ISNS

The 3rd International Symposium on Natural Science:

Natural Resource Sustainability and People's Responsibility for Society

1–2 December 2022

National Science Museum, Thailand

Abstracts and Schedule

ISNS

The 3rd International Symposium on Natural Science: Natural Resource Sustainability and People's Responsibility for Society

International Conference

1–2 December 2022

National Science Museum, Thailand

Rama 9 Museum

National Science Musuem, Thailand

39 Moo 3, Khlong 5, Khlong Luang, Pathum Thani, Thailand

Message from the President

On behalf of the National Science Museum, Thailand, I would like to extend our warmest welcome to all the participants of the 3rd International Seminar on Natural Science: Natural Resource Sustainability and People's Responsibility for Society, held during 1–2 December 2022 at the Rama 9 Museum, Thailand.

This seminar will support the exchange of academic and experiences among researchers, curators, educators, and others who may interested in natural science, both in Thailand and other countries, in the very important topic. As we know, natural resources and environmental issues are rapidly changing and affecting our lives and society, scientific explanations, practical solutions, and effective communication are extremely needed. It is my hope that this seminar will serve as the testimony of the commitment of all the participants in sharing and collaboration transcending boundaries. I wish you all the best and hope you enjoy the seminar.

Rawin Raviwongse, Ph.D.
President National Science Museum, Thailand

Contents

Schedule

1 December 2022

Time	Event
09.00 - 09.30	Registration: Hall in front of Saeng Duean-Saeng Thian Room, 2nd Floor of Rama 9 Museum
09.30 - 10.00	Opening Ceremony: Saeng Duean-Saeng Thian Room
10.00 - 10.10	Take a Break for the Event
10.10 - 11.00	**Keynote Speaker 1:** Ms. Chatchanin Sang Director Landscape Design Department **Benjakitti Park: Biological Infrastructure-Based Solutions to Increase Urban Adaptability** Saeng Duean-Saeng Thian Room
11.00 - 11.15	Coffee Break: Hall in front of Saeng Duean-Saeng Thian Room
11.15 - 12.00	**Keynote Speaker 2:** Ms. Siriporn Sriaram Co-founder & Managing Director, Blue Renaissance **Investing in Nature Conservation: Case Studies on Business and Biodiversity** Saeng Duean-Saeng Thian Room
12.00 - 13.00	Lunch: Hall at 1st floor of Scientist Lodge

	Session 1 **Sailom Seminar Room** **Insect Taxonomy** Chairman: Assoc. Prof. Dr. Nantasak Pinkaew	Session 2 **Saifon Seminar Room** **Zoology** Chairman: Dr. Arom Mucharin
13.00 – 13.15	Bumblebee's Journey: How Museum Archives Reveal the Story Behind Siamese Bumblebees Chawatat Thanoosing and Paul H. Williams	Diversity of Recent Ostracods (Ostracoda, Crustacea) in Thailand Lalita Weerachai and Anisong Chitnarin
13.15 -13.30	Taxonomy of the Ant Genus *Lepisiota* Santschi, 1926 in Thailand (Hymenoptera: Formicidae: Formicinae) Kochaporn Jarernkong *et al.*	Species Diversity of Isopods in Amphawa Estuary, Samut Songkhram Province Worradon Ngamboonkup *et al.*
13.30 - 13.45	Tentative Study of Water Beetles Family Dytiscidae Leach, 1815 (Coleoptera) in Thailand. Ryohei Okada	Gut Contents of *Cerapus* sp. (Amphipoda: Senticaudata: Ischyroceridae) Found at Amphawa Estuary, Thailand Nattavadee Tipsut *et al.*
13.45 – 14.00	First Record of the Genus *Xenolepis* Diakonoff, 1973 (Lepidoptera: Tortricidae: Olethreutinae) from Thailand, with Description of Three New Species Phawin Thonongtor *et al.*	Rediscovery and Redescription of *Grandidierella gravipes* (Aoridae: Amphipoda) in the Gulf of Thailand with a Note on the Seasonal Distribution of Amphipod Genus *Grandidierella* in Amphawa Estuary, Samut Songkhram Province Kijjar Saneewong Na Ayuthaya *et al.*
14.00 - 14.15	Taxonomy of the Genus *Anax* (Odonata: Aeshnidae) in Thailand Tosaphol Saetung Keetapithchayakul *et al.*	Fossil Ostracods (Crustacea) in Thailand: Diversity and Paleoenvironment Anisong Chitnarin
14.15 – 14.30	Coffee break: Hall in front of Saeng Duean Room	

	Session 3 **Sailom Seminar Room** Ichthyology Chairman: Prof. Dr.Toshio Kawai	Session 4 **Saifon Seminar Room** Ecology Chairman: Dr. Koraon Wongkamhaeng
14.30 - 14.45	Twenty-four New Recorded Marine Fishes from Thai Waters	A Survey on Arthropod Diversity, Environmental Factors and Micro-plastics on Koh Yao Area, Phangnga Province
	Chavalit Vidthayanon *et al.*	Sireepus Koypokaisawan *et al.*
14.45 - 15.00	Bangpakong Basin, the River of Life, Potential for a Global Key Biodiversity Area	Diversity and Nesting Habits of the Ant Genus *Polyrhachis*. Smith (Formicidae: Formicinae) in Kho Hong Hill, Songkhla Province
	Chavalit Vidthayanon	Punnawis Onrthammaratand and Nawee Noon-anant
15.00 - 15.15	Literature Search Reveals Great Opportunities for Research on the Diversity of the Fish in the Family Carangidae in Thailand	The Influence of Environmental Variability on Insect Wing Shape: a Case Study of Odonata
	Pacharapan Chanmuang and Jenjit Khudamrongsawat	Rungtip Wonglersak *et al.*
15.15 - 15.30	A Taxonomic Review and a Re-evaluation of the Generic Status of the Southeast Asian Cyprinid Fish *Cyclocheilichthys heteronema* (Actinopterygii: Cypriniformes)	
	Nalin Preechanukunpanich and Prachya Musikasinthorn	
15.30 - 15.45	Scientific Multi-dimensional Drawing for the Taxonomy of Fish Larvae	
	Sucha Munkongsomboon *et al.*	
15.45 - 17.30	Take a Break for the Event	
17.30 - 20.00	Welcome Party: Thailand Forest Ecosystem Exhibition Zone	

2 December 2022

Time	Event
09.30 - 10.15	**Keynote Speaker 3:** Mr. Tomorn Sookprecha Chief Creative Director (OKMD) **A Guide to Lifelong Learning** Saeng Duean-Saeng Thian Room
10.15 – 10.30	Coffee Break: Hall in front of Saeng Duean-Saeng Thian Room

	Session 5 — Sailom Seminar Room Insect Biodiversity Chairman: Dr. Weeyawat Jaitrong	Session 6 — Saifon Seminar Room Plants Chairman: Dr. Bhanumas Chantarasuwan
10.30 - 10.45	Alien Ant Species (Hymenoptera: Formicidae) in Khlong Lan National Park, Central Thailand Netnapa Phosrithong *et al.*	The Resurrection of *Leucobryum scalare* Müll. Hal. ex M. Fleisch. Based on Molecular, Chemical, and Morphological Evidence Patsakorn Tiwutanon *et al.*
10.45 - 11.00	A Checklist of Stingless Bees (Hymenoptera: Apidae: Meliponini) in Thailand Kanyakorn Piraonapicha *et al.*	Community Biobank: Case Study on Tuberous Medicinal Plant Biobank in Nakhon Ratchasima Province, Thailand Santi Watthana *et al.*
11.00 - 11.15	Diversity of Insect Defoliators and Their Natural Enemies of Teak in Northern Thailand Supaporn Srisamer *et al.*	Species Diversity of Lichens on Archeological Site in Dvaravati Period at Sema Ancient City for Promotion of Eco-culture Tourism Khwanyuruan Naksuwankul *et al.*
11.15 - 11.30	Diversity and Use of Saturniidae and Bombycidae in Northeastern of Thailand Based on Museum Specimens and Surveys Papitchaya Teawkul	Determination of Antioxidant Activity from Medicinal Mushroom *Phellinus gilvus* (Schwein.) Pat. Crude Extract Orathai Sertsri
11.30 - 11.45	Preliminary Survey of Lepidoptera Diversity on Natural Tourism Trails on Khao Pong Tabaek, Saraburi Province Pongthep Suwanwaree and Sasitorn Hasin	Evaluation of Antioxidant Properties, Total Phenolic and Flavonoid Content of Foliose Lichens Species *Parmotrema gardneri* (C.W. Dodge) Sérus Crude Extract Areerat Saisong
12.00 - 13.00	Lunch: Hall at 1st floor of Scientist Lodge	
	Session 7 — Sailom Seminar Room **Science Education** Chairman: Dr. Wilasinee Triyarat	**Session 8 — Saifon Seminar Room** **Science Communication** Chairman: Dr. Chanin Suriyakul Na Ayudhya
13.00 - 13.15	Digital Story Telling: the Alternative Method for Promoting Students' Biodiversity Learning Experiences Jenjit Khudamrongsawat *et al.*	Primate & Me: Know Non-human Primates to Understand Humans: The Challenge of Interdisciplinary Interpretation Areerat Panchap

	Session 7 **Sailom Seminar Room** **Science Education** Chairman: Dr. Wilasinee Triyarat	Session 8 **Saifon Seminar Room** **Science Communication** Chairman: Dr. Chanin Suriyakul Na Ayudhya
13.15 - 13.30	The Manual Development of Classification of Vertebrates for Elementary Students	Research Translation Increasing Impact of Natural Science Communication from Evidence-based to Policy Action
	Weerawich Wongroj and Ruthairat Siriwattanarat	Puvadol Doydee
13.30 - 13.45	Report on the Project for the Development and Dissemination of a Problem-based Learning (PBL) Ecology Curriculum on Water Resources	Designing a Zoological Research Exhibition Using an Art Exhibition Design Framework
	Napat Malathum *et al.*	Niti Vatiwutipong *et al.*
13.45 - 14.00	A Study of Instructional Methods Based on Place-based Learning for Small Schools: A Case Study of Ya Mee School, Kho Yao Yai Island, Phangnga Province and Mae La Mung School, Tak Province	Practical Partnerships: Role of Museum in Science Teacher Preparation
	Suchada Khamha *et al.*	Tanwarat Pinthong *et al.*
14.00 - 14.15	Children's Interest in Dinosaur Museums	
	Saranpat Ouilapan *et al.*	
14.15 - 14.30	Coffee Break: Hall in front of Saeng Duean-Saeng Thian Room	
14.30 – 15.30	Poster Presentation: Hall in front of Saeng Duean-Saeng Thian Room	
15.30 – 17.00	Closing Ceremony: Saeng Duean-Saeng Thian Room	

Oral Presentation

ORAL PRESENTATION

Session 1: *Insect Taxonomy*

Bumblebee's Journey: How Museum Archives Reveal the Story Behind Siamese Bumblebees

Chawatat Thanoosing[1,2*] and Paul H. Williams[1]

Bumblebees (Apidae: *Bombus*) are important pollinators. In Thailand, bumblebees can be found mostly in the mountains of the north. However, from the south, specimens of *Bombus eximius* have been deposited in the collection of the Natural History Museum, London (NHMUK). These specimens were collected in 1922, at Khao Luang, Nakhon Si Thammarat, Siam, at that time, by Henry Maurice Pendlebury (1893–1945), the last director of the Federated Malay States (FMS) Museums in Kuala Lumpur. These specimens had been described as a new species by Pendlebury in 1923, named *B. discrepans*, now a synonym of *B. eximius*. Pendlebury deposited the *B. discrepans* specimens including the holotype and paratypes in the FMS Museums, as mentioned in the original description. This raises the question as to why the specimens were transferred to London and were deposited in the NHMUK collection, where they are still present in good condition. Here, this study reveals the story behind this bumblebee collection by using the NHMUK Library and Archives collection. This story involves the period of colonization, WWII, and the independence of Malaysia. Apart from the bumblebees in the NHMUK collection, two records of *B. eximius* specimens from Khao Luang, Nakhon Si Thammarat, can be found online in the Global Biodiversity Information Facility (GBIF) database. The actual specimens have been deposited in the Smithsonian Institution (USNM), and the Entomology Research Museum, University of California, Riverside (UCRC), respectively. These bumblebees were collected by Arthur F. G. Kerr (1877–1942) in 1928 during his botanical survey in the South of Siam. No *B. eximius* have been recorded from Khao Luang since 1928. Now, the status of the Khao Luang bumblebees is still unknown, due to the lack of recent specimens and entomological surveys, and the difficulty in accessing the area.

