Biological Collection
Management in Sabah, Malaysia
- How Do We Share Data? -

Edited by
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Japan International Cooperation Agency (JICA)
Sabah State Government
Universiti Malaysia Sabah (UMS)
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Preface

There are many important institutions to conserve, manage and research the biodiversity and ecosystems in Sabah. They are Forest Research Centre (FRC), Sabah Parks Natural History Museum (Kinabalu Park Museum) (SPM), Sabah Museum (SM), and Institute for Tropical Biology and Conservation, Universiti Malaysia Sabah (ITBC, UMS). Each institute has been actively involved in the biodiversity and ecosystems studies, and has much information on them, respectively. There are over 560,000 of botanical, zoological and insect specimens in Sabah, most of which are satisfactorily managed. Database system for collection management has not been introduced in Sabah globally, though each institute has their independent database system. Useful information on specimen and distributional data remain scattered or not arranged.

To conserve the biodiversity and ecosystems in Sabah, it may be the best way to share or network the information one another. By doing this, the common knowledge and understanding for conserving the biodiversity and ecosystems in Sabah will distinctly increase. Moreover, it also provides to promote coordination in the management of the biodiversity resources, exchange for conservation purposes among institutes, and inform general public and decision-makers about the factors affecting biodiversity. A special workshop on data sharing was held during the BBEC international conference in February 2003 especially to discuss on how the institutes in Sabah can network or share information.

We also visited the four above-mentioned institutes (FRC, SPM, SM, and ITBC) and examined their collection data and management system. The purpose of this visit is to know the present condition of collection management system in Sabah.

All the information gathered are compiled in this book. For example, how many specimens and species are stored, whether type specimen(s) is/are or not, and how they are managed. The features of collections in each institute are also discussed in this book. It may be very useful for displaying the future framework of each organization. In addition, these data will be certainly needed to understand the biodiversity and ecosystems in Sabah. We would appreciate if this book can be used as a resource for sharing or networking such information among the institutions.

We are grateful to all the staff from the institutes in giving information on collection data and also in the preparation of this book. We wish to express our thanks to Dr. Arthur Y.C. Chung (Forest Research Centre), Mr. Maklarin B. Lakim (Sabah Parks Natural History Museum), and Mr. Jaffit Majuakim and Mr. Janis Galait (Sabah Museum) for their kindness and cooperation in providing information.

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Conservation of biodiversity and ecosystem require detail knowledge of natural resources available in the environment. Inventory of organisms is critical in formulating management plan and strategies. By knowing what is available and in what amount, an organization can plan its uses sustainably. This all pointed out to the fact that we should know what we have. Collecting and documenting the existence of natural resources (biodiversity and ecosystems) can be a daunting task. The 1.75 million organisms recorded and with many more awaiting to be discovered, mostly are found in the tropical rainforest. It is not an easy job to discover and document them. With the many data to handle a good management system is required.

In Sabah we are fortunate that several organizations are actually involved in the collection and documentation of organisms. The laborious task of collecting and documenting require expert taxonomic skill and knowledge. In addition money, time and labour support are essential. It would be more cost-benefit and efficient that collection and documentation effort are being coordinated and data shared.

With such idea in mind, Research and Education Component of the Bornean Biodiversity and Ecosystem Conservation (BBEC) Programme proposed that a data sharing effort being implemented. Three organizations with major collection, UMS, FRC and Sabah Parks could work together to collect and document organisms found in Sabah and perhaps Borneo, in a coordinated manner.

In such effort, nobody looses anything, but everybody gain. Data when shared will ensure that no duplication to collect and document organisms happened. This will cut down cost, time and labour for all institutions involved. Secondly, the amount of data accumulated on a shared basis can multiply several folds in the same time frame if carried out by a single institution. This will highlight Sabah as a State concerned with, and implementing the National Policy of Biological Diversity that strategized on collection and documentation of biodiversity. The knowledge on biodiversity will expedite biotechnology, and as biotechnology may be wisely used for economic gain, perhaps this is one way for Sabah to move forward, to overcome the present poor economic situation.

