# BIODIVERSITY AND SOCIO-ECONOMIC ASSESSMENT

# ON

# MOEYUNGYI WETLAND WILDLIFE SANCTUARY

Biodiversity And Nature Conservation Association

(July 2014)

# BIODIVERSITY AND SOCIO-ECONOMIC SURVEY

## OF

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The survey is funded by Amatae

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# ACKNOWLEDGEMENTS

The importance of wetlands in Moeyungyi Wetland WS has been greatly emphasized. The objective of this survey is to promote that the full participation of all stakeholders is essential for reviving wetland goods and ecological services for the good of humans and the environment. The socio-economic survey was conducted to generate baseline data on community, its livelihood base, institutional and legal issues in order to create a foundation upon which evaluations can be made on the progress for future studies.

We thank the Director General of the Forest Department for permission to conduct the surveys in Moeyungyi Wetland WS which is under his jurisdiction. We are also grateful to those who participated in the surveys, both biological and social surveys.

We greatly appreciated the financial support provided to BANCA by the Amatae Programme which made it possible for this study to be materialized. We would also like to thank all respondents in the Moeyungyi Wetland area for sharing information and cooperation during the field visits.

Special thanks go to the Park Warden and staff of the Moeyungyi Wetland WS for their continuous support during the desk studies and also valuable suggestions for the field studies.

BANCA

# EXECUTIVE SUMMARY

Wetlands cover approximately 6% of the Earth's surface and provide to the human population with goods and services such as food storage, water quality sustenance, agriculture production, fisheries and recreation. However, around the world wetlands are being lost and degraded due to economic development resulting in increased pressure to drain and reclaim land for agriculture, settlement and other uses.

They may, therefore, range from permanent to seasonal lakes, seasonally waterlogged soils, and estuarine systems to marine systems, with particular emphasis on the importance as waterfowl habitats.

Five major wetland types are generally recognized:

- marine (coastal wetlands including coastal lagoons, rocky shores, and coral reefs);
- estuarine (including deltas, tidal marshes, and mangrove swamps);
- lacustrine (wetlands associated with lakes);
- riverine (wetlands along rivers and streams); and
- palustrine (meaning "marshy" – marshes, swamps and bogs).

In 1996 Wild Bird Society of Japan made discussions with the Forest Department of Myanmar for conservation of wetlands and threatened bird projects in Myanmar. The discussions were aimed at compiling the Red Data Book of Asian birds and the possibility of Myanmar ratifying the Ramsar Convention. Three wetland management training courses had been conducted at the Moeyungyi Wetland Wildlife Sanctuary in 1998, 2000 and 2001. A baseline study of the environment of Moeyungyi WS was also conducted. The outcome of these activities paved the way for the listing of Moeyungyi Wetland Wildlife Sanctuary as the first Ramsar Site in Myanmar.

Moeyungyi Wetland WS is located in the southern part of Bago Region; the western and southwestern parts belong to Bago Township and the southern and eastern parts to Waw Township. It lies between north latitudes 17° 30' and 17° 36' and between east longitudes 96° 33' and 96° 39'. The Moeyungyi WS facilitates transport of people and goods by boats from villages at the perimeter of the wetland. Natural wetlands have also been providing services as suitable "field laboratories" for research, education and environmental monitoring.

Currently the degradation and loss of wetlands is more rapid than that for other ecosystems. Wetland-dependent biodiversity in many parts of the world is in continuing and accelerating decline. The wetlands of Moeyungyi offer immense potential for development of nature-oriented tourism also.

Moeyungyi Wetland Wildlife Sanctuary is one of the 99 wetlands sites in Myanmar (Ministry Of Environment Japan, 2004) designated as a Wildlife Sanctuary in 1988 with the sole objective of protecting the seasonal migratory birds and resident bird species as well as for conserving the ecosystem of the wetland habitat. People have settled around the wetland in 17 villages many years ago. The warm wetland habitat attracts various kinds of birds, including the migratory birds from the Arctic Region for wintering, which provides a good indicator of site significance. Moeyingyi is under those flyways acting as a crucial sanctuary for both migratory and resident water birds.

Moeyungyi Wetland Wildlife Sanctuary comprises a floodplain and storage reservoir that is important for flood control. The site now functions as a source of fresh water for downstream areas where rice cultivation takes place. It floods in the wet season May-October and from October to March hosts over 20,000 migratory water birds. These include the globally threatened Baer's Pochard (*Aythya baeri)*, Sarus Crane (*Grus Antigone)* and Greater Spotted Eagle (*Aquila clanga)*, as well as >1% of the regional population of the Northern Pintail (*Anas acuta)*.

**Previous Surveys in Moeyungyi Wetland Wildlife Sanctuary**

A desk survey was made by a team of consultants in the fields of Avifauna, Mammals, Fish, Entomology, Flora, Herpeto fauna and Mammals in 2013 December. Desk studies were carried out at the following departments and institutions:

- Nature and Wildlife Conservation Department (NWCD),
- Moeyungyi Wetland WS
- Seinyatu Library at Yangon
- Zoo Department at Bago University
- Zoo Department at Yangon University
- Wildlife Conservation Society (WCS)
- Myanmar Nature and Bird Society (MBNS)

Based on the desk survey during 1998, a socio-economic study was performed by NWCD but reports were not produced. In 2001, a wetland survey was organized by Ministry of Environment (Japan) but social survey was not included in the program. It was also observed that no social surveys were conducted by Yangon University as well as Bago University.

**Currrent Surveys**

The current biological studies and socio-economic studies were conducted from 24th February to 2nd March 2014 by the following teams of scientists from BANCA and Bago University.

## A. SURVEY TEAMS

| Survey Field | Team Members |
|---|---|
| Avifauna | Lay Win and Saw Moses (BANCA) |
| Mammal | Swe Swe Aung and Thaw Zin (BANCA) |
| Herptofauna | Min Kyaw Thura and Min Thein Htet (BANCA) |
| Flora | Dr. Khin Swe Oo, Kyaw Zay Moe (Bago University) and Thet Tun (BANCA) |
| Fishery | Moe Moe Myint, Zaw Lin Htun and Tint Wai (BANCA) |
| Entomology | Naing Naing Win and Kyaw Naing Oo (BANCA) |
| Socio-economic | Dr. Min Aung Pan (Bago University), Ma Thinzar Phwe and Ma Swe Zin Myint |

The data collection was randomly conducted by four ways:

1) Capturing (such as pitfall trap);
2) Observing in the field (such as quadrats);
3) Observation of track and signs such as footprints, scats, feeding signs in their natural habitats, and
4) Interview survey.
5) Points transect.

## Results

### Avifauna

During the survey, a total of 133 bird species were recorded out of which 1 was found out to be Vulnerable (VU) and 4 Near Threatened (NT) species (a total population of 18,364 of bird). The team managed to cover a relatively large area. The large number of birds can be seen due to the wintering of migratory birds.

### Mammals

A total of 12 mammal species belonging to 9 genera, 6 families and 4 orders were captured and recorded. 1 species of Insectivores, 4 species of Bats, 1 species of Carnivores and 6 species of Rodents were recorded. There is no endemic or globally threatened species of mammals according to the IUCN Red list (2013).

### Herpetofauna

A total of 24 species of amphibians and reptiles were captured or observed (6 species of frogs, 1 turtle, 8 lizards and 9 snakes). According to the conservation status by IUCN Red List (2013), one turtle (*Morenia occellata)* was recorded as Vulnerable (VU), three species of frogs and five species of snakes were as Least Concern (LC). Moreover, the turtle is an endemic species of Myanmar

### Flora

A total of 74 plant species belonging to (33) families were identified. In this study, some specimens were found in missed local names when specimens were matched with available literatures. There is no globally threatened flora species according to the IUCN Red list (2013).

### Fish

A total of 37 fish species were observed during the survey period. Altogether 37 species, 31 genera under 23 families were recorded. There are five species recorded in this survey which

assumed by the conservation status of IUCN Red List (2013) as Near Threatened (NT). The rest 28 species are recorded as Least Concern (LC).

## Entomology

A total of 41 different butterfly species belonging to 8 families and 89 genera under the order Lepidoptera were recorded in the study area. According to the IUCN Red data list 2013, 4 species of butterfly namely; *Eurema andersoni*, *Eurema brigitta*, *Euploea core* and *Junonia almanac* were listed as Least Concern (LC). Nine families consisting of 14 species of beetle were recorded in the study are during the survey period.

## Socio-economic Surveys

Questionnaire surveys were conducted by socio-economic team from 24-2-2014 to 2-3-2014. The 8 villages around the wetland have 1,117 households of which 160 were selected as sample households to which the questionnaires were distributed according to the sampling numbers. It represents more than 10 percent of the total households. The responses to 120 questionnaires were analyzed together with information from open talks and discussion with the local inhabitants. Therefore, the analysis was solely based on the primary data for the assessment by using simple statistical methods as well as certain UNDP's indicators and MHRD's indicators.

## Socio-economic data of Moeyungyi Wetland Wildlife Sanctuary

| Particulars | Waw Township | | | | Bago Township | | | |
|---|---|---|---|---|---|---|---|---|
| | Tarkhwa | Hpalauk | Kapin | Punchaung | Pauktaw (or) Hlayseik | Hpalauktan | Thoneeinsu | Tarsone |
| Population | 55 (25M, 30F) | 264 (107M, 157F) | 1741 (859M, 882F) | 1080 (400M, 680F) | 95 (40M, 55F) | 260 (120M, 140F) | 1141 (551M, 590F) | 1285 (610M, 675F) |
| Households<br>-brick buildings<br>-wooden buildings<br>-wood and bamboo buildings | 18 | 47 | 287 | 200<br>4<br>75<br>120 | 37<br>0<br>2<br>35 | 62<br>7<br>30<br>25 | 228<br>20<br>30<br>178 | 238<br>30<br>100<br>95 |
| Education | - | Primary | Primary | Primary | - | - | Primary | Primary |
| Health | Pyinbongyi dispensary or traditional medicine practitioner in Kapin Village.<br>For emergency or serious cases, Waw Township Hospital. | | | | | | | |
| Settlement Plan | On the shore of the wetland and the shapes of villages are oriented by the alignment of the shore. | | | | | | | |

| Particulars | Waw Township | | | | Bago Township | | | |
|---|---|---|---|---|---|---|---|---|
| | **Tarkhwa** | **Hpalauk** | **Kapin** | **Punchaung** | **Pauktaw (or) Hlayseik** | **Hpalauktan** | **Thoneeinsu** | **Tarsone** |
| **Recreation**<br>**-TV**<br>**-DVD Player**<br>**-Satellite Dish** | 2<br>2<br>- | 10<br>-<br>- | 200<br>-<br>2 | -<br>-<br>3 (1 Skynet) | 3<br>-<br>- | 50<br>-<br>5 | 50<br>-<br>6 | -<br>-<br>- |
| **Agriculture (% of Households)** | 11 | 32 | 61 | 10 | 5 | 16 | 13 | 21 |
| **Fishery (% of Households)** | 78 | 60 | 39 | 85 | 81 | 76 | 22 | 14 |
| | 18% of total fishery households practices electric shock fishing. | | | | | | | |
| **Income and Expense (Sample size – 120 HH)** | Daily Income<br>26% - <3000 MMK<br>58% - >3001 - <6000 MMK<br>16% - >6001 MMK | | | | Daily Expense<br>18% - <2000 MMK<br>64% - >2000 - <4000 MMK<br>18% - >4000 MMK | | | |
| **Energy (Sample size – 120 HH)** | Electricity – 8%<br>Charcoal – 10%<br>Wood – 76%<br>Others – 6% | | | | | | | |
| **Water Use (Sample size – 120 HH)** | Tube well – 35%<br>Lake's water – 13%<br>Wetland water – 52% | | | | | | | |
| **Small Scale Industry** | - | - | 2 rice mills, ngapi industry | 1 rice mill, ngapi industry | Dried pain industry, | Cheroot industry | Cheroot industry, lotus textile industry | - |
| **Sanitation Awareness (Sample size – 120HH)** | Fly-proof toilet – 28% | | | | | | | |

## Issues and Threats

Major issues and threats observed during the field surveys of Moeyungyi Wetland WS indicated that the following threats are currently exerting adverse impacts towards the objectives of managing the Moeyungyi Wetland WS.

- Bird hunting with nets
- Electric shock fishing
- Invasive species
- Insect catching using mistnets
- Trapping small mammals for food
- Trading of Turtles and Snakes to China
- Land encroachment (paddy field)
- Use of fertilizers and pesticides
- Indiscriminate dumping of solid and liquid waste
- Raising of Livestock
- Flood during the rainy season
- Infrastructure development
- Water Use
- Fuel wood collection
- Popultion growth

## Ranking threats

To rank threats, WCS has developed criteria against which each threat is assessed. Within the Living Landscapes Program, it is strongly advocated that criteria assess only the level of threat and not the feasibility of intervention. This ensures that focus is made on the factors that most likely jeopardize the conservation of wildlife and wild places rather than that are easiest to address. These factors are severity, urgency, recovery time once the threat is abated, proportion of the area affected, and the probability that the threat will occur (WCS, 2002).

Once the criteria for assessing the severity of threats and/or feasibility of addressing them, the next step is to rank them. Using the Living Landscapes Program's criteria and ranking system, the total score for each threat using the following equation:

**[Total= (Urgency+Recovery) x Severity x Proportion of Area affected x Probability]**

and rank the threats according to their scores, and identify the most important threats to conservation at the site.

## Assessment of Threats

| No. | Threats | Severity | Urgency | Area | Recovery | Probability | Total | Rank |
|---|---|---|---|---|---|---|---|---|
| | | (0-3) | (0-3) | (0-4) | (0-3) | (0-1) | | |
| 1. | Bird Hinting/Trapping with nets | 2 | 3 | 4 | 2 | 1 | 40 | 2 |
| 2. | Electrc shock fishing | 3 | 3 | 4 | 2 | 1 | 60 | 1 |
| 3. | Invasive species | 1 | 2 | 4 | 2 | 1 | 16 | 6 |
| 4. | Insect cacthing using mistnets | 2 | 2 | 2 | 1 | 1 | 12 | 7 |
| 5. | Trapping small mammals for food | 1 | 2 | 2 | 1 | 1 | 6 | 10 |
| 6. | Trading of Turtles and snakes to China | 2 | 3 | 3 | 2 | 1 | 30 | 3 |
| 7. | Land encroachement (paddy field) | 2 | 3 | 3 | 2 | 1 | 30 | 3 |
| 8. | Use of fertilizers and pesticides | 2 | 3 | 2 | 2 | 1 | 20 | 5 |
| 9. | Indiscriminate dumping of solid and liquid waste | 2 | 2 | 2 | 1 | 1 | 12 | 7 |
| 10. | Raising of Livestiock | 2 | 3 | 2 | 1 | 1 | 16 | 6 |
| 11. | Flooding during the rainy season | 1 | 2 | 4 | 1 | 0.75 | 9 | 8 |
| 12. | Infrastrucure development (Resort) | 1 | 1 | 2 | 1 | 1 | 4 | 11 |
| 13. | Water Use | 2 | 1 | 4 | 2 | 1 | 24 | 4 |
| 14. | Fuel wood collection | 1 | 2 | 2 | 2 | 1 | 8 | 9 |
| 15. | Population growth | 1 | 3 | 4 | 2 | 1 | 20 | 5 |

***Total = (Urgency + Recovery) x Severity x Area x Probability) Source: WCS (2007)***

## Priority Ranking of Assessment of Direct Threats

| Sr. | Rank Scores | Priority Ranking | Remarks |
|---|---|---|---|
| 1. | 1-3 | Very High | |
| 2. | 4-6 | High | |
| 3. | 7-9 | Moderate | |
| 4. | >9 | Low | |

**Ranking Results**

| Very High | High | Moderate | Low |
|---|---|---|---|
| Bird Hinting/Trapping with nets | Invasive species | Insect catching using mistnets | Trapping small mammals for food |
| Electric shock fishing | Use of fertilizers and pesticides | Indiscriminate dumping of solid and liquid waste | Infrastructures development (Resort) |
| Trading of Turtles and snakes to China | Raising of Livestock | Flooding during the rainy season | |
| Land encroachment (paddy field) | Water use | Fuel wood collection | |
| | Population growth | | |

## B. RECOMMENDATIONS FOR FUTURE CONSERVATION MEASURES

### Electric Shock Fishing [Priority Ranking: Very High]

**Recommendations**

- Enforce the law for protection around Moyungyi wetland area to stop illegal activities including electric-shock fishing, use of destructive fishing gears, and overexploitation on the extraction of fish resources.
- *Tilapia mossambica* (Tilapia) should be treated as controlled species with no more input to wetland.
- Environmental Awareness program should be promoted for grassroots' level in the region.

### Bird Hinting/Trapping with Nets [Priority Ranking: Very High]

**Recommendations**

- Bird hunting should not be allowed in the Moeyungyi Wetland Wildlife Sanctuary
- Bird survey should be done annually in winter season (open season) to collect up-to-date data in order to understand the changing habitat for resident as well as migratory birds.
- Publish data on annual counts and regular surveys should be released to all interested persons.
- For capacity building trainings should be organized for NWCD staff as well as all stakeholders pertaining to wildlife conservation matters.
- Workshops should be conducted for local communities concerning environmental education programs.

**Trading of Turtles and Snakes [Ranking: Very High]**

- The herpetofauna species depend on season as some species are active only during the rainy season. Hence, the survey work should be carried out throughout the whole year.
- Enough time should be allotted to carry out for the herpetofauna survey.

**Land encroachment (paddy field) [Priority: Very High]**

quite a serious threat.

**Recommendations**

- As 30 hh out of 120 hh included in the study are engaged in farm work representing 25% of the household under study no further cultivation encroachment should be allowed in the Moeyungyi Wetland WS.
- Chemical fertilizers should be substituted with organic fertilizer if situations are favorable.
- Educate local communities not to use pesticides and its negative impacts on the environment.
- As the water spread of the Moeyungyi Wetland WS is getting smaller, agricultural land should not be extended further horizontally: instead, the farmers should concentrate vertically on the increase of the yield per unit area.

**Water Use [Priority: High]**

**Recommendations**

- Encourage to use fly-proof latrines for all villages in the environs of Moeyungyi Wetland WS so as not to pollute the water sources
- Contact with concerned authorities for regulating the water volume particularly during the summer where the water level is low.
- If Moeyungyi Wetland WS is to be used as portable water, it should be either boiled or use of water purifiers for safe portable water.
- To assess the current status of water quality in Moeyungyi Wetland WS for finding out whether it is within the threshold values.

**Raising of Livestock [Priority: High]**

**Recommendations**

- A research study should be organized to find out the grazing regime of the animals that has least impact on the vegetation of Moeyungyi Wetland WS.
- Proper waste disposal techniques should be adopted
- Local commuties should be educated on proper waste disposal techniques by the staff of Moeyungyi Wetland WS.

**Population Growth**

**Priority: High**

**Recommendations**

- Wait for the population census data to have the actual population data for the villages in the environs of Moeyungyi Wetland WS.
- Socio-economic data should be collected at 5 year interval to find out the changes in socio-economic status of the villages

**Indiscriminate dumping of solid and liquid waste**

**Priority: Moderate**

**Recommendations**

- Prior should be taken to organize more fly-proof latrines for villages in the vicinity of Moeyungyi Wetland WS.
- Chemical fertilizer application should be phased out step by step to use organic fertilizer instead.
- Also, chemical pesticides should be replaced gradually by using organic type natural pesticides.
- Waste management system should be developed at Moeyungyi Wetland Resort Hotel.

**Flooding during rainy season**

**Priority: Moderate**

**Recommendations**

- Removal of vegation cover should be controlled around Moeyungyi Wetland WS.
- Develop first growing fire wood plantations for the community living at the vicinity of Moeyungyi Wetland WS.
- Firewood-saving stoves should be promoted for the villages in the vicinity of Moeyungyi Wetland WS.

**Fuel wood Collection**

**Priority: Moderate**

**Recommendations**

1. As fuel wood will still be the energy source for the villages, it is necessary to establish fast growing tree plantations with a very short rotation.

2. Educate local communities on the use of energy efficient cook-stoves for saving fire wood for cooking.

**Trapping Small Mammals**

**Priority: Low**

**Recommedations**

- Suitable trees need to be supported for some small mammals as food source.
- It is necessary to enforce the wildlife law in and around the Moeyungyi WS so as to prevent from illegal activities being done.
- Also, local people should be educated for the effective protection of the WS through environmental education and extension programs.

**Infrastructure Development**

**Priority: Low**

**Recommendations:**

- Environmental Management Plan should be developed for Moeyungyi Resort Hotel
- Corporate Social Responsibiity program shall be adopted to establish closer links with the tourism staff, staff of NWCD and the community
- Create income generation for local communities by training them to become bird-watching guides with the full participation of travellers, locals and entrepreneurs in a triple-win situation
- Promote capacity building of NWCD staff awareness and education programs on the coexistence of tourism and conservation.

**Institutional Arrangement**

**Recommendations:**

- At least budget allotment for Moeyungyi Wetland WS should be provided to cater the appointment of daily staff level of 2007.
- Training should be arranged for Park Warden and Staff for management level and operational trainings respectively by organization like WCS occasionally when they conduct surveys at Moeyungyi Wetland WS.
- Particularly for effective patrolling to monitor and control threats and wildlife which is the most important operation for Moeyungyi Wetland WS, the SMART (Spatial Monitoring and Reporting Tool) patrolling system should be introduced with the assistance of WCS.

  SMART have 2 levels of Training, basic level training for junior staff and advanced level training for senior staff.
- Funding for community relations should be organized from CSR program from Moeyungyi Wetland Resort Hotel.

- Sufficient funds should be acquired for environmental education and outreach activities through CSR programs and interested donors.
- Instead of working on annual work plan, a proper 'Moeyungyi Wetland WS Management Plan" should be developed at least on a 4 year-plan which should be implemented, updated on a regular basis and evaluated at the end of the plan period. Prior action should be given on research, surveys, and extension programs for the local communities and effective patrolling activities.

## C. DISCUSSION

| Source | Avifauna | Mammal | Herptofauna (Amphibians + Reptiles) | | Flora | Fishery | Entomology (Butterfly + Insects) | |
|---|---|---|---|---|---|---|---|---|
| WCS | 128 (2007)<br>139 (2008)<br>119 (2009)<br>133 (2011) | | | | | | | |
| Yangon University | 87 (2007) | | | | | 33 (2004 – 2005) | | |
| Bago University | 52 (2008 – 2009) | 9 (2008 – 2009) | 12 (2008) | 20 (2008) | | 36 (2008 – 2009) | 37 (2009) | 16 (2008) |
| NWCD, Moeyungyi | 126 (2008 – 2013) | | 8 (2003) | 20 (2003) | | 36 (2003) | 33 (2003) | |
| BANCA (2014) | 133 | 12 | 24 | | 74 | 37 | 41 | 14 |

It can be observed from the above table that previous surveys are concentrated on avifauna surveys as Moeyungyi Wetland WS is quite famous for the presence of migratory waterbirds and habitats which also constitute the main attraction for tourists.

Based on the above mentioned surveys Moeyungyi Wetland WS as a RAMSAR site is still significant for conservation of birds and aquatic life. The socioecomic survey indicated that about 77% of the populations are dependent of Moeyungyi Wetland WS for their livelihood. By occupation 49% engaged in fishery while 25% are engaged in agriculture with the rest for services and others. With the increase in population in the near future more and more people will depend on the wetland for their livelihood.

It is also realized from the study that water pollution is also a serious threat in the Moeyungyi wetland. Likewise, illegal means of fishing like electric-shock fishing will lead to the depletion of fish resources in the very near future.

The socio-economic studies carried out in this study indicated that the livelihood of poor communities living near the wetlands should be given due consideration so that their dependence on wetland resource can be made sustainable. This can be accomplished through education programs for the effective protection of the WS through environmental education and extension programs.

As human activities are responsible for such kind of negative impacts mentioned already, NWCD should coordinate with relevant stakeholders such as local administrators, academia, NGOs, local communities and donors to effectively manage the one and only listed 'Ramsar site' of Myanmar

# BIODIVERSITY AND SOCIO-ECONOMIC SURVEY OF MOEYUNGYI WETLAND WILDLIFE SANCTUARY

## 1. THE WETLAND

Wetlands cover approximately 6% of the Earth's surface and provide to the human population with goods and services such as food storage, water quality sustenance, agriculture production, fisheries and recreation (Acreman et.al., 1996). However, around the world wetlands are being lost and degraded due to economic development resulting in increased pressure to drain and reclaim land for agriculture, settlement and other uses.

### 1.1 Definition of Wetlands

The Ramsar definition (Ramsar, 1971) on wetlands is the most widely used and defines as areas of marsh, fen, peat land or water; whether natural or artificial, permanent or temporary with water that is static or flowing, fresh, brackish or salty including areas of marine water, the depth of which at low tides does not exceed six meters.

They may, therefore, range from permanent or seasonal lakes, seasonally waterlogged soils, and estuarine systems to marine systems. This definition basically covers "natural", "artificial" and "marine" wetlands as long as the depth does not exceed 6 m at low tide. Whereas the Ramsar (1971) emphasizes on wetlands in regards to their importance as waterfowl habitats,

### 1.2 Convention on Wetlands

The official name of the treaty, *The Convention on Wetlands of International Importance especially as Waterfowl Habitat*, reflects the original emphasis upon the conservation and wise use of wetlands, primarily as habitat for water birds. Over the years, however, the Convention has broadened its scope of implementation to cover all aspects of wetland conservation and wise use, recognizing wetlands as ecosystems that are vital for biodiversity conservation and for the well-being of human communities, thus fulfilling the full scope of the Convention text.

The Convention entered into force in 1975 and now (as of January 2013) has 163 Contracting Parties, or Member States, in all parts of the world. The List of Wetlands of International Importance (the "Ramsar List") presently designated more than 2,060 wetlands for special protection as "Ramsar Sites", covering 197 million hectares (1.97 million square kilometres).

Five major wetland types are generally recognized:

- marine (coastal wetlands including coastal lagoons, rocky shores, and coral reefs);
- estuarine (including deltas, tidal marshes, and mangrove swamps);
- lacustrine (wetlands associated with lakes);
- riverine (wetlands along rivers and streams); and
- palustrine (meaning "marshy" – marshes, swamps and bogs).

In addition, there are human-made wetlands such as fish and shrimp ponds, farm ponds, irrigated agricultural land, salt pans, reservoirs, gravel pits, sewage farms and canals.

### 1.3 Wetland Services, Functions and Values

The wetland facilitates transport of people and goods by boats for local inhabitants residing at the perimeter of the wetland. Natural wetlands have also been providing services as suitable "field laboratories" for research, education and environmental monitoring.

The benefits of wetland concerning climate change mitigation still remain uncertain. On the one hand, wetland acts as a carbon sink. However, on the other, wetland micro-organisms emit other greenhouse gases, especially methane.