Keywords: *Bombus eximius*, deaccession, decolonization, digitization, Henry Maurice Pendlebury

[1] Department of Life Sciences, Natural History Museum, Cromwell Road, London, SW7 5BD, United Kingdom
[2] Department of Life Sciences, South Kensington Campus, Imperial College London, Exhibition Road, London, SW7 2AZ, United Kingdom
[*] Corresponding author: c.thanoosing@nhm.ac.uk or t.chawatat@gmail.com

Taxonomy of the Ant Genus *Lepisiota* Santschi, 1926 in Thailand (Hymenoptera: Formicidae: Formicinae)

Kochaporn Jarernkong[1], Monththip Kongmee[1*],
Nantasak Pinkaew[1] and Weeyawat Jaitrong[2]

Taxonomic study of the ants has only been seriously started recently in Thailand. The main purpose of this study is to clarify the ant genus *Lepisiota* Santschi, 1926 in Thailand mainly based on the worker caste. Ant specimens used in this research were mainly based on specimens deposited in the collection at the Natural History Museum of the National Science Museum, Pathum Thani Province, Thailand. Type specimens or images of type specimens from AntWeb and AntWiki were examined and identified correctly. Currently, a total of eight species are recognized among the *Lepisiota* fauna of Thailand including three new species. They belong to the following three species groups: *L. rothneyi* species group (*L. pilosa* **sp. nov.**, *L. rothneyi*), *L. chutimae* species group (*L. chutimae* and *L. siamensis*), and *L. bicolor* species group (*L. bicolor*, *L. burapa* **sp. nov.**, *L. minima* **sp. nov.**, and *L. thepthepae*). Four species (*L. bicolor*, *L. chutimae*, *L. siamensis*, and *L. thepthepae*) were previously described as new to science from Thailand. Three new species: *L. pilosa* **sp. nov.**, *L. burapa* **sp. nov.**, *L. minima* **sp. nov.**, are described based on worker caste. A key to the species groups and a key to the Thai species of the genus based on the worker caste are provided. The distribution pattern and bionomic information for each species are also discussed.

Keywords: distribution, *Lepisiota*, Formicinae, taxonomy, Thailand

[1] Department of Entomology, Faculty of Agriculture at Kamphaeng Saen, Kasetsart University, Kamphaeng Saen Campus, Nakhon Pathom, 73140 Thailand.
[2] Office of Natural Science Research, National Science Museum, 39, Moo 3, Khlong 5, Khlong Luang, Pathum Thani, 12120 Thailand.
[*] Corresponding author: fagrmtk@ku.ac.th

Tentative Study of Water Beetles Family Dytiscidae Leach, 1815 (Coleoptera) in Thailand

Ryohei Okada*

The family Dytiscidae Leach, 1815 is classified in the order Coleopetra and commonly known as predaceous diving beetles. The members of this family are highly adapted for aquatic life, and with more than 4,000 described species worldwide. In Thailand, although these beetles are very popular as food and regarded as important group in freshwater ecosystem, its family is very poorly known. Based on recent filed and literature survey, more than 100 species are recorded from Thailand. Here, I introduce a check list, illustration key and environment for common species distributed in central Thailand.

Keywords: distribution, Dytiscidae, taxonomy, Thailand

Office of Natural Science Research, National Science Museum, 39, Moo 3, Khlong 5, Khlong Luang, Pathum Thani, 12120 Thailand

* Corresponding author: wasserinsekt@kub.biglobe.ne.jp

First Record of the Genus *Xenolepis* Diakonoff, 1973 (Lepidoptera: Tortricidae: Olethreutinae) from Thailand, with Description of Three New Species

Phawin Thonongtor, Sopita Muadsub, Soraya Jaikla and Nantasak Pinkaew*

Tortricidae is a family of small to medium size moths, which is composed of over 10,300 species in approximately 1,050 genera. The larvae of tortricid moths are mostly leaf rollers, however they also have a variety of feeding behaviors such as leaf miner, fruit, brunch and bark borers. They were reported as agricultural and forest pests around the world. Tortricidae consists of three subfamilies: Tortricinae, Olethreutinae, and Chlidanotinae. Olethreutinae is the second largest subfamily of Tortricidae. This subfamily is more likely present in temperate and tropical upland regions, with 4,839 species in 463 genera worldwide. *Xenolepis* is belonging to the tribe Olethreutini described by Diakonoff in 1973 with only two described species, *X. gabina* (Meyrick, 1909) from India and *X. dolichoschiza* Diakonoff, 1973 from Indonesia. The specimens in this study were collected throughout Thailand. Light traps with 500-watt mercury vapor bulbs were used for attracting tortricid moths. All specimens were preserved and deposited in Kasetsart Kamphaengsaen Insect Collection (KKIC). Adult specimens were photographed then male genitalia were dissected and prepared for species identification. In the present study, three new species of *Xenolepis*: *X. fissurarta* **sp. nov.,** *X. apicula* **sp. nov.** and *X. cultrata* **sp. nov.** are described. This genus is recorded in Thailand for the first time and increases number of described *Xenolepis* up to five species worldwide.

Keywords: anal lobe, hindwing cleft, bifid spine, Olethreutini

Department of Entomology, Faculty of Agriculture at Kamphaeng Saen, Kasetsart University, Kamphaeng Saen Campus, Nakhon Pathom, 73140, Thailand

* Corresponding author: agrnsp@ku.ac.th

Taxonomy of the Genus *Anax* (Odonata: Aeshnidae) in Thailand

Tosaphol Saetung Keetapithchayakul[1*], Kaewpawika Rattanachan[2],
Noppadon Makbun[3], Patchara Danaisawadi[1] and Koraon Wongkamhaeng[1]

The dragonfly genus *Anax* Leach in Brewster, 1815 has more than 30 recognized species distributed throughout the world. Nine species are recorded in Asia and six of those species have been recorded in Thailand such as *Anax aurantiacus* Makbun, Wongkamheang & Keetapithchayakul, 2022; *A. ephippiger* (Burmeister, 1839); *A. guttatus* (Burmeister, 1839); *A. indicus* Lieftinck, 1942; *A. nigrofasciatus* Fraser, 1935; and *A. panybeus* Hagen, 1867. The description of these *Anax* spp. in adult stage are well recorded, while those of larval stage are poorly known. In this work, six species of *Anax* were studied and reviewed based on voucher specimens and original descriptions. In addition, the distribution map and comparative morphology of Thai species were made. The results from this study will provide a basic taxonomic review of *Anax*, which will provide significant knowledge for biodiversity conservation needed to establish Odonata conservation priorities before they become a locally extinct species.

Keywords: systematics, dragonfly, taxonomy, conservation

[1] Department of Zoology, Faculty of Science, Kasetsart University, Bangkok, Thailand
[2] Forest and Plant Conservation Research Office, Department of National Parks, Wildlife and Plant Conservation, Bangkok, Thailand
[3] 211/5 Moo 4, Takhli, Nakhon Sawan, Thailand
[*] Corresponding author: Keetapithchayakul.TS@gmail.com

ORAL PRESENTATION

Session 2: *Zoology*

Diversity of Recent Ostracods (Ostracoda, Crustacea) in Thailand

Lalita Weerachai* and Anisong Chitnarin

Ostracods or seed shrimps are microscopic crustaceans whose bodies are covered with a calcareous bivalved shell, living in almost all aquatic and semi-terrestrial habitats. They have lived on the Earth since the Ordovician and are abundant as both living and fossil species. Many studies on morphology and shell composition revealed that ostracods have a great potential for ecological monitoring, paleoenvironmental analyses in highly variable environments, for modern pollution studies, sea-level change, basin evolution, plate tectonics, and paleoceanography. This research aimed to review the diversity of recent marine and non-marine ostracods (Cenozoic Era) known in Thailand and their habitat preferences. At present, more than 250 ostracod species have been reported. Ninety species of non-marine ostracods have been found in reservoirs, ponds and rice fields in Northern, Northeastern, and Eastern regions of the country. Ninety-six species were reported from the Khlong Thom River in Krabi Province, representing brackish water inhabitants living in estuary and transitional environments. More than 80 species of shallow marine ostracods have been found in the Gulf of Thailand and the Andaman Sea. Subfossilized ostracod assemblages recovered from sediments associated with a whale skeleton excavation site and the Phanom Surin Shipwreck site in Samut Sakhon Province suggest depositions in shallow marine and estuary environments. Those cases indicated that ostracods can be used as efficient paleoenvironmental tools. Therefore, more research on ostracods is needed in order to fill gaps in Arthropoda biodiversity, biogeography and environmental applications.

Keywords: recent ostracods, crustaceans, paleoenvironmental analyses, diversity

School of Geotechnology, Institute of Engineering, Suranaree University of Technology, Nakhon Ratchasima 30000, Thailand
* Corresponding author: Lalita347@gmail.com

Species Diversity of Isopods in Amphawa Estuary, Samut Songkhram Province

Worradon Ngamboonkup*, Koraon Wongkamhaeng,
Tosaphol Saetung Keetapithchayakul and Chanikan Katnoum

Isopod crustaceans are common benthos, widely distributed in various habitats, both terrestrial and aquatic. However, in Thailand, the study of isopods is almost unknown. This study aimed to explore the species diversity of isopods in Amphawa Estuary, Samut Songkhram Province, from March – June 2022. The isopods were sampled by Ekman grab and seven artificial settlement pads, i.e., fine filter, coarse filter, flute board, coconut husk, dried oyster shell, doormat, and brush. A total of 4 species from 4 families were found. The dominant species were *Idotea* sp. The result revealed that Bangchang Creek contained the highest diversity, followed by Soi Mangkorn Tong, Ampawan Wittayalai School, and Darunanukrao School. Moreover, the doormat had the highest isopod diversity.

Keywords: isopods, Amphawa Estuary, species diversity

Department of Zoology, Faculty of Science, Kasetsart University, Chatuchak, Bangkok 10900, Thailand
* Corresponding author: worradon.n@ku.th

Gut Contents of *Cerapus* sp. (Amphipoda: Senticaudata: Ischyroceridae) Found at Amphawa Estuary, Thailand

Nattavadee Tipsut*, Chanikan Katnoum, Tosaphol Saetung Keetapithchayakul and Koraon Wongkamhaeng

Amphipods in the genus *Cerapus* are tube-dwelling amphipods, commonly found in coastal habitats. In this study a *Cerapus* sp. was found in the mouth of the Mae Klong River, Amphawa District, Samut Songkhram Province, Thailand. Herein, the gut contents of *Cerapus* sp. were investigated from twenty individuals (10 males and 10 females). The major food items were unidentified as organic material, algae, fungi, and protozoa. There was no difference in food content in both sexes. In summary, *Cerapus* sp. can be considered a filter-feeding or predatory type.

Keywords: tube-building amphipod, gut contents, feeding behavior

Department of Zoology, Faculty of Science, Kasetsart University, 50 Ngam Wong Wan Rd, Lat Yao Chatuchak Bangkok, Thailand 10900
* Corresponding author: nattavadee.ti@ku.th

Rediscovery and Redescription of *Grandidierella gravipes* (Aoridae: Amphipoda) in the Gulf of Thailand with a Note on the Seasonal Distribution of Amphipod Genus *Grandidierella* in Amphawa Estuary, Samut Songkhram Province

Kijjar Saneewong Na Ayuthaya*, Koraon Wongkamhaeng, Tosaphol Saetung Keetapithchayakul, Chanikan Katnoum and Worradon Ngamboonkup

Grandidierella gravipes Barnard, 1935 was firstly collected in 1925 from the Songkhla Lagoon and was identified as *G. magnae*. After ten years, the specimens were identified as a new species and named *G. gravipes*. The amphipod was reported once in India but has not been reported in Thai Waters since the first sampling in 1925. In this study, the *G. gravipes* was found living together with *G. gilesi.* The amphipods were collected by Ekman grab and seven types of settlement plates from March – August 2022. The number of both species were highest in March, in which the number *G. gilesi* was higher than *G. gravipes*. Both species showed a preference of fine filter. We provide a redescription of newly collected material with an illustration and a key to species of *Grandidierella* in Thailand.

Keywords: amphipod, distribution, Amphawa, *Grandidierella*

Department of zoology, Faculty of Science, Kasetsart University, Chatuchak, Bangkok, 10900, Thailand
* Corresponding author: kijjar.s@ku.th

Fossil Ostracods (Crustacea) in Thailand: Diversity and Paleoenvironment

Anisong Chitnarin*

Ostracods are crustaceans of millimeter size which have lived on the Earth since the Ordovician. They originally thrived in marine environments from shallow water to the deeper parts of the ocean, then they invaded brackish and freshwater environments in the Carboniferous. Although research on the Ostracoda in Thailand is sporadic, many materials have been recovered from rocks of different ages. The objective of this paper was to review and illustrate diversity of fossil ostracods found in Thailand. The oldest ostracods were found from Middle Ordovician limestones of the Ta Manoa and Rung Nok Formations in Kanchanaburi and Satun Provinces, respectively. Late Ordovician fauna were discovered from the Pa Kae Formation in Satun Province. Early to Middle Devonian ostracods were reported from the Kuan Tang Formation (Satun). Early Carboniferous materials were recovered from mudstones of the Kuan Klang Formation (Satun) and limestones East of the city of Phitsanulok. Early to Middle Permian ostracods can be found from rocks of the Saraburi Group in central and northeastern Thailand. All Paleozoic materials are marine fauna suggesting paleoenvironments from shallow water, euryhaline with high terrigenous sediments to the deeper part on carbonate platforms with normal salinity. Middle Triassic marine ostracods were reported from shallow marine limestones of the Pha Kan Formation exposed in Lampang Province. Mesozoic freshwater ostracods were found in carbonate rocks of the Huai Hin Lat and Nam Phong Formations, in Phetchabun and Chaiyaphum Provinces. The Huai Hin Lat fauna lived in a shallow lake associated with freshwater stromatolites. The Nam Phong fauna was recovered from limestones of fluviolacustrine environment. At present, there are more than two hundred fossil species discovered, most are Paleozoic fauna. The Cenozoic fauna is less known and waiting for discovery.

