia* that was not previously included in the plant list of Turner *et al.* (1993) was made. Other interesting species observed and collected included the rare *Licuala longicalycata* and the special plant, *Pemphis acidula* that was still well distributed on the island. Another species widely observed was *Eurycoma longifolia, even quite commonly at the hard to access Tg Buntut Meriam where* species of *Ixora*, *Hoya*, *Melastoma*, and *Podocarpus polystachyus* were also collected and four individuals of *Cycas rumphii* were seen.
Dugong monitoring using drones (Ahmad, Z., Ayob, A. F. & Kassim, Z)	Recorded 8 dugong sightings (1 individual and 3 group sightings14 turtle sightings were also recorded. All of these sightings were located at the Southwest of Sibu Island and South of Sibu Tengah Island. It is the site of a large seagrass meadow but also a busy boat and ship route. Local fisherman have also been observed to use "*Rawai*" seine in this area. Technically, high altitude drone blades showed great performance at a lower altitude as well. However, these blades may scare the dugongs away due to its noise even at the altitude of 30m. To increase the chances of finding the dugongs, sighting time suggested was therefore during dawn (from 6:30pm to 7:15pm) where the dugongs were found at similar locations.
Seabirds of Seribuat archipelago (Abdulmaula, H., Mamat, I. & Abdullah, M.T.)	In total over 6200 birds were counted in two-day survey, representing five tern species: Bridled Tern (*Onychoprion anaethetus*), Black-naped Tern (*Sterna sumatrana*), Great Crested Tern (*Thalasseus* bergii), Roseate Tern (*Sterna dougallii*) and the Lesser Crested Tern (*Thalasseus bengalensis*). The first two species are confirmed breeding, while other species are either passage migrants, or breeding needs confirmation earlier in the season. The survey led to rediscovery of small population of roseate tern at Pulau Yu (one of two site of the species breed in Malaysia).

DISCUSSION AND CONCLUDING REMARKS

By merging the terrestrial and marine aspects of island biodiversity study, the P. Sibu Scientific Expedition 2017 that was successfully co-organized JTLM and UMT was a first of its kind. A commendable effort, the expedition brought together researchers from various research institutions that added value to the biodiversity profile of the marine park island via scientific records of the uniqueness and connectivity between species, ecosystems and livelihoods on the island and contributed towards developing a trans-disciplinary research framework in a marine park ecosystem. Key findings suggest that Pulau Sibu is an aesthetically beautiful and biologically diverse island ecosystem that supports an interesting socio-ecological system. This important marine conservation site is rich in terrestrial biodiversity that could be further explored to support the development of sustainable eco-tourism-based livelihood opportunities for the Sibu islanders who are key stakeholders in ensuring the successful management of this marine park. However, being a small island ecosystem, threats to its socio-ecological balance must be given due attention as the delay in management actions may result in irreparable biodiversity, economic and cultural losses. Due to their insular characteristics, islands are the most vulnerable ecosystem to biodiversity loss, particularly when alien species invasion occur (Reaser et al 2007). Further study on the terrestrial ecosystem of the island is encouraged, particularly at the less accessible pristine areas and formerly used sites that have long been abandoned by the human population.