Wetland functions are those activities or actions, which occur naturally in wetlands as a result of the interactions between ecosystem structure and process. Those functions include: floodwater control, nutrient flow, sediment and contaminant retention; food web support, shoreline stabilization and erosion controls; storm protection and stabilization of local climatic conditions, particularly rainfall and ambient temperature.

Another significant benefit from wetlands is the improvement of freshwater quality, in particular retention, removal and transformation of nutrients. Furthermore they can capture heavy metals and complex organic pollutants. The conservation of a habitat for target species was the main aim of the creation of wetlands. The habitat attracts a wide range of species and has high biodiversity values.

Currently the degradation and loss of wetlands is more rapid than that for other ecosystems. Similarly, the status of both freshwater and, to a lesser extent, coastal species is deteriorating faster than that of species in other ecosystems. Wetland-dependent biodiversity in many parts of the world is in continuing and accelerating decline. The wetlands offer immense potential for development of nature-oriented tourism also.

## 2. MOEYUNGYI WETLAND WILDLIFE SANCTUARY

In 1996 Wild Bird Society of Japan made discussions with the Forest Department of Myanmar for conservation of wetlands and threatened bird projects in Myanmar. The discussions were aimed at compiling the Red Data Book of Asian birds and the possibility of Myanmar ratifying the Ramsar Convention. Three wetland management training courses had been conducted at the Moeyungyi Wetland Wildlife Sanctuary in 1998, 2000 and 2001. A baseline study of the environment of Moeyungyi WS was also conducted. The outcome of these activities paved the way for the listing of Moeyungyi Wetland Wildlife Sanctuary as the first Ramsar Site in Myanmar.

Moeyungyi Wetland WS has been identified as one of the 19 sites qualified for Global Conservation Significance according to various criteria (Ministry Of Environment Japan, 2004): See table 1 and 2.

.

**Table 1 Criteria for Global Conservation Initiative of of Moeyungyi Wetland**

| No. | Site | Fulfillment of Criteria for Global Conservation Initiative | Remarks |
|---|---|---|---|
| 1. | Moeyungyi Lake | • Ramsar Site | High Tourism Value |
| | | • Important Bird Area | |
| | | • Anatidae Network Site | |

**Table 2 Moeyungyi Wetland- Globally and Nationally Significant Wetland**

| Sr. | Site | Justification | | | Conservation Value |
|---|---|---|---|---|---|
| | | 1% Criterion (Water Birds) | Species | Other Values | |
| 1. | Moeyungyi Lake<br>Max Spp:34<br>Max No. 27,524 | | VU: Spoon Billed Pelikan, Sarus Crane, Baers Pochard, Greater Spotted Eagle<br>Others: Eurasian Spoonbill (2) | | Endemic Bird Area<br>EBA 132<br>National IBA (Criteria A1 &A4)<br>Ramsar Site<br>(Criteria 1,2,3,4,5,6,7,8)<br>Anatidae Network<br>(Criteria 1 and 3) |

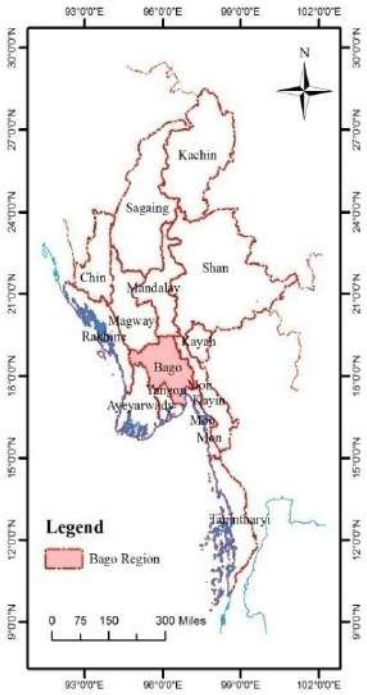
**Source: MOEJ (2004) See Appendix 1 for details**

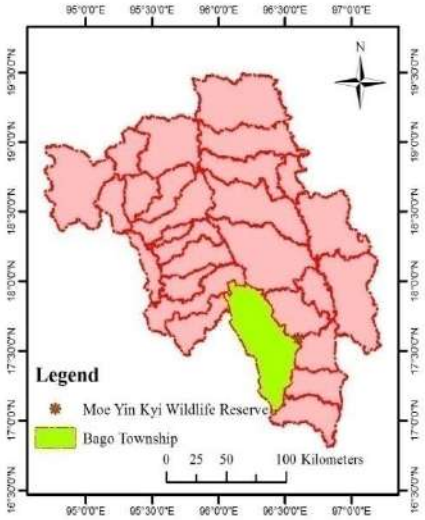
Moeyungyi Wetland Wildlife Sanctuary is one of the 99 wetlands sites in Myanmar (Ministry Of Environment Japan, 2004) designated as a Wildlife Sanctuary in 1988 with the sole objective of protecting the seasonal migratory birds and resident bird species as well as for conserving the ecosystem of the wetland habitat. People have been settled around the wetland in 17 villages many years ago. There are diverse terrestrial and aquatic animals, birds, insects and natural vegetation in and around the Moeyungyi Wetland WS. The warm wetland habitat attracts various kinds of birds, including the migratory birds from the Arctic Region for wintering, which provides a good indicator of site significance. Moeyingyi is under those flyways and it becomes a crucial sanctuary for both migratory and resident water birds.

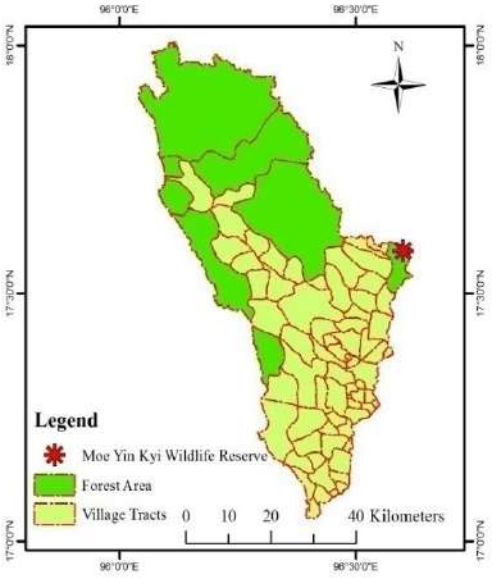
Moeyungyi Wetland Wildlife Sanctuary comprises a floodplain and storage reservoir that is important for flood control. Originally it was constructed in 1904 in the form of a rectangular man-made water storage reservoir by bunding, to provide water to the Bago-Sittaung canal (linking the Bago and Sittaung rivers) for transport of timber by boat. The site now functions as a source of fresh water for downstream areas where rice cultivation takes place. It floods in the wet season May-October and from October to March hosts over 20,000 migratory waterbirds. These include the globally threatened Baer's Pochard *Aythya baeri*, Sarus Crane *Grus antigone* and Greater Spotted Eagle *Aquila clanga*, as well as >1% of the regional population of the Northern Pintail *Anas acuta*. The site is also important for supporting the vulnerable Myanmar Eyed Turtle *Morenia ocellata*. The local communities use the site for fishing, grazing, duck-rearing and some paddy-growing; and there is a small tourist facility to accommodate birdwatchers. Moeyungyi Ramsar site No. is 1431 (MOEJ, 2004).

## 2.1 Location and Size

Moeyungyi Wetland WS is located in the southern part of Bago Region; the western and southwestern parts belong to Bago Township and the southern and eastern parts to Waw Township. It lies between north latitudes 17° 30' and 17° 36' and between east longitudes 96° 33' and 96° 39'. The northern boundary demarcates between the wetland and Daik-Oo Township. It lies immediately the east of Yangon-Mandalay Highway between mile-post 63 and 70. The wetland is 16.7 feet deep when the water level rises to the brim. The frame or the width of the embankment is 8 feet. The wetland covers an area of 40 square miles or 256,000 acres.



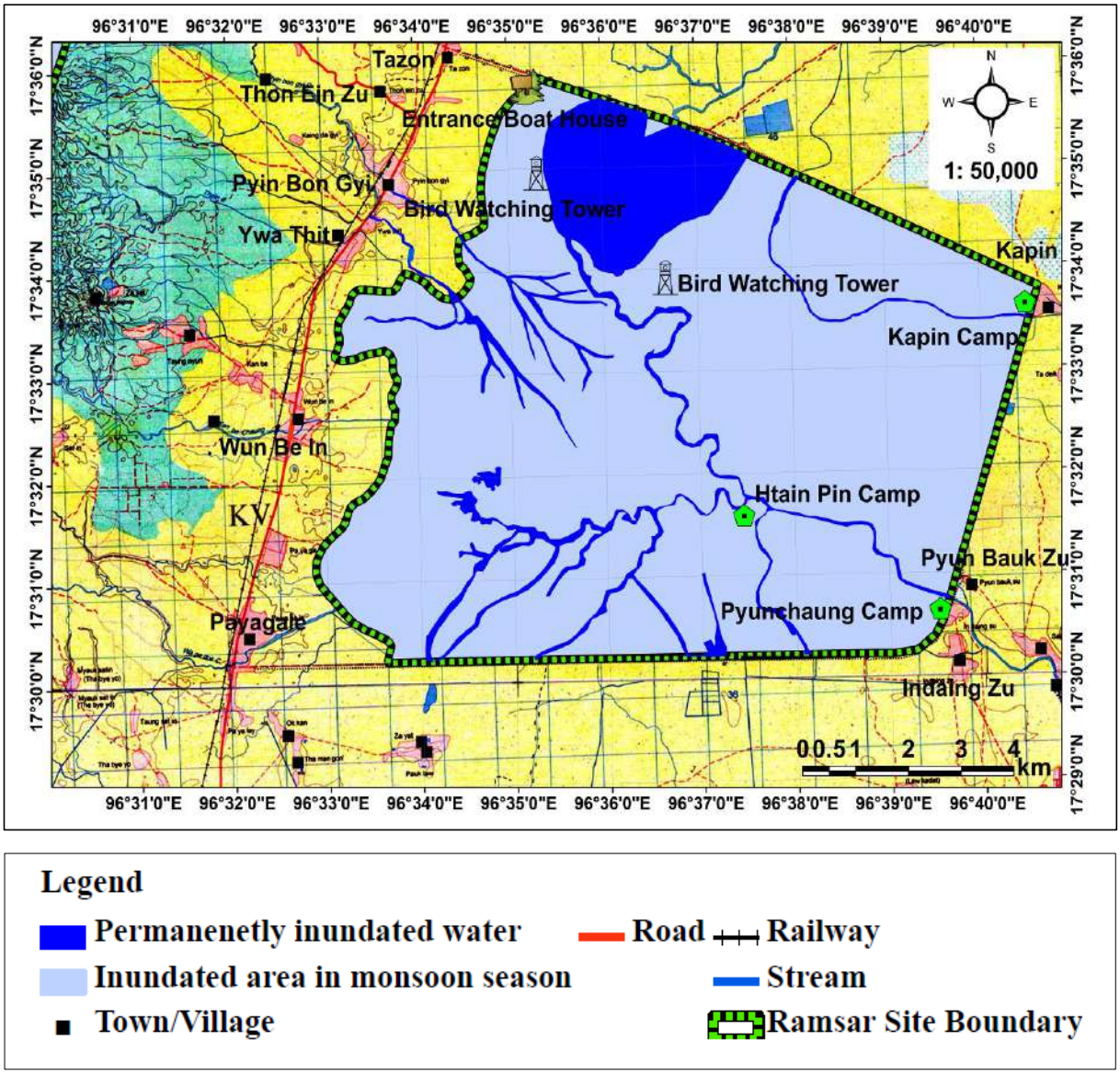



**Figure 1 Location Map of Bago Region and Moeyungyi Wetland Wildlife Sanctuary**

## 2.2 Topographic Feature and Relief

Generally Moeyungyi Wetland WS lies in a low, flat plain, being part of lower Sittaung valley. However, the land slopes slightly towards the west to the foothill of the Bago Yoma. It is the southern continuation of Daik-U-Pyuntansar plain characterized by deep water fields. The creeks which drain into the wetland are Sinsu-Phayarlay, U Kaung Ywathit, Wunbae wetland, Yetarshay and Pyinbongyi which take their sources over the mountain spurs of Bago Yoma.

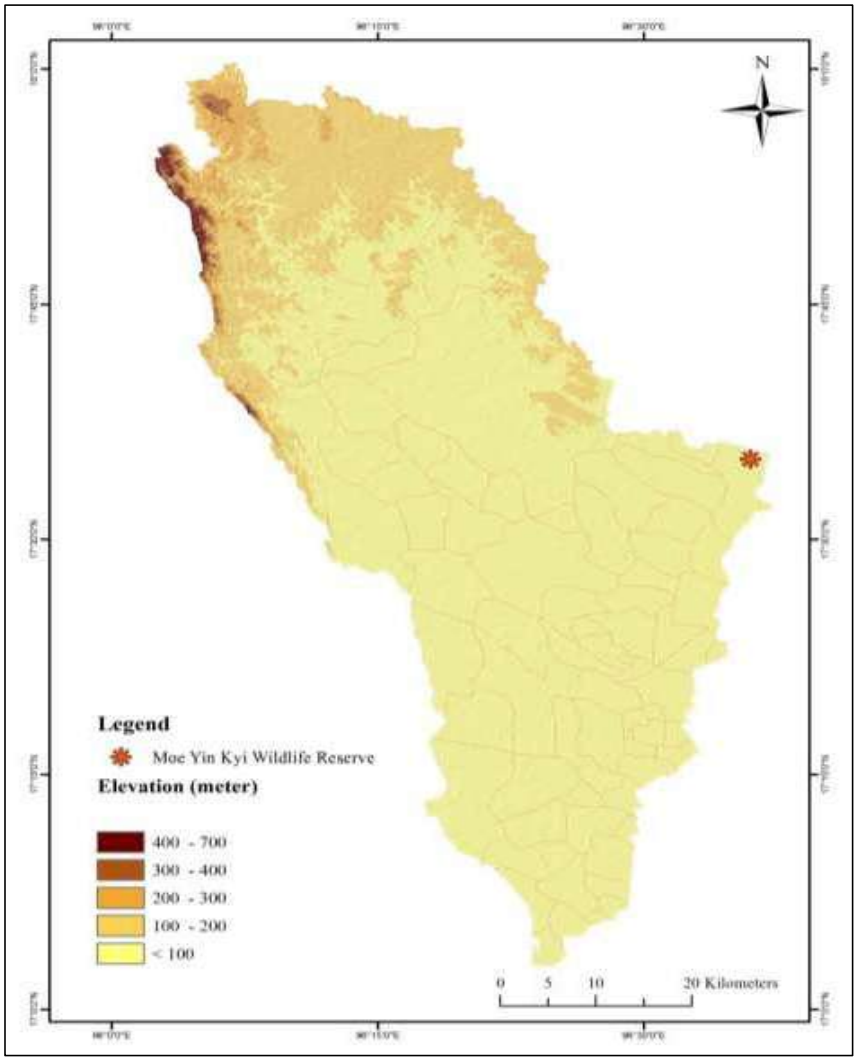



**Figure 2 Topography around Moeyungyi Wetland WS**

## 2.4 Climate

Moeyungyi Wetland WS falls within the tropics and temperatures fairly high throughout the years with a mean annual temperature of 26.95°C. The mean monthly temperature is highest in April with 30.5°C and lowest in January with 23.72°C. The mean monthly maximum temperature is highest in April with 38°C and the mean monthly minimum temperature is lowest in August with 29.4°C. With an annual rainfall of 3543.05 mm, the study area experiences the Tropical Monsoon climate, characterized by alternate wet and dry season. The summer monsoon rain refills the water of the wetland and provides flooded fields for successful growing of paddy crops that thrive under the rainy condition. Plants of different species grow rapidly in the rainy season. In the dry season, the water of wetland serves as the main source of water. After the retreat of southeast summer monsoon wind, the cool, dry northeast wind dominates the area. In winter months, the wetland itself and the areas around the wetland are wormer than the surrounding areas as large water body cools more slowly than the land areas. Moeyungyi Wetland WS serves as a significant link in flying network route of Asian Winter Migratory Birds during the period from December to February. When the water level of the wetland recedes in the dry season, the local inhabitants depend more on catching fish from the wetland.

Table (1.3.1) The temperature and rainfall conditions of the Bago Township (1995-2011)

| Month | J | F | M | A | M | J | J | A | S | O | N | D | T/Av |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rainfall | 0.51 | 7.11 | 7.62 | 38.86 | 319.53 | 331.7 | 771.1 | 756.67 | 497.8 | 449.6 | 52.58 | 9.4 | 3543 |
| Max Temp | 31.5 | 33.7 | 36.4 | 37.5 | 34.8 | 30.5 | 29.9 | 29.4 | 30.8 | 32.1 | 32.1 | 30.7 | 22.45 |
| Min Temp | 16 | 16.9 | 21.5 | 23.5 | 24.3 | 23.5 | 23.6 | 23.5 | 23.7 | 23.1 | 20.9 | 16.7 | 21.35 |
| Mean Temp | 23.7 | 25.3 | 28.4 | 30.5 | 29.5 | 27 | 26.4 | 26.7 | 27.1 | 27.6 | 27.5 | 23.7 | 26.95 |

Source: Department of Meteorology and Hydrology from Bago Township (2014)

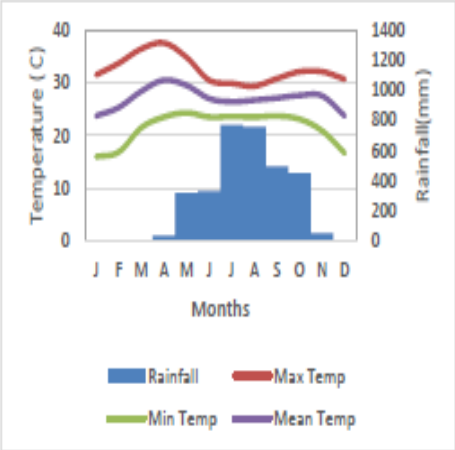



**Figure 3The Climatograph conditions of the Bago Region**

## 2.5 The natural vegetation

The natural vegetation of the study area is more associated with the water body of the wetland, in addition to its low relief and periodical changing of monsoon climate. Therefore, hydrophytes of different species in and near the wetland, essentially includes plants of Arum family (Pain), reeds, water-hyacinth, water-lily and raw grasses. A certain kind of grasses bear fruits richly in the winter and this is one of the reasons that the wetland can attract more birds in winter. The sacred lotus plants *Nelumbium speciosum* or Padonmar lily grow in thick groups. Some local inhabitants gather the stalks of the lilies for producing small strands useful for making valuable textile. Plants of Arum are also cut for sale by the locals. The dry Kaing (reed) plants are used as fuel. Reeds and other hydrophytes serve as favorable habitat for the reproduction processes of the aquatic animals. The natural vegetation of the wetland, to some extent, supports the livelihood of some local inhabitants.

## 2.6 Soils

The original dominant soils are that derived from alluvium and thus meadow gley soils and meadow alluvial soils cover the floor of Wetland upon which a substantial amount of sediments is deposited by mountain torrents, causing serious silting. This leads to lowering the depth of the wetland, though it enriches the soil fertility.

# 3. PREVIOUS SURVEYS IN MOEYUNGYI WETLAND WILDLIFE SANCTUARY

## 3.1 Biodiversity Surveys

A desk survey was made by a team of consultants in the fields of Avifauna, Mammals, Fish, Entomology, Flora, Herpeto fauna and Mammals in 2013 December. Desk studies were carried out at the following departments and institutions:

- Nature and Wildlife Conservation Department (NWCD),
- Moeyungyi Wetland WS
- Seinyatu Library at Yangon
- Zoo Department at Bago University
- Zoo Department at Yangon University
- Wildlife Conservation Society (WCS)
- Myanmar Nature and Bird Society (MBNS)

The following table represents the biodiversity survey data by organizations and respective periods. Detailed data from previous surveys are provided in attached Annex.

(number/period)

| Source | Avifauna | Mammal | Herptofauna (Amphibians + Reptiles) | | Flora | Fishery | Entomology (Butterfly + Insects) | |
|---|---|---|---|---|---|---|---|---|
| WCS | 128 (2007)<br>139 (2008)<br>119 (2009)<br>133 (2011) | | | | Nil | | | |
| Yangon University | 87 (2007) | | | | Nil | 33 (2004 – 2005) | | |
| Bago University | 52 (2008 – 2009) | 9 (2008 – 2009) | 12 (2008) | 20 (2008) | Nil | 36 (2008 – 2009) | 37 (2009) | 16 (2008) |
| NWCD, Moeyungyi | 126 (2008 – 2013) | | 8 (2003) | 20 (2003) | Nil | 36 (2003) | 33 (2003) | |

## 3.2 Socio-economic Studies in Moeyungyi WS

There are about 17 villages in the vicinity of Moeyungyi Wetland WS and the livelihood of villagers relies wholly or partly on the wetlands. The villagers earned their living by cultivating summer paddy, fishing, raising cows, buffaloes and ducks. Though Moeyungyi WS is protected by Wildlife Protection Law of 1994, due to population pressure, poverty and lack of knowledge on environmental conservation, the wetland resources has been overused and as a result there are serious environmental impacts currently being faced with.

Based on the desk survey during 1998, a socio-economic study was performed by NWCD but reports were not produced. In 2001, a wetland survey was organized by Ministry of Environment (Japan) but social survey was not included in the program. It was also observed that no social surveys were conducted by Yangon University as well as Bago University.

A Ph.D. thesis on "Human Impact on Fish Community and Moeyungyi Wetland Wildlife Sanctuary" was submitted by Dr.Myint Myint Khine but did not include socio-economic survey. Also it was found out that no social survey conducted by any government organizations like Forest Department (Yangon /Bago) and other related Ministries.

During 2010-2011 with the assistance of Moyungyi Wetland WS Park Warden "A Survey on the Reliance of WS by villagers in Bago and Waw townships" was conducted.

**Table 3 Reliance of WS by villagers from Bago and Waw townships**

| Sr. | Village Name | Population | Fisherman % | Cultivator % | Property% | | | Fisherman % | Cultivator % |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Boat | Buffalo | Duck | | |
| 1. | Pyin-bon-gyi | 10,679 | 300 (3%) | 106 (1%) | 225 (2%) | 1074 (15%) | 2500 (23%) | 2 | 6 |
| 2. | Phaya-gale | 8,300 | 2138 (25%) | 133 (2%) | 84 (4%) | 1137 (14%) | 2008 (24%) | 6 | 5 |
| 3. | Wum-be-wetland | 7195 | 122 (2%) | 45 (0.62%) | 46 (0.63%) | 570(8%) | 7000 (97%) | 1 | 3 |
| 4. | Pyun-chaung | 1358 | 600 (44%) | 10 (0.73%) | 150 (11%) | 110 (8%) | 1000 (73%) | 5 | 2 |
| 5. | Indaing-su | 1605 | 500 (31%) | 50(3%) | 300 (18%) | 730 (45%) | 2500 (155%) | 4 | 4 |
| 6. | Kapin | 1500 | 400 (26%) | 3(0.2%) | 300 (20%) | 470 (31%) | 700 (46%) | 3 | 1 |

The above table indicates that fisherman relies more on Moeyungyi Wetland WS for their livelihood.

## 4. OBJECTIVES OF THE STUDY

1. The aim of the survey was to collect up-to-date baseline data on the fauna and flora of Moeyungyi Wetland WS including birds, fish, insects, reptiles and amphibians, aquatic plants and mammals.

2. The collected information will be used to help determine conservation priorities for effective conservation of Moeyungyi Wetland WS.

3. To conduct socio-economic survey of selected villages in the vicinity of Moeyungyi Wetland WS, so as to make recommendations for developing legal and institutional measures to promote Wetland Conservation and Wise Use.

## 5. CURRENT BIOLOGICAL SURVEYS

The current biological studies were conducted from 24th February to 2nd March 2014 by the following teams of scientists from BANCA and Bago University.

- Avifauna: Lay Win and Saw Moses (BANCA)
- Mammals: Swe Swe Aung and Thaw Zin (BANCA)
- Herpetofauna: Min Kyaw Thura and Min Thein Htet (BANCA)
- Flora: Dr. Khin Swe Oo, Dr. Kyaw Zay Moe (Bago University) and Thet Tun (BANCA)
- Fish: Moe Moe Myint, Zaw Lin Htun and Tint Wai (BANCA)
- Entomology: Naing Naing Win and Kyaw Naing Oo (BANCA)
- Social Survey: Dr. Min Aung Pan, Ma Thinzar Phwe and Ma Shwe Zin Myint (Bago University)

The habitats representing Moeyungyi Wetland WS during the survey is as follows:

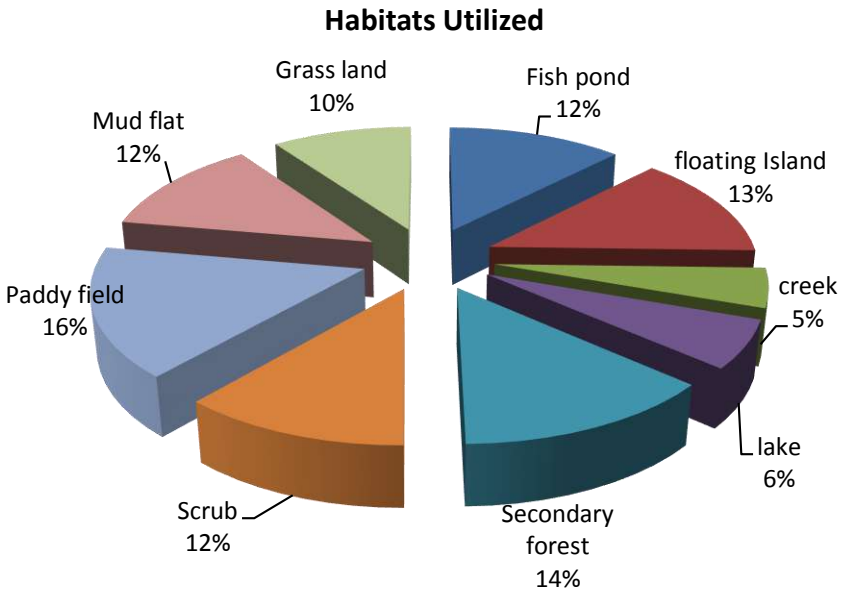



**Figure 4Habitat representing Moeyungyi Wetland WS during the survey**

## 5.1 Avifauna

**Principle Investigator: Lay Win and Saw Moses (BANCA)**

### 5.1.1 Methodology

Bird surveys were carried out according to the following methods:

The team conducted the survey by using boats to cover selected sites in the lake as well as on foot along the banks. The birds were observed in different habitats such as fish pond, floating island, creek, lake, secondary forest, scrub land, paddy fields, mudflats and grass lands.

Fish Pond

Floating Island

Floating island

Small Pond

Scrub land

Paddy field and secondary forest

Birds recorded were noted down together with GPS locations and also significant facts such as habitats and number of birds. Random recordings were also made along the waterways and embankment. Visual sighting with binoculars and auditory surveys were conducted along the banks and water ways. The team also used mist nets to identify reed warblers and release them, after recordings were made. Each bird identified was noted down and the quantity was also recorded.