Keywords: Ostracoda, marine ostracod, nonmarine ostracod, Paleozoic Era, Mesozoic Era

School of Geotechnology, Institute of Engineering, Suranaree University of Technology, Nakhon Ratchasima 30000, Thailand
* Corresponding author: anisong@sut.ac.th

ORAL PRESENTATION

Session 3: Ichthyology

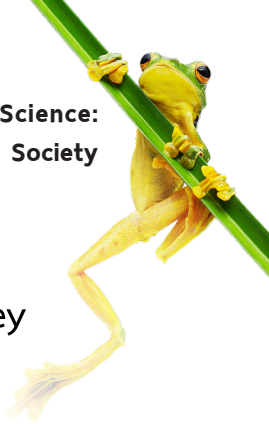
Twenty-four New Recorded Marine Fishes from Thai Waters

Chavalit Vidthayanon[1*], Veera Vilasri[2],
Jirapong Jeewarongkul[3] and Thanisorn Wasinopas[4]

At least 2,300 marine fishes known to date in Thai waters. The recent surveys to develop a checklist of Thai fish fauna, found 24 new species recorded in Thai Waters from the Andaman Sea and Gulf of Thailand, five species were obtained from local fish landings in Pang-nga and Phuket Provinces to a Japanese restaurant, namely: variable torpedo ray, *Torpedo sinuspercisi* von Olfers, 1831; Black cardinalfish, *Apogonichthyoides melas* (Bleeker, 1848); yellow-striped goatfish, *Parupeneus chrysopleuron* (Temminck & Schlegel, 1843); deepsea bigeye, *Priacanthus fitchi* Starnes, 1988; rosy wrasse, *Polylepion russelli* (Gomon & Randall, 1975), and one-blotch grouper, *Epinephelus melanostigma* Schultz, 1953. Fifteen more species were recorded from photos in Losin and Sichang Islands, Gulf of Thailand, namely: flower cardinalfish, *Ostorhinchus fleurieu* Lacepède, 1802; yellowtail dascyllus, *Dascyllus flavicaudus* Randall & Allen, 1977; Philippine butterflyfish, *Chaetodon adiergastos* Seale 1910; ornate butterflyfish, *Chaetodon ornatissimus* Cuvier, 1831; mirror butterflyfish, *Chaetodon speculum* Cuvier, 1831; horned bannerfish, *Heniochus varius* (Cuvier, 1829); Lesson's thicklip, *Plectorhinchus lessonii* (Cuvier, 1830); peppered spinefoot, *Siganus punctatissimus* Fowler & Bean, 1929; manybar goatfish, *Parupeneus multifasciatus* (Quoy & Gaimard, 1825); barred knifejaw, *Oplegnathus fasciatus* (Temminck & Schlegel, 1844); Lesson's thicklip, *Plectorhinchus lessonii* (Cuvier, 1830); blackblotch Emperor, *Lethrinus semicinctus* Valenciennes in Cuvier and Valenciennes (1830); Twotone wrasse, *Halichoeres prosopeion* (Bleeker, 1853); steephead parrotfish, *Chlorurus microrhinos* (Bleeker, 1854) and pacific bullethead parrotfish, *Chlorurus spilurus* (Valenciennes, 1840). Descriptions, general morphometrics and meristics, and photographs for five voucher specimens are provided and deposited in the THNHM Reference Collection.

Keywords: new record, Thai ichthyofauna, Andaman Sea, Gulf of Thailand

[1] SeubNakasathien Foundation 54/26 Bangkasor, Nonthaburi 11000
[2] Office of Natural Science Research, National Science Museum, Klong Luang, Pathum Thani, 12120
[3] Enlive Foundation No 1 Premier Coperate Park Bldg., Soi Premier 2, Sri Nakarint Rd. Praves, Bangkok 10250
[4] Kensaku Japanese Restaurant. 7/1 Phahonyothin Alley, Samsen Nai, Phaya Thai, Bangkok 10400
[*] Corresponding author: chavaliv@hotmail.com



Bangpakong Basin, the River of Life, Potential for a Global Key Biodiversity Area

Chavalit Vidthayanon

The Bangpakong is small river basin, covering 19,536 km^2, but it supports a high diversity of ecosystems and important species, including endemic and highly threatened. At least 415 fishes known from this basin, with 19 threatened, one endemic *Ceratoglanis pachynema*, and 1 of 100 the most globally endangered species Sompong's rasbora, *Trigonostigma sompongsi*. The basin also supports important shorebird migrations (The East Asian-Australasian Flyway) and roosting/nesting area of black kites. It is a water plant hotspot, important marine mammal habitat (Irrawaddy dolphin), and it has one of largest Siamese crocodile populations. Because of its importance, it needs further mobilization for long-term inventory research and conservation for nomination into a global Key Biodiversity Area so it can strengthen more local participation for green policies.

Keywords: taxonomic diversity, biodiversity hotspot, threatened ecosystem, noteworthy species

Seubnakasathien Foundation 54/26 Bangkasor, Nonthaburi 11000
* Corresponding author: chavaliv@hotmail.com

Literature Search Reveals Great Opportunities for Research on the Diversity of the Fish in the Family Carangidae in Thailand

Pacharapan Chanmuang and Jenjit Khudamrongsawat*

Fish of the family Carangidae, currently 147 species recognized worldwide, are commercially important high-value products. Their economic importance is also acknowledged in Thailand, and the fish are widely used and commonly found in markets. Unfortunately, few studies focus on the diversity of this family. We performed a literature search on any studies of the family Carangidae in Thailand in the databases of the Department of Fisheries (E-Library Department of Fisheries) and the Department of Marine and Coastal Resources data center (DMCR data center) using generic names and Thai common names as keywords. We also explored the SCOPUS database as well as the genetic records of carangid samples collected in Thailand in GenBank. In addition, we sequenced fragments of the COI gene that served as a DNA barcode of common carangid samples obtained from five fish markets around the upper Gulf of Thailand and compared the results with GenBank records. The literature search revealed only 27 studies from the Thai government databases and 25 articles from SCOPUS from 1960 to present. Variations in topics of studies on this family were limited to a few species. There were 52 species recorded in Thailand based on the article published in 2011. Since then, scientific names of some genera and species have been revised recently but not updated in Thai databases. Data on genetic diversity of carangid species in Thailand were scarce as only information on three species was found, *Atule mate*, *Megalaspis cordyla*, and *Selar crumenophthalmus* published in the GenBank database. Our DNA barcoding results based on only small sample size revealed new haplotypes never reported, representing hidden genetic diversity awaiting discovery. This finding indicates vast opportunities for research on the diversity of carangid fish in Thailand.

Keywords: Carangidae, diversity, literature, research, DNA barcode

Department of Biology, Faculty of Science, Mahidol University, Rama VI Road, Rajathewi District, Bangkok, 10400, Thailand
* Corresponding author: khudamrong@gmail.com

A Taxonomic Review and a Re-evaluation of the Generic Status of the Southeast Asian Cyprinid Fish *Cyclocheilichthys heteronema* (Actinopterygii: Cypriniformes)

Nalin Preechanukunpanich and Prachya Musikasinthorn*

The cyprinid fish, *Cyclocheilichthys heteronema* (Bleeker, 1854), is a relatively small freshwater species that is distributed in Southeast Asia including Indochina, Malay Peninsula and Borneo. It is diagnosed by unique multifid maxillary barbels which each have 6–7 branches; silvery or whitish body and fins without markings; and rows of sensory papillae on the head. In this study, 9 meristics, 26 morphometrics, color pattern, sensory papillae, intestinal coiling patterns and osteological characters of 58 specimens of *C. heteronema* from 7 basins were examined for study of intraspecific variation, and comparison with all other congeners (*C. apogon, C. armatus, C. janthochir, C. lagleri, C. repasson, C. schoppeae*) and related genera (73 specimens), for re-evaluation of its generic status. As a result of comparison of the local populations, all of them were recognized as a single morphological group or species. From comparison of *C. heteronema* with other congeners, besides its multifid maxillary barbels (vs. unbranched or no barbels), the following characters were found to be different: 6 osteological characters (3rd infraorbital wide [vs. slender]; hyomandibular slender [vs. wide]; interorbital septum possessing a large hole at the middle [vs. without hole]; posteriorly located supratemporal commissure, away from the orbit [vs. much anteriorly located, attaching or almost attaching to the orbit]; supraoccipital crest short and thick [vs. long and thin]; and very large fontanelle, its length 5–6% of standard length [vs. small or medium, its length 1–3% of standard length]), the absence of color pattern on the body (vs. black stripes along body) and sparsely distributed sensory papilla rows (vs. numerous and very closely set) on the head. In conclusion, *C. heteronema* is morphologically distinct from all other members of the genus *Cyclocheilichthys* Bleeker, 1859 and other related genera. Therefore, it is appropriate to separate *C. heteronema* into a different genus, *Oxybarbus* Vaillant, 1893.

Keywords: *Cyclocheilichthys, Cyclocheilichthys heteronema,* Cyprinidae, *Oxybarbus*

Research Laboratory of Ichthyology (RLIKU), Department of Fishery Biology, Faculty of Fisheries, Kasetsart University, Chatuchak, Bangkok 10900, Thailand
* Corresponding author: prachya.m@ku.th

Scientific Multi-dimensional Drawing for the Taxonomy of Fish Larvae

Sucha Munkongsomboon*, Ratima Karuwancharoen,
Sarunya Yimyong and Janjarus Watanachote

A scientific drawing of a small group of organisms that cannot be seen with the naked eye had been drawn under a stereo microscope with the camera lucida arm for a long time. However, the technique of superimposing multi-dimenstional images has not yet been used. The authors established a technique by improving the traditional paper drawing, using multi-dimensional overlays with wax paper, and enhancing the depth of a three-dimensional virtual image in drawing paper by adding multiple overlays of a living specimen. Basically, the wax paper was placed on the side of the camera, adjusting the contrast between the camera and the camera lucida arm, and then the lighting was adjusted to make the double image more visible. Next, we sketched the outline with a 2B pencil on the drawing paper. Therefore, details for the classification of juvenile fish species such as size measurements, proportions, and percentages have been illustrated by using the method of Leis and Rennis (1983). The position of the mouth, the size of the teeth, the spines on the head, the air sacs, the muscle bundle and the number, and the location of the fins were located for a classification drawing. Finally, multi-dimensional superimposed scientific drawings provide depth of field and create a better perspective. The set numbers of dots add intensity and boldness to the image. Layout-only photography and under-camera drawing are not possible however, using multi-dimensional overlays will help create shadows and depths that help to better classify larval and juvenile fishes.

Keywords: scientific drawing, fish larvae, multiple layers drawing

Institute of Marine Science, Burapha University, Saensuk, Chonburi, 20131, Thailand
* Corresponding author: sucha@buu.ac.th

ORAL PRESENTATION

Session 4: *Ecology*

A Survey on Arthropod Diversity, Environmental Factors and Micro-plastics on Koh Yao Area, Phangnga Province

Sireepus Koypokaisawan[1*], Suphapipatana Yothee[2], Oratai Surarit1,
Suchada Khamha[1], Papitchaya Teawkul[3]

In this study, we observed and investigated the diversity of arthropod communities and environmental factors on Yao Noi and Yao Yai Islands, Phangnga Province from 3–11 April 2021, by picking and sweeping methods. A total of 25 species of arthropods consisting of 11 orders and 24 families were found on Koh Yao Noi Island and 45 species of arthropods consisting of 13 orders and 31 families were found on Koh Yao Yai Island. We also found *Herteroneda reticulata*, *Phlogiellus moniqueverdezae* and *Misumenops nepenthicola*, which are species that can only be found in Southern Thailand.

Based on our results, there were differences in the insect ecosystem functionals at Yao Yai Island, compared with Yao Noi Island. Yao Yai Island consists mainly of insect pests related to land that is largely being used for agriculture. Microplastic analysis of water and sludge showed that there were more microplastics in water and sediment at Yao Noi Island than at Yao Yai Islands. Because of the large human population on Yao Noi Island, the majority of microplastics were fiber shape that originate from fishing nets, nets, ropes, or fabric fibers from the breakage of synthetic fabrics. Though the present study was conducted as a preliminary step, the data on arthropods and physical environments indicated that Yao Noi and Yao Yai Islands have a great diversity of arthropods species and thus are worthy of conservation.
.