Thirdly, currently at the international level, developed nations are struggling to compile data on biodiversity, for they know the database will form the basis for conservation effort, as well as support strategies to promote biotechnology. It will be good if Sabah, rich in biodiversity is actually doing the data-basing in a coordinated manner.

However, although it is a fact that data sharing is an important tool and support sustainable development, through conservation of biodiversity and ecosystem, and promotion of biotechnology, those involved will need to understand the implication and consequences. Ownership of the information has to be clear. The level of information to be revealed to users, including those who are sharing has to be agreed on. Commitment in an equal manner has to exist. Last but not least, if any data used leads to commercialization, prior agreement to the sharing of benefit has to be in place.

It is my hope that the sincere proposal of the Institute for Tropical Biology and Conservation, Universiti Malaysia Sabah to share data will one day be materialized. It may come later, it may be now. The fact remains : the world is proceeding at a rapid pace to document biodiversity, do we want to wait and see?

Maryati Mohamed
Head of Research & Education Component
BBEC Programme
(Director, ITBC, Universiti Malaysia Sabah)
Part 1

Special Workshop: How do We Share Data?
1.1 Global Trends and Local Tide for Biodiversity Information Networking
by Dr. Yoshiaki Hashimoto, Advisor on “Inventory & Museum Management”, BBEC, JICA
(Hyogo Museum of Human & Nature, Japan)

We will talk about three topics today. They are collection management in Sabah, why we need data base network in Sabah which we do not have now, which I would also like to show a proposal on how to establish a database networking today and we will discuss on why data networking is important.

In conservation of ecosystem, we need biodiversity information to conserve ecosystems. That is why we need specimen, organism and habitats although we are facing with limitation of resources, money and man power, thus making it difficult to collect biodiversity information to conserve the ecosystem.

Networking is very important for exchange, in sharing of inventory of data and join efforts together to conserve biodiversity.

In Sabah situation, we have good management and high identification level of more than 560,000 specimens housed. All the specimens are kept safely. There are botanical collection, insect collection and zoological collection. In FRC, the major collection is plant collection inclusive of four hundred types of specimens. Another major collection is the frog collection with eighty nine species and three thousand specimens. In Sabah museum we have bugs collection of two hundred seventy two species and two thousand five hundred specimens. In ITBC, we have a very unique collection of snails with forty four species and two hundred fifty specimens.

The condition of the specimens are good but we have not established digital database and networking them. This is a serious handicap for understanding the ecosystem in Sabah.

There is no database network on biodiversity in Sabah. A common database is important for summarization of inventory in Sabah exist in different institutes. Therefore, we need to establish a system for exchanging and sharing of information. If this is not done, it would be a handicap of Sabah in the globalisation of biodiversity.

In conclusion, we need a collection of management database network in order to grasp biodiversity information quickly, to exchange and to develop biodiversity information cooperatively.

We propose that periodic workshops for exchanging of information and establishing a united network monthly or annually among ITBC, Sabah Museum & FRC.
We should standardize the inventory on data entry format and should have the same data management method. The collection data management should be standardized with a sound local network, so that from any part of Sabah, we would be able to access and exchange information.

**Slides Presentation**

**Slide 1:** Local tide and Global trends for Biodiversity information

**Slide 2:** Why do we need collection database networking in Sabah?

**Slide 3:** Limitation of resources

**Slide 4:** The networking is a rapid way to conserve ecosystems
Slide 5

Sabah

- Collections and collection management in Sabah
  1. More over 560,000 specimens housed
  2. Good management for collections
  3. High identification level (except for insects)

Slide 6

Biological Collections in Sabah

Major institutes housing collection in Sabah

- Biological collections in Sabah
  - 201,504 specimens
  - Botanical collection
  - Zoological collection
  - Sheet collection

More over 560,000 specimens

Slide 7

Major zoological collections in Sabah

- FRC
  - 242,911 specimens
  - 495 species
- SPM
  - 59 spp.
  - 2579 specimens
- SM
  - 252 spp.
  - 7,456 specimens
- ITBC
  - 208 spp.
  - 42,446 specimens

Slide 8

Sabah

- Collection data management database and the networking in Sabah
  1. Not establishing the database
  2. Not establishing the network

*These are serious handicaps for understanding biodiversity and conservation of ecosystems in Sabah.*

Slide 9

Problem: How many species are there in Sabah collections

Slide 10

How many frog species are there in Sabah collection?