### 5.1.2 Study Sites

In this survey, there are three parts of the survey areas, the north, the central and the south of the wetland. The team spent more time to search the bird in the north because the habitats there seem to be better than the others.

### 5.1.3 Results

A total population of 18,364 of birds' from 133 species under 51 families was recorded. The richest 2 species are from the family Ardeidae and the poorest 14 species are recorded from the family Ardeidae, Pelecanidae, Falconidae, Rallidae, Vanellidae, Cuculidae, Tytonidae, Coraciidae, Alcedinidae and Phylloscopidae. Among them, the maximum numbers of individual 3,218 birds were recorded in the species Little Egret *Egrettagarzetta* and the minimum number of individual 1 bird was recorded from 14 bird species.

During the survey, a total of 133 bird species were recorded out of which 1 was found out to be Vulnerable (VU) and 4 Near Threatened (NT) species. The team managed to cover a relatively large area. The large number of birds can be seen due to the wintering of migratory birds.

**Conservation Status**: Reference to IUCN Red list (2013), 5 species of globally threatened species was recorded in this study.

**Vulnerable (VU)**

1. Sarus Crane *Grus Antigone*

   Two birds were recorded by Saw Moses on 1st March from the north of the lake near Phalouk village at coordinate 17°30'59.56"N, 96°35'30.64"E and the birds use to come and feed in the paddy field everyday near the village according to the information from the villagers.

**Near Threatened (NT)**

1. Painted Stork *Mycterialeucocephala*

   26 birds feeding around the small pond from the north on 25th February, 28 birds flying across the lake on 28th February and 30 birds feeding in the paddy field were recorded.

2. Black-headed Ibis *Threskiornismelanocephalus*

   40 birds on 25th February, 8 birds on 26th February, 26 birds on 28th February and 7 birds on 1st March were recorded in the mudflat and fish pond.

3. Spot-billed Pelican *Pelecanusphilippensis*

A single bird flew in the small pond during the team observed the other species on 25th February.

4. Oriental Dater *Anhinga melanogaster*

   4, 3,17,8 and 9 birds were recorded in the floating island and water in the lake on each day of 25th, 26th, 27th, 28th February and 1st March respectively.

Insect catching net

Long-toed stint was caught in the net

Trying to save the bird

Final release of the bird

## 5.2 Mammals

**Principal Investigator: Swe Swe Aung and Thaw Zin (BANCA)**

### 5.2.1 Methodology

The data collection was randomly conducted in four ways:

(1) Capturing mammals;

(2) Observing mammals in the field;

(3) Observation of track and signs such as footprints, scats feeding signs in their natural habitats, and

(4) Interview survey.

The small carnivores and smaller mammals such as insectivores and rodents were captured by live traps, using both raw and roasted fish as bait. Mist netting was

conducted to capture the bats. Measurements of Head-and-body length (HB), Tail (T), Hind foot (HF), Ear length (E), Forearm (FA) (in bats) were taken for the captured mammals and identified the species based on the characteristics described in the field guide. The method of observing mammals in the field was conducted for the species of arboreal mammals such as squirrels and tree shrews. Track and sign observation was used for some small carnivores. All encountered signs and footprints were examined, photographed and measured on width and length by using vernier calliper. The presence or absence of the very well-known mammal species was confirmed by interviewing local people already familiar with the forest. All data collected in the survey area were recorded in the field data sheets.

### 5.2.2 Results

A total of 12 mammal species belonging to 9 genera, 6 families and 4 orders were captured and recorded in the Moeyungyi Wetland WS during the survey period of seven days. These are 1 species of Insectivores, 4 species of Bats, 1 species of Carnivores and 6 species of Rodents. Although a staff of WCS informed the presence of squirrels, no squirrels were found on trees of some man-made islets being approached during the survey period. There is no endemic or globally threatened species of mammals according to the IUCN Red list (2013).

Mist netting for bats

Taking measurements

Placing live traps

**Notes on small insectivores**

Only 1 species of insectivorous mammal was recorded in the survey area.

Genus ***Suncus***

***Suncus murinus*** House Shrew - This species is widespread and abundant in disturbed areas; apparently introduced in some areas, including the Philippines (Francis 2008). One alive House (or Musk) Shrew was caught by a live trap in disturbed habitats near Thoneeainsu village environ and one hand captured juvenile House Shrew was collected under the guest house of Moeyungyi Resort.

**Notes on Bats**

Four species of bats were documented in the study area.

Genus ***Rousettus***

***Rousettus leschenaultia*** Leschenault's Rousette-This species is not currently at risk (Francis 2008). The two dead bodies of fruit bat Leschenault's Rousette were collected from the mist nets of local people set for some edible insects especially Giant Water Bug (Local name; Belar).

Genus ***Taphozous***

***Taphozous longimanus*** Long-winged Tomb Bat-This species is not currently at risk (Francis 2008). One alive and four dead bodies of Long-winged Tomb Bat were collected from the mist nets of local people.

Genus ***Myotis***

***Myotis muricola*** Asian Whiskered Myotis –This species is not currently at risk (Francis 2008). Hand captured Asian Whiskered Myotis was found on tree trunk near the guest house of Moeyungyi resort.

Genus ***Scotophilus***

***Scotophilus heathii*** Greater Asian House Bat –This species is not currently at risk (Francis 2008). One alive and one dead body of Greater Asian House Bat were collected from the mist nets of local people.

**Notes on small Carnivores**

Only one species of Carnivores was recorded during the survey.

Genus ***Herpestes***

***Herpestes javanicus*** Small Asian Mongoose –This species is not currently at risk (Francis 2008). IUCN Status: Least Concern ver 3.1 Pop. Trend: unknown. One dead body hunted by local people and one alive Small Asian Mongoose was caught by live trap set in the shrubby habitat near Targwa village. This is the largest mammal of Moeyungyi recorded during the survey period. According to the habitat preference and the information from local people, it can be considered that only the Small Asian Mongoose is present in the survey area. The Mongoose is hunted for food by some local people.

**Notes on small Rodents, Rats and Mice**

A total of six species of Rat and Mice were documented in the survey area. Of these species, Norway Rat and three species of Bandicoot Rats are hunted for food by most of people live in the villages near Moeyungyi WS.

Genus ***Rattus***

***Rattus rattus*** House Rat- not currently at risk; considered as pest in most areas (Francis 2008). One alive specimen was captured by live trap set in herbaceous vegetation near the restaurant of Moeyungyi Resort.

***Rattus norvegicus*** Norway Rat–Not currently at risk; non-native in most of region and usually considered as pest (Francis 2008). A total of three specimens of Norway Rat were collected; two from live traps set in agricultural fields near ThoneEainsu village and one from near Moeyungyi Resort.

Genus ***Bandicota***

***Bandicota indica*** Greater Bandicoot Rats - Not currently at risk: very common and considered as pest in some areas; hunted for food (Francis 2008). A total of five alive Greater Bandicoot Rats were captured in wet swampy areas between Thoneeainsu village and Moeyungyi Resort.

***Bandicota savilei*** Savile's Bandicoot Rats - Not currently at risk; locally abundant and considered as pest in some areas; also hunted for food (Francis 2008). Two alive of this species were collected by live traps; one from herbaceous marsh habitat near ThoneEainsu village and one near Moeyungyi Resort.

***Bandicota bengalensis*** Lesser Bandicoot Rat - Not currently at risk; considered as pest in many areas (Francis 2008).One alive Lesser Bandicoot Rat was captured by live trap near Thone Eain su village.

Genus ***Mus***

***Mus cervicolor*** Fawn-colored Mouse - Not currently at risk (Francis 2008).One

alive was captured in the rice field near Moeyungyi Resort.

**House Shrew**

**Leeschenaults's Rousette**

Long-winged Tomb Bat

Asian Whiskered Myotis

Greater Asian House bat

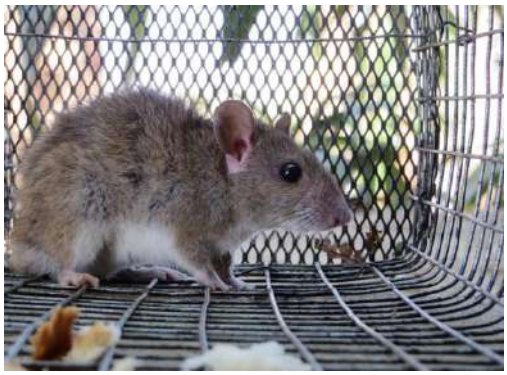
Small Asian Mongoose

24 House rat

Norway Rat

Greater Bandicoot Rat

Savile's Bandicoot Rat



Lessser Bandicoot Rat

Fawn-colored Mouse

## 5.3 Herpetofauna

**Principal Investigator: Min Kyaw Thura and Min Thein Htet (BANCA)**

### 5.3.1 Methodology

A random survey was carried out by Herpetology team in the study area and its surroundings. Surveys were made twice a day during day and night periods. Reptiles and amphibians were surveyed by direct observation and focused on aquatic micro-habitats. Visual observations, documented when possible by photographs, were made of some captured specimens that were not collected for preservation. These included protected species and also species for which large series had already been collected. Wherever possible, animals were captured by hand with the aid of long stick caliper. Latitude and longitude of collected localities were recorded using a Garmin GPS map 78 s. Photo records were taken by digital camera (Cannon Sx280 HS with lens 20 x IS). Their morphometric characters and measurement of each specimen were recorded such as sizes, shapes, patterns, spots, stripes, colour and body length in the data sheet. The specimens were measured in the analysis, as snout, vent length (SVL), tail length (TL), head length (HL), head width (HW), tail scale (TS), and scale row (SR) were conducted using caliper and measuring tape.

**Pitfall trap**

Two arrays were located in each of two habitat types: near the small pond and on land among leaf litter. Arrays were placed in areas with little to no vegetation (Tuberville et al. 2005). Arrays consisted of dark vinyl sheet held in place by wooden dowels or stakes. Two primary transects (each 30 ft long) were placed in each of the appropriate habitats. The primary transect was in the same straight line without any transect.

**Figure 5Study Site close to the Moeyungyi Resort**

Three buckets were evenly placed at an interval of 15 ft along the transect line (see below). The buckets were plastic bucket with smooth wet lander wall to prevent the animal from escaping. They were buried in the ground to a depth of 1 ft so the rim was as the same level of ground. A small amount of litter or dry leaves was put in the buckets as a temporary shelter for the animals that were trapped inside the buckets. The buckets were checked once daily in the early afternoon to minimize exposure time for captured individuals. Captured individuals were identified using *AField Guide to the Reptiles of Thailand and South-east Asia* (Indraneil Das 2010). They were recorded, measured, marked, photographed, and subsequently released back into the area of capture.

### 5.3.2 Results

A total of 24 species of amphibians and reptiles were captured or observed during the survey period. These included 6 frogs, 1 turtles, 8 lizards and 9 snakes. The 6 species of frog belong to two families Microhylidae and Ranidae; one species of turtle belong to the family Emydidae; 8 species of lizard belong to three families

**Placing bucket as a trap**

**Searching for reptiles**


Catching snake with clipper

Placing a trap

Placement of Arrays

Agamidae, Gekkonidae and Scincidae and 9 species of snake belong to five families Natricidae, Homalopsidae Colubridae and Xenopeltidae. Two arrays were placed in two places; near the small pond and on land among leaf litter in the survey area. Three amphibians and three reptile species were trapped in plastic buckets of pitfall traps. But those species were also encountered on ground and among leaf litter respectively. Among them, one species of turtle is endemic species. Among 8 species of snakes, two species are venomous snake. These two species come from only one family Elapidae.

**Status and species conservation**: According to the conservation status by IUCN Red List (2013), one turtle *Moreniaoccellata* was recorded as Vulnerable (VU), three species of frogs and five species of snakes were as Least Concern (LC). This turtle species was listed in CITES (2013). Moreover, the turtle is endemic species of Myanmar.

*Hlyloran marcrodactyla*

*Occidozyga lima*

*Gekko gecko*

*Eutropis multifasciata*

*Morenia occellata*

*Bungarus fasciatus*

*Naja kaouthia*

44 Dead snakes in fish-net

## 5.4 Flora

**Principal Investigator: Dr. Khin Swe Oo, Dr. Kyaw Zay Moe (Bago University) and Thet Tun (BANCA)**

### 5.4.1 Methodology

In this study, a total of (54) study sites were included in which (24) study sites were data ollections of the upland and wetland plants and (30) study sites were sampling points using quadrats in this wetland vegetation

**Frequency classes of wetland vegetation**

To clarify the relative frequency of different herbaceous plant species for this wetland vegetation, (30) quadrats (10 x 10 m each) were set up for emergent and floating-leaved macrophyte communities and the data were calculated by the following equation for RF% value of the wetland vegetation.

$$RF = \frac{\text{No. of points of occurrences of the species}}{\text{Total numbers of quadrats studied}} \times 100$$

The spatial location (latitude and longitude) of each quadrat was recorded using a Global Positioning System (GPS). In these 30 quadrats, a total of (18) quadrats was set up for emergent macrophyte community and (12) quadrats for floating-leaved macrophyte community.

Taking photographs, making voucher specimens and specimen collections of both the upland and wetland plants were carried out.

**Species identification**

The identification was made by available literature in the department of Botany, Bago University and some photo-specimens were matched and verified with International Plant Names Index (http://www.ipni.org/ipni/plantnamesearchpage) and other available identification websites. The plant specimens were alphabetically arranged in accordance with their families and presented together with their local names.

### 5.4.2 Results

A total of 74 plant species belonging to (33) families were identified and presented in which Poaceae (13 species), followed by Asteraceae (8 species), Cyperaceae (6 species), Fabaceae (4 species), Acanthaaceae, Araceae, Nymphaceae (each 3 species), Commelinaceae, Convolvulaceae, Hydro-charitaceae, Lentibulariaceae, and the rest families were only (1) species respectively. In this study, some specimens were found in missed local names when specimens were matched with available literatures. In such a case, these missed local names were omitted and expressed as “Nil”).

## Plant relative frequency of wetland vegetation

The relative frequency classes (RF%) of emergent and floating-leaved macrophytes of this wetland was presented. Quadrats were not used in floating macrophytes. Only first class of plants that provide ecological services to the migratory birds or local birds, were included as their food habitats, landing platform or nesting sites. The relative frequency (80-100%) and their constancy (E) classes of plant species from these two communities were extracted and mentioned in this paper.

**Flora Survey Photos**






## 5.5 Fish

**Principal Investigator: Moe Moe Myint, Zaw Lin Htun and Tint Wai (BANCA)**

### 5.5.1 Methodology

The fishery study group started their studies from Moyungyi resort base camp, gradually visited to selected sampling sites in lake, villages and at fish market, day by day using a motorized local boat and motorbike. The team traveled in the wetland area to collect fish samples and recorded the GPS points of the target sampling sites. Utilized fishing gears of Moyungyi Wetland WS were also recorded during the study period and all recorded data were input into fishing log sheet.

In the survey, the team practiced three kinds of methods in data collection. Interview, market observation and specimen collection was conducted at 13 sampling sites of Moyungyi Wetland WS. Interview, to know current fisheries status of Moyungyi area includes fish species and utilized fishing gears of the study area. For visual observations in the survey, the team practiced three kinds of methods in data collection: interview, market observation and specimen collection were conducted at 13 sampling sites of Moyungyi Wetland area. Interview, to know current fisheries status of Moyungyi Wetland includes fish species and utilized fishing gears of the study area. Visual observation at markets was taken in two markets, Pyinpongyi market and Wanbeiwetland market, to record various local species. Specimen collection was carried out at seven villages, two markets and four fishing sites of Moeyungyi Wetland for species identification.

In the survey, a scoop net and a gill net were used in fishing for small fishes. They lived in lowland water habitat, mostly for juvenile fishes such as *Puntius sp, Systomus sp, Channa sp* and *Badis sp.* Commercial fish specimen were observed and collected in a target point of Moeyungyi Wetland with the help of fishermen and some market-fish of Pyinpongyi and Wanbei inn were also observed for species composition. Fishermen, village authorities and villagers at each village were interviewed for fish and fishery information.

## Status and Species conservation

There are five species recorded in this survey which assumed by the conservation status of IUCN Red List (2013) as Near Threatened (NT). The rest 28 species are recorded as Least Concern (LC). See detailed list in Annex.

**List of IUCN Red List of Fish Species**

| No | Family | Scientific name | Local name | IUCN status |
|---|---|---|---|---|
| 1 | Cichlidae | *Tilapia mossambica* (Peter,1852) | Tilapia/ Ngaphe ma | NT (2007) |
| 2 | Cyprinidae | *Osteobrama belangeri* (Valenciennes,1844) | Nga phe aung/ phan ma | NT (2010) |
| 3 | Cyprinidae | *Catla catla* (Hamilton,1822) | Nga own ton/ nga gaung | NT (2010) |
| 4 | Siluridae | *Ompok bimaculatus* (Bloch,1794) | Nga nu than | NT (2010) |
| 5 | Siluridae | *Wallago attu* (Bloch &Schneider,1801) | Nga but | NT (2010) |


**Survey at Fish Market**


**Conversation with fishers**


**Fish survey photographs**


**Electric-shock fishing equipment**

Collected fish specimens were identified and photographed at the camp and some species were identified on the spot at sampling site. They were tagged and then preserved in 10 per cent formaldehyde solution for further identification at the base camp.

In the identification process, references such as Talwar and Jingran (1991), Inland fishes India and adjacent country, Chavalit vidthayanon, Apichart termvidchakron and Myint Pe,(2005) Inland fishes of Myanmar and Carl J. Ferraris, jr (1995) Identification guide to the commercial inland fishes of Myanmar, TCP/MYA/4553.(draft) were referred.

In the identification process,

- Talwar and Jingran (1991), Inland fishes India and Adjacent country,
- Chavalit vidthayanon, Apichart termvidchakron and Myint pe,(2005) Inland fishes of Myanmar, and
- Carl J. Ferraris, jr (1995) Identification guide to the commercial inland fishes of Myanmar, TCP/MYA/4553 (draft) were referred.

### 5.5.2 Results

A total of 37 fish species were observed during the survey period and their occurrences in the respective townships are described. A total of 31 species were observed in Bago Township area and 29 species were comprised in the Waw Township of Moeyungyi Wetland boundary. Altogether 37 species, 31 genera under 23 families were recorded.

The highest species composition at fish landing site was found in Pyinpongyi site with 26 species and the lake sites were found to be lowest quantity with 8 species. *Notopterus notopterus* (Nga lar/Nga phe) was the dominant species in the survey area. *Channa puntatus*, *Channa striata* and *Heteropnustes fossilis* were followed as second , *Parambasis ranga* , third and *Osteobrama belangeri*, *Macrognathus aral* ,forth and others 5,6,7,etc respectively.

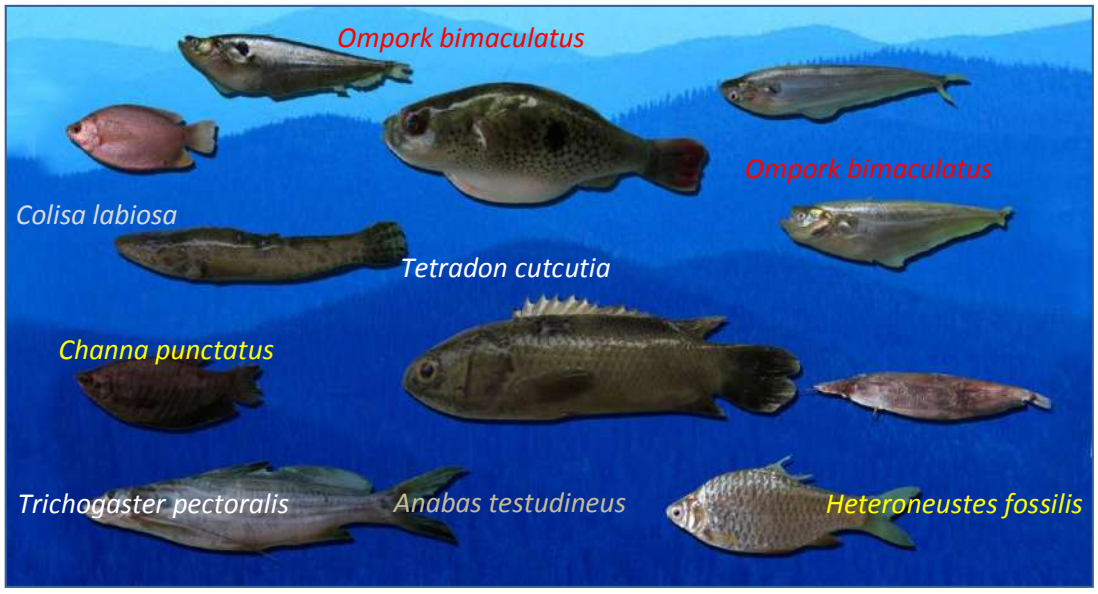



**Figure 6Some Fish Species of Moeyungyi Wetland Bird Sanctuary**

### Fishing implements

A total of 13 types of fishing gears were recorded in the survey period as small scale fisheries. Push net(Yin ton), Set gill net(Tar pike), long line(Nga myar tann), Pole and line(nga myar tan), Trap(Myone), Beach seine(Swe pike), Stationary bush park (Chone cha) and Electric-shock fishing gears were found primarily in Moyungyi wetland area during the survey period.

**Some Fishing Gears in Moeyungyi Wetlands**

## 5.6 Entomology

**Principal Investigator: Naing Naing Win and Kyaw Naing Oo (BANCA)**

### 5.6.1 Methodology

Random survey method was conducted around the Moeyungyi Wetland WS along the trails or pathways. Identification of butterfly species was primarily made directly in the field. In some cases, if the encountered butterflies were not identified directly in the field, they were collected by using the long-handled aerial nets and then, the collected specimens were observed and recorded for their morphological characters such as patterns, spots, stripes and color. Their mouth part was carefully examined and the body and wing's length measured. And photos were taken by using the camera. After that, the specimens were released back to the original place. Unidentified by sighting species were kept separately in the triangle envelopes and recorded the collection date and the location of collected points (GPS coordinates) on the envelopes. All separated envelopes were preserved in the airtight plastic containers to avoid humidity and also put mothballs inside containers to prevent from the growth of mold.

**Insect collection with Aerial Nets**

Also battery operated light traps were used for collecting insects by placing the light trap in or about the middle of a suitable site (vegetation type) and left over night. All collected insects were identified the following morning and released back.

**Equipment used for insect survey**

### 5.6.2 Results

A total of 41 different butterfly species belonging to 8 families and 89 genera under the order Lepidoptera were recorded in the study area representing families of Papilionidae (2 species of 2 genera), Pieridae (16 species of 8 genera), Danaidae (6 species of 2 genera), Satyridae (2 species of 2 genera), Nymphalidae (6 species of 4 genera), Riodinidae (2 species of 2 genera), Lycaenidae(5 species of 4 genera) and Hesperiidae (2 species of 1genera) during the survey period of 7 days

**List of some insect species from Moeyungyi Wetland WS**

*Eurema andersoni*

*Danaus limniace*

*Euploea core*

*Dysphania militaris*

*Junonia atlites*

*Papilio polytes*

*Lethocerus americanus*

*Hydrophilus triangularis*

Nine families consisting of 14 species of beetle were recorded in the study are during the survey period. These families are Scarabaeidae (3 species), Carabaeidae (2 species), Hydrophalidae (1 species), Cicinedelidae (2 species), Cerambycidae (1 species), Lucanidae (1 species), Passalidae (1 species), Coccinelidae (2 species) and Buprestidae (1 species).In addition, 5 species of dragonfly and 7 species of other insects (water bug, moth, cricket, spider and red ant) were also encountered.

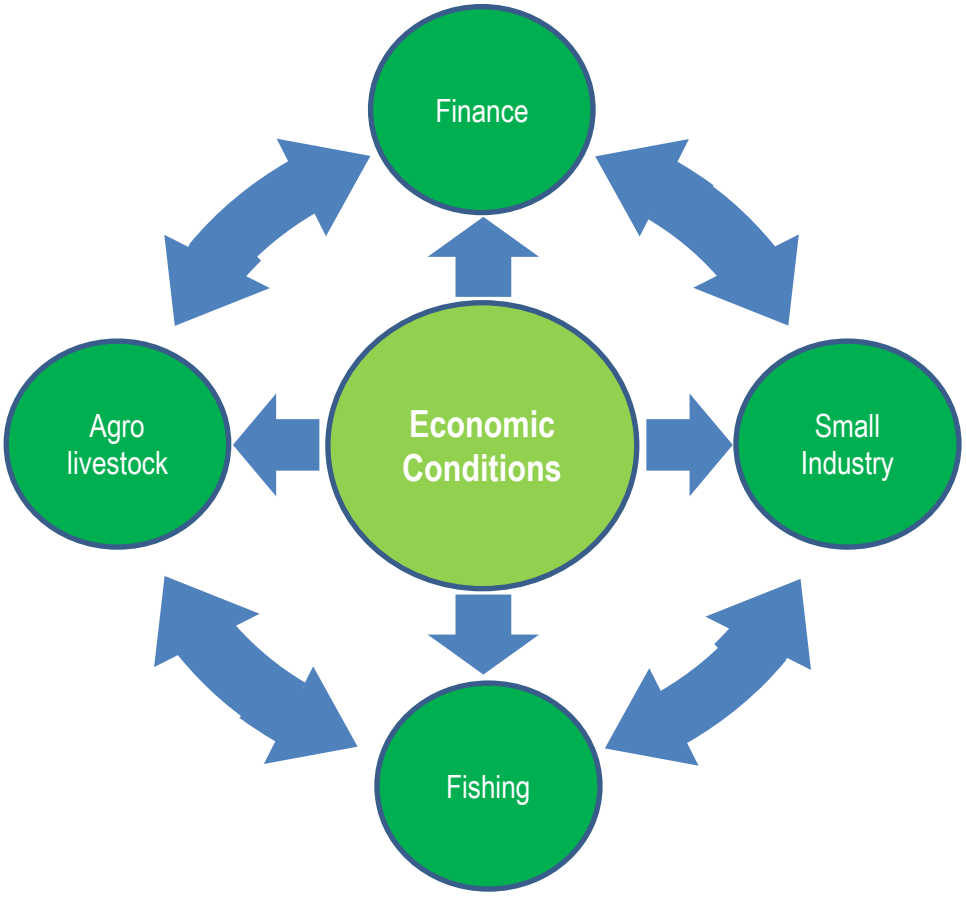
**Conservation Status**: According to the IUCN Red data list 2013, 4 species of butterfly namely; *Eurema andersoni*, *Eurema brigitta*, *Euploea core* and *Junonia almanac* was listed as Least Concern (LC).

# 6. SOCIAL SURVEY

**Principal Investigator: Dr. Min Aung Pan (Bago University)**

## 6.1 Methodology

Questionnaire surveys were conducted during the period from 24-2-2014 to 2-3-2014. The 8 villages around the wetland have 1,117 households of which 160 were selected as sample households to which the questionnaires were distributed. It represents more than 10 percent of the total households. Some 44 responses were not complete and thus, the responses to 120 questionnaires were analyzed together with information from open talks and discussion with the local inhabitants. Therefore, the analysis was solely based on the primary data for the assessment by using simple statistical methods as well as certain UNDP indicators and MHRD indicators.