Keywords: arthropod, environmental factors, biodiversity, microplastic, Koh Yao Island, Thailand

[1] Office of Natural Science Research, National Science Museum, Khlong Luang District, Pathum Thani Province 12120
[2] National Center for Public Awareness of Science, National Science Museum, Khlong Luang District, Pathum Thani Province 12120
[3] FDepartment of Entomology and Plant Pathology, Faculty of Agriculture Khon Kaen University , Khon Kaen 40000 Thailand
[*] Corresponding author: sireepus@nsm.or.th

Diversity and Nesting Habits of the Ant Genus *Polyrhachis* Smith (Formicidae: Formicinae) in Kho Hong Hill, Songkhla Province

Punnawis Onrthammarat* and Nawee Noon-anant

Polyrhachis is one of the ant genera with the most species richness in Southeast Asia but has few reports on nesting habits in peninsular Thailand. This study aimed to investigate the species richness and nesting habits of this genus at Kho Hong Hill, Songkhla Province. The ant specimens were deposited in the Division of Biological Science (Biology), Faculty of Science, Prince of Songkla University were collected by several methods such as colony sampling, canopy fogging and leaf litter sifting from 2005–2022. These specimens were examined and identified based on the morphological characteristics of the workers. A total of 18 species belonging to five subgenera were found. *Myrmhopla* had the highest number of species (10 species), followed by *Myrma* (4 species) and *Cyrtomyrma* (2 species), respectively. At the same time, *Myrmatopa* and *Myrmothrinax* were equal (1 species). In this study, *P. thailandica* Kohout, 2006 was recorded for the first time from peninsular Thailand and foraged in the lower vegetation. Nesting locations were found mainly in arboreal habitats (4 subgenera and 10 species) and the most dominant species in terms of the highest nest frequency was *P. furcata* Smith, 1858. Nests of *P. furcata* were found between and/or the underside of living and/or dead plant leaves, located at 0.36–2.76 m (mean 1.50 ± 0.16, n = 23) from the ground, and their most preferred plant habits for nesting were shrubs (16 nests).

Keywords: diversity, Formicidae, Kho Hong Hill, nesting habits, *Polyrhachis*

Division of Biological Science (Biology), Faculty of Science, Prince of Songkla University, Hat Yai, Songkhla, 90110, Thailand
* Corresponding author: 6210210097@psu.ac.th

The Influence of Environmental Variability on Insect Wing Shape: A Case Study of Odonata

Rungtip Wonglersak[1*], Phillip B. Fenberg[2,4], Peter G. Langdon[3],
Stephen J. Brooks[4] and Benjamin W. Price[4]

Wing shape is highly correlated with flight performance and is suggested to be an adaptive trait to environmental conditions. In this study, the first of its kind, we evaluate the response of Odonata wing shape to latitude and specifically mean seasonal temperature, and how this is influenced by wing size and sex, using 5,661 museum specimens of 14 species of British Odonata. Wing shape variation was analyzed using a geometric morphometric approach. We tested for 1) the sexual dimorphism in wing shape; 2) a correlation between wing shape and wing size; and 3) a correlation between wing shape and environmental variables, including latitude and mean seasonal temperature using a partial least square analysis. We found a significant difference in the wing shape between sexes across twelve species in this study, most markedly in *Calopteryx splendens* and *C. virgo* which are known for their male display flights. This finding suggests that wing ornamentation and sexual selection are the main drivers of sexual wing shape dimorphism. A significant correlation between wing shape and length is found in all Zygoptera and two Anisoptera species, suggesting that the variation in wing length across temperature conditions are also associated with wing shape alterations. A significant influence of latitude and mean seasonal temperature on wing shape is found in all Zygoptera species, with broader and shorter wings found at lower latitudes with warmer temperatures. Overall, the results suggest that the wing shape of Zygoptera species is more sensitive to local environmental conditions and adaptive to latitude and temperature than in Anisoptera.

Keywords: Anisoptera, museum collection, temperature, wing shape response, Zygoptera

[1] Office of Natural Science Research, National Science Museum, Khlong 5, Khlong Luang, Pathum Thani, Thailand 12120
[2] Department of Ocean and Earth Sciences, University of Southampton, Southampton, SO14 3ZH, United Kingdom
[3] Department of Life Sciences, Natural History Museum, London, SW7 5BD, United Kingdom
[4] Department of Geography and Environment, University of Southampton, Southampton, SO17 1BJ, United Kingdom
[*] Corresponding author: rungtip.w@nsm.or.th

ORAL PRESENTATION

Session 5: *Insect Biology*

Alien Ant Species (Hymenoptera: Formicidae) in Khlong Lan National Park, Central Thailand

Netnapa Phosrithong[1*], Kaewpawika Rattanachan[1] and Weeyawat Jaitrong[2]

A study of alien ant species in Khlong Lan National Park, Kamphaeng Phet Province, from November 2021 to July 2022 was carried out using pitfall traps in three different kinds of ecosystems: 1) natural forest areas, 2) guesthouse areas, and 3) nature trails. A total of nine alien ant species in seven genera: *Anoplolepis gracilipes* (Smith, 1857); *Tapinoma melanocephalum* (Fabricius, 1793); *Technomyrmex albipes* (Smith, 1861); *Technomyrmex difficilis* Forel, 1892); *Monomorium floricola* (Jerdon, 1851); *Monomorium pharaonis* (Linnaeus, 1758); *Paratrichina longicornis* (Latreille, 1802); *Tetramorium kheperra* (Bolton, 1976), and *Trichomyrmex destructor* (Jerdon, 1851) were collected in the national park. About 60 percent of all alien ant species were estimated occurring in Thailand, among them: three species, *Anoplolepis gracilipes*, *Tapinoma melanocephalum*, and *Monomorium pharaonis* can be found in all habitats and seasons. The most abundant species was *A. gracilipes.* This species adapted forging in the natural forests and seems to be an invasive alien species. Seven alien species were collected around the guesthouses, five species in natural forests and along the nature trails. Alien ant species of the national park had the highest diversity and abundance in the dry season and the lowest in the rainy season.

Keywords: alien species, national park, diversity

[1] Forest Entomology and Microbiology Research Group, Forest and Plant Conservation Research Office, Department of National Parks, Wildlife and Plant Conservation, 61 Phaholyothin Road, Chatuchak, Bangkok, 10900, Thailand.
[2] Office of Natural Science Research, National Science Museum, Technopolis, Khlong 5, Khlong Luang, Pathum Thani, 12120, Thailand
[*] Corresponding author: netnapaphosrithong@gmail.com

A Checklist of Stingless Bees (Hymenoptera: Apidae: Meliponini) in Thailand

Kanyakorn Piraonapicha[1*], Orawan Duangphakdee[1], Preecha Rod-im[1],
Kanuengnit Wayo[1] and Yudthana Samung[2]

As a zoogeographical crossroads and biodiversity hotspot area, Thailand has a great diversity of stingless bees. In the present study, the taxonomic literatures of stingless bees in Thailand were investigated and summarized based on an examination of museum specimens and published records. A total of forty-two species in nine genera were previously recorded from the country between 1939 and 2021. After careful analysis of the data, three species were misidentified and three species were synonymised with other species. Currently, 36 valid species (including an unidentified species) in ten genera are listed in Thailand. *Tetragonula* has the largest number of species with a total of 16 species. This checklist also provides information on distribution, a comprehensive bibliography, and reference collection, if available. This study will be useful for a comprehensive reference list relating to conservation and economic utilization which may be used for beekeepers, policy makers, and conservation planners concerned with the management of insects, in particularly stingless bee diversity in Thailand.

Keywords: stingless bees, diversity, Thailand

[1] Native Honeybee and Pollinator Research Center, King Mongkut's University of Technology Thonburi, 126, Bangmod, Thung Khru, Bangkok 10140, Thailand
[2] Faculty of Tropical Medicine, Mahidol University, Bangkok 10400, Thailand
[*] Corresponding author: Kpiraonapicha@gmail.com

Diversity of Insect Defoliators and Their Natural Enemies of Teak in Northern Thailand

Supaporn Srisamer*, Wattanachai Tasen, Decha Wiwatwitaya and Sutee Duangjai

Teak defoliators are the most important insect pests of the teak plantations in Thailand. The objectives were to provide an update of the teak pest incidence and diversity of insect natural enemies in teak plantations. A study on teak pests and their natural enemies of teak were selected from two different age teak plantation (< 10 years and > 10 years). Observations were carried out by sweep nets, window traps and air-flight Malaise traps from tree canopies in each site from 2018 to 2019. As a results, the damage caused by teak insect defoliators were classified in three separate categories of free feeding, skeletonizing, and stepping. The damage of teak defoliators at Mae Li teak plantation (28.50%) was higher than in Wang Chin teak plantation (25 %). Total number of natural insect enemies enumerated were 54 species belonging to 25 families and 8 orders. Number species of natural enemies was found in insect predators (35 species), more than insect parasitoids (19 species). The highest number of species was in Order Hymenoptera followed by Coleoptera, Diptera, Hemiptera, Blattodea, Mecoptera, Neuroptera and Dermaptera (21, 14, 10, 5, 1, 1, 1, and 1 species, respectively). The largest amount of natural insect enemies was found in Mae Li plantation (65.22 %), more than in Wang Chin plantation (34.78 %). This study showed that different land-use ecosystems influenced both quantity and species diversity of natural insect enemies and teak insect defoliators.

Keywords: teak, defoliator, insect enemies, predator, parasitoid

Department of Forest Biology, Faculty of Forestry, Kasetsart University, Ladyao 50 Ngamwongwan rd. 10900, Thailand.
* Corresponding author: Supaporn.srisame@Ku.th

Diversity and Use of Saturniidae and Bombycidae in Northeastern Thailand Based on Museum Specimens and Surveys

Papitchaya Teawkul*

The knowledge of Saturnidae and Bombycidae moths is relevant because of silk production (sericulture) over thousands of years. However, the understanding of the biological diversity and its future potentials in Thailand is extremely limited. The present study contributes basic knowledge of the biological diversity and local uses of Saturniidae and Bombycidae in food cultures. I identified the specimens housed in the insect collection of Department of Entomology and Plant Pathology, Khon Kaen University, from 2000 to 2022 and conducted individual semi-structured questionnaire surveys from local people among various ages from 25 to 70 years to understand the potential of silkworms as food. Over 80 specimens were collected from seven provinces from Northeastern Thailand, 23 species of Saturniidae consisted mainly of *Attacus atlas*, *Antheraea pernyi*, and *Samia canningii.* Four species of Bombycidae consisted mainly of *Bombyx mori*, *Bombyx incomposita*, *Bombyx mandarina*. According to the surveys from local people, there are ten entomophagy species and four species of Saturniidae having social beliefs.

Keywords: Bombycidae, entomology, Saturniidae, silkworm, Thailand

Department of Entomology and Plant Pathology Faculty of Agriculture Khon Kaen University , Khon Kaen 40000 Thailand
* Corresponding author: Papit@kku.ac.th

Preliminary Survey of Lepidoptera Diversity on Natural Tourism Trails on Khao Pong Tabaek, Saraburi Province

Pongthep Suwanwaree[1*] and Sasitorn Hasin[2]

Lepidoptera provides numerous ecological and socio-economic services, and they have been reported as living organisms for tourist attractions in ecotourism programs. This study aimed to survey the diversity of Lepidoptera (butterflies and moths) along the tourist trails on a small mountain, namely Khao Pong Tabaek, in Saraburi province, central Thailand. Study sites were covered by mixed deciduous forest. Butterfly diversity was observed by direct sampling and bait traps in three transect lines of one km each. Moths were observed by standardized light trapping. The study was conducted from May to October 2022. A total of 103 species of Lepidoptera were recorded with 13 species of butterflies belonging to Nymphalidae and Pieridae families and 90 species of moths belonging to 12 families. For moths, Geometridae was the most the most diverse family containing 25 species or 27.8% of the total species identified, followed by Noctuidae (18 species, 20%), and Erebidae (14 species, 15.6%). This study provides Lepidoptera diversity data for possible butterfly tourism activities such as painting butterflies and moths as souvenirs and outdoor learning programs for schools or families. The data set of butterfly and moth diversity could also help further the goals of Thailand's National Biodiversity Conservation Strategy and Action Plan for 2022–2030, which can used as a sustainable approach for socio-economic development in the post COVID-19 era, and for supporting SDGs 15.