- SM
  - 4,048 specimens
  - 54 spp.
  - 5,663 specimens
- ITBC
  - 1,904 specimens
  - Species: Total 8,102
Slide 11: Database and network are needed: To summarize inventory projects in Sabah.

Slide 12: Problem: How to find inventory targets in Sabah?

Slide 13: Target insect in Sabah

Slide 14: Database and network are needed: To identify targets for inventory project in Sabah

Slide 15: Handicap: For globalization of biodiversity information

Slide 16: Conclusion: Why do we need collection database networking in Sabah?
1. To grasp biodiversity info. quickly
2. To gather biodiversity info. efficiently
3. To develop biodiversity info. cooperatively

“A rapid way to conserve ecosystems in Sabah”
Biological Collection Management in Sabah, Malaysia - How Do We Share Data?

**Slide 17**

Proposal (good):
To have workshops periodically for exchanging collection info. and establishing regional collections

**Slide 18**

Proposal (better):
To standardize format of collection data

**Slide 19**

Proposal (best):
To establish Local Network of Biodiversity Inf.
In 2002, the first GTI regional workshop in Asia was held in Putrajaya, Malaysia. GTI focal point of Japan surveyed region-wide taxonomic needs and capacity prior to the workshop. Workshop and the result of survey identified regionally common impediments in implementing Convention on Biological Diversity. 1) Patchy knowledge base in region 2) poor coverage of many taxonomic groups, especially lower organisms such as lichens, fungi and micro-organisms compared to higher plants and larger animal of this megadiverse region 3) Restricted access to collections held elsewhere - need for data repatriation, on-line images and data, etc. 4) Restricted access to taxonomic literature, both old and recent - need for on-line access.

The relevant initiatives to overcome the above exist, although currently, Asians are not fully participating. For example, Global Taxonomy Initiative pilot project under Japanese Global Environmental Research fund has started to develop software to assist dissemination of data from small collections, and to provide an opportunity to submit names of organisms from regional species checklists. Global Biodiversity information Facility initiated various projects on digitization of specimen collections and creating Electronic Catalog of Life (global species name catalog). Large expectation is there to Asian scientists, particularly in taxonomy and bioinformatics to join these projects and to share the task.

Problems are foreseen in any global data projects. Unless each one of the taxonomic institutes in Asia takes a part to fill in the gaps in such on-going global database projects, serious bias of species information may be created as baseline information of global biodiversity. The unique information of specimens kept in Malaysia has great value if it was scrutinized by reliable taxonomic experts. Needs to access on-line images of type specimens and taxonomic literature for better scrutiny are already well recognized all over the world. To be users of such data and at the same time to be a unique data provider from Asia, bioinformatics capacity building is urged in Malaysia and Asia. Taxonomists’ commitment to work on database is a key in taxonomy to be recognized as the fundamental of conservation biology and to answer the vast number of questions on biological materials of the earth.
Biological Collection Management in Sabah, Malaysia - How Do We Share Data?

**Global Taxonomy Initiative:**
global trends on biodiversity collections and informatics

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**Why taxonomy?**
- Over 1.7 million different species have been named in the world.
- There may be 30 million or more…
- Expertise needed to IDNETIFY & DESCRIBE
- Lack resources even to find out what species live within and across the boundary, long way to know globally.
- Combat with TAXONOMIC IMPEDIMENT!

**What is GTI programme of work?**
- Taxonomic needs assessment
- Generating taxonomic information
- Accessing taxonomic information
- Taxonomic information for decision making on thematic work of CBD
- Taxonomic information for decision making on cross cutting issues of CBD

**Existing initiatives on biodiversity research and conservation**
- UNEP/CBD/Global Taxonomy Initiative (GTI) – Programme of Work
- Global Biodiversity Information Facility (GBIF)
- DIVERSITAS
  - DIWPA - e.g. ANet
  - e.g. Species 2000 Asia Oceania
- BioNET INTERNATIONAL
  - ASEANET, EASIANET

**Imbalance of experts and estimated biodiversity**

**Is staff sufficient to address CBD issues?**

Average number of staff:
- Invertebrates: 4
- Vascular Plant: 2
- Fungi: 1
- Yeast: 1
- Not sure: 1

Slide 1

Slide 2

Slide 3

Slide 4

Slide 5

Slide 6
Impediments in Asia

- Patchy knowledge base in region
- Poor coverage of many taxonomic groups, especially lower organisms such as lichens, fungi and micro-organisms
- Restricted access to collections held elsewhere.
- Restricted access to taxonomic literature, both old and recent.