**Economic Factors**

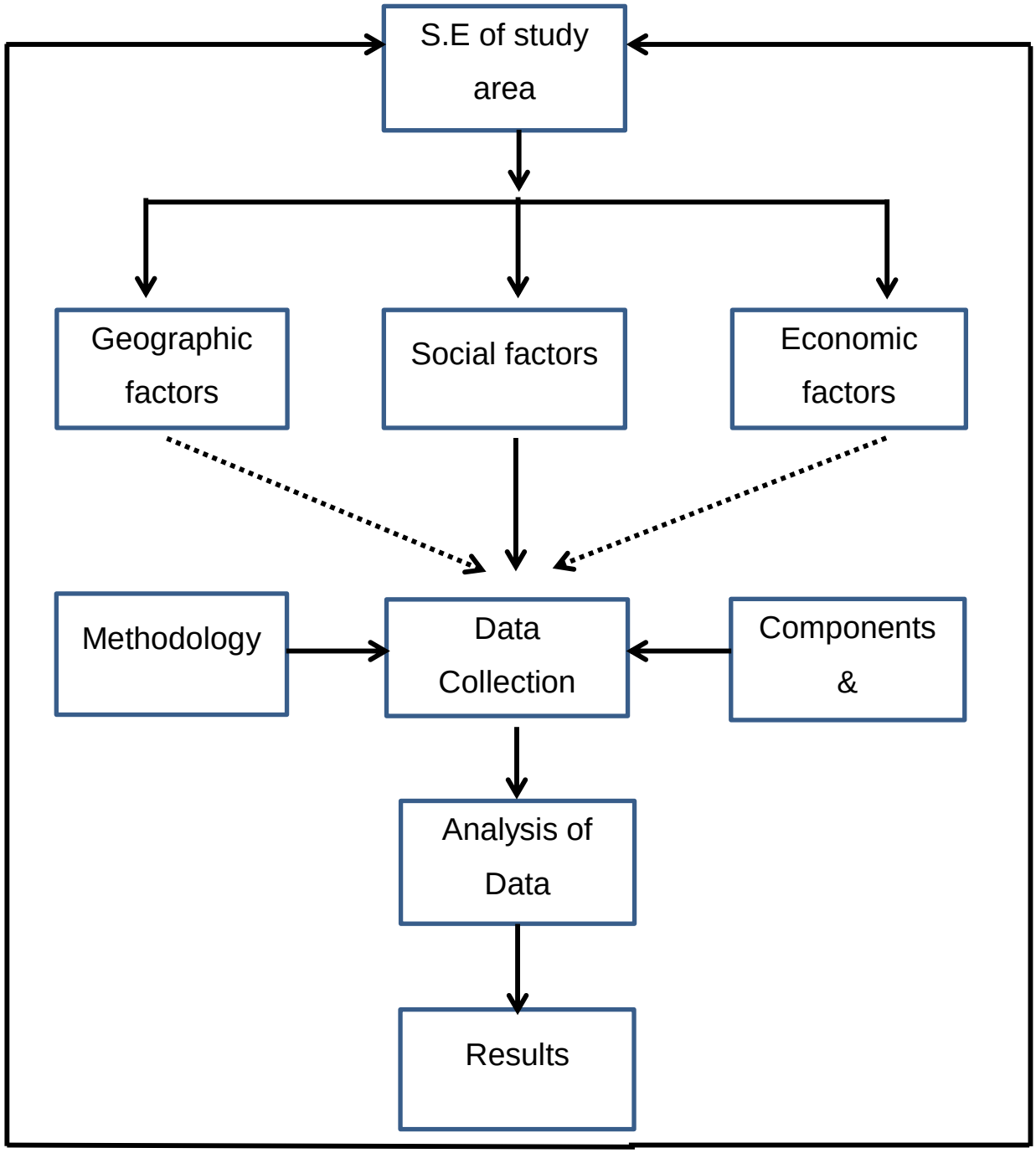



**Figure 7Conceptual Framework of the study area for social survey**

**COMPONENTS AND INDICATORS OF SOCIO-ECONOMIC IMPACT CONDITIONS**

| No. | Components | | Indicators | Condition | Expression |
|---|---|---|---|---|---|
| 1 | F Family Life | 1 | Happiness & Satisfaction on Life | Percentage | |
| | | 2 | Public Safety on Life | Percentage | |
| 2 | ØEducation | 3 | Literacy | Percentage | |
| | | 4 | Graduated Condition | Percentage | |
| 3 | ¨Health | 5 | Fly Proof Toilet Utility | Percentage | |
| | | 6 | Medical Staff: Population | Ratio | |
| 4 | ¨Material Possession | 7 | Owned House | Percentage | |
| | | 8 | Owned Telephone | Percentage | |
| 5 | Ä Occupation Status | 9 | Livelihood depend on Inn | Percentage | |
| | | 10 | Main Job Function | Percentage | |
| 6 | ØFinance | 11 | Income (per day) | Percentage | |
| | | 12 | Expanse (per day) | Percentage | |
| 7 | Ä Human Activities | 13 | Positive Impacts | Percentage | |
| | | 14 | Negative Impacts | Percentage | |

Source : F Malaysia QOL (2002)
Ø UNDP's HDI Report (2005)
¨ Myanmar Human Resources Development Indicators (MOL-2003)
Ä Field Survey Observation

**Fig. 6.2 Component and Indicators of Socio Economic Impact Conditions**

## 6.2 People in the vicinity of Moeyungyi Wetland Wildlife Sanctuary

### 6.2.1 Population

The number of population gives hint to the impact potential of people upon the wetland. The area around the wetland altogether has 17 villages of which this study was concerned with only 8 villages, 4 included in Waw Township (Tarkhwa, Hpalauk, Kapin and Punchaung) and another 4 included in Bago Township (Pauktaw or Hlayseik, Hpalauktan, Thoneeinsu and Tarsone). According to fig. 5.1 and fig. 5.2, there are 55 people in TarKhwa, village (25 males and 30 females), 264 people in Hpalauk village (107 males and 157 females), 174 people in Kapin village (859 males and 882 females), 1080 people in Punchaung village (400 males and 680 females), 95 people in Pauktaw (Hlayseik) village (40 males and 45 females), 260 people in Hpalauktan village (120 males and 140 females), 1141 people in Thoneeinsu village (551 males and 591 females), 1285 people in Tarsone village (610 males and 675 females).

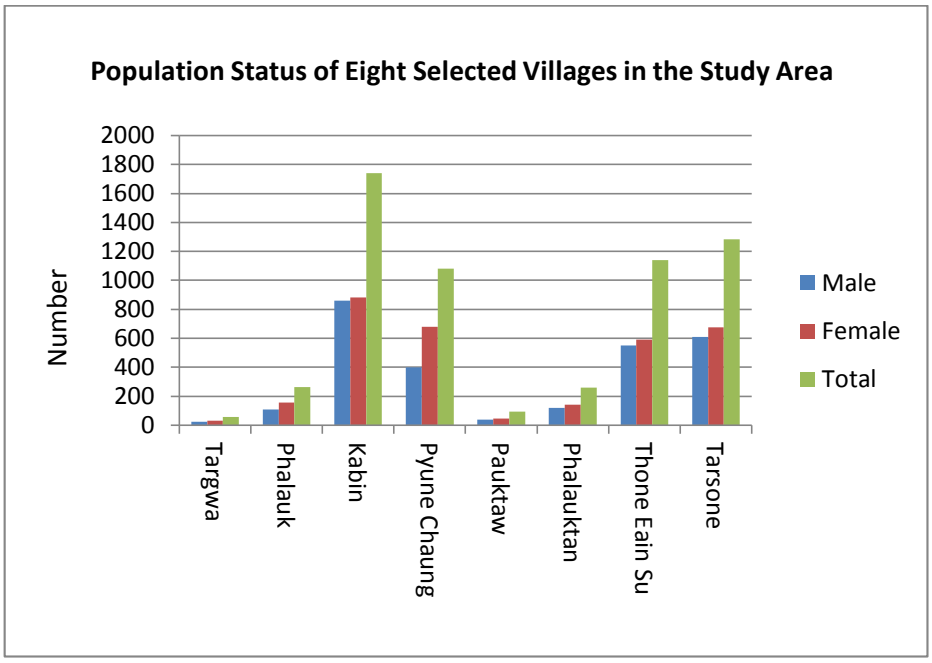



**Figure 8Population Status of Eight Selected Villages in the Study Area**

Thus, Kapin village has the largest number of population, followed by Tarsone Village, while Tarkhwa village has the least. Kapin village is located on the eastern shore of the wetland and the inhabitants are engaged in fishery, catching bilas, agriculture and bamboo cutting. Having more jobs for livelihood, the village is more populated than others. The relative large number of population in Tarsone village is attributable to being located besides the Yangon-Mandalay road and engaged in fishery and fish depot and agricultural activity. The small number of population in Tarkhwa village is due to being occupied by people that come from other places with no experience in fishing. According to field surveys, 44 percent of the households came from Htani village (Maubin Township) of Ayeyarwady Region in 2011. Likewise, 43 percent of households in Pauktaw (Hlayseik) village are migrants from Nyaungdone and Maubin Township of Ayeyarwady Region, attracted by the fishery of the wetland.

### 6.2.2 Race and Religion

Based on the responses to the interviews, all the inhabitants living in the selected 8 villages are Bamars. Being Bamars, all are Buddhist adherents with pagodas, Buddha image, Sima, Monastery and hall for religious purpose in these villages. The cult of "Namkarine", a tradition handed down from Hantharwady Era is common among them, represented by shrine of "Nat" for "Nankarine"

**Kapin village monastery**

### 6.2.3 Households and Housing conditions

In the villages included in Waw Township, there are 18 households (1.6%) in Tarkhwa village, 47 households (4.2%) in Hpalauk village, 287 households (26%) in Kapin village and 200 households (18%) in Pyunchaung village. In Bago Township, Puaktaw (Hlayseik) village has 37 households (3.3%), Hpalauk village 62 households (6%), Thoneeinsu village 228 households (20.4%) and Tarsone Village 238 households (21.3%). The house types which reflect the socio-economic status are highly different.

Among the 200 houses in Pyunchaung Village 4 (2%) are brick buildings, 75(38%) wooden buildings and 12 (60%) wood and bamboo buildings: This indicates that the majority are low and moderate income families. In Bago Township, Pauktaw (Hlayseik), being a recently established village, has only 37 houses, including 2 wooden houses (5.4%), and 35, wood and bamboo houses (95%). Most villagers depend on fishery and hence income is fairly low. Hpalauktan village has 62 houses of which 7 are brick houses (11.3%), 30 wooden houses (48.4%) and 25 wood and bamboo houses (40.3%).

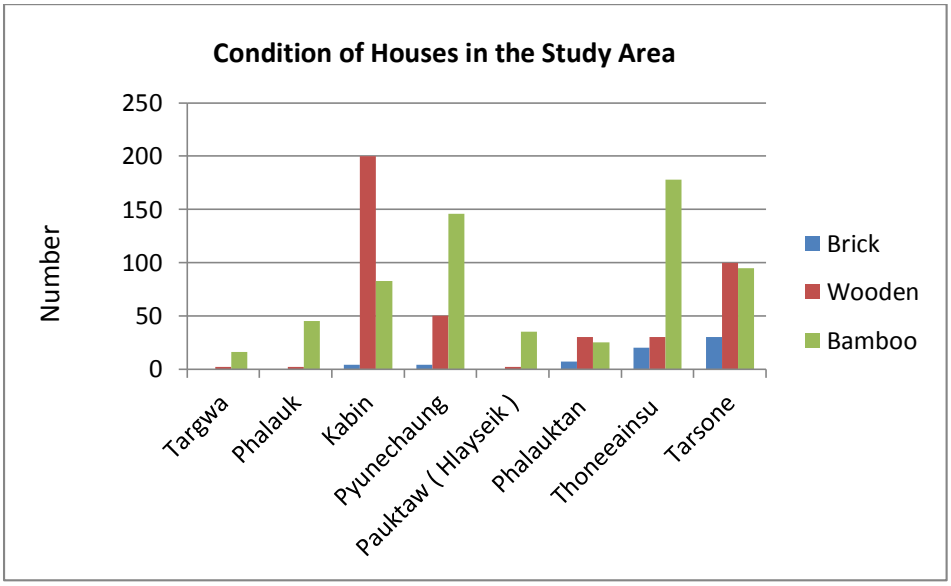



**Figure 9Condition of Houses in the Study Area**

**Different Housing types in the study area**

**Cheroot making industry**

Thus, the majority has moderate socio-economic status. Thoneeinsu village has 228 houses including 20 brick houses (8.8%), 30 wooden houses (13.6%) and 178 wood and bamboo houses (78%). The village has cheroot making industry, fishery, agriculture and other service activities. However, the majority earn only small income, though a few are fairly well off. Tarsone has 238 houses including 30 brick houses (1.3%), 100 wooden houses (42%) and 95 wood and bamboo houses (40%). The village has farming (agriculture), fishing Industry and others. The majority earns fairly/moderate income for their life.

### 6.2.4 Education

Education standard and public health care service reflect the socio-economic conditions of the areas concerned. Tarkhwa, Hpalauktan and Pauktaw (Hlayseik) have no school, being very small villages. The children of these villages can attend the schools in the neighboring villages. There is primary school each in Phalauk, Kapin, Pyunchaung, Thoneeinsu and Tarsone villages.

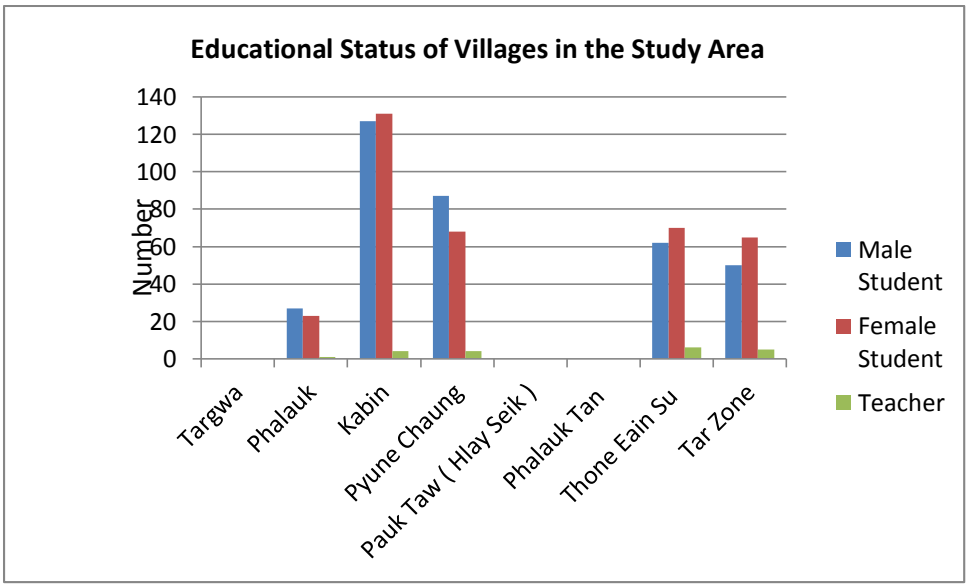



**Figure 10Educational Status of Villages in the Study Area**

The primary school in Phalauk was opened on self-help basis in the 2013-14 academic year with 50 students run by a teacher. Thus, the teacher-student ratio is 1:50. Kapin BEPS has 254 students and 4 teaching staffs in 2013-14 and the teacher-student ratio was 1:64. Pyunchaung BEPs had 155 students and 4 teaching staffs and the teacher-student ratio was 1:38. With 132 students and 6 teaching staffs in Thoneeinsu BEPs, the teacher-student was high with 1:22, good for effective teaching. Tarsone BEPS had 115 students and 5 teachers in the 2013-14 academic year, resulting in a teacher-student ratio of 1:23. Except Kapin BEPS, the teacher-student ratios in other schools are fairly high for effective teaching.

**Figure 11Self-help Primary School at one of the villages**

### 6.2.5 Health

Public health care is one of the prime needs for every citizen. Usually most rural areas of Myanmar have no sufficient health facilities and health care personal. There is no rural health care center in the 8 selected villages. Whenever they suffer ill-health they have to go to Pyinbongyi dispensary or to the traditional medicine practitioner in Kapin Village. There is a small local health center near Kapin Village, usually served by a midwife. For emergency or serious cases, they have to go to Waw Township Hospital. The inhabitants of Pauktaw take treatment at Pauktaw Ywama which has a midwife. The lack of rural health care center in these villages is due to being a small village. In general, there are a total of 8 medical staffs in the study area that includes traditional practitioners, midwife, nurse, health assistant etc. Therefore, the health condition of the local inhabitants is not so bad, though the villages have no health related facilities.

### 6.2.6 Settlement Pattern

Generally the 8 selected villages are located on the shore of the wetland and the shapes of villages are oriented by the alignment of the shore. Hpalauktan, Thoneeinsu and Tarsone villages are located beside Yangon-Mandalay road and thus, they have a linear shape. Tarkhwa and Hpalauk villages have linear shape, being developed along

Pakaing Embankment, whereas Kapin Village has a nucleus shape being aligned by Pakaing Embankment and the sluice gate of the wetland. Pyunchaung Village, located to the southeast of the wetland has nucleus shape, while Pauktaw (Hlayseik) has linear shape, being developed along the southern embankment.

### 6.2.7 Recreation

People need recreation to relax the stress caused by heavy manual labor, low income and social conflicts. For the rural inhabitants, they relax themselves by watching, TV or DVD, listening radio and playing in the open space. According to field survey records, there are 2 TVs, 2 DVDs in Tarkhwa village, 10 TVs are at Hpalauk village, 200 TVs and 2 Satellite Dishes in Kapin village, 50 TVs and 6 Satellite Dish in Thoneeinsu village, one Skynet Dish and 2 Satellite Dish in Pyunchaung village, 50 TVs and 5 Satellite Dish in Hpalauktan village and 3 TVs in Pauktaw village.

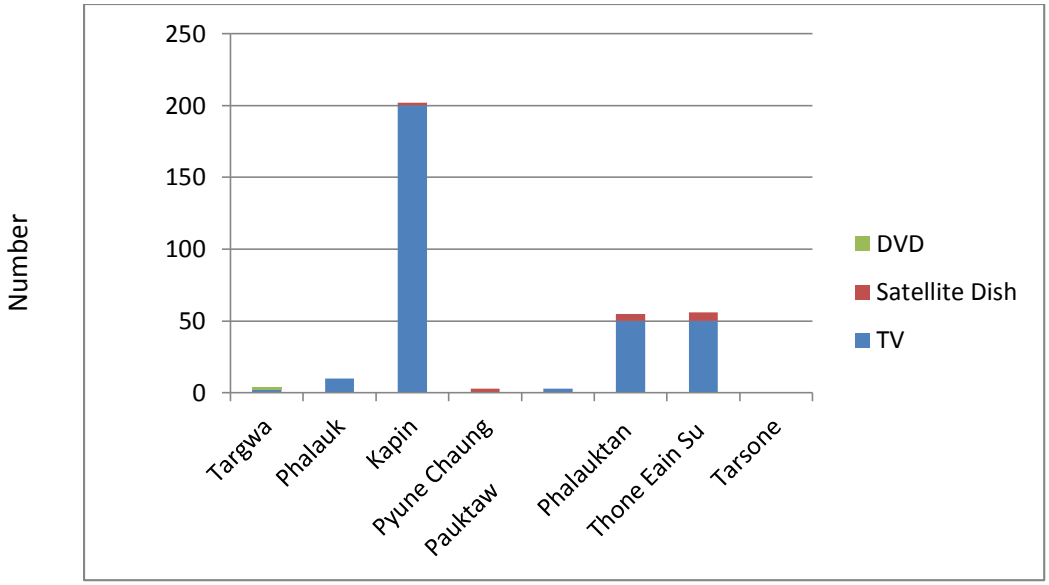



**Figure 12Recreational Media at Villages**

**A house with a satellite dish**

# 7. ECONOMIC FACTORS

## 7.1 Agriculture

In Waw Township, there are two peasant households (11%) out of 18 in Tarkhwa Village, 15 (32%) out of 47 in Hpalauk Village, 174 (61%) out of 287 in Kapin Village, and 20 (10%) out of 200 in Pyunchuang Village. Among the 4 selected villages in Bago Township, 2 (5%) out of 37 households in Pauktaw (Hlayseik) Village, 10 (16%) out of 62 households in Hpalauktan Village, 30 (13%) out of 228 households in Thoneeinsu Village, and 50 (21%) out of 238 households in Tarsone Village mostly depended on agriculture.

Tthe areas encroached over the wetland area are 20 acres by Hpalauk Village, 10 acres by Kapin Village, 100 acres by Pyunchaung Village, 89 acres by Phalauktan Village, 10 acres by Thoneeinsu Village, totaling 229 acres. The total encroachment area over the wetland is 1080 acres, covering (21%) of the Moeyungyi Wetland area.

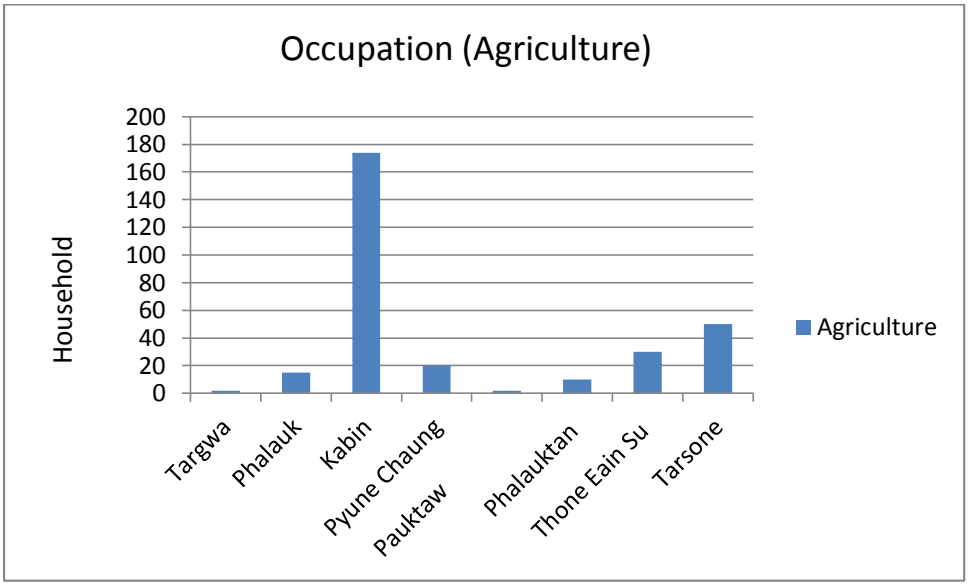



**Figure 13Number of Households engaged in Agriculture**

**Water supply for Agriculture in summer**

**Sluice gate for irrigation water**

In Waw Township, there are two peasant households (11%) out of 18 in Tarkhwa Village, 15 (32%) out of 47 in Hpalauk Village, 174 (61%) out of 287 in Kapin Village, and 20 (10%) out of 200 in Pyunchuang Village. Among the 4 selected villages in Bago Township, 2 (5%) out of 37 households in Pauktaw (Hlayseik) Village, 10 (16%) out of 62 households in Hpalauktan Village, 30 (13%) out of 228 households in Thoneeinsu Village, and 50 (21%) out of 238 households in Tarsone Village mostly depended on agriculture.

According to the responses to the questionnaires distributed to 30 farming households out of 120 in the 8 selected villages, 2 household (7%) in Tarkhwa Village grow (50%) short-lived and medium-lived paddy varieties each half the land holdings are less than 5 acres each and the another half more than 10 acres each, of which (50%) yield 25-50 baskets per acre and the remaining half (50%) over 50 baskets per acre. Both households (100%) had more than 10 years in farming experience and both are the land owners. Buffaloes are used in the farm work. Paddy is grown in the rainy season as well as in summer. Both households use chemical fertilizers and pesticides.

## 7.2 Fishery

Fishing is main industry in the study area. In Waw Township there are 14 fishing households (78%) out of 18 in Tarkhwa village, 28 (60%) out of 47 in Hphalauk village, 113 (39%) out of 287 in Kapin village, and 170 (85%) out of 200 in Pyunchaung village. Among the 4 selected villages in Bago Township, 32 (81%) out of 37 households in Pauktaw (Hlayseik) Village, 47 (76%) out of 62 households in Hpalauktan Village, 50 (22%) out of 228 households in Thoneeinsu Village and 34 (14%) out of 238 households in Tarsone village depend on fishery.

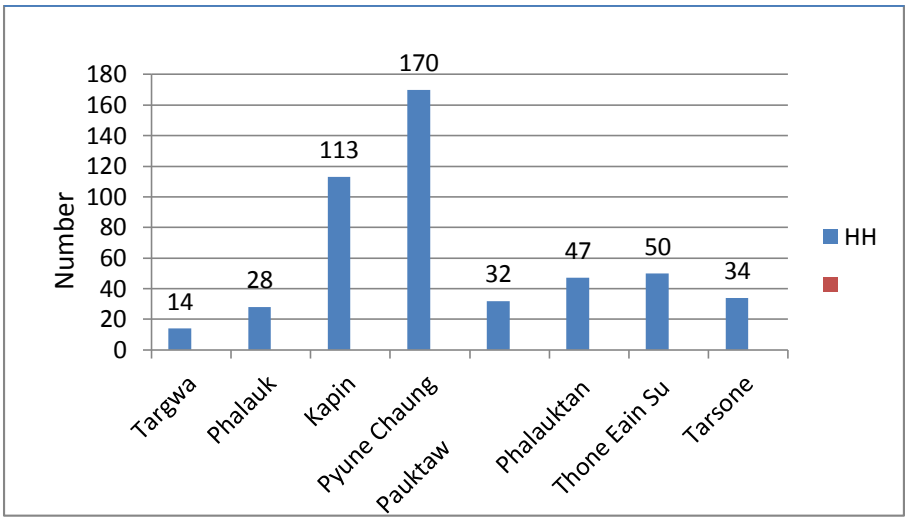



**Figure 14Number of Fishing HH and percentage of total HH**

In summary, there are 1,117 total households in the study area that include 303 household of farming (27%) of total households, 488 households of fishing (44%) of total households, 398 households of traditional fishing (36%) of total households, 88 households of electric shock fishing (8% of total households and 18% of total households fishing) and others 326 (29% of total households.) Therefore, we can say that the 8 selected villages are mostly depend on fishing industry

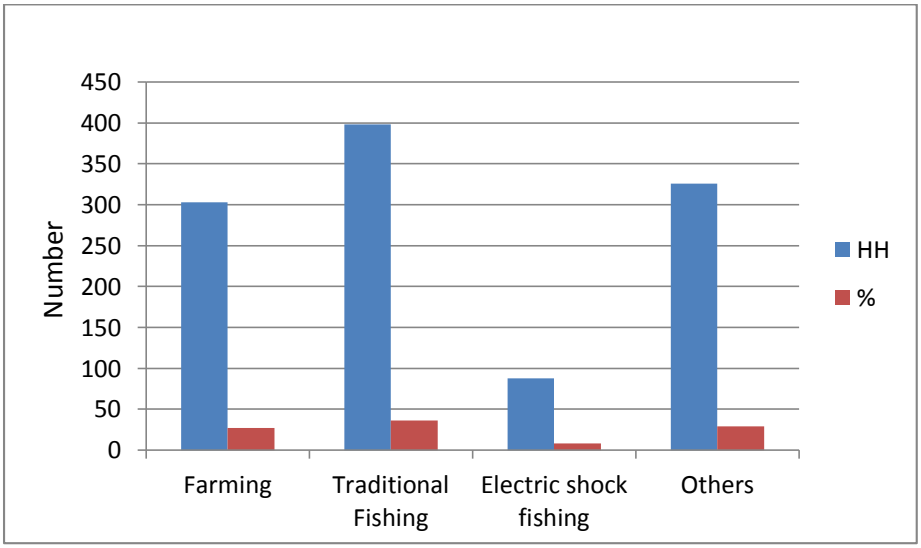



**Figure 15Farming, Fishing and Others in the study area**

## 7.3 Occupation and Ownership

Working condition of occupation whether good or bad indicates in sense, the economic activities of the people concerned. Occupation differs as agriculture, fishing industry, services and others. According to Annex 2 and field survey records, among the 120 sample households, the major occupations are consisted of 30 (25%) agriculture households, 158 (49%) fishing households, 16 (13%) services households and 16 (13%) other households. Migration may reduce for human resource of the study area. Some natives move temporarily to other places for job that include 8 households, 7 persons

out of 120 in 2014. These household migrated to places like 2 to Malaysia, 3 to Thailand, 2 to Yangon and 1 to Mon State. Fishing is the main occupation in the study area.