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Appendix 1

List of researchers for Pulau Sibu Expedition 2017

No	Principle investigator	PAX	Institution	Members	Title
1	Jarina Mohd Jani	2	UMT	Nor Syafiqah Anis Bt Badrul Zaman	Exploring the potential of Pulau Sibu as Tongkat Ali (*Eurycoma longifolia*) Sanctuary for conservation and local community livelihood
				Nur Shahira Abdullah	
2		2		Muhammad Allim Jamalludin	Human-wild boar conflict in P Sibu
3		2		Hasrolzaman Bin Hassan Basri	Feral Animals And Their Impact on The Biodiversity, Ecosystem And Sustainability Of Pulau Sibu
				Muhamad Aidil Zahidin	
4	Jamilah Mohd Salim @ Halim	3		Tuan Haji Muhamad Razali Salam	Hill and Heath Vegetation of Pulau Sibu, Johor
				Elizabeth Pesiu	
5	Hazman Samsudin	2		Mohd Nasir Nawawi	Total Economic Valuation (TEV) of Pulau Sibu
6	Rohani Shahrudin	3		Cheo Jia Yi	Diversity and Distribution of Mangrove Forest of Pulau Sibu
				Muhammad Hakim	
7	Aqilah Mohamad	3		Nur Shahira Abdullah	Diversity of Macrofungi at Pulau Sibu
				Lee Shyen Yee	
8	Mohd. Fazlin Mat Saaidin	3		Mohamad Haris bin Hussain	Diversity of Insects of Pulau Sibu
				Muhammad Firdaus bin Mohd Hatta	
9	Mazrul Aswadi Mamat	3		Baizul Hafsyam Badli Shah	Diversity of Herpetofauna and Fish of Pulau Sibu
				Mohamad Aqmal Mohd Naser	
				Muhammad Fahmi Ahmad	
10		2		Gertrude David	Diversity of Birds of Pulau Sibu
11	Jillian Ooi	2	UM	Effendi Yang Amri	Monitoring and Surveying of Seagrass and Coral Reefs in the Sibu Group of Islands
12	Adam Lim	1	SOS	-	Syngnathid fishes of P. Sibu
13	Siti Munirah	2	FRIM	Angan Atan	Flowering Plants of P. Sibu
14	Zuhairi Ahmad	2	UIAM	Ahmad Faezal B. Ayob	Dugong monitoring using drones
15	Fareez Mahmood	2	Perhilitan	Mohamad Firdaus Parlan	Feral animal in P. Sibu (assisted UMT team)
Total no of researchers		34			

List expedition support team members

No	**Name**	**Affiliation**
1	**Abd Muntalib bin Juli**	**JTLM**
2	Mohd Nizam bin Ismail	**JTLM Johor**
3	Albert Apollo Chan	**JTLM**
4	Izarenah binti Md Repin	
5	Bahrinah binti Bahrim	**JTLM Johor**
6	Mohd Asri bin Awalluddin	
7	Abdul Ghaffar bin Salleh	
8	Saipullah bin Jamaludin	
9	Mohd Shaiful Marzuki bin Sharibudin	
10	Mohd Hafiz bin Abdul Wahab	
11	Mohd Fami bin Mohd Said	
12	Hashim bin Chek	
13	Mohd Hazmi bin Abdullah	
14	Herman Peter Alek	**BPP, NRE**
15	Amirul Ariff bin Masion	**JTLM (Interns)**
16	Nur Izzaty bt Ismail	
17	Nurhalimah bt Mohd	
18	Amirul Ariff bin Masion	
19	Nazirul Amin Azmi	**Reefcheck**

Appendix 2

Tongkat ali, orkid vanila di Pulau Sibu

Ditemui menerusi ekspedisi saintifik UMT, jadi tarikan baharu eko pelancongan

Orkid ini, Bulbophyllum Petersi ditemui di Pulau Sibu. Kredit Penyelidik UMT.

MERSING - Pulau Sibu ternyata kaya dengan pelbagai spesies hidupan yang boleh menjadi tarikan baharu bagi tujuan penyelidikan dan eko pelancongan seperti tongkat ali dan orkid vanila.

Pasukan penyelidik yang terlibat dalam Ekspedisi Saintifik Pulau Sibu selama tiga hari menemui pelbagai spesies tumbuhan, serangga dan haiwan baik di laut mahupun darat.

Ketua ekspedisi, Dr Jarina Mohd Jani dari Universiti Malaysia Terengganu (UMT) berkata, ekspedisi kali ini begitu menarik kerana ia dijalankan meliputi komponen laut dan darat bagi melihat jenis-jenis hidupan di kepulauan berkenaan.

"Kebiasaannya ekspedisi anjuran Jabatan Taman Laut Malaysia (JTLM) ini tertumpu pada lautan, tapi kali ini buat pertama kali ia dijalankan dengan komponen darat-an sekali.

"Kita ada pasukan penyelidik khusus untuk serangga, burung, tumbuh-tumbuhan dan haiwan liar. Kita ada juga pasukan untuk kajian hidupan di laut seperti kuda laut, spesies ikan, batu karang, rumput laut serta dugong," katanya kepada Sinar Harian ketika ditemui pada program Ekspedisi Saintifik Pulau Sibu baru-baru ini.