What informatics can help

- Index biodiversity originated within the boundary
- Integration of data regionally and globally.
- Improve access to information which is only remotely available –Type images, specimen location, literature etc.

Global Data Integration

Are we users or providers?

Provider’s aspects
- Species checklist
- Data filling gaps
- New type/reference specimen
- Monographs

User’s aspects
- Conservation planning
- Decision making
- Access to type specimen
- Access to taxonomic literature
- Access to experts information

Tools and organisation for mutual benefit

- TaxoNote Java
- NHCJ specimen data management tool
- Proxy data server for late commers

Concept based name information system: Nomencurator database and TaxoNote

- Multiple taxonomic views
- Synonyms – with publication
- Taxonomic hierarchy
- [Isolation of the specimens and distribution of the named species]
Biological Collection Management in Sabah, Malaysia - How Do We Share Data?
1.3 Questions & Answers (Paper 1.1 & 1.2)
Chairperson: Dr. Menno Schilthuizen (Institute for Tropical Biology & Conservation, UMS)

Q: Mr. Moktar Yassin Ajam
With regard to networking, are we looking at Malaysia as a whole?

A: Dr. Yoshiaki Hashimoto
I would think local network is to be established first in Sabah, then connect to the other parts of Malaysia.

A: Dr. Junko Shimura
The best way is to start with small collection, as it is important to have a good local network especially with limited funds.

Q: Dr. Menno Schilthuizen
It seems that many are making the initiative of sharing information, what do you think is the pro & cons?

A: Dr. Junko Shimura
We are in the transition phase and everybody is having the same goal of sharing data. SML is a great technology of access to others’ data providing more opportunities for geographical analysis, and relationship between species. At the moment there are discussion of intellectual property right, who is paying and who is receiving the fund, so we are at that stage.

Q: Hj. Amat Ramsa
a. What is the level of your data base? At what level can it be extracted out?
b. We are also concerned with the security of our information.

A: Dr. Junko Shimura
a. We concentrate on species level data and we prefer to have geographical information where the species originated from and where they habitat and so forth. We also set a link to the information and sequence data.
b. There is a discussion whether data can be fully accessible or with restricted access, and restricted access is preferred. The control would be through MOU to be signed.
Data in this context is referred to as biodiversity inventory information of fauna and flora. It is also referred to bioinformatics, a scientific discipline which encompasses all computational aspects of biological information.

Sabah is known for its rich and pristine tropical rain forests with very high biodiversity. Thus, information on this subject is abundantly rich. Such information is procured from the field and is stored as reference collections, e.g. herbarium, insect museum and xylarium with proper cataloguing system or database, similar to how books are arranged and catalogued in the library. The reference collections with documented information are assets and heritage to Sabah. It is the most fundamental form of research without which nothing could be accurately accomplished (Chey, 1998; Chung & Chey, 2001). Setting-up and procurement of this information or data from the field involves a great deal of effort, time and money. In addition to this, maintenance and up-grading of the collection and its data is equally important in order for it to be recognised locally and internationally, and to be efficiently used by researchers and students.

Various organisations in Sabah have taken much effort in establishing their reference collection and database, such as Sabah Forestry Department (SFD), Sabah Parks, Sabah Museum and Agriculture Department. Universiti Malaysia Sabah has also embarked on their flora and fauna collection, known as 'BORNEENSIS'. The Forestry Department has the most extensive collection of plants, insects and wood specimens in Sabah, located at the Sepilok Forest Research Centre (FRC). The plant collection at the Sandakan Herbarium was established since 1916, with more than 240,000 specimens while the insect museum, established since 1960s, has more than 110,000 specimens. More than 5,000 wood specimens are housed in the Sepilok Xylarium. It takes time and effort to establish a collection and its database, thus such information is invaluable.