Ownership is one of the most important indicators to measure the economic activities of the study area. The economy depends on largely on the ownership of the basic necessities, namely house and other facilities such as, motor car, telephone, TV set, satellite dish, boat, htawlargi, electrical household appliances. Among these facilities ownership of the house and telephone are the most important to measure economic activity of the study area. According to the Annex 5b, 119 owned houses (99% of total sample households) and 20 households owned telephone (17% of sample total households) of the study area.

Therefore, the inhabitants are mostly strong condition for the ownership of housing but, it has a little weak condition concerning possession of telephone.

## 7.4 Income and Expense

Income and expense are important for the local communities. Income and expense are concerned with economic condition of the communities. The status in terms of daily income condition for the households is:

High = >Ks 6001,

Moderate = Ks 3001-6000 and

Low = <Ks 3000

According to field survey there were 31 (26%) out of 120 households as <Ks 3000 per day income, 70 (58%) out of 120 households between Ks 3001-6000 per day income and 19 (16%) out of 120 households > Ks 6001.

Likewise, the status in terms of expenditure condition for the households is :

High = >K4000

Moderate: K 2000-4000

Low = <K2000

There were 21 (18%) out of 120 households with less than Ks 2000 per day expense, 77 (64%) out of 120 households with between Ks 2000-4000 and 22 (18%) out of 120 households as more than Ks 4000.

These incomes mostly depend on wetland from various services such as fishing, agriculture and others.

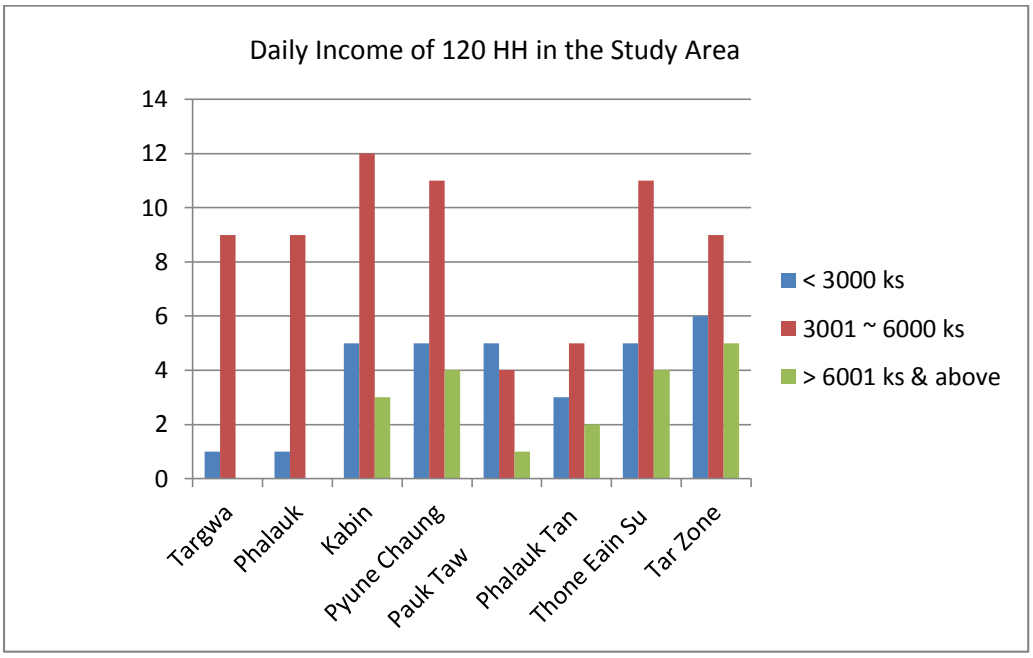



**Figure 16Daily income of 120 HH in the Study Area**

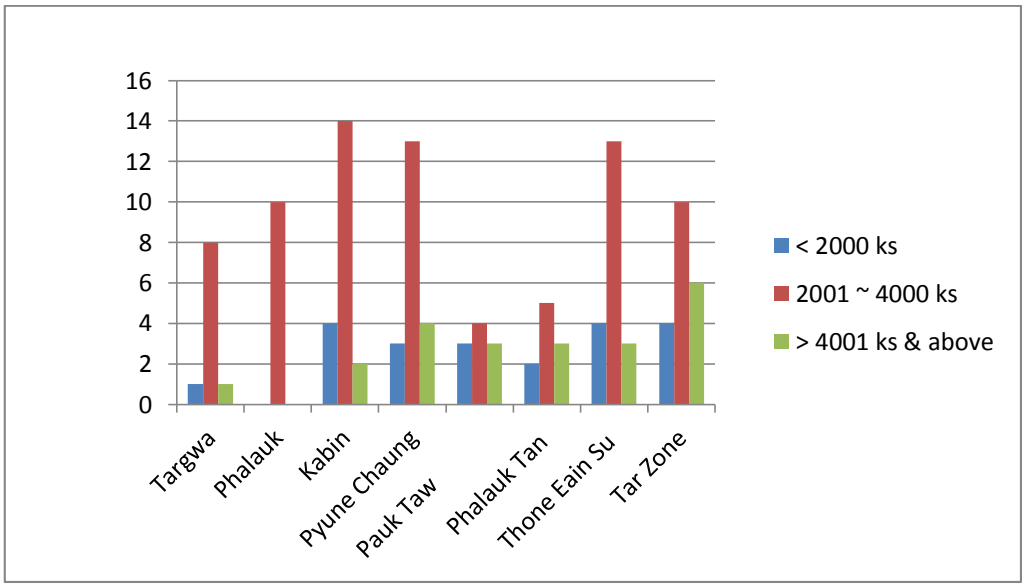



**Figure 17Daily Expenditure of 120 HH in the Study Area**

## 7.5 Energy and Water Use

Energy is so important in the study area that, it is widely used for the communities. It includes such as electricity, charcoal, wood and others. It is used for lighting and for cooking in the study area. According the data shown in Annex 7a there are 9 (8%) out of 120, 12 (10%) out of 120, 92 (76%) out of 120, 7 (6%) out of 120 respectively. Among them, wood is mostly used for cooking in the study area.

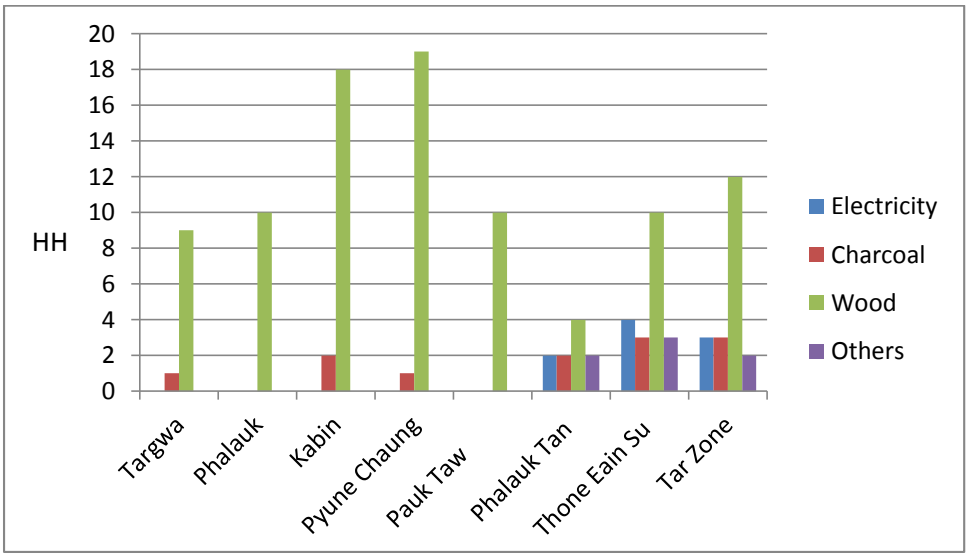



**Figure 18Different types of energy use in the study area**

**Firewood for cooking**

Besides, water use is the basic necessities for the local people in the study area. The availability of safe drinking water is in dispensable for the local inhabitants. The inhabitants depend on different water sources, including water from tube well, rain water, lake water and wetland water. Majority of the local communities use water from the Moeyungyi Wetland. Out of a sample 120 households, 42 (35%) households have access to water from tube well, 15 (13%) have access to Lake's water, 64 (52%) households have access to Wetland water. So, we can conclude that the natives are mostly used with wetland water for their daily life.

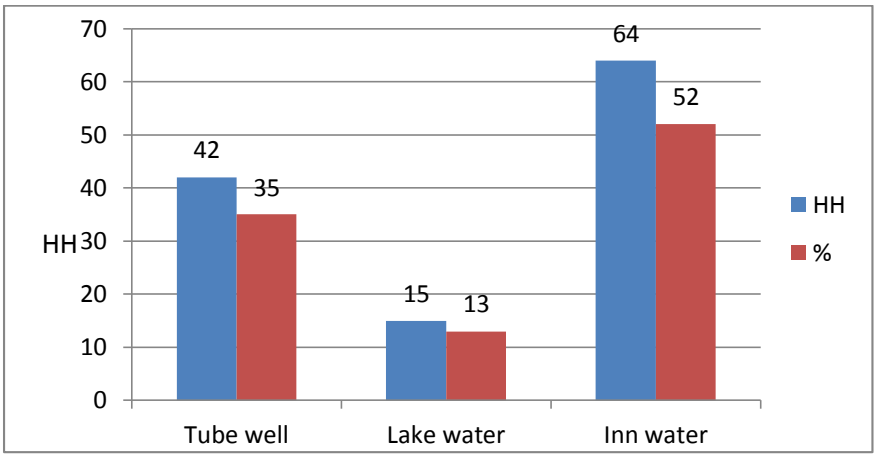



**Figure 19Water consumption of different sources**

## 7.6 Small Scale industry and Transportation

Industry is also partly important for the livelihood of the local communities. It includes, Rice milling, Ngapi industry, Cheroot industry, Lotus textile industry, Dried Pein industry and etc. There are two rice mills at the Kapin Village and one at Pyunchaung Village. There are many Ngapi industries at both Kapin and Pyunchaung Villages. Besides, there are many Cheroot industries in the study area such as, Hpalauktan and Thoneeinsu village. Lotus textile industry lies close to Thoneeinsu Village. Dried Pein industry locates at the Pauktaw (Hlayseik) Village.

Transportation is also needed for the local people. It includes roads and water ways. According to field surveys, the main transport road is along earth embankment known as "Pakaingtar". Phayargyi (Yangon-Mandalay Road), Phayargyi-Waw Road and Waw-Pyunchaung Road, etc. The main vehicles used are bicycle, boat, car and htawlargyi, etc.

**Ngapi industruy and Rice mill**

**Lotus industry and some boats for transport**

# 8. ANALYSIS ON THE SOCIOECONOMIC CONDITIONS

## 8.1 Identification of the socio-economic condition of the 8 selected villages

The socio-economic conditions of the 8 selected villages are analyzed by 7 factors and 14 indicators. The 7 factors are family life, education, health, property ownership, occupation, finance and social activity. 14 indicators include happiness and satisfaction, life security, literacy, education standard (graduates), the use of fly-proof toilet, the ratio between health service personnel (medical staffs) and population, house and telephone ownership, occupation depending on the wetland, major jobs for livelihood, income and expanse the positive impact, profit gained from fishery and the negative impact of the use of chemical fertilizers and pesticides.

According to the UNDP classification, economic level is weak/low if the value is between 0.1-0.4 (10%-40%), fairly/moderate between 0.4-0.8 (40%-80%) and strong/high above 0.8 (over 80%). Health care condition in Myanmar is checked by the ratio between the health care personnel and the population. It is good if the ratio is 1:500, moderate if it is 1:1000 and low over 1:1500. In concerned with financial matter, income and expense are classed into 3 levels. The economic activities are checked by the positive impacts and negative impacts on the socio-economic conditions and quality of environment.

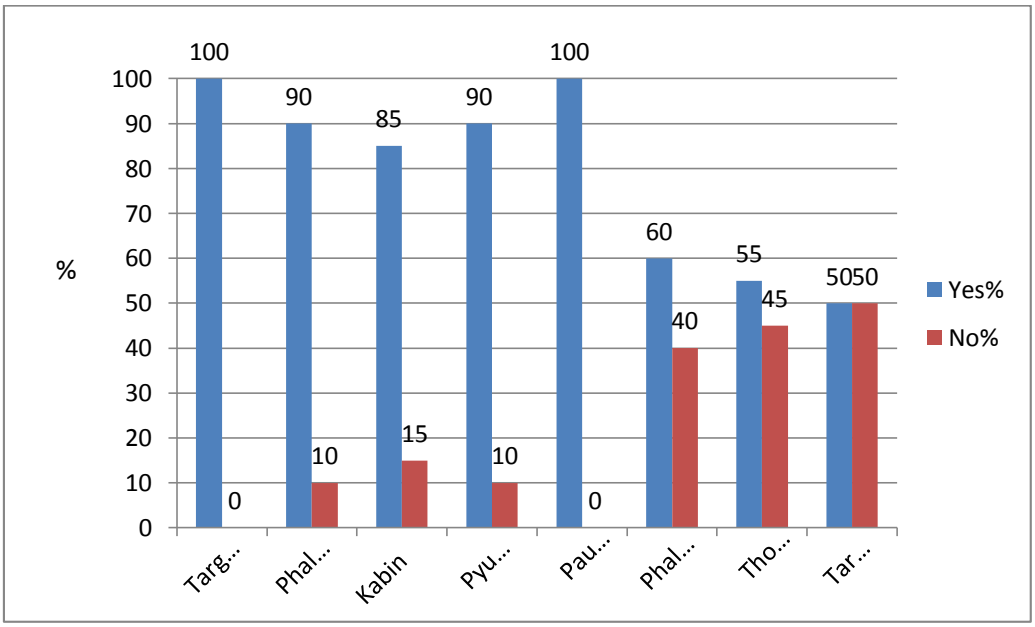



**Figure 20Percentages showing villages depending on MoeyunGyi WS**

As regards family life 109 (91%) households said that they were satisfied with their present living condition while are not well accustomed with the new environment. Among the 120 households 116 (97%) households feel secure whereas 4 (3%) households feel less secure. The education of local people is characterized by monastic education and primary school level. However, it can be considered "moderate/fair" for 98 (73%) households and weak for 8 (7%) who were graduated11 (9%) households gave the negative response, because they came from other places and. As regards sanitation awareness, 34 (28%) households use fly-proof toilet and the majority (86

households or 72%) are less health conscious. The public health care service is moderate as the health service personal and population ratio of 1:716.

Among the 120 households 118 (98%) have their own houses, but telephone ownership is limited to 20 households (11%). As regards occupation, 91 (76%) households somehow depend on the Moeyungyi WS, 58 (49%) households engaging in fishery, 30 (25%) households in agriculture, 16 (13%) households in services, and 16 (13%) households in others.

Household daily income are classed into three levels, 31 (26%) below Ks 3000, 70 (58%) between Ks 3001 and Ks 6000, 19 (16%) above Ks 6001.Aas regards daily expense, 21 (18%) less than Ks 2000, 77 (64%) between Ks 2001 and 4000, 22 (18%) above Ks 4001. Fishery is perceived as favorable job by the majority (111 households or 93%), among the 30 peasant families 23 (72%) use chemical fertilizers and pesticides. This can impact the Moeyungyi Wetand WS and its immediate environment. Based on 14 indicators or criterion the weak or low condition is presented by 21%, moderate condition by 50% and strong or high condition by 29%. Therefore, the socio-economic conditions of the villages under study can be considered as moderate. The livelihood of the majority of local inhabitants depends on fishing and agriculture related to the Moeyungyi WS.

## 8.2 Positive Results Derived from the Moeyungyi Wetland to the Local Communities

(1) **Direct use of Moeyungyi Wetland water**- The local communities can directly use the Moeyungyi wetland water and indirectly through surface well for agriculture and livestock breeding as well as for home consumption.

**(2) Re-chargeability of groundwater**- The wetland water can somehow recharge the ground water of the adjoining area in the hot dry season. Otherwise the surface wells would dry up in that period.

**(3) Water storage capability**- The Sinsu Phayarlay, Ukaungywarthit, Wunbae wetland, Yaytarshay and Pyinbongyi creeks drain into the Moeyungyi Wetland. In addition, the wetland also receives some water from the Sittoung River through Bago-Sittoung canal.

**(4) Mitigation of flow velocity and erosion**- The diverse plant species that grow within the wetland can reduce the flow velocity of the streams draining into the wetland and decrease soil erosion, leading to flood mitigation in some low lying villages of Waw and Bago Townships.

**(5) Serving as storage and controlling barrier**- The wetland itself not only store water received from rains, but also store waters discharged by the streams that flow into and the sediments carried by the streams as well. As a result, some parts of the wetland get shallower, producing suitable fertile land for growing paddy.

**(6) Provision of fuelwood**- Reeds and, raw grasses and other plants that thrive in the wetland provide fuel to the commuities around the wetland.

**(7) Serving as waterways**- The local inhabitants can easily go from village to village by small boats.

**(8) Serving as the medium of economic activity**- A great majority of those living around the wetland are engaged in fishing in the wetland for their livelihood.

**(9) Serving as medium for paddy cultivation**- The local inhabitants grow paddy in the relatively shallow parts of the wetland for food sufficiency.

**(10) Job generation to the local inhabitants**- The pressure of wetland naturally create jobs for the local inhabitants, particularly fishing and crop growing.

**(11) Serving as the interesting place for the researchers**- The wetland itself in an interesting place for the researchers of different academic fields.

## 8.3 The Negative Impacts Caused by the Local Inhabitants

**(1) Water spread** - the wetland water is gradually getting smaller due to the extension of farmlands by the local people.

**(2) Use of Chemical Fertilizers and Pesticides** - contaminates the wetland water and threatens the existing biologically diverse plant and animal species and enhances difficulty in conserving the environment of the wetland.

**(3) Indiscriminate dumping of solid and liquid wastes** - into the wetland degrades the quality of the wetland water and natural beauty of the wetland.

**(4) Encroachment of the people** - over wetland area reduces the aerial extent of the wetland and increases the level of water pollution.

**(5) Raising of livestock** - particularly ducks and buffaloes, increases the level of water pollution by the faeces of these animals.

**(6) Fishing in the wetland by the illegal means** - of electric-shock enhances the depletion and extinction of aquatic animals of the wetland.

**(7) Flooding every year in the rainy season**, cause damage more or less to the planted crop and the property belonging to the inhabitants around the wetland.

**Buffalo Raising**

**Duck Raising**

## 9. ISSUES AND THREATS

Major issues and threats observed during the field surveys of Moeyungyi Wetland WS indicated that the following threats are currently exerting adverse impacts towards the objectives of managing the Moeyungyi Wetland WS.

Threats found in Moeyungyi WS were insect catching nets which are set in the eastern part of the lake and at least 20 birds a day were killed. Over fishing, livestock grazing close to the lake and extend the paddy field in the lake can disturb birds as well.

Moyungyi wetland is a good habitat for migratory birds and residence birds. Bird hunting practice exists in the area due to demand of local consumers. Potassium cyanide used in bird hunting is so poisonous that it has affect on water bird and fish resources.

Mist nets to catch some edible insects, specifically Giant Water Bug (Vernacular Name, Belar) set by local people are threats to the survival of bats. Approximately, 20 bats were caught by these nets set along the waterways adjacent to PyonChaung village.

Moyungyi Wetland WS environment has faced many threats currently being faced with due to human activities. Four thousand fishermen are involved in fishing with several types of gears. Regardless of any other types of fishing, electric-shock fishing practice is a serious threat on the Moyungyi Wetland aquatic resources. Moreover, introduction of exotic species (i.e., *Tilapia mossambica)* ten years ago will one day become dominant species, resulting in the decline of native species population in the very near future. According to field survey records, among the 120 sample households, the major occupations are consisted of 158 (49%) fishing households, 30 (25%) agriculture households, 16 (13%) services households and 16 (13%) other households and fishing is the major occupation in this area.

Domestic animals grazing are also threats on wetland area because 703 cows / buffaloes and 22,000 ducks are grazing in the wetland area.

Small Asian Mongoose, 3 species of Bandicoot Rat and also Norway Rat are hunted for food. Although these rodents are considered as pests, over-exploitation may lead to the scarcity of natural food source for some animals such as birds and small carnivores.

The main threats of herpetofauna species are illegal trade, especially turtle and snakes. There are brokers or middle men in Waw Township who export these animals to China. Among the snakes, the species Yellow-banded Krait, Monocellate Cobra and Russell Viper are mainly traded. The local people used to consume frogs and snakes that were edible. Moreover, fishing net is a hindrance for snakes because snakes were caught in fishing nets. Some villagers discarded the snakes that were caught in the net. But, some villagers used these captured snakes as animal feed for the domestic pigs.

Encroachment for agricultural purposes is a serious threat in Moeyungyi Wetland WS. As mentioned already the area encroached over the Moeyungyi WS area are 20 acres by Hpalauk Village, 10 acres by Kapin Village, 100 acres by Pyunchaung Village, 89 acres by Phalauktan Village, 10 acres by Thoneeinsu Village, totaling 229 acres. The total encroachment area over the Moyungyi Wetland is 1080 acres, covering (21%) of the Wetland Area.

Use of chemical fertilizers and pesticides also contaminates the lake water and threatens the existing biologically diverse plant and animal species and enhances difficulty in conserving the environment of the lake. The extensive use of fertilizer in agriculture lands can encourage the excessive growth of algae and aquatic submerged plants, which can reduce dissolved oxygen level of environment and harm the aquatic life.

## 9.1 Ranking Threats

To rank threats,Wildlife Conservation Society(WCS) has developed criteria against which each threat is assessed. Within the Living Landscapes Program (LLP), it is strongly advocated that criteria assess only the level of threat and not the feasibility of intervention. This ensures that focus is made on the factors that are most likely jeopardize the conservation of wildlife and wild places rather than that are easiest to address. These factors are severity, urgency, recovery time once the threat is abated, proportion of the area affected, and the probability that the threat will occur (WCS, 2002).

Once the criteria for assessing the severity of threats and/or feasibility of addressing them, the next step is to rank them. Using the Living Landscapes Program's criteria and ranking system, the total score for each threat using the following equation:

**[Total= (Urgency+Recovery) x Severity x Proportion of Area affected x Probability],**

and rank the threats according to their scores, and identify the most important threats to conservation at the site.

**Criteria Used by the Living Landscapes Program to assess Threats (WCS, 2002)**

| | |
|---|---|
| **SEVERITY** | |
| none or positive | 0 |
| measurable effect on density or distribution | 1 |
| substantial effect but local eradication unlikely | 2 |
| local eradication a possibility | 3 |
| **URGENCY** | |
| won't happen in >10 yrs | 0 |
| could happen between 3-10 years | 1 |
| could (or will) within 1-3 years | 2 |
| threat is occurring must act now | 3 |
| **PROPORTION OF LOCAL AREA AFFECTED** | |
| 0 | 0 |
| 1-10% | 1 |
| 11-25% | 2 |
| 26-50% | 3 |
| >50% | 4 |
| **RECOVERY TIME** | |
| immediate | 0 |
| 1-10 yrs recovery | 1 |
| 11-100 yrs recovery | 2 |
| 100+ yrs or never | 3 |
| **PROBABILITY** | |
| | 0-1 |

## Assessment of Threats

| No. | Threats | Severity | Urgency | Area | Recovery | Probability | Total | Rank |
|---|---|---|---|---|---|---|---|---|
| | | (0-3) | (0-3) | (0-4) | (0-3) | (0-1) | | |
| 1. | Bird Hinting/Trapping with nets | 2 | 3 | 4 | 2 | 1 | 40 | 2 |
| 2. | Electric shock fishing | 3 | 3 | 4 | 2 | 1 | 60 | 1 |
| 3. | Invasive species | 1 | 2 | 4 | 2 | 1 | 16 | 6 |
| 4. | Insect cathing using mistnets | 2 | 2 | 2 | 1 | 1 | 12 | 7 |
| 5. | Trapping small mammals for food | 1 | 2 | 2 | 1 | 1 | 6 | 10 |
| 6. | Trading of Turtles and Snakes to China | 2 | 3 | 3 | 2 | 1 | 30 | 3 |
| 7. | Land encroachement (paddy field) | 2 | 3 | 3 | 2 | 1 | 30 | 3 |
| 8. | Use of fertilizers and pesticides | 2 | 3 | 2 | 2 | 1 | 20 | 5 |
| 9. | Indiscriminate dumping of solid and liquid waste | 2 | 2 | 2 | 1 | 1 | 12 | 7 |
| 10. | Raising of Livestiock | 2 | 3 | 2 | 1 | 1 | 16 | 6 |
| 11. | Flooding during the rainy season | 1 | 2 | 4 | 1 | 0.75 | 9 | 8 |
| 12. | Infrastrucure development (Resort) | 1 | 1 | 2 | 1 | 1 | 4 | 11 |
| 13. | Water Use | 2 | 1 | 4 | 2 | 1 | 24 | 4 |
| 14. | Fuel wood collection | 1 | 2 | 2 | 2 | 1 | 8 | 9 |
| 15. | Population growth | 1 | 3 | 4 | 2 | 1 | 20 | 5 |

***Total = (Urgency + Recovery) x Severity x Area x Probability) Source: WCS (2007)***

## Priority Ranking of Assessment of Direct Threats

| Sr. | Rank Scores | Priority Ranking | Remarks |
|---|---|---|---|
| 1. | 1-3 | Very High | |
| 2. | 4-6 | High | |
| 3. | 7-9 | Moderate | |
| 4. | >9 | Low | |

## Ranking Results

| Very High | High | Moderate | Low |
|---|---|---|---|
| Bird Hinting/Trapping with nets | Invasive species | Insect catching using mistnets | Trapping small mammals for food |
| Electric shock fishing | Use of fertilizers and pesticides | Indiscriminate dumping of solid and liquid waste | Infrastructures development (Resort) |
| Trading of Turtles and snakes to China | Raising of Livestock | Flooding during the rainy season | |
| Land encroachment (paddy field) | Water use | Fuel wood collection | |
| | Population growth | | |

# 10. RECOMMENDATIONS FOR FUTURE CONSERVATION MEASURES

## 10.1 Electric Shock Fishing

**(Priority Ranking: Very High)**

Wetlands provide many services to human and their environment, accompanied by social economical and ecological values. It also provides food, nursery area for juvenile and habitat for commercial important species such as fish, shrimp, shell fish and crab. A nursery is an area or habitat where, on average, juveniles make a larger contribution per unit area to the recruitment of the adult population, and overall contribute more recruits to the population than other areas where juveniles occur. (Dahlgren *et al.* 2006).