Menurut Dr Jarina, kajian itu dijalankan bagi mengetahui status biodiversiti di pulau itu selain mengesan sebarang masalah yang timbul supaya pihaknya dapat membuat perancangan terbaik untuk masa akan datang.

Kumpulan penyelidik diketuai Dr Jarina (empat, kiri) bersedia untuk meneroka kawasan kerangsa terpencil di barat laut Pulau Sibu.

Catatan Cik Num

"Bagi kami potensi di sini sangat baik kerana pulau ini walaupun kecil tapi macam-macam ada. Ini memang menarik. Tapi apabila penyelidikan dijalankan, perlu ada rancangan pengurusan.

"Kita perlu tahu apa yang ada tapi tak semestinya apa yang ada ini terus dikomersialkan. Tak boleh. Perlu ada pelan supaya ia dijalankan secara terurus," katanya.

Penyarah Jabatan Sains Marin, Dr Zuhaini Ahmad (kiri) dan Penolong Pegawai Sains, Ahmad Fauzi Ayob mengendalikan dron bagi mengesan dugong di kawasan kajian.

Dua penyelidik dari Universiti Malaya yang turut menyelam ke dasar laut bagi mengesan spesies hidupan di

Manfaatkan ilmu berkaitan biodiversiti

Jika tongkat ali sukar ditemui di tempat lain, Dr Jarina memberitahu, di Pulau Sibu ia begitu mudah dan banyak ditemui sepanjang ekspedisi.

"Di tempat lain ada, cuma susah nak jumpa. Di sini sampai pelajar saya yang tak pernah tengok, boleh kenal spesies itu dalam sehari kerana dalam setiap langkah, mereka boleh sampak.

"Begitu juga orkid di mana banyak spesies orkid vanila di sini. Orang tahu vanila tapi tak tahu vanila itu adalah orkid sebenarnya. Di sini ada banyak spesies," katanya yang turut terus melihat kepelbagaian itu.

Melihat peluang untuk membantu sosioekonomi penduduk setempat, Dr Jarina berkata, ilmu pengetahuan berkaitan biodiversiti ini perlu diberikan kepada penduduk supaya mereka dapat memanfaatkannya sebagai penandu pelancong.

Selain itu, ada pasukan penyelidik yang menyelam bagi mengesan spesies hidupan di dasar laut dan saya sendiri berpeluang menyertai pasukan penyelidik dari Universiti Islam Antarabangsa Malaysia (UIAM), diketuai Timbalan Dekan Fakulti Sains (Pascasiswazah dan Penyelidikan), Profesor Madya Dr Zaleha Kassim.

Pasukan penyelidik UIAM ini membuat pemerhatian mengesan dugong di kawasan sekitar habitat, menggunakan dron dan ternyata mereka berjaya menakam kewujudan beberapa kumpulan haiwan ikonik itu.

INFO

- Ekspedisi libatkan komponen darat dan laut.
- Tongkat ali paling mudah ditemui.
- Kesan dugong guna dron dan rakam kewujudan beberapa kumpulan habitat haiwan ikonik itu.

Bukukan hasil kajian

Sementara itu, menurut Pengarah JTLM Negeri Johor, Mohd Nizam Ismail, hasil dapatan kajian itu bakal dibukukan dan diterjemahkan dalam bentuk yang menarik untuk tatapan umum.

"Biodiversiti di sini habitat yang perlu kita pelihara mungkin sebagai kawasan lapangan kajian bukan untuk dieksploitasi.

"Sekurang-kurangnya aktiviti di darat dapat mengurangkan tekanan pada terumbu karang di kepulauan kita," katanya.

Institusi terlibat termasuk UMT, UIAM, Universiti Malaya, Institut Penyelidikan Perhutanan Malaysia, Jabatan Perlindungan Hidupan Liar dan Taman Negara serta Selamatkan Kuda Laut Kita dengan dibantu 10 pegawai JTLM dan tiga anggota Angkatan Pertahanan Awam Malaysia.

Cik Num