It is no doubt important to share data on flora and fauna in order to conserve biodiversity and ecosystems in this region, especially in Sabah. However, in view of the extensive and intensive effort, time and money invested by each Organisation in establishing their collection and database, the Forest Research Centre believes that it is only fair to share information when there are mutual benefits or in a 'win-win' situation. There should be a bilateral or multilateral exchange of information, and not a unilateral approach which only benefit certain parties. In cases where the participating party(s) are not able to provide data, then the party(s) should contribute in other means, e.g. funding.

The Sandakan Herbarium (SAN) for example, has already established a networking known as "South East Asian Botanical Collections Information Network" (SEABCIN) with several S.E. Asian herbaria and the National Herbarium of the Netherlands. All these herbaria contribute significantly in exchange of information multilaterally. There are also rules and regulation with different levels of access to the collection data. Thus, in order to establish other networking, one would have to take consideration of the terms and conditions of the existing collaborative networking system.
It should be emphasized that there should be a limit to data sharing to avoid abuse of information. General information can be obtained through networking. However, in-depth information should be dealt with the participating agencies on a project-to-project basis. The followings are some considerations to be noted in data sharing:

a. Full access should only be granted to 'published' data.

b. Collaborating institutions on specific research projects should be allowed to have access to data in hard copy only, limited to the objectives and scope of the project (inclusive of information on labels), and viewing data on website.

c. Data in digital form can be granted if the applicant agrees to non-disclosure condition and:
   i. If there is an internal research project or the entire project is funded by the Sabah State Government (no external funding), and the SFD is in favour of the project, with condition that the access is limited to the objectives and scope of the research project.
   ii. If there is equal exchange of data between the collaborating agencies (e.g. Sabah Park staff will be allowed to access to the SAN data if SAN staff can have the same level of access to their data)
   iii. If the cost of digitising the information is borne by the other agencies (e.g. a researcher can have the data when the cost of digitising is borne by the researcher).
   iv. If data has been digitised, the project will have to purchase the data (suggested RM3.00 / record for data entry and editing cost).

d. A system will have to be established to enable the owner of the data to keep track record of access and download, i.e. user must register and obtain a password before downloading.

e. Owner must be acknowledged, informed of any updated materials and given a copy of the final report.

In conclusion, FRC emphasis on data sharing is to have equal benefit sharing, and should not be viewed as a setback to the progress of biodiversity research in Sabah.

Acknowledgements

This presentation was compiled based on discussion and contributions from various FRC researchers: Dr Lee Ying Fah, Anuar Mohamad, Dr Chey Vun Khen, Lim Sheh Ping and Dr Arthur Y. C. Chung.

References


How do we share data?

Forest Research Centre,
Sabah Forestry Department

Introduction
- Data - biodiversity inventory information of fauna and flora: bioinformatics
- Sabah - highly diverse. Data in the field is abundantly rich
- Information from the field is stored in reference collections and databases
- Fundamental form of research

Introduction (continued)
- Involves effort, time and money
- Maintenance and upgrading is important
- Importance of collection and its data

Reference collections and databases in Sabah
- Sabah Forestry Department
- Sabah Parks
- Sabah Museum
- Sabah Agriculture Department
- Universiti Malaysia Sabah

Collections at the Forestry Department
- Botanical collection (Sandakan Herbarium) since 1916, with > 240,000 specimens
- Insect collection (Insect Museum) since 1960s, with > 110,000 specimens
- Wood collection (Xylarium), with > 5,000 wood specimens

Data sharing
- Important to share data for conservation of biodiversity
- In view of the invested time, effort and money, FRC believes that there should be:
  1. Mutual benefits (‘win-win’ situation)
  2. Bilateral (multilateral) exchange of information
  3. Funding or expertise from agency(s) not able to provide data
Existing networking system
- E.g. SEABCIN at Sandakan Herbarium
- Have to consider the existing terms and conditions, rules and regulation
- Different level of access

Considerations for data sharing
- Only general/limited information to avoid abuse of information
- In-depth information - project-to-project basis
- Full access on ‘published’ data only
- Collaborative agencies - access to data in hard copy only & viewing on website

Considerations for data sharing (continued)
- Data in digital form granted if applicant agrees to non-disclosure condition and if:
  1. The project is funded by state government
  2. Equal exchange of data with collaborating agencies
  3. Cost of digitising borne by other agencies
  4. (For digitised data), the project will have to purchase it (suggested RM3.00/record)

Considerations for data sharing (continued)
- Networking system to have password & to keep track of users
- Owner must be acknowledged, informed and given a copy of the final report

Conclusion
- FRC emphasis is on equal benefit sharing of data and should not be viewed as a setback to the progress of research activities in Sabah.