In Moyungyi wetland area, fishers used several types of fishing gear and fishing methods to catch fish for daily food and income. Therefore fishers could have serious impact on Moyungyi wetland area. In particular, electric-shock fishing practice is posing serious threat on the Moyungyi wetland aquatic resources. The diversity and habitats of freshwater fishes are threatened by destructive fishing practices, illegal and over exploitation of fish.

A total of 13 type of fishing gears were recorded in the survey period as small scale fisheries. Push net(Yin ton), Set gill net(Tar pike), long line(Nga myar tann), Pole and line(Nga myar tan), Trap(Myone), Beach seine(Swe pike), Stationary bush park(Chone cha) and Electric Shock fishing gears were found in Moyungyi wetland area.

Electric Shock fishing gear is the most threaten gear on aquatic resoruces of Moyungyi wetland area. A total of above 10 fishers have made electric-shock fishing in day time. Therefore it is very difficult to predict how many fishers have made at night time. This practice leads to depletion of fish resources and may extinct to any species in future. Electric-shock fishing gear utilizes a source of electric current, in general a battery, a converter and two bamboo sticks with iron sieve. It functions when electric current passes through anode to cathode and fishes meet shock and die. If some fish escape from the dead, it will lose spawning opportunity in life. The gear is targeted to *Channa sp, Monoterus sp and Notopterus sp.*

According to recorded information, beach seine (swe pike) stationary bush parks provided catch tremendous amount of fish within the short period that mean these gears were highly affected to the wetland fish population.

Fishing lead to affect on countless number of fishes and other aquatic organism also suffer in the same time, following the results, lake ecosystem may be decreased and reach to worse condition for next generation in future.

As stated earlier there are altogether 1,117 households in the study area that include 302 hh (27%) of farming and 488 hh (44%) fishing. The most striking feature is that 398 hh (36%) of traditional fishing and 88 hh (18%) practice electric-shock fishing indicating that this is a serious threat for the sustainable fish resource in the Moeyungyi Wetland Wildlife Sanctuary.

**Recommendations**

- Enforce the law for effective protection around Moyungyi wetland area to stop illegal activities including electric-shock fishing, use of destructive fishing gears, and overexploitation on the extraction of fish resources.
- *Tilapia mossambica* (Tilapia) should be treated as controlled species with no more input to wetland.
- Environmental Awareness program should be promoted for grassroots' level in the region.

## 10.2 Bird Hinting/Trapping with Nets

**(Priority Ranking: Very High)**

Birds are good indicators, and can be used to identify the most biologically rich areas, as well as environmental changes and problems. They are found in almost all natural habitats, they are high in the food chain and thus reflect changes lower down, a wealth of data have been collected by ornithologists, and their conservation status is well known relative to other taxa. In general, places that are rich in bird species are also rich for other forms of biodiversity.

Studying birds can tell us about the habitats on which we all depend, and the loss of threatened birds from many parts of the region is a measure of a more general deterioration in other biodiversity and the natural environment (BirdLife International, 2005).

Wetland-adapted birds spend all or part of their life cycle on the waters or in the wetlands that dive or swim through the water in pursuit of fish prey. Other birds, including most diving ducks and shorebirds seek invertebrate prey in the sediments of the wetlands. Marsh-dwelling passerine birds search for insects on plants or the soil surface. Some seek a variety of mobile prey including fish, crabs, small mammals and other birds.

An Ornithological investigation on Moeyungyi Wetland Wildlife Sanctuary was carried out by scientists from BANCA. A total of 18,364 birds from 133 species under 51 families were recorded out of which one was considered Vulnerable (VU) and four Near Threatened species (NT).The team managed to cover a relatively large area. Moreover, the large number of bird species can be seen because of the winter migration of birds. Therefore many migrating birds were already seen in this area. The habatits varies from creek (5%), lake (6%), secondary forest (14%), scrub (12%), paddy field 16%), mudflat (12%), grass land (10%), fish pond (12%) and floating island (13%).

As Moeyungyi Wetland WS was designated as Ramsar site for Myanmar, birds play an important role in this context. Degradation of wetlands could occur at Moeyungyi Wetland WS through water diversions, irrigion and changed land use towards agricultural lands. It is also proven that wetlands are important sites of high biodiversity, conservation and other values .As wetland degradation will more or less have detrimental effects on bird population, it is advisible to maintain shallow seasonal wetlands where habitat ranges from open water of varying depts., to mudflats which can support greater bird diversity owing to a greater diversity of microhabitats.

One of the threats of birds in Moeyungyi is the bird hunting made by local communities for their living. To make the matter worse some tried to trap wildbirds with the use of nets which have serious impacts on the bird population.

According to the 'Potection of Wildlife and Protected Areas Law" enacted in 26 October, 1994, the following are the status of protection of birds in Myanmar: The Director General of Forest Department, Ministry of Forestry and Environmental Conservation notify the following endangered bird species as protected bird species by categories:

- Totally Protected Species (50 species)
- Protected Species (43 species), and
- Seasonally Protected Species (13)

A Park Warden from Nature and Wildlife Conservation Department (NWCD) is responsible to look after the Moeyungyi Wetland Wildlife Santuary and enforced the Wildlife Protection Law. However, due to insufficient staff and funds the enforcement is not quite effective.

**Recommendations**

- Bird hunting should not be allowed in the Moeyungyi Wetland Wildlife Sanctuary
- Bird survey should be done annually in winter season (open season) to collect up-to-date in ordere to understand the chainging habitat for resident as well as migratory birds.
- Publish data on annual counts and regular surveys should be released to all interested persons.
- For capacity building trainings should be organized for NWCD staff as well as all stakeholders pertaining to wildlife conservation matters.
- Workshops should be conducted for local communities concerning environmental eduction programs.

## 10.3 Trading of Turtles and Snakes

**Ranking: Very High**

South Asia has a very rich biodiversity including a high diversity of amphibian and reptilian fauna including several unique and endemic species (Shah and Tiwari 2004). It appears that only about 50% of the biodiversity of amphibians in South Asia has been discovered. Myanmar being a country of South Asia has high herpetofauna diversity richness in the world. Herpetofauna plays an important role in the fauna of a country. But, herpetology is poorly known in Myanmar. Herpetofauna includes amphibians and reptiles. Amphibians include frogs, caecilians and salamanders. And reptiles include lizards, geckos, skinks, snakes, crocodiles, water monitors, turtles and tortoises. Reptiles and amphibians occupy a diverse range of habitats and microhabitats, i.e they are found from desserts to grasslands from forests to oceans and from hills to own houses.

Herpetofauna (i.e. amphibians and reptiles) are considered an integral but undervalued part of natural ecosystems (Gibbons et al. 2000, Meyers and Pike 2006). Gibbons et al.

(2000) reflect that declines of herpetofauna species diversity and population size can be attributed in part to several causes including: anthropogenic factors, habitat loss, and presence of invasive and introduced species, pollution, and disease. Site-specific lists of species presence are important in the development of baseline information for a site, especially when directing conservation or management efforts (Tuberville et al. 2005); this information can also provide indicators of the health of a site. Amphibians and reptiles are recognized as key bioindicators of environmental health.

A total of 24 herpetofauna species were observed during the survey period. The results recorded from the field survey were 6 frogs, 1 turtle, 8 lizards and 9 species of snakes. Live, *Ptyas korros* was not encountered but many molted skins were observed here and there, indicating the presence of this species in the area. Among all the species found, one turtle is regarded as Vulnerable (VU) and three species of frog and five species of snake as Least Concern (LC). They were namely, the turtle species, *Morenia ocellata*, three frog species namely, *Kaloula pulchra*,*Occidozyga lima* and *Hylorana macrodactyla* and five snakes namely, *Bungarus fasciatus*, *Naja kaouthia*, *Enhydris enhydris*, *Homalopsis buccata* and *Xenopeltis unicolor*. *Bungarus fasciatus* and *Naja kaouthia* that are venomous snakes.

As the IUCN vulneranle turtle species *Morenia ocellata* is traded to China which is also endemic to Myanmar, it is urgently need for the protection of this species, which can become critically endangered (CR) at any time. This turtle species was also listed as Appendix I in CITES (2013)

The main threats of herpetofauna in Moeyungyi Wetland Wildlife Sanctuary are illegal trade of turtle and snake. Particular concern is that these turtles and snakes are export to China by broakers in Waw Township which may lead to extinction of these species in the very near future.

**Recommendations**

- The herpetofauna species depend on season as some species are active only during the rainy season. Hence, the survey work should be carried out throughout the whole year.
- Enough time should be allotted to carry out for the herpetofauna survey.

## 10.4 Land encroachment (paddy field)

**Priority: Very High**

Agriculture can affect wetlands areas in many ways. Historically, agriculture's greatest impacts have arisen from draining, filling, and/or clearing of wetlands for agricultural production. Although wetlands provide valuable environmental benefits, they have been widely converted to other uses particularly for agriculture purposes. The functions of wetland areas located near agricultural areas can be threatened by:

Hydrologic modification

- Ground water withdrawals for irrigation;
- Diversions that reduce the flow of water into a wetland;
- Flooding that raises water levels, converting a wetland to a lake or pond

Erosion and sedimentation

- Excessive sediment from soil erosion that clogs wetland vegetation and impairs water holding capacity; and
- Diverting or withholding of sediment that prevents the regeneration of wetlands in natural areas

Alteration of vegetation

- Clearing vegetation by burning, applying herbicides or other means for extensive cultivation due to population growth.

Land encroachment for cultivation is one of the serious threats for the sustenance of the Moeyungyi Wetland Wildlife Sanctuary. The encroachment of farms usually takes place during the summer time, planting summer paddy. According to the previous survey carried out by NWCD in 2010-2011 it was found out that there were 1687 acres encroached by 491 farmers at an average of about 3.4 acres.

| Township | Village | Farmers (number) | Encroachment (acres) |
|---|---|---|---|
| Bago | Phayargalay | 133 | 400 |
| | Wanbein | 45 | 156 |
| | Ywarthit | 62 | 172 |
| | Pyinbongyi | 106 | 458 |
| | **Total** | **346** | **1186** |
| Waw | Kabin | 3 | 10 |
| | Ninetisu | 9 | 20 |
| | Indaingsu | 50 | 200 |
| | Pyunchaung | 10 | 50 |
| | Ayekarit | 70 | 200 |
| | Htienbin | 3 | 20 |
| | **Total** | **145** | **500** |
| | **Grand Total** | **491** | **1686** |

As shown in Annex 4, the areas encroached during over the survey area in 2004 are 20 acres by Hpalauk village, 10 acres by Kapin Village, 100 acres by Pyunchaung Village, 89 acres by Phalauktan Village, 10 acres by Thoneeinsu Village, totaling 229 acres. During the current survey it was stated that an area of about 1080 acres has been encroached for growing summer paddy inside the Moeyungyi Wetland WS, about 21% in extent which is quite a serious threat.

**Recommendations**

- As 30 hh out of 120 hh included in the study are engaged in farm work representing 25% of the household under study no further cultivation encroachment should be allowed in the Moeyungyi Wetland WS.
- Chemical fertilizers should be substituted with organic fertilizer if situations are favorable
- Educate local communities not to use pesticides and its negative impacts on the environment.
- As the water spread of the Moeyungyi Wetland WS is getting smaller, agricultural land should not be extended further horizontally: instead, the farmers should concentrate vertically on the increase of the yield per unit area.

## 10.5 Water Use

**Priority: High**

Wetland ecosystems provide a diversity of services vital for human well-being and poverty alleviation. It is well established that provisioning services from wetlands, such as food (notably fish) and fiber are essential for human well-being. Among supporting and regulating services such as nutrient cycling, sustaining vital ecosystem functions that deliver many benefits to people, the delivery of fresh water is a particularly important service both directly and indirectly.

Around the world wetland are being lost and degraded, resulting from increasing pressure to drain and reclaim land for agriculture, and others uses. In such situation, a complete study on wetlands is necessary to increase the awareness for protecting and preserving the wetland.

Traditional water and watershed management is an approach that integrates ecosystem management with traditional water and watershed management goals and techniques. It manages water resources, wetlands and related ecosystems. The watershed management in wetland is very important because it has several benefits to the whole community. These benefits include (a) improved achievement of traditional watershed management goals, (b) improved protection and restoration of wetlands and related ecosystems, (c) improved ability to allocate lands throughout a community to their most appropriate uses and protect the overall "quality of life.

Apart from that whenever there are bodies of water which varies seasonally in an area like Moeyungyi Wetland WS, there is always going to be a conflict between the activities of fishing and agriculture. Areas of land when inundated will be used for fishing and when dry will be used for agriculture.

One of the main functions of Moeyungyi Wetland WS is the supply of water for human use. The villages in the vicinity of Moeyungyi Wetland WS depends their water supply mainly on the wetland.

In the present study, Moeyungyi Wetland WS is associated with agro-irrigation, where huge water withdrawal is necessary, particularly during the summer time where summer paddy is growing.

During the present study it was realized that the use of chemical fertilizers and pesticides will be a serious threat for the water quality not only for the aquatic life but also for those depending on the water from the wetlands.

Besides, water use is the basic necessities for local people existence. It is more important in the study area because it was found out that nobody use purified drinking water: 35% rely on tube well, 13% on lake and the rest 52% on wetland for portable water.

As the vast majority of people in the study area depend on wetland water for drinking, cooking and bathing and other domestic purposes, they should be well educated on how to conserve the clean water without being polluted due to their day to day activities.

**Recommendations**

- Encourage to use fly-proof latrines for all villages in the environs of Moeyungyi Wetland WS so as not pollute the water sources
- Contact with concerned authorities for regulating the water volume particularly during the summer where the water level is low.
- If Moeyungyi Wetland WS is to be used as portable water, it should be either boiled or use of water purifiers for safe portable water.
- To assess the current status of water quality in Moeyungyi Wetland WS for finding out whether it is within the threshold values.

## 10.6 Raising of Livestock

**Priority: High**

Grazing livestock in the Moeyungyi Wetlands WS can lead to both positive benefits and potentially significant negative outcomes. Positive benefits of good grazing practices include:

- sustainable plant growth
- high plant species diversity; •
- limited development of plant monocultures; and
- economic benefits

Negative outcomes of poor grazing practices can include:

- increased populations of exotic plants
- loss of desirable grazing species
- reduction in plant species diversity
- loss of bird breeding habitat
- soil structural problems
- increased water turbidity
- removal of groundcover

- damage to aquatic habitats; and
- damage to long-term economic outcomes

It was also found out that the raising of livestock is also a problem for the deterioration of the water quality of the wetland by the faeces of these animals. At the moment there are 135 cattle, 568 buffaloes, 25 goats, 77 pigs, 1955 poultry and 8260 ducks are being reared in the villages which will increase the level of water pollution in the Moeyungyi Wetland WS.

At the present moment there is no proper grazing regime in the Moeyungyi Wetland WS. In some countries graziers operate set stock grazing regimes with stock moved after periods of more than 6 months. Movement is dictated by vegetation condition rather than time. Most graziers appear to have adopted rotational grazing based on pasture condition. Some apply strategic grazing systems based mainly on pasture condition or time based strategic grazing.

**Recommendations**

- A research study should be organized to find out the grazing regime of the animals that has least impact on the vegetation of Moeyungyi Wetland WS.
- Proper waste disposal techniques should be adopted
- Local commuties should be educated on proper waste disposal techniques by the staff of Moeyungyi Wetland WS.

## 10.7 Population Growth

**Priority: High**

Rural population growth is bound to have adverse effects on the environment, if it is not accompanied by proper planning. Population growth will be understood as an increase in the number of people residing in a square kilometer. In the context of Moyungyi Wetland WS, increase in population could be attributed to rural migration as well as an increase in the number of people born. In fact the social survey report carried out in 2011 provided some information on population of 13 villages in the Bago and Waw townships. During the current survey of 8 villages, there were only 3 villages overlapped with the previous coverage. The exact figures of population data from 17 villages in Bago and WaW townships will be obtained from the National Census data recently conducted in 2014 from March 29 to April 10. The data is still in the process and will be released in August 2014. It is expected that population of 17 villages in the vicinity will be in the increasing trend based on the fact that there were 21% of the Moyungyi Wetland WS being encroached for paddy cultivation.

Popuation growth is also a serious threat for the existence and sustenance of the Moeyungyi Weltand WS. Most of the study villages are situated quite close to the Moeyungy WS. Moreover seasonal migration for jobs outside the Moeyungyi Wetland WS is found to be only 7% which is quite low to have impact on the population pressure of the adjoining villages towards Moeyungyi Wetland WS. With the growth in population, it is envisioned that there will be a growth of unplanned informal housing and challenges related to solid waste accumulation, wetland encroachment for cultivation, livestock raising and water pollution.

**Recommendations**

- Wait for the population census data to have the actual population data for the villages in the environs of Moeyungyi Wetland WS.
- Socio-economic data should be collected at 5 year interval to find out the changes in socio-economic status of the villages

## 10.8 Indiscriminate dumping of solid and liquid waste

**Priority: Moderate**

The dumping of refuse from villages, discharge of domestic sewerage, as well as agricultural runoff containing fertilizer and pesticides into wetlands, increases the organic loading of the wetlands waters. This increases the biochemical oxygen demand (BOD) of the water body, leading to inadequate oxygen supply to support plant and animal life. The discharge of the various forms of wastes into the water bodies creates two major environmental health problems. First, they create a fertile environment for microbiological and biological agents to flourish and allow the spread of disease pathogens. Secondly, the chemical constituents in the waste create various health problems for humans and aquatic organisms. The indiscriminate dumping of solid and liquid waste into the wetland degrades the quality of the wetland water and natural beauty of the wetland.

Water pollution is generally classified into two categories, namely, point source (PS) and nonpoint source (NPS). NPS pollution generally consists of sediment, nutrients, organic and toxic pollutants, and originates from more diffuse pollution sources such as agriculture, storm water runoff or other land-uses. Furthermore, NPS pollution impacts at a larger scale but generally at lower concentrations, making pollution sources difficult to identify. In addition, more people contribute to the problem and are usually affected, increasing the difficulty of management. This is a serious threat for villages at the vicinity of Moeyungyi Wetland WS as only 28% of the villages have fly-proof latrines while the rest 72% of the villages have no fly-proof latrines.

This kind of pollution puts rural inhabitants at great risk-directly by affecting human health and indirectly by degrading the resource base on which many people depend. This kind of poor sanitation affects not only rural dwellers but others at the downstream as well. This kind of lack of basic sanitation services can cause pathogens to spread more quickly and reach greater numbers of people in the Moeyungyi Wetland WS that have become degraded over time.

Due to agricultural activities Moeyungyi Wetland WS water resources can become enriched by fertilizer and animal waste in runoff from croplands and also leaching of pesticides and toxic substances.

This kind of threat can also be aggravated by the presence of a Resort Hotel facility in the Moeyungyi Wetland WS. It is not only a source of income, employment, transport and recreation, but should pose restrictions that the wetland should not be used as a dumping ground for various types of waste. If not, the ecological health of the once clear, life-filled Moeyungyi Wetland WS can become murky and smelly due to the pollution.

**Recommdendations**

- Prior should be taken to organize more fly-proof latrines for villages in the vicinity of Moeyungyi Wetland WS.
- Chemical fertilizer application should be phased out step by step to use organic fertilizer instead.
- Also, chemical pesticides should be replaced gradually by using organic type natural pesticides.
- Waste management system should be developed at Moeyungyi Wetland Resort Hotel.

## 10.9 Flooding during rainy season

**Priority: Moderate**

The effectiveness of wetlands for flood abatement may vary, depending on the size of the area, type and condition of vegetation, slope and location of the wetland in the flood path and the saturation of wetland soils before flooding.

Different types of wetlands play important flood control roles in different situations. In the upper reaches of Moeyungyi Wetland WS, vegetation cover and grassland can act like sponges, by absorbing rainfall and allowing it to percolate more slowly into the soil, thereby reducing the speed and volume of runoff entering water courses. This means that water levels rise more slowly and human lives and livelihoods are less likely to be affected by destructive flash flooding.

However, destruction of ground vegetation in the upper reaches for Moeyungyi Wetland WS for fuel wood collection has led to soil erosion and as a result siltation has reduced the area of the flood plain causing flooding during the rainy reason. This has serious threat to properties and lives of those residing in the vicinity of Moeyungyi Wetland WS.

The cost of replacing the flood control function of the wetlands by engineering means will more or less offset the costs when compared to the potential lost due to flooding. However, the most effective way for preventing floods is to preserving wetlands in the first place and restoring some of those that have been drained could help reduce future flood losses.

Moeyungyi Wetland WS experienced flooding every year during the rainy season which can cause damage more or less to the planted crops and property belonging to the inhabitants.

**Recommendatios**

- Removal of vegation cover should be controlled at the environ of Moeyungyi Wetland WS.
- Develop first growing fire wood plantations for the community living at the vicinity of Moeyungyi Wetland WS.
- Firewood-saving stoves should be promoted for the villages in the vicinity of Moeyuungyi Wetland WS.

## 10.10 Fuel wood Collection

### Priority: Moderate

Majority of the villagers in the environs of Moeyungyi Wetland WS are poor, mainly relying on fishing and farming for subsistence livelihoods. In addition to that, various factors such as population growth, loss of assess to land can lead to unsustainable levels of natural resource use, leading to degradation and loss of natural habitats. As stated earlier the majority of the inhabitants rely mainly on wood fuel for their day to day needs of cooking. Reeds and, raw grasses and other plants that thrive in the wetland provide fuel to the inhabitants around the wetland.

If the local communities have extracted excessive firewood from the Moeyungyi Wetland WS, the remaining wetland may become degraded due to the influence of human activities. The loss and degradation of wetlands has negatively affected water birds, which depends on wetland habitats. How to provide high quality habitats for water birds through effective management is a critical issue in water bird conservation for a Ramsar site like Moeyungyi Wetland WS.

The energy use of villages around Moeyungyi Wetland WS is from 4 sources, namely, electricity (8%), charcoal (10%), wood (76%) and others (6%). Sources of wood are from reeds, raw grasses and other plants that thrive in the wetland. Wetland plants are susceptible to degradation if subject to excessive extraction for fuel wood and also grazing by domestic animals.

### Recommendations

1. As fuelwood will still be the enery source for the villages, it is necessary to establish fast growing tree plantations with a very short rotation.

2. Educate local communities on the use of energy efficient cook-stoves for saving fire wood for cooking.

## 10.11Trapping Small Mammals

### Priority: Low

Small mammals are a generic grouping biologists generally use to refer to shrews, moles, mice, bats and ground squirrels etc. Bountiful food resources of wetlands allow small mammals to thrive in and along wetlands. And small mammals help wetlands flourish as they disperse seeds, provide predators with food, aerate soils with burrows and help control insect populations.

Particularly this kind of small mammal surveys can help biologists better understand distributions, habitat associations and population status for various species of small mammals at Moeyungyi Wetland WS.

Many species of mammals depend on wetland habitats for survival. Some mammals are herbivores, while others are omnivores or carnivores that rely on varying combinations of aquatic invertebrates, amphibians, fish, and other prey. Many wetland mammals consume large numbers of insects, cultivate the soil, or modify habitat used by waterfowl and other wildlife.

The decrease in mammal species which appear to be at low densities was attributed mainly due to vegetation cover degradation due to fuel wood collection and encroachment for agricultural purposes. All wildlife populations have declined steadily over the past few decades, as a result of both legal and illegal hunting. Mist nets to catch some edible insects especially Giant Water Bug (Vernacular Name, Belar) set by local people are threats to the survival of bats.

All animals including small mammals depend on the plants or forests for food, shelter, and hidden places for the enemies or predators. There is interactive relationship between forest and mammals. Most of the diverse mammal populations live in wetland areas. Bountiful food resources allow small mammals to thrive in and along wetlands. Two main causes of population decline of small mammals are food and shelter. Scarcity of food and decreasing vegetation cover are the main causes of population decrease of animals. Their presence indicates about habitat quality and the success of conservation and management. Many species of mammals depend on wetland habitats for survival. Some mammals are herbivores, while others are omnivores or carnivores that rely on varying combinations of aquatic invertebrates, amphibians, fish, and other prey. Many wetland mammals consume large numbers of insects, cultivate the soil, or modify habitat used by waterfowl and other wildlife.

As stated earlier small Asian mongoose, 3 species of Bandicoot rat and also Norway rat are hunted for food by the local inhabitants. Although these rodents are considered as pests, over-exploitation may lead to the scarcity of natural food source for some animals such as some birds and small carnivores.

**Recommedations**

- Suitable trees need to be supported for some small mammals as food source.
- It is necessary to enforce the wildlife law in and around the Moeyungyi WS so as to prevent from illegal activities being done.
- Also, local people should be educated for the effective protection of the WS through environmental education and extension programs.

## 10.12 Infrastructure Development

**Priority: Low**

It is stated by Myanmar Investment Commission (MIC) that all developers will need to allocate Corporate Social Responsibility (CSR) program every year for any kind of development projects. This program is in line with the idea on how the tourism company operates in relation to protected areas and contributions willingly make to the management and conservation of protected areas. This will help develop the increased cooperation between Protected Area Managers and the Tourism Industry with the goal of preserving biodiversity through “Responsible Tourism”.

**Moeyungyi Wetland Resort**

Moeyungyi Wetland WS can benefit from tourism program in several ways:

- Additional funds for conservation can be generated from tourism through CSR program; this is important, as many protected areas face serious financial constraints in Myanmar.
- By raising awareness amongst visitors and raising the profile of the protected area at the local and national level, tourism can help promote conservation of the site, especially for the "Ramsar Site" like Moeyungyi Wetland Wildlife Sanctuary.
- By organizing environmental education programs for people living in and around the protected area, funds provided by tourism (CSR) may help reduce unsustainable exploitation of natural resources, habitat degradation by cultivation encroachment and particularly bird hunting and illegal fishing using electrode fishing gear which are serious threats to the aquatic resources of Moyungyi Wetland WS.