Keywords: butterfly, moth, checklist, ecotourism

[1] School of Biology, Institute of Science, Suranaree University of Technology, Nakhon Ratchasima 30000, Thailand
[2] Innovation of Environmental Management, College of Innovative Management Valaya Alongkorn Rajabhat University under the Royal Patronage, Khlong Luang, Pathum Thani 13180, Thailand
[*] Corresponding author: pongthep@sut.ac.th

ORAL PRESENTATION

Session 6: *Plants*

The Resurrection of *Leucobryum scalare* Müll. Hal. ex M. Fleisch. Based on Molecular, Chemical, and Morphological Evidence

Patsakorn Tiwutanon[1], Kasidis Chaiyasut[2], Natthawadi Wongthet[1], Srunya Vajrodaya[1], H. Thorsten Lumbsch[3] and Ekaphan Kraichak[1,4*]

Leucobryum scalare Müll. Hal. ex M. Fleisch. was originally described in 1904, but later reduced to a variety of *L. aduncum* Dozy & Molk. by Eddy in 1990, but in the same year, *L. scalare* was also synonymized with *L. aduncum* by Enroth. The taxonomic confusion of this taxon has not been solved since. Therefore, the objective of this study was to use phylogenetic, chemical, and morphometric approaches to determine the status of *L. scalare*. A total of 27 samples from *L. aduncum* var. aduncum and *L. aduncum* var. scalare were examined and used for DNA and phytochemical extraction. From DNA extracts, four markers, including ITS1, ITS2, atpB-rbcL spacer, and trnL-trnF, were amplified to reconstruct a phylogeny. From methanolic crude extract, chemical profiles from HPLC were generated and compared between the two taxa. Both qualitative and quantitative morphological characters were measured and analyzed with PCA and PERMANOVA. The results showed that phylogenetics and chemical profiles could separate the two taxa. The morphological characters could also separate *L. aduncum* var. scalare and *L. aduncum* var. aduncum as shown with PCA and PERMANOVA. We propose the resurrection of the species rank for *L. scalare* as a separate species from *L. aduncum*. This work showed the need for a more thorough revision of *Leucobryum* to clarify the true level of diversity of this genus.

Keywords: bryophytes, classification, mosses, revision

[1] Department of Botany, Faculty of Science, Kasetsart University, 50 Ngamwongwan Road, Chatuchak, Bangkok, 10900, Thailand
[2] Science Division, Mahidol University International College, Mahidol University, 999 Salaya, Phutthamonthon, Nakhon Pathom 73170, Thailand
[3] The Grainger Bioinformatics Center & Negaunee Integrative Research Center, Science & Education, The Field Museum, 1400 South Lake Shore Drive, Chicago, Illinois, U.S.A.
[4] Biodiversity Center, Kasetsart University, 50 Ngamwongwan Road, Chatuchak, Bangkok, 10900, Thailand
* Corresponding author: ekaphan.k@ku.th

Community Biobank: Case Study on Tuberous Medicinal Plant Biobank in Nakhon Ratchasima Province, Thailand

Santi Watthana[1*], Nooduan Muangsan[1], Chuthapond Musimun[1],
Thotsaporn Chanokkhun[1] and Tanit Chanthavorn[2]

The community enterprises utilizing natural resources could play a role on bioeconomy and conservation. Thus, the Biodiversity-based Economy Development Office (BEDO) has initiated the Community Biobank framework to support the natural resources utilization by the community enterprise throughout the country. Effective collaboration requires three partners, which are the community enterprises, local governments, and researchers. The Tuberous medicinal plant community biobank is one of successful community biobanks supported by BEDO, is selected to present here. In total, 150 accession numbers were registered in the community biobank and 17 species were identified by taxonomists. They belonged to nine genera and five families, mainly Zingiberaceae (75%). The community was trained on how to manage a living plant collection including plant registration, voucher specimen preparation, and photograph taking using mobile phones. Overall, the Community Biobank by communities' participation is a promising alternative for plant conservation and sustainable use.

Keywords: living collection, community biobank, medicinal plant

[1] School of Biology, Institute of Science, Suranaree University of Technology, Nakhon Ratchasima, 30000 Thailand
[2] Biodiversity-Based Economy Development Office (Public Organization), The Government Complex, Building Ratthaprasasanabhakti. 9th floor 120 Moo 3 Chaeng-watthana Rd., Thungsonghong Laksi, Bangkok 10210 Thailand
[*] Corresponding author: santiqsbg@gmail.com

Species Diversity of Lichens on Archeological Site in Dvaravati Period at Sema Ancient City for Promotion of Eco-culture Tourism

Khwanyuruan Naksuwankul[1,2*], Areerat Saisong[1,2], Orathai Sertsri[1,2],
Pongthep Suwanwaree[3] and Kawisara Hengtanarat[3]

Sema ancient city in Sung Noen District, Nakhon Ratchasima Province is an interesting and important ancient site for community history in prehistoric. Currently, Sema ancient has been developed for eco-culture tourism and conservation also this site is learning the history of the religious place that is important in Thailand. The local storytellers are serving the data about archeological sites all around the Sema ancient city. The archaeological site surface was covered by foliose and crustose lichens. The objective of this study is observation for species diversity of lichen growth on an archaeological site in the Dvaravati period for creating data at this site on important lichens that are bio-indicator for air pollution and the biodiversity of living things. The result of this study showed ten species of foliose and five species of crustose lichens, the data of this project was supported for eco-culture tourism and conservation of Sema ancient city in the future.

Keywords: Species diversity, Lichens, Archeological site, Dvaravati period, Eco-culture tourism

[1] Department of Biology, Faculty of Science, Mahasarakham University, Kantarawichai, Maha Sarakham Province 44150, Thailand
[2] Research Unit of Mushroom and Lichens for Sustainable Utilization Mahasarakham University, Kantarawichai, Maha Sarakham Province 44150, Thailand
[3] School of Biology, Institute of Science, Suranaree University of Technology, Muang, Nakhon Ratchasima Province 30000, Thailand
[*] Corresponding author: khwanruan.p@msu.ac.th

Determination of Antioxidant Activity from Medicinal Mushroom *Phellinus gilvus* (Schwein.) Pat. Crude Extract

Orathai Sertsri[1,2*]

The purpose of this research was to study the antioxidant properties of *Phellinus gilvus* extract from three solvents, ethanol extraction, methanol extraction and boiled water, by using FRAP test, and DPPH test. Antioxidant properties of *Pellinus gilvus* extracts, tested by FRAP assay, showed that ethanol mushroom extracts had the greatest antioxidant activity, equal to 280,394.12 ± 334.00 mg $FeSO_4$/g Extract. The antioxidant properties were also tested by DPPH and ABTS tests. It was found that mushroom extract extracted by methanol had the greatest antioxidant activity. The IC_{50} values were 0.0688 ± 0.0003 and 0.0373 ± 0.0004. The highest total phenolic, total flavonoid content of ethanol mushroom extract was 1,224.26 ± 1.98 mg GAE/g Extract and 308.410 ± 2.53 mg QE/g Extract. Correlation analysis found the amount of phenolic and flavonoids. There was a correlation with the FRAP assay, DPPH assay and ABTS assay, positively correlated with the FRAP assay and negatively correlated with the DPPH assay and ABTS assay.

Keywords: FRAP assay, DPPH assay, ABTS assay, flavonoid, phenolic

[1] Department of Biology, Faculty of Science, Mahasarakham University, Kantarawichai, Maha Sarakham Province 44150, Thailand
[2] Research Unit of Mushroom and Lichens for Sustainable Utilization Mahasarakham University, Kantarawichai, Maha Sarakham Province 44150, Thailand
[*] Corresponding author: 64010257009@msu.ac.th

Evaluation of Antioxidant Properties, Total Phenolic and Flavonoid Content of Foliose Lichens Species *Parmotrema gardneri* (C.W. Dodge) Sérus. Crude Extract

Areerat Saisong[1,2*]

This research aimed to study the antioxidant potential of extracts of lichen *Parmotrema gardneri* (C.W. Dodge) Sérus. crude extracted with four solvents: ethanol, ethyl acetate, acetone, and boiling water for 30 minutes. The results showed that acetone extract contains the highest amount of total phenolic and flavonoid contents were followed 199.05 ± 0.54 mg GAE/g Extract, and 170.60 ± 0.88 mg QE/g Extract, respectively. While of antioxidant activity by DPPH assay and ABTS assay were found that ethanolic extract had the high antioxidant activity with IC_{50} values of 0.8 ± 0.08 and 0.97 ± 0.00 respectively. The FRAP assay was found that ethanolic extract had the highest value of 4,411.49 ± 24.09 mg $FeSO_4$/g Extract. In addition, correlation analyses revealed that phenolic compound content was positively correlated with antioxidant activity in the FRAP assay at a significance level of 0.01, and flavonoid content was negatively correlated with the antioxidant activity in the ABTS assay and was positively correlated with the antioxidant activity in the FRAP assay at a significance level 0.01, respectively.

Keywords: ABTS assay, DPPH assay, flavonoid, FRAP assay, total phenolic

[1] Department of Biology, Faculty of Science, Mahasarakham University, Kantarawichai, Maha Sarakham Province 44150, Thailand
[2] Research Unit of Mushroom and Lichens for Sustainable Utilization Mahasarakham University, Kantarawichai, Maha Sarakham Province 44150, Thailand
[*] Corresponding author: 64010257004@msu.ac.th

ORAL PRESENTATION

Session 7: *Science Education*

Digital Story Telling: The Alternative Method for Promoting Students' Biodiversity Learning Experiences

Jenjit Khudamrongsawat[1*], Pacharapan Chanmuang[1], Supatchaya Techachoochert[2] and Parichat Puangmanee[3]

21st century young students are familiar with using digital equipment and technology but rarely employ this skill in their school learning experiences. Students participating in school field trips are usually required to write reports or work on worksheets to illustrate their learning outcomes, which is quite insipid and does not promote creativity and digital skills. Teachers also have to prepare learning papers for students while storage space is limited. To solve such problems, we introduced a method of using digital technology for recording field experiences, preparing and editing stories under the concept of "Exploring Local Biodiversity." Moreover, students must use at least one set of vocabulary related to biodiversity and ecology provided by the researchers as an additional condition for short video presentations. One hundred participants including primary school students, secondary school students, teachers, and local people participated in mangrove field trips in their communities. Students were not required to write a report but were encouraged to use their digital equipment such as mobile phones to record their finding. After that, students took their recorded materials to create a digital story using free software and present their works to the groups. We found that young students were comfortable using digital equipment and software to create their video stories while teachers and local people were less familiar with such technology. Students and teachers enjoyed this method over the traditional paper reports based on their feedback. As we enter the digital era, digital technology should be employed in order to promote learning experiences for young generations. Advice on using digital technology for promoting learning experiences was provided

Keywords: biodiversity, creativity, digital story-telling, field trips

[1] Department of Biology, Faculty of Science, Mahidol University, Rama VI Road, Ratchathewi District, Bangkok, 10400, Thailand
[2] Mae Fah Luang Foundation under Royal Patronage, 1875/1 Rama IV Road, Lumpini Sub-strict, Pathumwan District, Bangkok, 10330, Thailand
[3] GLOBE unit, Institute for the Promotion of Teaching Science and Technology, 924 Sukhumvit Road, Phra Kahnong Sub-district, Khlong Toei District, Bangkok, 10110, Thailand
[*] Corresponding author: khudamrong@gmail.com

The Manual Development of Classification of Vertebrates for Elementary Students

Weerawich Wongroj[1] and Ruthairat Siriwattanarat[2*]

The purpose of this research was to develop a manual for the classification of vertebrates for elementary school students. For elementary students, the tool can be used for the classification of vertebrates. The sample group was fourth-grade students in the first semester of 2022. Thirty students were in the experimental group learning through a conventional method for eight periods of 60 minutes each. The design of this research was the one group pretest-posttest design. The data were statistically analyzed by t-test for dependent samples. The results showed that this material had its efficiency E1/E2 = 82.52/83.67 which was corresponding with the 80/80 criterion. The study focused on the science achievement of the classification of vertebrates for elementary school students in Grade 4 2022 study of an average of 30 students, after learning then before learning with a statistically significance at the .01 level. Attitude towards learning science that focuses on the classification of vertebrates for elementary school students in Grade 4 2022 study of an average of 30 students,after learning then before learning, with a statistically significant at the .01 level.