Acknowledgements
- This presentation has benefited much from discussion and contributions from Dr Lee Ying Fah, Anuar Mohamad, Dr Chey Vun Khen, Lim Sheh Ping and Dr Arthur Y. C. Chung.
Kinabalu Park museum housed our own natural history collection. The scientific specimen collection in Kinabalu Park area has started since year 1800. However all the specimen has been taken out of the state by respective researches to Unites States and Europe until the first establishment of Kinabalu National park in 1964.

The turning point of our scientific collection was in 1979 with the establishment of ecology section at Kinabalu Park as a plan to focus on research activities within the area. In 1980, we started with the specimen collection of plants, insects, birds and small mammals. The collection was in a small scale due mostly to limited space of storage room during that time.

In 1994, the ecology section was expanded in research and move into the Kinabalu Conservation Center with more space and equipment. The specimen collection was triggered by Kinabalu uniqueness and richness of Sabah biodiversity.

At the later stage, the collection side was expanded to cover all parts of park areas and other area throughout Sabah of Borneo.

The development of our natural history is simply based on three objectives. Firstly, the collection management is a collection tool used in decision making. Secondly, it provides material for nature indication as well as eco-tourism activity. Thirdly, it is a resource for continuous and long term academic exercise.

The Sabah Park natural history collection is housed at the Kinabalu Conservation Center built at Kinabalu Park Headquarter. The right wing of the building is the administration office of Sabah Park while the left wing is the Natural History Collection comprised of zoological museum etc. and we have a natural history gallery.

Over the past twenty years, we have collected a total of 86,566 specimens and to maintain such amount of specimens is time consuming, requiring large number of staff and costly. Currently, we have more than twenty people to look at the specimens. We ensure and maintain the accuracy in the storage room. We have a capacity of eighty units of compactors.

The entomological museum at first floor of Kinabalu Conservation Center has a capacity of 1,262 insect boxes. Currently we have a total of 47,856 specimens of 19 orders of insects.

The zoological museum is located next to the entomology room. The specimen collection is 11,782 specimens which comprise of 86% of the total number of collection.
In addition we also collect tissue samples for future analysis.

Currently, we have 13,794 specimens of 758 species dominated by amphibians which contributed 43% of the collection and followed by fresh water fishes and birds. All in all we have a total of 86,566 specimens.

The practice of data storage involves the usage of logbook. We use Microsoft excel to enter the data base and we print out the hard copy to save storage in the file.

Basically, data can be categorized into identification data, collection information data and ecological information data. So sharing of data is not a new idea, it has been proposed since the last millennium but any proposal to do so was rejected due to requirement to involved several different related agencies. The fact that sharing must adopt a win-win situation to all involved parties through technical assistance in terms of equipment expertise, identification of specimen by expert, as well as publication of data and most importantly in accordance with agency’s policy on their respective collection.

The consideration includes security system of the data base with the use of password and precaution on data piracy and the ability of linking data to the public. There would also be the control of data.

The unhappiness over the sharing of data originate from the fact that different agency contribute different amount of data and the issue of unfairness to party concern. To overcome this, we propose the shared data be limited to certain level with three levels of data control.

The level one would be data without password with data on name of specimen. The level two would be data with password limited to certain parties which are the participating agencies and this involve collection of information that require proper control. The level three would be for exclusive use and control of owner with ownership of data intact. The data include measurement and ecological information such as width, length and so on. I believe such mechanism is more secure.

In conclusion we agree to share data and for the public this would be the most effective way of utilizing the natural history collection through standard coordinated data management with the use of ICP among agencies and in the spirit of unity in diversity.