In March 2014, the Shwe Pyi Aye Tour Co., Ltd. submitted application to the Myanmar Investment Commission (MIC) to get approval for its investment proposal to run the Resort at Moeyoungyi Wildlife Sanctuary, Bago Region, by renting 145.69 ha (360 ac.) of forest land for 30 years from the Ministry of Environmental Conservation and Forestry (MOECAF). The Moeyungyi resort will employ 60 local staff for providing good services to the tourists, both local and foreign. The company will allocate some funds for its Corporate Social Responsibility (CSR) program. In order to protect the Moeyungyi Wetland Wildlife Sanctuary the following measures should be undertaken:

- To use the sewage disposal system that has least impact on the environment
- To adopt proper wastewater treatment system
- To use natural lighting sysem to save electrical power

Waste from the resort such as liquid waste and used oils should not be disposed of directly into the streams and rivers: the wastes should be treated such that it is in line with the 'Ministry of Industry Effluent Standards' before disposed of at natural water courses and proper waste management plans to be developed.

To reduce the waste derived from the resort, waste reduction methods 3 Rs, such as 'Reduce, Reuse and Recycle' should be adopted and draw up a plan and implement that will reduce the daily waste production.

A management plan has to be developed to have least impact on the environment by the operations of the resort.

It was stated by the Nature and Wildlife Conservation Department (NWCD) that Moeyungyi Wetland Wildlife Sanctuary receives about 150 foreigners (mostly from

USA and Europe) and about 7,500 domestic tourists each year (NWCD, 2014). Foreign tourist mostly visit for bird watching between September and March and stay for 2-3 days. Domestic tourists generally pay visit for a day trip. Visitors are allowed to wander around the lake using boats provided by the resort. They are not allowed to enter the core zone of the wetland as well as prohibited to enter ecological sensitive areas like breading sites for waterfowls. They are allowed to watch birds from a bird-watching tower with nominal fees. Moreover, visitors are not allowed to catch fish from the Wetland WS. Therefore, negative impacts on biodiversity in general are very improbable due to the visitors.

**Recommendations:**

- Environmental Management Plan should be developed for Moeyungyi Resort Hotel
- Corporate Social Responsibiity program shall be adopted to establish closer links with the tourism staff, staff of NWCD and the community
- Create income generation for local communities by train them to become bird-watching guides with the full participation of travellers, locals and entrepreneurs in a triple-win situation
- Promote capacity building of NWCD staff awareness and education programs on the coexistence of tourism and conservation.

## 10.13 Institutional Arrangement

The Moeyungyi Wetland WS is managed by NWCD according to an annual plan of operations that includes patrolling activities, maintenance of roads and buildings and zoning programme. No human access is allowed in the core zone. The organization of NWCD staff as it stands on 2007 is as follows: (Myint Aung, 2007).

If you compare the staff level at 2007 and 2014 for Moeyungyi Wetland WS the permanent staff position in 2014 is increased by 1 additional staff. During 2007 the daily staff acoounted for 14 whereas in 2014 it does not mentioned about the number of daily wages staff which depends on the budget allocation of the site.

According to the studies made by Myint Aung (2007) concering the limiting factors for effective management of Protected Areas in Myanmar are:

- Lack of education and training of PA staff
- Short period for staff for posting at a site (4 years)
- Inadequate staff for effective law enforcement and patrolling
- Lack of training for wardens and rangers
- Funding for community relations
- Insufficient services for environmental education and outreach activities

**Table 4Staffing levels of protected areas in Myanmar -2007(paper parks are those with an absence of staff, law enforcement, infrastructure, and boundary markers)**

| Protected Area | Total Area | Permanent Staff | Daily Staff | Total Staff | Staff ($km^2$) | Comment |
|---|---|---|---|---|---|---|
| Alaungdaw Kathapa NP | 1581 | 99 | 30 | 129 | 0.08 | |
| Chatthin WS | 268 | 60 | 12 | 72 | 0.26 | |
| Hkakabo Razi NP | 3812 | 4 | 12 | 16 | 0.00 | |
| Hlawga Park | 6 | 138 | 54 | 192 | 30.14 | Overstaffed |
| Htamanthi WS | 2151 | 26 | 15 | 41 | 0.02 | |
| Indawgyi Wetland BS | 775 | 5 | 0 | 5 | 0.01 | Understaffed |
| Inlay Wetland BS | 642 | 13 | 8 | 21 | 0.03 | |
| Kahilu WS | 161 | 0 | 0 | 0 | 0.00 | Paper Park |
| Kelatha WS | 24 | 0 | 0 | 0 | 0.00 | Paper Park |
| Kyaikhtiyoe WS | 156 | 8 | 0 | 8 | 0.03 | Understaffed |
| Lampi Island Marine Park | 205 | 0 | 0 | 0 | 0.00 | Paper Park |
| Lawkanadar WS | 0.5 | 20 | 45 | 65 | 130 | Overstaffed |
| Loimwe WS | 43 | 0 | 0 | 0 | 0.00 | Paper Park |
| Meinmahla Kyun WS | 137 | 16 | 5 | 21 | 0.15 | |
| Minsontaung WS | 23 | 7 | 7 | 14 | 0.61 | |
| Minwuntaung WS | 206 | 0 | 0 | 0 | 0.00 | Paper Park |
| Moscos Islands Marine Park | 49 | 0 | 0 | 0 | 0.00 | Paper Park |
| Moyingyi BS | 104 | 10 | 14 | 24 | 0.23 | |
| Mulayit WS | 139 | 0 | 0 | 0 | 0.00 | Paper Park |
| Natmataung NP | 723 | 38 | 15 | 53 | 0.07 | |
| Panlaung-Pyadalin Cave WS | 334 | 3 | 0 | 3 | 0.01 | Understaffed |
| Parsar WS | 78 | 0 | 0 | 0 | 0.00 | Paper Park |
| Pidaung WS | 698 | 8 | 8 | 16 | 0.02 | |
| Popa Mountain WS | 129 | 159 | 13 | 172 | 1.33 | Overstaffed |
| Pyin Oo Lwin WS | 127 | 0 | 0 | 0 | 0.00 | Paper Park |
| Rakhine Yoma WS | 1756 | 10 | 11 | 21 | 0.01 | Understaffed |
| Shwe U Daung WS | 326 | 8 | 9 | 17 | 0.05 | Understaffed |
| Shwesettaw WS | 553 | 61 | 7 | 68 | 0.12 | |
| Taungyi WS | 16 | 0 | 0 | 0 | 0.00 | Paper Park |

| Protected Area | Total Area | Permanent Staff | Daily Staff | Total Staff | Staff ($km^2$) | Comment |
|---|---|---|---|---|---|---|
| Thamihla Kyun WS | 1 | 0 | 0 | 0 | 0.00 | Paper Park |
| Wetthikan WS | 5 | 0 | 0 | 0 | 0.00 | Paper Park |

**Table 5The existing staff at Moeyungyi Wetland WS as of 2014 is as follows:**

| Sr. | Position | Approved | Existing | Shortage | Surplus | Remarks |
|---|---|---|---|---|---|---|
| 1 | Staff Officer | - | 1 | - | 1 | |
| 2 | Auditor | - | 1 | - | 1 | |
| 3 | Range Officer | 1 | - | 1 | - | |
| 4 | Ranger | 1 | 1 | - | - | |
| 5 | Senior Clerk | - | 2 | - | 2 | |
| 6 | Junior Clerk | 1 | - | 1 | - | |
| 7 | Forester | 2 | 3 | - | 1 | |
| 8 | Security-4 | 1 | - | 1 | - | |
| 9 | Sale-4 | 1 | - | 1 | - | |
| 10 | Forest Guard (Nursery) | 1 | 1 | - | - | |
| 11 | Security-5 | 1 | - | 1 | - | |
| 12 | Driver/Mechanic | 1 | - | 1 | - | |
| 13 | Wildlife Conservation Staff | 2 | 2 | - | - | |
| 14 | Carpenter-5 | - | 1 | - | 1 | |
| 15 | Helper | 1 | - | 1 | - | |
| | **Total** | **13** | **12** | **7** | **6** | |

## Recommendations:

- At least budget allotment for Moeyungyi Wetland WS should be provided to cover the appointment of daily staff level of 2007.
- Training should be arranged for Park Warden and Staff for management level and operational level trainings respectively by organization like WCS occasionally when they conduct surveys at Moeyungyi Wetland WS.
- Particularly for effective patrolling to monitor and control threats and wildlife which is the most important operation for Moeyungyi Wetland WS, the SMART (Spatial Monitoring and Reporting Tool) patrolling system should be introduced with the assistance of WCS.

SMART includes:

- Map reading, GPS & compass using to point out patrol route and tracking position
- Digital cameras using to collect evidence of threats and wildlife encountered during patrol
- Radio transceiver communication
- Data form using for wildlife, threats and other data collection
- Wildlife tracks & signs identification
- Crime scene investigation
- Physical strength practice
- Encounter & confront skill
- First aids

SMART have 2 levels of Training, basic level training for junior staff and advanced level training for senior staff.

- Funding for community relations should be organized from CSR program from Moeyungyi Wetland Resort Hotel.
- Sufficient funds should be acquired for environmental education and outreach activities through CSR programs and interested donors.
- Instead of working on annual work plan, a proper 'Moeyungyi Wetland WS Management Plan" should be developed at least on a 4 year-plan which should be implemented, updated on a regular basis and evaluated at the end of the plan period. Prior action should be given on research, surveys, extension programs for the local communities and effective patrolling activities.

**Table for Monthly Operations of Moeyungyi Wetland Sanctuary in Fiscal Year 2013-2014**

| Sr | Operation | April | May | June | July | August | September | October | November | December | January | February | March | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Conservation of anmilas and plants | | | | | | | | | | | | | |
| | (i) Study of Fish species | | | | ↔ | | | | ↔ | | | | ↔ | |
| | (ii) Study of Migratory Birds | | | | | | | | ← | | | | → | |
| | (iii) Study of Aquatic Plants | | | | ↔ | | | | ↔ | | | | ↔ | |
| | (iv) Monitoring of Bird Flu | | | | | | | | ← | | | → | | |
| 2 | Extension for Biodiversity Conservation | | | | | | | | ← | | → | | | |
| 3 | Patrolling | | | | | | | | | | | | | |
| | (i) Regular Inspection | ← | | | | | | | | | | | → | |
| | (ii) Surprise Check | ← | | | | | | | | | | | → | |
| 4 | Fire Protection | ← | | → | | | | | | | ← | | → | |
| 5 | Construction and Renovations | | | | | | | | | | | | | |
| | (i) Improvement of Information Centre | | | | | | | ← | | → | | | | |
| | (ii) Construction of camps for conservation | | | | | | | ← | → | | | | | |
| | (iii) Construction of Park Warden Residence | | | | | | | ← | → | | | | | |
| | (iv) Renovation of Staff Quarters | | | | | | | ← | | → | | | | |
| | (v) Renovtion of Signboards | | | | | | | | | | | | | |
| | (a) Warning Signboards | | | ← | → | | | | | | | | | |
| | (b) Educational Signboards | | | ← | → | | | | | | | | | |
| | (vi) Zone Demarcation | | | ← | → | | | | | | | | | |

## 11.0 CONCLUSION

In Myanmar wetlands are important natural resources. Moeyungyi Wetland WS is a famous wetland as well as Important Bird Areas (IBA) in Myanmar. Moeyungyi Wetland WS is situated along flying routes which is essential for the migratory water birds as they need a chain of protected feeding and resting areas to enable them to travel from the northern breeding ground to the south non-breeding areas.

A desk study was made in 2013 December for previous surveys and the current survey by BANCA on the status of biological survey data to reflect the changes that take place during the different time periods. It was found out that the following institutions were involved in the studies in stated periods as mentioned in the following table:

| Source | Avifauna | Mammal | Herptofauna (Amphibians + Reptiles) | | Flora | Fishery | Entomology (Butterfly + Insects) | |
|---|---|---|---|---|---|---|---|---|
| WCS | 128 (2007)<br>139 (2008)<br>119 (2009)<br>133 (2011) | | | | | | | |
| Yangon University | 87 (2007) | | | | | 33 (2004 – 2005) | | |
| Bago University | 52 (2008 – 2009) | 9 (2008 – 2009) | 12 (2008) | 20 (2008) | | 36 (2008 – 2009) | 37 (2009) | 16 (2008) |
| NWCD, Moeyungyi | 126 (2008 – 2013) | | 8 (2003) | 20 (2003) | | 36 (2003) | 33 (2003) | |
| BANCA (2014) | 133 | 12 | 24 | | 74 | 37 | 41 | 14 |

It can be observed from the above table that previous surveys are concentrated on avifauna surveys as Moeyungyi Wetland WS is quite famous for the presence of migratory waterbirds and habitats which also constitute the main attraction for tourists.

Wildlife Conservation Society (WCS) is also interested in avifauna survey. The two Universities, namely, Yangon and Bago are also interested in conducting surveys more comprehensively. Bago University takes opportunity to conduct surveys quite extensively by taking advantage of being situated quite close to Moeyungyi Wetland WS, compared to Yangon University. Even then, surveys were carried out in 2008-2009 only. However, the period of surveys are found to be not well planned and carried out on an ad hoc basis.

As stated earlier the objectives of conducting current surveys conducted by BANCA when compared to previous surveys are quite comprehensive. It covers avifauna, fish, entomology, harpetology, mammals and also socioeconomic aspects. However, this kind of assessment is like a rapid assessment as the survey period is 7-8 days only. This will provide some information on the current situation of the biodiversity of the Moeyungyi Wetland WS at a galance and the social context for 'wise use' of wetlands. Based on the surveys data it is quite

certain that the status of biodiversity resources in Moeyungyi Wetland WS is quite stable during the time period between 2007 and 2014.

Based on the above mentioned surveys Moeyungyi Wetland WS as a RAMSAR site is still significant for conservation of birds and aquatic life. The socioecomic survey indicated that about 77% of the populations are dependent of Moeyungyi Wetland WS for their livelihood. By occupation 49% engaged in fishery while 25% are engaged in agriculture with the rest for services and others. With the increase in population in the near future more and more people will depend on the wetland for their livelihood.

People living in the vicinity of Moeyungyi Wetland WS depend for their livehood because wetlands are major sources of water for drinking, cooking, transportion, fishing and cultivation of crops.

Concerning income and expenditure of the inhibatants, it was realized that 58% of the household income was between K 3000-6000 while for expenditure it was between K 2000-4000 for 64% of household. Hence, the socio-economic condition of the villages under study can be considered as moderate situation.

It is also realized from the study that water pollution is also a serious threat in the Moeyungyi wetland. Likewise, illegal means of of fishing like electric-shock fishing will lead to the depletion of fish resources in the very near future.

It is thus necessary to study the analysis of the socio-economic life of the inhabitants living in the environs of Moeyungyi Wetland WS from the geographic perspective. Also, a detailed study of the fishery resources as well as wetland agriculture so as to have least impact on the water resources as the wetland water is being used for day to day needs by the inhabitants. Hence, water pollution studies and monitoring at Moeyungyi Wetland WS should be given high priority.

Forest Department is a 'Ramsar Focal Point' for Myanmar and is responsible to manage closely in collaboration relevant Ministries. According to the current studies communities living in close proximity to Moeyungyi Wetland may not be supportive of conservation efforts and protected area management. Most probable reasons for this may include low awareness about the objectives or value mechanism of Moeyungyi Wetland WS for local communities concerning benefits accrued from protected areas that in turn limit opportunities for grassroots participation in conservation activities.

The socio-economic studies carried out in this study indicated that the livelihood of poor communities living near the wetlands should be given due consideration so that their dependence on wetland resource can be made sustainable. This can be accomplished through education programs for the effective protection of the WS through environmental education and extension programs.

Also, it is necessary to develop the Management Plan for a long-term duration (at least 4 years period) for Moeyungyi Wetland WS, rather than annual program currently in practice.

As human activities are responsible for such kind of negative impacts mentioned already, NWCD should coordinate with relevant stakeholders such as local administrators, academia, NGOs, local communities and donors, particularly national and international (such as CSR, GEF) to effectively manage the one and only listed 'Ramsar site' of Myanmar.

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# APPENDICES

**Appendix 1**

## CRITERIA FOR THE DESIGNATION OF WETLANDS OF INTERNATIONAL IMPORTANCE (RAMSAR CRITERIA)

**Criterion 1:** A wetland should be considered internationally important if it contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.

**Criterion 2:** A wetland should be considered internationally important if itsupports vulnerable, endangered, or critically endangered species or threatened ecological communities.

**Criterion 3:** A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintainingthe biological diversity of a particular biogeographic region.

**Criterion 4:** A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.

**Criterion 5:** A wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds.

**Criterion 6:** A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.

**Criterion 7:** A wetland should be considered internationally important if it supports a significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/or populations that are representative of wetland benefits and/or values and thereby contributes to global biological diversity.

**Criterion 8:** A wetland should be considered internationally important if it is an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend.

**Criterion 9**: A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of wetland-dependent non-avian animal species.

**Source: A Wetland inventory of Myanmar (MOEJ, 2004)**

# DESK STUIES OF BIODIVERSITY AND SOCIOECONOMIC DATA FOR MOEYUNGYI WETLAND WILDLIFE SANCTUARY

## Appendix 2.1

### List of Avifauna in Moeyungyi Wetland Wildlife Sanctuary

| Sr.no | Reference | Author | Period | Total Species |
|---|---|---|---|---|
| 1 | Wildlife Conservation Society | Naing Lin | Jun 2007 | 128 |
| 2 | Wildlife Conservation Society | Naing Lin | 2008 to 2009 | 139 |
| 3 | Wildlife Conservation Society | Naing Lin | Jan 2009 | 119 |
| 4 | Wildlife Conservation Society | Naing Lin | Jan 2011 | 133 |
| 4 | Bago University | Group | 2008 to 2009 | 52 |
| 5 | Moeyingyi Bird Sanctuary | NWCD* | 2008 to 2013 | 126 |
| 6 | Yangon University | Naw Tar Ma Lar Htoo | 2007 | 87 |

Nature Wildlife Conservation Department*

**Appendix 2.1**

## Compiled Bird List of the Moeyingyi Bird Sanctuary (2007 t0 2013)

| Sr. no | Family | Common name | Scientific name | Water Birds | Terrestrial Birds | Range and Status |
|---|---|---|---|---|---|---|
| 1 | **ANATIDAE** | Lesser Whistling-duck | *Dendrocygna javanica* | + | | R |
| 2 | | Comb Duck | *Sarkidiornis melanotos* | + | | R |
| 3 | | Ruddy Shelduck | *Tadorna ferruginea* | + | | M |
| 4 | | Cotton Pygmy-goose | *Nettapus coromandelianus* | + | | R |
| 5 | | Gadwall | *Anas strepera* | + | | M |
| 6 | | Indian Spot-billed Duck | *Anas poecilorhyncha* | + | | R |
| 7 | | Northern Shoveler | *Anas clypeata* | + | | M |
| 8 | | Northern Pintail | *Anas acuta* | + | | M |
| 9 | | Garganey | *Anas querquedula* | + | | M |
| 10 | | Eurasian Teal | *Anas crecca* | + | | M |
| 11 | | Baer's Pochard | *Aythya baeri* | + | | M |
| 12 | | Tufted Duck | *Aythya fuligula* | + | | M |
| 13 | **PODICIPEDIDAE** | Little Grebe | *Tachybaptus ruficollis* | + | | R |
| 14 | **CICONIIDAE** | Painted Stork | *Mycteria leucocephala* | + | | M |
| 15 | | Asian Openbill | *Anastomus oscitans* | + | | M |
| 16 | | Woolly-necked Stork | *Ciconia episcopus* | + | | R |
| 17 | **THRESKIORNITHIDAE** | Black-headed Ibis | *Threskiornis melanocephalus* | + | | M |
| 18 | | Red-naped Ibis | *Pseuidbis papillosa* | + | | R |
| 19 | | Glossy Ibis | *Plegadis falcinellus* | + | | R |
| 20 | | Eurasian Spoonbill | *Platalea leucorodia (Only one sighted)* | + | | M |
| 21 | **ARDEIDAE** | Great Bittern | *Botaurus stellaris* | + | | M |
| 22 | | Yellow Bittern | *Ixobrychus sinensis* | + | | R |
| 23 | | Cwetlandamon Bittern | *Ixobrychus cwetlandamomeus* | + | | R |
| 24 | | Black-crowned Night-heron | *Nycticorax nycticorax* | + | | R |

| Sr. no | Family | Common name | Scientific name | Water Birds | Terrestrial Birds | Range and Status |
|---|---|---|---|---|---|---|
| 25 | | Indian Pond-heron | *Ardeola grayii* | + | | R |
| 26 | | Chinese Pond-heron | *Ardeola bacchus* | + | | R |
| 27 | | Eastern Cattle Egret | *Bubulcus coromandus* | + | | R |
| 28 | | Grey Heron | *Ardea cinerea* | + | | R |
| 29 | | Purple Heron | *Ardea purpurea* | + | | R |
| 30 | | Great Egret | *Ardea alba* | + | | R |
| 31 | | Intermediate Egret | *Mesophoyx intermedia* | + | | R |
| 32 | | Little Egret | *Egretta garzetta* | + | | R |
| 33 | **PELECANIDAE** | Great White Pelican | *Pelecanus onocrotalus* | + | | M |
| 34 | | Spot-billed Pelican | *Pelecanus philippensis* | + | | M |
| 35 | **PHALACROCORACIDAE** | Little Cormorant | *Phalacrocorax niger* | + | | R |
| 36 | | Great Cormorant | *Phalacrocorax carbo* | + | | M |
| 37 | **ANHINGIDAE** | Oriental Darter | *Anhinga melanogaster* | + | | R |
| 38 | **FALCONIDAE** | Ospery | *Pandion haliaetus* | | + | M |
| 39 | | Black-shouldered Kite | *Elanus caeruleus* | | + | M |
| 40 | | Black Kite | *Milvus migrans* | | + | R |
| 41 | | Black-eared Kite | *Milvus lineatus* | | + | M |
| 42 | | Western Marsh-harrier | *Circus aeruginosus* | | + | M |
| 43 | | Eastern Marsh-harrier | *Circus spilonotus* | | + | M |
| 44 | | Hen Harrier | *Circus cyaneus* | | + | M |
| 45 | | Pied Harrier | *Circus melanoleucos* | | + | R |
| 46 | | Shikra | *Accipiter badius* | | + | R |
| 47 | | Greater Spotted Eagle | *Aquila clanga* | | + | M |
| 48 | | Tawny Eagle | *Aquila rapax* | | + | M |
| 49 | **RALLIDAE** | Slaty-breasted Rail | *Gallirallus striatus* | + | | R |
| 50 | | Water Rail | *Rallus indicus* | + | | M |
| 51 | | Ruddy-breasted Crake | *Porzana fusca* | + | | R |

| Sr. no | Family | Common name | Scientific name | Water Birds | Terrestrial Birds | Range and Status |
|---|---|---|---|---|---|---|
| 52 | | White-breasted Waterhen | *Amaurornis phoenicurus* | + | | R |
| 53 | | Grey-headed Swamphen | *Porphyrio poliocephalus* | + | | R |
| 54 | | Watercock | *Gallicrex cinerea* | + | | R |
| 55 | | Common Moorhen | *Gallinula chloropus* | + | | R |
| 56 | | Common Coot | *Fulica atra* | + | | R |
| 57 | **GRUIDAE** | Sarus Crane | *Grus antigone* | + | | R |
| 58 | **PLUVIALIDAE** | Pacific Golden Plover | *Pluvialis fulva* | + | | M |
| 59 | **RECURVIROSTRIDAE** | Black-winged Stilt | *Himantopus himantopus* | + | | R |
| 60 | **VANELLIDAE** | Grey-headed Lapwing | *Vanellus cinereus* | + | | M |
| 61 | | Red-wattled Lapwing | *Vanellus indicus* | + | | R |
| 62 | **CHARADRIIDAE** | Little Ringed Plover | *Charadrius dubius* | + | | M |
| 63 | | Kentish Plover | *Charadrius alexandrinus* | + | | M |
| 64 | | Greater Sand-plover | *Charadrius leschenaultii* | + | | M |
| 65 | **JACANIDAE** | Pheasant-tailed Jacana | *Hydrophasianus chirurgus* | + | | R |
| 66 | | Bronze-winged Jacana | *Metopidius indicus* | + | | R |
| 67 | **SCOLOPACIDAE** | Jack Snipe | *Lymnocryptes minimus* | + | | M |
| 68 | | Pintail Snipe | *Gallinago stenura* | + | | M |
| 69 | | Common Snipe | *Gallinago gallinago* | + | | M |
| 70 | | Black-tailed Godwit | *Limosa limosa* | + | | M |
| 71 | | Common Sandpiper | *Actitis hypoleucos* | + | | M |
| 72 | | Spotted Redshank | *Tringa erythropus* | + | | M |
| 73 | | Common Greenshank | *Tringa nebularia* | + | | M |
| 74 | | Green Sandpiper | *Tringa ochropus* | + | | M |
| 75 | | Marsh Sandpiper | *Tringa stagnatilis* | + | | M |
| 76 | | Wood Sandpiper | *Tringa glareola* | + | | M |
| 77 | | Temminck's Stint | *Calidris temminckii* | + | | M |

| Sr. no | Family | Common name | Scientific name | Water Birds | Terrestrial Birds | Range and Status |
|---|---|---|---|---|---|---|
| 78 | | Long-toed Stint | *Calidris subminuta* | + | | M |
| 79 | **GLAREOLIDAE** | Oriental Pratincole | *Glareola maldivarum* | + | | M |
| 80 | **STERNIDAE** | White-winged Tern | *Chlidonias leucopterus* | + | | M |
| 81 | | Little Tern | *Sternula albifrons* | + | | R |
| 82 | | Whiskered Tern | *Chlidonias hybridus* | + | | M |
| 83 | | Black-bellied Tern | *Sterna acuticauda* | + | | R |
| 84 | **LARIDAE** | Brown-headed Gull | *Chricocephalus brunnicephalus* | + | | M |
| 85 | **COLUMBIDAE** | Rock Pigeon | *Columba livia* | | + | R |
| 86 | | Spotted Dove | *Streptopelia chinensis* | | + | R |
| 87 | **CUCULIDAE** | Plaintive Cuckoo | *Cacomantis merulinus* | | + | R |
| 88 | | Asian Koel | *Cacomantis merulinus* | | + | R |
| 89 | | Greater Coucal | *Centropus sinensis* | | + | R |
| 90 | | Lesser Coucal | *Centropus bengalensis* | | + | R |
| 91 | **TYTONIDAE** | Common Barn-owl | *Tyto alba* | | + | R |
| 92 | **APODIDAE** | Asian Palm-swift | *Cypsiurus balasiensis* | | + | R |
| 93 | **ALCEDINIDAE** | White-throated Kingfisher | *Halcyon smyrnensis* | | + | R |
| 94 | | Black-capped Kingfisher | *Halcyon pileata* | | + | M |
| 95 | | Blue-eared Kingfisher | *Alcedo meninting* | | + | R |
| 96 | | Common Kingfisher | *Alcedo atthis* | | + | R |
| 97 | **MEROPIDAE** | Little Green Bee-eater | *Merops orientalis* | | + | R |
| 98 | | Blue-tailed Bee-eater | *Merops philippinus* | | + | M |
| 99 | | Chestnut-headed Bee-eater | *Merops lechenaulti* | | + | R |
| 100 | **UPUPIDAE** | Common Hoopoe | *Upupa epops* | | + | M |
| 101 | **RAMPHASTIDAE** | Coppersmith Barbet | *Megalaima haemaccephala* | | + | R |
| 102 | **ORIOLIDAE** | Black-naped Oriole | *Oriolus chinensis* | | + | R |
| 103 | **AEGITHINIDAE** | Common Iora | *Aegithina tiphia* | | + | R |
| 104 | **DICRURIDAE** | Black Drongo | *Dicrurus macrocercus* | | + | R |