Keywords: classification, elementary students, vertebrates

[1] Weerawich Wongroj Srinakharinwirot University Prasarnmit Demonstration School (Elementary), Bangkok, Thailand
[2] Ruthairat siriwattanarat* Faculty of Science and Technology, Suan Sunandha RajabhatUniversity, Bangkok, Thailand
* Corresponding author, email: ruthairat.si@ssru.ac.th

Report on the Project for the Development and Dissemination of a Problem-based Learning (PBL) Ecology Curriculum on Water Resources

Napat Malathum*, Supara Kamolpattana and Siraprapah Srisupan

Water is important to the environment and human quality of life. However, many countries around the world, including Thailand, are experiencing water crises, such as droughts and pollution, more frequently with increasing severity. Therefore, it is of the utmost priority that youths are prepared to manage and conserve this critical natural resource for their own sakes as well as the planet. As learning institutions with a shared vision in science education, the National Science Museum of Thailand (NSM) and the Children & Youth Science Center (CYSC) from China partnered to develop a water education curriculum centered on problem-based learning for use in schools, aiming to foster youths' environmental awareness and understanding in the matters of water management. The working procedure involved a series of meetings among both institutions' staff, including experts from partnered institutions such as Beijing Normal University (China) and the Green World Foundation (Thailand). In these meetings, loosely based on Taba's (1962) model of curriculum development, we determined the scope of the curriculum and the activities to include. Ultimately, seven different activities were chosen; during the implementation phase, teachers would have to adapt them to the context of their problems in the students' communities, through which students could get involved in solving local environmental issues. Then, to test the curriculum's efficacy, we recruited teachers from ten Thai schools across the country, both urban and rural, to implement and adapt the activities in their classrooms, ranging from primary to high school students. Preliminary results show that students in the program gained a better understanding and awareness of water resources and were able to be more proactive citizens via problem-based learning activities. The Thai and English curriculum manuals are now pending publishing.

Keywords: Environmental Education, Water Education, Problem-based Learning

Center for the Public Awareness of Science, National Science Museum, Khlong Luang, Pathum Thani, 12120, Thailand
* Corresponding author: napat.m@nsm.or.th

A Study of Instructional Methods Based on Place-based Learning for Small Schools: A Case Study of Ya Mee School, Kho Yao Yai Island, Phangnga Province and Mae La Mung School, Tak Province

Suchada Khamha[1*], Dom Pratumthong[1], Sireepat, Oratai Surarit[1],
Sireepus Koypokaisawan[1] and Niti Vatiwutipong[2]

This qualitative study aimed to explore methods to solve instructional issues in science education for two small primary schools in Thailand: Ya Mee School, Kho Yao Yai Island, Phangnga Province, and Mae La Mung School, Palata, Tak Province. The researchers conducted non-intrusive observations, then in-depth interviews afterwards. The sample groups in the study include school administrators, teachers, students, and local citizens, a total of 30 participants per location. Thematic analysis was performed on data from both locations, from which four themes emerged: 1) problems in science instruction in small schools; 2) using local biodiversity information as an educational tool; 3) using experiential activities to create a prototype of instructional methods using place-based learning; and 4) creating a learning environment conducive to contextual learning. Results from both schools revealed similar problems. The first is lack of funding to acquire teaching materials and technological infrastructure to support effective education for all grades. The second is teacher scarcity, especially teachers with high expertise in the subject matter. The researchers then developed educational programs for these small schools centered on place-based learning, which then underwent implementation to test the programs' efficacy. We observed that the integration of locally relevant subject matter into science education increased students' enjoyment and enthusiasm in learning, as well as an environmentally conscious mindset. Teachers were also highly satisfied with the program because it was simple to implement, while also matching the curriculum requirements. Furthermore, the instructional methods could also be applicable to other subjects with relevance to local contexts.

Keywords: place-based learning, small school, learning environment, science instruction

[1] Office of Natural Science Research, National Science Museum, Khlong Ha, Pathum Thani, Thailand 12120
[2] Pleiades Bangkok Co.,Ltd. 21 Sukhaphiban 5 (Soi 10/3), Tharaeng, Bang Khen, Bangkok 10220
[*] Corresponding author: Suchada@nsm.or.th

Children's Interest in Dinosaur Museums

Saranpat Ouilapan[1*], Phornphen Chanthasit[2] and Gavan Cooke[1]

Many research studies focused on children's development by using dinosaurs as a tool and found that in an interested-subject environment, children learn faster. This is why information on children's opinion in museum exhibits are important. This research was conducted by surveying dinosaur exhibition preferences of children in Thailand (nursery, primary and secondary students) if they had visited dinosaur museums and rated their preferences of museum exhibits. The survey's results represent that only 45.95% of children surveyed have been to a dinosaur museum. Unfortunately, within the number of children that had never gone to a dinosaur museum (54.05%), 74.29% of them liked dinosaurs. The main causes for children not going to dinosaur museums are: the museums are far away from their residence (54.29%); parental causes (26.43%); and they are not interested in dinosaurs (12.14%). In Thailand, The Golden Jubilee National Geological Museum, Pathum Thani, has the highest percentage of visits by children (50.42%), followed by Sirindhorn Museum, Kalasin, (34.03%), and Phu Wiang Dinosaur Museum, Khon Kaen, (20.17%). For children that have been to dinosaur museums, animatronics (robotic dinosaurs) were most liked by nursery and primary children whilst fossils/dinosaur bones were most liked by secondary children. On the other hand, the most disliked museum exhibitions for each academic group were fossils/dinosaur bones for nursery, animatronics for primary and dinosaur models for secondary children. The results may be useful for museums to understand the target group (children) and improve their content and exhibitions according to children's preferences in the future. Additionally, at the end of this research, the initial creation of a global dinosaur museum webpage with dinosaur museums and/or dinosaur education centers in Thailand and the world listed within the webpage was completed to support children who have no access to dinosaur museums.

Keywords: dinosaur museums, children, exhibition, webpage, survey

[1] Heathfield International School, Saphan Sung, Bangkok, 10240, Thailand
[2] Sirindhorn Museum, Sahatsakhan, Kalasin, 46140, Thailand
[*] Corresponding author: saranpat.ouilapan@gmail.com

ORAL PRESENTATION

Session 8: *Science Communication*

Primate & Me: Know Non-human Primates to Understand Humans: The Challenge of Interdisciplinary Interpretation

Areerat Panchap*

Primate & Me: Know Non-human Primates to Understand Humans Exhibition was exhibited by Thammasat Museum of Anthropology in collaboration with Laboratory of Physical Anthropology and Ethnology, Faculty of Sociology and Anthropology, Thammasat University during the budget year 2022–2023 with the main objective to understand human beings through information and research that combines the concepts of physical anthropology, primatology, and cultural anthropology. In the process of creating such an exhibition, it was necessary to convey meaning by the interpretation process. However, the interpretation process is more challenging due to this exhibition's need for an interdisciplinary interpretation. The concept of this exhibition presents scientific knowledge that is part of physical anthropology, such as evolutionary anthropology, primatology, zoology, comparative anatomy, and animal taxonomy to be combined with the knowledge of contemporary sociology and cultural anthropology. The goal of this article is to present the exhibition's concept and working process, as well as difficulties encountered in interdisciplinary interpretation. The author found problems with using interpretation of scientific terms, definitions of primatology terminology that were linked to perceptions in primatology knowledge in Thai society, and linking scientific findings through anthropological explanations. The curators have tried to interpret each section's exhibits in order to help the audience comprehend the objectives of the exhibition.

Laboratory of Physical Anthropology and Ethnology, Faculty of Sociology & Anthropology, Thammasat University Rangsit Campus, Khlong Luang, Pathum Thani 12120
* Corresponding author: nan_jjp@hotmail.com

Research Translation Increasing Impact of Natural Science Communication from Evidence-based to Policy Action

Puvadol Doydee*

Research translation helps fill the gap between what natural scientist discovered and what policymakers perform or employ in policy. This is called in short, the "know-do gap". This gap is a major problem for users and practitioners in many fields. In natural resource stability, practices that are not based on the most current research can result in miscommunication of agroecosystem properties, climate, and land use change. which can result in the threatening of life, biodiversity loss, and livelihood insecurity, which are consequences from multi-hazard risks and improper reactions. Thus, if natural science programs and policies that are not evidence-based, this issue can cause worsening research outcomes. Suitable natural science development programing can have a great benefit on the quality of life of vulnerable and rural communities in the nation. Therefore, research translation framework are needed to improve natural science communication. How to create a window of opportunity and increase natural science research impact through research translation were incorporated and discussed in this article. Key outcome is the success of natural science communication.

Keywords: research translation, natural science communication, conveying research

Faculty of Natural Resources and Agro-Industry, Kasetsart University Chalermphrakiat Sakon Nakhon Province Campus, Sakon Nakhon 47000, Thailand
* Corresponding author: puvadol.d@ku.th

Designing a Zoological Reaearch Exhibition Using an Art Exhibition Design Framework

Niti Vatiwutipong[1*], Patamaporn Virojphan[1], Phatcharintorn Detsomboonrat[1] and Dome Pratumthong[2]

Traditional science exhibition designs tend to focus exclusively on transmitting scientific knowledge, unlike historical, social, cultural, or art exhibitions. This single-minded communication is a barrier to many visitors. Nevertheless, the National Science Museum, Thailand (NSM Thailand) is aware of this gap in interpretive design and is actively working towards exhibitions that are more user-friendly and accessible to those outside the field of science. The Office of Natural Science Research, a division of NSM Thailand, tackled this challenge by applying exhibition design theory from art exhibitions to present an exhibition on zoological research, which includes an academic zoology book launch that the exhibition promoted: "Mammals of Natural World Heritage Thung Yai Naresuan-Huai Kha Khaeng". The curators used the 'narrative method' as a tool to generate storytelling from the book and transformed it into the exhibition "Guardian and Gradient," which debuted at the National Science and Technology Fair 2022.

Keywords: exhibition design, science exhibition, art exhibition, narrative method

[1] Pleiades Bangkok Co.,Ltd. 21 Sukhaphiban 5 (Soi 10/3), Tharaeng, Bang Khen, Bangkok 10220
[2] Office of Natural Science Research, National Science Museum, Klong Luang, Pathum Thani, 12120
[*] Corresponding author: niti_v@pleiadesbangkok.com

Practical Partnerships: Role of Museums in Science Teacher Preparation

Tanwarat Pinthong[1,3], Weeyawat Jaitrong[2] and Jeerawan Ketsing[3*]

The Natural History Museum (NHM) in Thailand, like other iInformal science education institutions, plays an important role in science communication and in supporting the public's understanding of science. NHM also has a range of affordances that could contribute to students' science understanding and teachers' professional development. Notwithstanding, the science teacher preparation programs generally do not utilize museum resources to support the curriculum, as is common in wWestern countries. So, presentationed here aims to: 1) describe twelve pre-service science teachers' learning and teaching experience in the Natural History Museum context where they engaged visitors in learning dialogs around objects in an exhibit,; and 2) investigate the critical roles that NHM could play in science teacher education. In this study, a descriptive interpretive approach was adopted, with principal data sources collected for four weeks including; non-participant observation, field notes and audio recordings; and student teachers' reflective journals. This finding explicitly reveals that the NHM informal context resulted in pre-service teachers constructing their philosophy of teaching and self-efficacy belief when they faced diverse visitors. They learn and understand how museum educators and scientists work. Moreover, the findings also demonstrate low interrelationships between staff in museum exhibitions and pre-service teachers. These findings are discussed alongside implications that illustrate a practical partnership toward science teacher education under these themes: (a) development of content knowledge about science; (b) integration between science teaching in museums and methods courses; (c) constructing understandings about scientists' work; and (d) science teacher identity formation and development.

Keywords: museum, informal context, pre-service science teachers, museum-university partnership, teacher preparation

[1] Division of Science, Faculty of Education, Valaya Alongkorn Rajabhat University under the Royal Patronage, Pathum Thani 13180, Thailand
[2] Office of Natural Science Research, National Science Museum, Khlong 5, Prathum Thani, Thailand 12120
[3] Faculty of Education, Kasetsart University, Bangkok 10900, Thailand
[*] Corresponding author: fedujwk@ku.ac.th

Poster Presentation

Molecular Evidence of 28S Ribosomal DNA Sequences with Histology and Epidermal Topography of *Diceratocephala boschmai* (Platyhelminthes: Temnocephalida) Collected on Crayfish in Astaciculture from Thailand

Arin Ngamniyoma[1*], Patarapong Kroeksakul[1], Weerawich Wongroj[2],
Ruthairat Siriwattanarat[3] and Ichaya Paijitpimuk[1]

The temnocephalida ectosymbiont, *Diceratocephala boschmai*, is a turbellarian flatworm that lives on the body of *Cherax* spp., a crayfish native to Australia. These freshwater crayfish are also an exotic species and commercial pet in Thailand and can harbour *D. boschmai.* In this study, we provided the 28S ribosomal DNA (rDNA) sequences, histology and of *D. boschmai* collected from crayfish farming in Thailand. The 28S rDNA was utilized for confirmation of the identity of these worms, origin of habitat, and increased genetic data. In the phylogenetic tree, *D. boschmai* are monophyletic among Rhabdocoela based on 28S rDNA. In addition, there was found that an inconsistency between the results of molecular analysis and morphological information within Neodalyellida. Histological views described the following organ systems: epidermis, muscles, and some regions of the digestive and reproductive tracts. Surface morphology was observed under a scanning electron microscope that included tentacles, mouth, adhesive disc and digestive tract inside the body. We believe that the presented data increases the body of knowledge surrounding the temnocephalid flatworms. Furthermore, this report suggested that *D. boschmai* infesting crayfish might be established in the freshwater astaciculture of Thailand.

Keywords: *Diceratocephala boschmai*, histological views, SEM, 28S rDNA, crayfish farming

[1] Major in Environment, Faculty of Environmental Culture and Eco-tourism, Srinakharinwirot University, Bangkok 10110, Thailand
[2] Prasarnmit Elementary Demonstration School, Srinakharinwirot University, Bangkok 10110, Thailand
[3] Faculty of Science and Technology, Suan Sunandha Rajabhat University, Bangkok 10300, Thailand
[*] Corresponding author: arin@g.swu.ac.th

Investigation of Microbiota and Piece of Debris of Monofilament Lines in Guts of Blue Swimming Crabs

Ichaya Paijitpimuk[1*], Patarapong Kroeksakul[1], Thayat Sriyapai[1],
Wirongrong Duangjai[2] and Arin Ngamniyom[1]

Pollution of plastic debris is an environmental aspect concerning human health and wildlife. Plastic waste distributes and contaminates environments such as aquatic ecosystems causing diseases of aquatic animals. In decapod species, blue swimming crabs (*Portunus armatus* or *P. pelagicus*) are the famous marine crustacean species used for human consumption in many countries. They may be affected by a risk of plastics pollution in their natural environment or aquaculture. Therefore, the aim of this study was to examine microbial diversities and pieces of debris of monofilament lines in guts of blue swimming crabs. For bacteria identification, the V1–V3 hypervariable regions of the 16S rRNA gene was analysis by using illumina next generation sequencing. Moreover, monofilament lines were confirmed by fourier-transform infrared spectroscopy (FT-IR) for plastic materials. A total of 40 individuals gut samples of crabs were collected from the eastern coast of the gulf of Thailand. Four monofilaments were found (single monofilament per one gut), and length was 4–7 mm. FT-IR spectrum matched to polyamide. For microbes, the operational taxonomic units (OTUs) in guts without monofilament were 53 (n = 4 as group 1), and guts with monofilament were 26 (n = 4 as group 2). The OTUs in guts with and without monofilament were similarly detected at 131. In levels of bacterial phyla, "*Proteobacteria*" was highest in guts of both groups. In contrast, "*Firmicutes*" were highly detected in group 2. In bacterial genera, *Photobacterium* was predominant Vibrionaceae in both groups, but *Marinobacter* of Alteromonadaceae was high in group 1. However, it was found that a single sample in group 2 was dominated by Vibrio. For the Kyoto Encyclopedia of Genes and Genomes Pathway, infectious disease bacteria was higher in group 2 than that in group 1. These results suggest that microbial communities may be associated with the finding of monofilament in guts of blue swimming crabs

Keywords: plastic debris, *Portunus*, gut microbes, Thailand

[1] Major in Environment, Faculty of Environmental Culture and Eco-tourism, Srinakharinwirot University, Bangkok, 10110 Thailand
[2] Department of Silviculture, Faculty of Forestry, Kasetsart University, Bangkok, 10900 Thailand
[*] Corresponding author: ichaya.niw@g.swu.ac.th

Amphibians and Reptiles at 1,400 Meter Mean Sea-level Between the Thailand and Malaysia Border

Sunchai Makchai[1*], Michael Cota[1] and Phontawat Chalermwong[2]

The Hala-Bala Forest are two forests that are connected by an overlapping mountain range, and it is the last large tract of fertile rainforest in the southern border provinces. It covers an area of approximately 800,000 rai (1,280 square kilometers) and is also the watershed for the 3 southern border provinces, covering Bannang Sata Distrcit, Than To District, and Betong District of Yala Province to Sikhirin District, Waeng District, Chanae District, and Si Sakhon District of Narathiwat Province. These areas are adjacent to the border with Malaysia. The elevation is at an altitude of 1,400 meters above mean sea level at the border area. There is a cool climate and high humidity all year round. Environmental conditions consist of a wet basin (montane peat bog) with the deposition of non-rotating organic matter. Organic soil is covered with sphangum mosses is in a special area that is far away from normal routes. Getting there takes at least three days of walking. It was very fortunate to be part of this trip.

The survey and collection of data and samples took place from 21–28 May 2022. The collection of survey results and reference samples was carried out under the Long-term Forest Ecology Program, Office of Research, Forest and Plant Conservation, Department of National Parks. The data collection, and samples of the survey were collected using conventional survey and sampling methods and collected a total of 26 specimens of amphibians and reptiles, consisting of 18 species, 12 genera, and eight families.

Keywords: highland, diversity, distribution, Malay Peninsula

[1] National Museum of Science and Technology Organization, Khlong Ha Subdistrict, Khlong Luang District, Pathum Thani Province 12120
[2] Department of National Parks, Wildlife and Plant Conservation 61 Phaholyothin Road, Lat Yao Subdistrict, Chatuchak District, Bangkok 10900
[*] Corresponding author: sunchau@msn.or.th

Offshore Crabs from the Gulf of Thailand by R.V. Chulabhorn (Crustacea: Decapoda: Brachyura)

Kamonchanok Wongissarakul[1*], Bansan Siripitrakool[2] and Pornpirun Tokummanee[3]

The offshore crabs were investigated during an expedition on marine benthic fauna and marine environment in the Gulf of Thailand by R.V. Chulabhorn, organized by Department of Fisheries, Ministry of Agriculture and Cooperatives between 20 April and 1 May 2022. The offshore crab specimens were collected using trawling net in 16 stations throughout the Gulf of Thailand, and were deposited in Thailand Natural History Museum. A total of 40 species belonging to 34 genera in 11 families. Results of this study show the variation in species richness of offshore crabs in the Gulf of Thailand depending on sea floor physical features. The present knowledge on offshore crab diversity is fulfill marine biodiversity as baseline data for further monitoring and helpful as for sustainable conservation of marine fishery in the Gulf of Thailand.

Keywords: offshore, crab, trawling, Gulf of Thailand

[1] Office of Natural Science Research, National Science Museum Klong Luang, Pathum Thani, 12120, Thailand
[2] Marine Fisheries Research and Development Division, Department of Fisheries
Muang, Samut Prakan, 10270, Thailand
[3] Marine Fisheries Research and Development Division, Department of Fisheries
Chatuchak, Bangkok, 10900, Thailand
[*] Corresponding author: kamonchanok@nsm.or.th

Preliminary Results of an Inventory Survey of Sea Slugs (Gastropoda, Heterobranchia) on Underwater Rock Piles from Satun Province, Southern Thailand

Ratchaneewarn Sumitrakij*, Arom mucharin and Kochakorn Moonsatan

Filed surveys of sea slugs on underwater rock piles from Satun province, Southern Thailand were conducted between 11-18 January and 22-24 April 2022. A total of 41 species were recorded in the study area. Family Chromodorididae was the most common one. The rest species belonged to the family Phyllidiidae, Facelinidae, Arminidae, Discodorididae, Actinocyclidae, Aeolidiidae, Bornellidae, Cadlinellidae, Flabellinidae, Lomanotidae, Samlidae, Tergipedidae, and Trinchesiidae.

Keywords: sea slug, underwater rock, Gastropoda

* Office of Natural Science Research, National Science Museum, Khlong Ha, Khlong Luang District, Pathum Thani
Corresponding author: ratchaneewarn.s@nsm.or.th

Optimal Bedding for the Laboratory Culturing of *Cubaris murina*

Chakriya Rungrawi* and Koraon Wongkamhaeng

The isopods in the genus *Cubaris* are common isopods in tropical Asia. They play an important role in the ecosystem as a decomposer. Currently, the genus *Cubaris* was bred as pets due to their diversity and color. This experiment will examine survival rates of *Cubaris murina* rearing in five different beddings i.e., peat moss, tissues, sphagnum moss, sponge, and dry leaves. Each bedding type contained ten isopods and the data was collected daily for two months. The result revealed that the appropriate bedding which had the highest survival rates was dry leaves, tissues, peat moss, sphagnum moss, and sponge, respectively. The key to survival was the humidity retention.

Keywords: isopod, decomposer, survival rate

Department of Zoology, Kasetsart University, Chatuchak, Bangkok, 10900, Thailand
* Corresponding author: Chakriya.r@ku.th

Two Undescribed Species of the Crested Flounder Genus *Samaris* (Pleuronectiformes: Samaridae) from Eeastern Australia and South Africa

Kota Obata[1*], Toshio Kawai[1] and Hisashi Imamura[1,2]

The crested flounder genus *Samaris* (Samaridae) is composed of five valid species distributed in the Indian and West Pacific oceans. The genus is characterized by prolongation of anterior dorsal-fin rays and pelvic-fin rays on the ocular side, and absence of nostrils on blind side. We report two undescribed species of *Samaris* based on five specimens collected off the east coast of Australia *(Samaris* sp. 1) and two off the east coast of South Africa (*Samaris* sp. 2). Both undescribed species resemble to *Samaris costae* Quéro, Hensley and Maugé, 1989 and *Samaris macrolepis* Norman, 1927 in having 6–8 prolonged dorsal-fin rays and simple all caudal-fin rays, and lacking spines on caudal peduncle. *Samaris* sp. 1 and *S. costae* are separable from *Samaris* sp. 2 and *S. macrolepis* in having higher numbers of dorsal-fin rays (68–79 in the former two species vs. 57–62 in the latter two species), anal-fin rays (51–60 vs. 44–47) and lateral line scales (58–75 vs. 53–59). *Samaris* sp. 1 differs from *S. costae* in having lower numbers of dorsal-fin rays (68–70 vs. 73–79), anal-fin rays (51–54 vs. 57–60) and lateral line scales (58–68 vs. 69–75), and the coloration of body (large dark mottles vs. small dark spots). *Samaris* sp. 2 can be distinguished from *S. macrolepis* in having lower numbers of dorsal-fin rays (57–58 vs. 62), prolonged dorsal-fin rays (6 vs. 8) and anal-fin rays (44–45 vs. 47), higher number of lateral line scales (56–59 vs. 53), and shorter pelvic fin on ocular side (30.9–32.6 % of standard length vs. 41.3 %). Heemstra (1995) reported *S. macrolepis* from South Africa. This study examined the voucher specimen and found it to be *Samaris* sp. 2.

Keywords: *Samaris costae*, *Samaris macrolepis*, taxonomy, description

[1] Faculty / Graduate School of Fisheries Sciences, Hokkaido University, 3-1-1 Minato-cho, Hakodate, Hokkaido 041-8611, Japan
[2] Fisheries Science Center, The Hokkaido University Museum, 3-1-1 Minato-cho, Hakodate, Hokkaido 041-8611, Japan
[*] Corresponding author: obata.kota.z1@elms.hokudai.ac.jp

Preliminary Taxonomic Studies of Deep-sea Fishes Collected from Andaman Sea by the BIOSHELF Project

Toshio Kawai[1*], Fumihito Tashiro[2], Hisashi Imamura[1,2], Naohide Nakayama[3], Katsuya Kimura[1], Saki Kishimoto[1], Tetsuro Senda[1], Kota Kamiyama[1], Kota Obata[1], Kohei Mita[1], Charatsee Aungtonya[4] and Surapong Banchongmanee[4]

A deep-sea expedition was conducted by R/V Chakratong Tongyai, off western coast of southern Thailand in the southern Andaman Sea, eastern Indian Ocean under the Biodiversity of the Andaman Sea Shelf (BIOSHELF) project during 1996–2000. About 500 deep-sea fish specimens captured from 200 m – 1,020 m depths by this project have been deposited at the Phuket Marine Biological Center (PMBC). However, these specimens had not been examined taxonomically in detail. During the training course on identification of deep-sea fishes from the Andaman Sea held at PMBC in 2016, these specimens were identified to the following 21 orders: Chimaeriformes, Squaliformes, Torpediniformes, Rjiformes, Albuliformes, Anguilliformes, Argentiniformes, Stomiiformes, Ateleopodiformes, Aulopiformes, Myctophiformes, Lampriformes, Gadiformes, Ophidiiformes, Lophiiformes, Stephanoberyciformes, Beryciformes, Scorpaeniformes, Perciformes, Pleuronectiformes and Tetraodontiformes. We introduce current progress of taxonomic studies examining these specimens.

Keywords: taxonomy, Indian Ocean, new species, new record

[1] Faculty / Graduate School / School of Fisheries Sciences, Hokkaido University, 3-1-1 Minato-cho, Hakodate, Hokkaido 041-8611, Japan
[2] Fisheries Science Center, The Hokkaido University Museum, 3-1-1 Minato-cho, Hakodate, Hokkaido 041-8611, Japan
[3] School of Marine Science and Technology, Tokai University, 3-20-1 Orido, Shimizu, Shizuoka 424-8610, Japan
[4] Phuket Marine Biological Center, Muang District, Phuket 83000, Thailand
[*] Corresponding author: toshio.kawai@fish.hokudai.ac.jp

An Undescribed Species of the Genus *Garra* (Teleostei: Cyprinidae) from Khek River, Northeastern of Chao Phraya Basin, Thailand

Veera Vilasri*

The Khek River is located in the northeastern Chao Phraya basin, Thailand. It originates from the Phetchabun Mountains in the Khao Kho District of Phetchabun Province. The river flows through Thung Salaeng Luang National Park and Wang Thong District in Phitsanulok Province, and finally drains into the Nan River at the border of Phitsanulok Province and Phichit Province of Thailand. An undescribed species of the genus *Garra* is recognized from the river based on examining 26 specimens deposited in the Natural History Museum, Thailand (THNHM). The species can be distinguished from other congeners in having lateral line scales 31–33, branched dorsal rays 7½–8½, lower-lip disc length 35.1–44.8% of HL, lower-lip disc width 47.6–63.5% of HL. The species is similar to *Garra suribinnani* Page, Ray, Tongnunui, Boyd and Randall, 2019 in having a bilobed proboscis on the snout and an anterior transverse lobed separating from the remain of the snout by a deep transverse groove, but differs from the later by each lobe of proboscis with only a single prominent tubercle (vs. one large tubercle at each anterior corner and 1–2 smaller tubercles between large tubercle) and more circumpeduncular scales 14–15 (vs. 12–13).

Keywords: *Garra*, Khek River, Chao Phraya basin, Thailand

Office of Natural Science Research, National Science Museum, Klong Luang, Pathum Thani, 12120, Thailand
* Corresponding Author: Veera@nsm.or.th

Species Diversity of Waspfishes (Synanceiidae: Tetraroginae) in Thailand

Sirikanya Chungthanawong[1*] and Hiroyuki Motomura[2]

Waspfishes are Indo-West Pacific fish species belong to family Synanceiidae, sub-family Tetraroginae, comprised of 18 valid genera with 44 valid species. This study on waspfishes in Thailand collected from Andaman Sea and Gulf of Thailand revealed 5 genera with 5 species: *Ablabys taenianotus* (Cuvier 1829), *Neocentropogon affinis* (Lloyd 1909), *Richardsonichthys leucogaster* (Richardson 1848), *Snyderina guentheri* (Boulenger 1889) and *Trichosomus trachinoides* (Cuvier 1829).

Keywords: waspfishes, Tetraroginae, Andaman Sea, Gulf of Thailand

[1] Office of Natural Science Research, National Science Museum, Klong Luang, Pathum Thani, 12120, Thailand
[2] The Kagoshima University Museum, 1-21-30 Korimoto, Kagoshima 890-0065, Japan
[*] Corresponding Author: Sirikanya.c@nsm.or.th

Influence of Radiation on Color Modification and Color Stability in Rubies

Waratchanok Suwanmanee[1*], Chanenkant Jakkawanvibul[1], Thanapong Lhuaamporn[1], Chotika Kittikunlayaworakun[1], Thanong Leelawatanasuk[1] and Nongnuch Jangsawang[2]

The irradiation method has currently had an essential role in corundum enhancement. Some domestic and international entrepreneurs tried to irradiate purplish rubies to their purplish tint and turn it brighter red due to the addition of yellow shade after radiation. However, the color of corundum after irradiation was unstable when exposed to light or heat for a long time and faded into the original color. Color fading of corundum is unacceptable in the trade and damages the commercial value of such gemstones. In the present experiment, rubies from three sources, i.e., Myanmar, Mozambique, and Madagascar, were selected for the investigation. All rubies were treated with gamma and high-energy electron radiation and subjected to color stability tests after irradiation. The experimental results showed that gamma rays produced a more obvious color modification than the electron beams. In particular, the Mozambique rubies changed from purplish red to orange red. The UV-Vis absorption spectra of all rubies after irradiation presented an increasing of the absorbed band at 320-330 nm related to the color center. This result can be used as a preliminary indication of rubies that may have been improved by irradiation. The color stability tests found that most rubies presented color modification at cumulative times from five and six hours, showing slight color changes.

Keywords: ruby, treatment, gamma radiation, electron radiation, color stability test

[1] The Gem and Jewelry Institute of Thailand (Public Organization, Bang Rak, Bangkok, 10500, Thailand
[2] Thailand Institute of Nuclear Technology (Public Organization), Ongkarak, Nakorn Nayok, 26120, Thailand
[*] Corresponding author: swaratchanok@git.or.th

Comparing Species Diversity of Canopy Ants Between Dry Evergreen Forest and Deciduous Dipterocarp Forest in Sakaerat Biosphere Reserve

Tadsanai Jeenthong[1], Weeyawat Jaitrong[1],
Papichaya Teawkul[2] and Rungtip Wonglersak[1*]

The study collected the data of canopy ants in dry evergreen and deciduous dipterocarp forests in Sakaerat Biosphere Reserve and compared species diversity of canopy ants in both forests to facilitate appropriate management decisions. We collected data every three months during November 2021 to July 2022. Canopy ants were collected in both forests using canopy fogging method and were identified to species. An alpha diversity was calculated using Shannon-Wiener's Index (H') and a beta diversity was analyzed using an analysis of similarities. A total of 43 species were recorded in both forests. Twenty-nine and twenty-two species were found in dry evergreen and deciduous dipterocarp forest, respectively. An alpha diversity indicated that during hot season of dry deciduous forest contained the most ant diversity. In contrast, rainy season of dry deciduous forest has the lowest ant diversity. The analysis of similarities found a strongly significant dissimilarity between forest type. *Dolichoderus thoracicus* (Smith, 1860); *Dolichoderus affinis* Emery, 1889; *Crematogaster aurita* Karavaiev, 1935 and *Dolichoderus taprobanae* (Smith, 1858) are species with the most contribution on the difference between forest type.

Keywords: canopy ants, Sakaerat Biosphere Reserve, species diversity

[1] Office of Natural Science Research, National Science Museum, 39 Moo 3, Khlong 5, Khlong Luang, Pathum Thani, 12120 Thailand
[2] Faculty of Agriculture, Entomology and Plant Pathology, Khon Kaen University, Muang District, Khon Kaen Province 40002
* Corresponding Author: Rungtip.W@nsm.or.th

Plant Diversity of the Satun Geopark

Bhanumas Chantarasuwan* and Wisoot Supong

The plant diversity of the Satun Geopark is a part of the survey project collecting resources of the biodiversity in the Satun Geopark. The objective of the project was to record plant species in the area. After three years (2019–2022) of work, 210 plant species were recorded. It is comprised of 77 species of trees, 66 species of shrubs, 27 species of herbs, four species of palms, and 19 species of exotic plants.

Keywords: land plant, plant diversity, Satun Geopark

Office of Natural Science Research, National Science Museum, Klong Luang, Pathum Thani, 12120, Thailand
* Corresponding Author: Bhanumas@nsm.or.th

Diversity of Mushroom in the Eco-tourism at Pha Hin Ngam National Park, Chaiyaphum Province

Fueanglada Niyanan[1,2], Thantip Supama[1,2], Areerat Saisong[1,2], Orathai Sertsri[1,2], Khwanyuruan Naksuwankul[1,2*], Pongthep Suwanwaree[3], and Kawisara Hengtanarat[3]

Pha Hin Ngam National Park is an eco-tourism area in the rainy season blooming with krachiew flower field (*Curcuma sessilis* Gage.), during the high season from July to August were clouded with tourism to visit this area. The objective of this study is a survey the species diversity of mushrooms in the rainy season at Pha Hin Ngam NP. The dry dipterocarp, dry evergreen, tropical rainforest and secondary forest were surveyed and collected the mushrooms followed by the local people trail and nature trail. The mushroom family had the highest number of species followed by Boletaceae and Russulaceae, respectively. From the samples, we found 51 species, 26 genera, and 15 families belonging to edible, poisonous, and medicinal mushrooms, including mycorrhiza, saprophyte, and parasite mushrooms. The high biodiversity of mushrooms in this area serv to promot the eco-tourism at Pha Hin Ngam National Park.

Keywords: diversity, mushroom, eco-tourism, Pha Hin Ngam National Park

[1] Department of Biology, Faculty of Science, Mahasarakham University, Kantarawichai, Maha Sarakham Province 44150, Thailand
[2] Research Unit of Mushroom and Lichens for Sustainable Utilization Mahasarakham University, Kantarawichai, Maha Sarakham Province 44150, Thailand
[3] School of Biology, Institute of Science, Suranaree University of Technology, Muang, Nakhon Ratchasima Province 30000, Thailand
[*] Corresponding author: khwanruan.p@msu.ac.th

Biodiversity of Mushroom in the Wild Forest at Sai Thong National Park, Chaiyaphum Province

Thantip Supama[1,2], Fueanglada Niyanan[1,2], Areerat Saisong[1,2], Orathai Sertsri[1,2], Khwanyuruan Naksuwankul[1,2*], Pongthep Suwanwaree[3] and Kawisara Hengtanarat[3]

The objective of this study was an investigation the biodiversity of mushrooms in the wild forest at the conservation site in Sai Thong National Park, Chaiyaphum Province during the rainy season from July to August 2022. The Sai Thong National Park has comprised a diverse forest; dry dipterocarp, dry evergreen, lower montane rainforest, and secondary forest. This National Park during the rainy season permitted the local people to access edible mushroom for eating and selling in the local market. The result show edible, poisonous, and medicinal mushrooms in this area, including 90 species, 32 genera, and 14 families. Boletaceae had the highest number of species, followed by Agaricaceae, and Russulaceae respectively. The data on the biodiversity of mushrooms in this area serves to promote conservation and surveillance in the community.

Keywords: diversity, mushroom, wild forest, Sai Thong National Park

[1] Department of Biology, Faculty of Science, Mahasarakham University, Kantarawichai, Maha Sarakham Province 44150, Thailand
[2] Research Unit of Mushroom and Lichens for Sustainable Utilization Mahasarakham University, Kantarawichai, Maha Sarakham Province 44150, Thailand
[3] School of Biology, Institute of Science, Suranaree University of Technology, Muang, Nakhon Ratchasima Province 30000, Thailand
[*] Corresponding author: khwanruan.p@msu.ac.th

A New Platform for Science Communication and Outreach: "LASBOS" (Learning and Study by Balance de Ocean System)

Shunsuke Yamashita*, Hyojin Ahn, Naizheng Yan, Tohru Mukai and Atsushi Ooki

LASBOS (https://repun-app.fish.hokudai.ac.jp/) has been running Balance de Ocean Project, Hokkaido University since 2019. The project aims to foster the next generation of top scientists of the sea by developing and accumulating online educational materials for fisheries and marine sciences. This project is also open online to everyone who aspires to learn about fisheries science and engage in various practices. It is a system that promotes independent learning and inquiry beyond the limitations of place and time, and beyond the barriers of occupation, age, field of study, and grade, which is related to SDGs 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. We have accumulated and published more than 800 courses on the LASBOS Moodle and 400 educational movies on the LASBOS YouTube Channel. Some of the content is translated in English for International users. We are trying to seek various channels, topics, and interfaces to widely reach potential users: SDGs, wild animal researchers, columns by scientists, high school students, alumni, businesses. These efforts are project's responsibility for society, and they are also our tactics for sustainability of the project itself based on diversity. Our goal is to bring together excellent learners, to nurture them together, and to contribute to the local community and human society through this social education project.

Keywords: science communication, public relations, online education, SDGs, Moodle

Faculty of Fisheries Sciences, Hokkaido University, Hakodate, 0418611, Japan
* Corresponding author: ya.shunsuke@gmail.com

Committees

Committees

The 3rd International Symposium on Natural Science: Natural Resource Sustainability and People's Responsibility for Society

Assist. Prof. Dr. Rawin Raviwongse, President, National Science Museum	Advisor
Mr. Suwarong Wongsiri, Vice President, National Science Museum	Advisor
Dr. Ganigar Chen, Vice President, National Science Museum	Advisor
Dr. Chanintorn Wannawichitra, Vice President, National Science Museum	Advisor
Director of Office of Natural Science Research	Committee Chairman
Director of Office of Business and Corporate Partnership	Committee
Director of National Center for Public Awareness of Science	Committee
Director of Office of Central Service	Committee
Director of Office of Engineering and Media Production	Committee
Director of Office of Visitor Service	Committee
Director of Collection and Taxidermy Center	Committee
Director of Ecological Division	Committee
Director of Zoology Division	Committee
Director of General Affairs Division	Committee
Director of Science Communication and Public Engagement	Committee
Director of Plant Division	Committee and Secretary

Maps

Location

39 Moo 3, Technopolis, Khlong 5,
Khlong Luang, Pathum Thani 12120

Operating hours

Tuesday – Friday: 09.30 – 16.00 hrs.

Saturday – Sunday and holidays: 09.30 – 17.00 hrs.

Closed on Monday

Map of Rama 9 Museum

National Science Museum (NSM)
39 Moo 3, Khlong 5, Khlong Luang, Pathum Thani, 12120 Thailand
http://www.nsm.or.th