| Sr. no | Family | Common name | Scientific name | Water Birds | Terrestrial Birds | Range and Status |
|---|---|---|---|---|---|---|
| 105 | **CORVIDAE** | House Crow | *Corvus splendens* | | + | R |
| 106 | | Large-billed Crow | *Corvus japonensis* | | + | R |
| 107 | | Eastern Jungle Crow | *Corvus levaillantii* | | + | R |
| 108 | **LANIIDAE** | Tiger Shrike | *Lanius tigrinus* | | + | M |
| 109 | | Brown Shrike | *Lanius cristatus* | | + | M |
| 110 | | Long-tailed Shrike | *Lanius schach* | | + | M |
| 111 | **PLOCEIDAE** | Streaked Weaver | *Ploceus manyar* | | + | R |
| 112 | | Baya Weaver | *Ploceus philippinus* | | + | R |
| 113 | | Asian Golden Weaver | *Ploceus hypoxanthus* | | + | R |
| 114 | **ESTRILDIDAE** | Scaly-breasted Munia | *Lonchura punctulata* | | + | R |
| 115 | **PASSERIDAE** | House Sparrow | *Passer domensticus* | | + | R |
| 116 | | Eurasian Tree-sparrow | *Passer montanus* | | + | R |
| 117 | **MOTACILLIDAE** | Red-throated Pipit | *Anthus cervinus* | | + | M |
| 118 | | Paddy Field Pipit | *Anthus rufulus* | | + | R |
| 119 | | White Wagtail | *Motacilla alba* | | + | M |
| 120 | | Grey Wagtail | *Motacilla cinerea* | | + | M |
| 121 | | Western Yellow Wagtail | *Motacilla flava* | | + | M |
| 122 | | Eastern Yellow Wagtail | *Motacilla tschutschensis* | | + | M |
| 123 | | Citrine Wagtail | *Motacilla citreola* | | + | M |
| 124 | **STURNIDAE** | White-vented Myna | *Acridotheres grandis* | | + | R |
| 125 | | Jungle Myna | *Acridotheres fuscus* | | + | R |
| 126 | | Common Myna | *Acridotheres tristis* | | + | R |
| 127 | | Chestnut-tailed Starling | *Sturnus malabaricus* | | + | R |
| 128 | **MUSCICAPIDAE** | Bluethroat | *Luscinia svecica* | | + | M |
| 129 | | Grey Bushchat | *Saxicola ferreus* | | + | R |
| 130 | | Eastern Stonechat | *Saxicola maurus* | | + | R |
| 131 | | Pied Bushchat | *Saxicola caprata* | | + | R |

| Sr. no | Family | Common name | Scientific name | Water Birds | Terrestrial Birds | Range and Status |
|---|---|---|---|---|---|---|
| 132 | | Taiga Flycatcher | *Ficedulaalbicilla* | | + | M |
| 133 | | Oriental Magpie-robin | *Copsychus saularis* | | + | R |
| 134 | **ALAUDIDAE** | Oriental Skylark | *Alauda gulgula* | | + | R |
| 135 | **PYCNONOTIDAE** | Streak-eared Bulbul | *Pycnonotus blanfordi* | | + | R |
| 136 | | Red-whiskered Bulbul | *Pycnonotus jocosus* | | + | R |
| 137 | | Brown-breasted Bulbul | *Pycnonotus xanthorrhous* | | + | R |
| 138 | | Red-vented Bulbul | *Pycnonotus cafer* | | + | R |
| 139 | **HIRUNDINIDAE** | Asian House Martin | *Delichon dasypus* | | + | R |
| 140 | | Common Sand-martin | *Riparia riparia* | | + | R |
| 141 | | Barn Swallow | *Hirundo rustica* | | + | M |
| 142 | | House Swallow | *Hirundo tahitica* | | + | R |
| 143 | | Red-rumped Swallow | *Cecropis daurica* | | + | M |
| 144 | | Striated Swallow | *Cecropis striolata* | | + | R |
| 145 | **PHYLLOSCOPIDAE** | Dusky Warbler | *Phylloscopus fuscatus* | | + | R |
| 146 | **TAMALIDAE** | White-throated Babbler | *Turdoides gularis* | | + | R |
| 147 | **ACROCEPHALIDAE** | Black-browed Reed-warbler | *Acrocephalus bistrigiceps* | | + | R |
| 148 | | Blunt-winged Warbler | *Acrocephalus concinens* | | + | M |
| 149 | | Oriental Reed-warbler | *Acrocephalus orientalis* | | + | M |
| 150 | | Green Reed Warbler | *Acrocephalus arundinaceus** | | + | M |
| 151 | **MEGALURIDAE** | Striated Grassbird | *Megalurus palustris* | | + | R |
| 152 | **CISTICOLIDAE** | Zitting Cisticola | *Cisticola juncidis* | | + | R |
| 153 | | Common Tailorbird | *Orthotomus sutorius* | | + | R |
| 154 | | Yellow-bellied Prinia | *Prinia flaviventris* | | + | R |
| 155 | | Plain Prinia | *Prinia inornata* | | + | R |

Key

+ Water Bird and Terrestrial

R Resident , M Migratory

**Appendix 2.2**

**List of Fish Species in Moyungyi Area, Yangon University (2004-2005)**

| No. | Family | Scientific Name | FAO Name | Vernacular Name |
|---|---|---|---|---|
| 1 | Ambassidae | *Parambasis ranga* | Indian glassy fish | Nga-zin-zat |
| 2 | Anabantidae | *Anabas testudineus* | Climbing perch | Nga-byay-ma |
| 3 | Badidae | *Badis ruber* | Red badis | Nga-mee-loung |
| 4 | Bagridae | *Mystus bleekeri* | Dwarf catfish | Nga-zin-yine |
| 5 | | *Mystus cavasius* | Dwarf catfish | Nga-zin-yine |
| 6 | | *Mystus pulcher* | Dwarf catfish | Nga-zin-yine |
| 7 | Belonidae | *Xenentodon cancila* | Freshwater garfish | Nga-phaung-yoe |
| 8 | Belontidae | *Colisa labiosus* | Thicklipped gourami | Nga-pyin-tha-let |
| 9 | | *Trichogaster pectoralis* | Snakeskin gourami | Gorami |
| 10 | Channidae | *Channa oriantalis* | Brown snake head | Nga-yant-khaung-to |
| 11 | | *Channa panaw* | Panaw snake head | Nga-pa-naw |
| 12 | | *Channa striata* | Striped snke head | Nga-yant |
| 13 | Clarridae | *Clarias batrachus* | Walking catfish | Nga-khu |
| 14 | Cobitidae | *Lepidocephalicthys berdmorei* | Loach | Nga-tha-lae-doh |
| **No.** | **Family** | **Scientific Name** | **FAO Name** | **Vernacular Name** |
| 15 | | *Lepidocephalicthys hasselti* | Loach | Nga-yight-cut |
| 16 | Cyprinidae | *Amblypharygodon mola* | Carplet | Nga-beh-phyu |
| 17 | | *Esomus danricus* | Flying barb | Nga-maw-tawt |
| 18 | | *Osteobrama belangeri* | Carplet | Nga-phane-ma |

| No. | Family | Scientific Name | FAO Name | Vernacular Name |
|---|---|---|---|---|
| 19 | | *Osteobrama cunma* | Carplet | Nga-byat(Nga phane ma) |
| 20 | | *Puntius chola* | Barb | Nga-khone ma |
| 21 | | *Puntius sophore* | Barb | Nga-khone ma |
| 22 | | *Rasbora daniconius* | Common Rasbora | Nga-daung-zin |
| 23 | Gobiidae | *Glossogobius giuris* | Bar-eyed goby | Ka-tha-boh |
| 24 | Heteropneustidae | *Heteropneustes fossilis* | Stinging catfish | Nga-gyee |
| 25 | Mastacembelidae | *Macrognathus aculeatus* | Lesser spiny eel | Nga-mway-doe-pyaungchaw |
| 26 | | *Macrognathus zebrinus* | Zebrus eel | Nga-mway-doe-kyar |
| 27 | | *Mastacembelus armatus* | spiny eel | Nga-mway-nagar |
| 28 | Notopteridae | *Notopterus notopterus* | Featherbard | Nga- lar |
| 29 | Schilbeidae | *Pseudeutropius auctirostris* | Butter catfish | Nga-than-gyeik |
| 30 | Siluridae | *Ompok bimaculatus* | Butter catfish | Nga-nu-than |
| 31 | | *Wallago attu* | Freshwater shark | Nga-butt |
| 32 | Synbranchidae | *Monopterus albus* | Swamp eel | Nga-shint-mwe |
| 33 | | *Symbranchus bengalense* | Pigmy eel | Nga-shint-ni |

**Compile list of total fish species from three Department in Moeyingyi Area**

| No. | Family | Scientific Name | Common Name | Myanmar Name | IUCN |
|---|---|---|---|---|---|
| 1 | Ambassidae | *Parambasis ranga* | Indian glassy fish | Nga-zin-zat | LC (2012) |
| 2 | Anabantidae | *Anabas testudineus* | Climbing perch | Nga-byay-ma | DD (2010) |
| 3 | Anguillidae | *Anguilla bicolor* | Level finned eel | Nga-lin -ban | LC (2009) |
| 4 | | *Anguilla biculor pacifica* | True eel (Conger) | Nga-lin-ban | Not Evaluated |

| No. | Family | Scientific Name | Common Name | Myanmar Name | IUCN |
|---|---|---|---|---|---|
| 5 | Badidae | *Badis ruber* | Red badis | Nga-mee-loung | LC (2012) |
| 6 | Bagridae | *Aorichthys aor* | Long-whiskered catfish | Nga-kyaung | LC (2010) |
| 7 | | *Mystus bleekeri* | Dwarf catfish | Nga-zin-yine | LC (2010) |
| 8 | | *Mystus cavasius* | River catfish | Nga-zin-yaing | LC (2010) |
| 9 | | *Mystus menoda* | Fresh water catfish | Nga-eike | LC (2012) |
| 10 | | *Mystus microphthalmus* | Long whisker catfish | Nga-eike | LC (2010) |
| 11 | | *Mystus pulcher* | Dwarf catfish | Nga-zin-yine | LC (2010) |
| 12 | | *Mystus vittatus* | Striped dwarf catfish | Nga-zin-yaing | LC (2010) |
| 13 | Belontidae | *Colisa lobiosus* | Thick-lipped goromy | Nga-pyin-tha-lat | LC (2010) |
| 14 | | *Osphronemus goramy* | Gourrami | Nga-phin-tha-lat | LC (2010) |
| 15 | | *Trichogaster pectoralis* | Snakeskin gourami | Gorami | LC (2012) |
| 16 | Belonidae | *Xenentodon cancila* | Garfish | Nga-phaung-yoe | LC (2010) |
| 17 | Chandidae | *Cahanda nama* | Glass fish | Nga-zin-zap | LC (2010) |
| No. | Family | Scientific Name | Common Name | Myanmar Name | IUCN |
| 18 | Channidae | *Channa guchua* | Brown snake head | Nga-gaung-do | LC (2010) |
| 19 | | *Channa lucius* | Green-snake-head | Nga-pa-naw | LC (2012) |
| 20 | | *Channa oriantalis* | Brown snake head | Nga-yant-khaung-to | Not Evaluated |
| 21 | | *Channa panaw* | Panaw snake head | Nga-pa-naw | Not Evaluated |
| 22 | | *Channa striata* | Stripped-snakehead | Nga-yant | LC (2010) |
| 23 | Cichlidae | *Tilapia mossambica* | Tilapia | Telarbeyar (Telipia) | NT (2007) |
| 24 | Clarridae | *Clarias batrachas* | Walking catfish | Nga-khoo | LC (2011) |
| 25 | Cobitidae | *Lepidocephalicthys* | Loach | Nga-tha-lae-doh | LC (2010) |

| No. | Family | Scientific Name | Common Name | Myanmar Name | IUCN |
|---|---|---|---|---|---|
| | | *berdmorei* | | | |
| 26 | | *Lepidocephalichthys guntea* | Loach | Nga-thale-doe | LC (2012) |
| 27 | | *Lepidocephalicthys hasselti* | Loach | Nga-thale-doe | Not Evaluated |
| 28 | Cynoglossidae | *Cynoglossus lingua* | Long tongue fish | Nga-kway-shar | Not Evaluated |
| 29 | | *Cynoglossus microlepis* | Tongue fish (Sole) | Nga-con-shat | LC (2012) |
| 30 | Cyprinidae | *Amblyharynagodon mola* | Carplet | Nga-be-phyu | LC (2010) |
| 31 | | *Cirrhina mrigala* | Carp | Nga-gyin | LC (2010) |
| 32 | | *Esomus danricus* | Flying barb | Nga-mot-top | LC (2009) |
| 33 | | *Labeo nandina* | Carp | Nga-ohn-ton | NT (2010) |
| 34 | | *Osteobrama belangeri* | Carplet | Nga-phane-ma | NT (2010) |
| 35 | | *Osteobrama cunma* | Carplet | Nga-byat | LC (2010) |
| 36 | | *Osteochilus melanopleura* | Black banded systmus | Nga-own-toan | LC (2012) |
| No. | Family | Scientific Name | Common Name | Myanmar Name | IUCN |
| 37 | | *Puntius chola* | Barb | Nga-khone-ma | LC (2010) |
| 38 | | *Puntius sophore* | Barb | Nga-khone ma | LC (2010) |
| 39 | | *Rasbora daniconius* | Common radbora | Nga-daung-zin | LC (2011) |
| 40 | | *Rasbora rasbora* | Common rasbora | Nga-daung-zin | LC (2010) |
| 41 | Gobiidae | *Glossogobius giuris* | Bar-eyed goby | Ka-tha-boe | LC (2012) |
| 42 | Heteropneusitidae | *Heteropnustes fossilis* | Stinging catfish | Nha-kyee | LC (2010) |
| 43 | Latidae | *Lates calcarifer* | Giant sea perch | Kat-ka-tic | Not Evaluated |
| 44 | Mastacembelidae | *Macrognathus aculeatus* | Lesser spiny eel | Nga-mway-doe-pyaungchaw | Not Evaluated |

| No. | Family | Scientific Name | Common Name | Myanmar Name | IUCN |
|---|---|---|---|---|---|
| 45 | | *Macrognathus zebrinus* | Ophidian | Nga-mway-doh | LC (2010) |
| 46 | | *Mastacembelus armatus* | Spiny eel | Nga-mway-doh | LC (2010) |
| 47 | Nandidae | *Nandus nandus* | Spotted field perch | Nga-wat-ma | LC (2010) |
| 48 | Notopteridae | *Notopterus notopterus* | Feather bard | Nga-phe | LC (2010) |
| 49 | Schilbeidae | *Eutropiichthys vacha* | Dwarf carp | Nga-than-chate | LC (2012) |
| 50 | | *Pseudotropius auctirostris* | Butter catfish | Nga-than-chate | Not Evaluated |
| 51 | Sciaenidae | *Oryzias minutilus* | Fish larva | Nga-chee-khar | LC (2009) |
| 52 | | *Sciaena coitor* | Coitor croaker | Nga-byet | LC (2009) |
| 53 | Siluridae | *Ompok pabo* | Butter catfish | Nga-nu-than | NT (2010) |
| 54 | | *Ompok bimaculatus* | Butter catfish | Nga-nu-than | NT (2010) |
| 55 | | *Wallago attu* | Sheat fish | Nga-bat | NT (2010) |
| 56 | Synbranchidae | *Monopterus albas* | Mud eel | Nga-shint | LC (2010) |
| No. | **Family** | **Scientific Name** | **Common Name** | **Myanmar Name** | **IUCN** |
| 57 | | *Ophisternon bengalense* | Pigmy eel | Nga-shint-ni | LC (2010) |
| 58 | Tetraodontidae | *Monotrete leiurus* | Globe fish | Nga-pu-tin | LC (2012) |
| 59 | | *Tetrodon cutcutia* | Globe fish/puffer | Nga-pu-tin | LC (2010) |

**Comparison of Fish Spp. Data in Moeyingyi Area**

| No. | Family | Scientific Name | Forest Dep; | Bago Uni; | Yangon Uni; |
|---|---|---|---|---|---|
| 1 | Ambassidae | *Parambasis ranga* | + | | + |
| 2 | Anabantidae | *Anabas testudineus* | + | | + |
| 3 | Anguillidae | *Anguilla bicolor* | | + | |
| 4 | | *Anguilla biculor pacifica* | + | | |
| 5 | Badidae | *Badis ruber* | | | + |
| 6 | Bagridae | *Aorichthys aor* | + | | |
| 7 | | *Mystus bleekeri* | | | + |
| 8 | | *Mystus cavasius* | | + | + |
| 9 | | *Mystus menoda* | + | | |
| 10 | | *Mystus microphthalmus* | | + | |
| 11 | | *Mystus pulcher* | + | | + |
| 12 | | *Mystus vittatus* | + | + | |
| 13 | Belontidae | *Colisa lobiosus* | | + | + |
| 14 | | *Osphronemus goramy* | + | | |
| 15 | | *Trichogaster pectoralis* | + | | + |
| 16 | Belonidae | *Xenentodon cancila* | + | + | + |
| 17 | Chandidae | *Chanda nama* | | + | |
| 18 | Channidae | *Channa guchua* | + | + | |
| 19 | | *Channa lucius* | + | + | |
| 20 | | *Channa oriantalis* | | | + |
| 21 | | *Channa panaw* | | | + |
| 22 | | *Channa striata* | + | + | + |
| 23 | Cichlidae | *Tilapia mossambica* | | + | |
| 24 | Clarriidae | *Clarias batrachas* | + | + | + |
| 25 | Cobitidae | *Lepidocephalicthys berdmorei* | | | + |
| 26 | | *Lepidocephalichthys guntea* | | + | |
| 27 | | *Lepidocephalicthys hasselti* | + | | + |
| 28 | Cynoglossidae | *Cynoglossus lingua* | | + | |
| 29 | | *Cynoglossus microlepis* | + | | |
| 30 | Cyprinidae | *Amblyharynagodon mola* | + | + | + |
| No. | Family | Scientific Name | Forest Dep; | Bago Uni; | Yangon Uni; |
| 31 | | *Cirrhina mrigala* | | + | |
| 32 | | *Esomus danricus* | + | + | + |
| 33 | | *Labeo nandina* | | + | |
| 34 | | *Osteobrama belangeri* | + | | + |
| 35 | | *Osteobrama cunma* | | | + |
| 36 | | *Osteochilus melanopleura* | + | | |

| No. | Family | Scientific Name | Forest Dep; | Bago Uni; | Yangon Uni; |
|---|---|---|---|---|---|
| 37 | | *Puntius chola* | + | + | + |
| 38 | | *Puntius sophore* | + | + | + |
| 39 | | *Rasbora daniconius* | | | + |
| 40 | | *Rasbora rasbora* | | + | |
| 41 | Gobiidae | *Glossogobius giuris* | + | + | + |
| 42 | Heteropneusitidae | *Heteropnustes fossilis* | + | + | + |
| 43 | Latidae | *Lates calcarifer* | + | | |
| 44 | Mastacembelidae | *Macrognathus aculeatus* | | | + |
| 45 | | *Macrognathus zebrinus* | + | | + |
| 46 | | *Mastacembelus armatus* | + | + | + |
| 47 | Nandidae | *Nandus nandus* | + | + | |
| 48 | Notopteridae | *Notopterus notopterus* | + | + | + |
| 49 | Schilbeidae | *Eutropiichthys vacha* | + | | |
| 50 | | *Pseudotropius auctirostris* | | + | + |
| 51 | Sciaenidae | *Oryzias minutilus* | + | + | |
| 52 | | *Sciaena coitor* | | + | |
| 53 | Siluridae | *Ompok pabo* | + | + | |
| 54 | | *Ompok bimaculatus* | | | + |
| 55 | | *Wallago attu* | + | + | + |
| 56 | Synbranchidae | *Monopterus albas* | + | + | + |
| 57 | | *Ophisternon bengalense* | + | + | + |
| 58 | Tetraodontidae | *Monotrete leiurus* | + | | |
| 59 | | *Tetrodon cutcutia* | | + | |

Appendix 2.3

**1. List of Butterflies from Moeyingyi Wildlife Sanctuary (NWCD)**

| No | Family name | Scientific name | Common name |
|---|---|---|---|
| 1. | Papilionidae | *Papilio demoleus* | Lime Butterfly |
| 2. | Papilionidae | *Papilio polytes* | Common Mermon |
| 3. | Pieridae | *Catopsilia pomona* | Lemon Emigrant |
| 4. | Pieridae | *Catopsilia pomona crocale* | The Lemon Emigrant |
| 5. | Pieridae | *Catopsilia scylla* | Orange Emigrant |

| No | Family name | Scientific name | Common name |
|---|---|---|---|
| 6. | Pieridae | *Appias libythea* | Striped Albatross |
| 7. | Pieridae | *Appias lyncida* | Chocolate Albatross |
| 8. | Pieridae | *Eurema hecabe* | Not Known |
| 9. | Pieridae | *Delias descombi* | Common Yellow jezebal |
| 10. | Danaidae | *Danaus genutia* | Common Tiger |
| 11. | Danaidae | *Danaus limniace* | The Blue Tiger |
| 12. | Danaidae | *Euploea core* | Violet Tipped Crow |
| 13. | Danaidae | *Euploea klugii* | King Crow |
| 14. | Satyridae | *Melanitis phedima bela* | Not Known |
| 15. | Satyridae | *Melanitis zitenius* | Not Known |
| 16. | Satyridae | *Mycalesis mineus* | Not Known |
| 17. | Nymphalidae | *Precis almana* | Peacock Pansy |
| 18. | Nymphalidae | *Precis altites* | Gray Pansy |
| 19. | Nymphalidae | *Athyma perius* | Common Sergeant |
| 20. | Nymphalidae | *Cethosia cyane* | Leopard Lacewing |
| 21. | Nymphalidae | *Pantoporia hordonia* | Common Lascar |
| 22. | Nymphalidae | *Athyma asura* | Studded Serum |
| 23. | Nymphalidae | *Euthalia phermius* | White edge Blue Barom |
| 24. | Amathusiidae | *Descophora timora(male)* | Not Known |
| 25. | Amathusiidae | *Descophora timora (female)* | Not Known |
| 26. | Riodinidae | *Zemeras flegyas* | Not Known |
| 27. | Lycaenidae | *Logania regina* | Not Known |
| 28. | Lycaenidae | *Jamides alecto* | Cerulean |
| 29. | Lycaenidae | *Jamides alecto alocina* | Cerulean |
| 30. | Hesperiidae | *Parnara naso bada* | Not Known |
| 31. | Hesperiidae | *Halpe insignis* | Not Known |
| 32. | Hesperiidae | *Gerosis bhagava* | Not Known |
| 33. | Hesperiidae | *Pithauria marsena* | Not Known |

(Source – FD of Moeyungyi) 2003

**2. List of butterflies from Moeyingyi Wildlife Sanctuary (Bago University)**

| No | Family name | Scientific name | Common name |
|---|---|---|---|
| 1. | Pieridae | *Pieris* sp. | Butterfly |
| 2. | Pieridae | *Catopsilia pomona* | Lemon Emigrant |
| 3. | Pieridae | *Catopsilia scylla* | Orange Emigrant |
| 4. | Pieridae | *Appias libythea* | Striped Albatross |
| 5. | Pieridae | *Appias lynicda* | Chocolate Albatross |
| 6. | Pieridae | *Delias descombi* | Common Yellow Jezebel |
| 7. | Nymphalidae | *Precis atlites* | Gray Pansy |
| 8. | Nymphalidae | *Precis almana* | Peacock Pansy |
| 9. | Nymphalidae | *Athyma perius* | Common Sergeant |
| 10. | Nymphalidae | *Euthalia phemius* | White edged Blue Barom |
| 11. | Nymphalidae | *Cethosia cyane* | Leopard Lacewing |
| 12. | Nymphalidae | *Pantoporia hordonia* | Common Lascar |
| 13. | Nymphalidae | *Athyma asura asura* | The Studded Sergeant |
| 14. | Papilionidae | *Papilio demoleus* | Lime Butterfly |
| 15. | Papilionidae | *Papilio polytes* | Common Mermon |
| 16. | Danaidae | *Danaus limniace* | Blue Tiger |
| 17. | Danaidae | *Danaus genutia* | Common Tiger |
| 18. | Danaidae | *Euploea core* | Violet Tipped Crow |
| 19. | Danaidae | *Euploea klugii* | The King Crow |
| 20. | Lycaenidae | *Jamides alecto* | The Cerulean |
| 21. | Lycaenidae | *Jamides alecto alocina* | The Creulean |

(Source – Zoology Department of Bago University) (2008)

**List of Insects from Moeyingyi Wildlife Sanctuary (Bago University)**

| No | Family name | Scientific name | Common name |
|---|---|---|---|
| 1. | Petaluridae | *Tanypteryx hageni* | Dragonflies |
| 2. | Petaluridae | *Tachopterynx thoreyi* | Dragonflies |
| 3. | Acrididae | *Melanopus* sp. | Grasshopper |

| No | Family name | Scientific name | Common name |
|---|---|---|---|
| 4. | Blattidae | *Periplaneta americana* | Cockroach |
| 5. | Apidae | *Apis* sp. | Honeny bee |
| 6. | Muscidae | *Musca nebulo* | Housefly |
| 7. | Gryllidae | *Gryllus campestris* | House cricket |
| 8. | Vespidae | *Vespa orientalis* | Wasp |
| 9. | Pompilidae | *Araneus* sp. | Garden spider |
| 10. | Culicidae | *Culex, Anopheles, Aedes* | Mosquitoes |
| 11. | Elateridae | *Julus* sp. | Wireworm |
| 12. | Buprestidae | *Chrysochora vittata* | Metallic wood borers |
| 13. | Termitidae | *Macrotermes* sp. | Termites |
| 14. | Calopterygidae | *Calopteryx maculate* | Broad-winged Damsel flies |
| 15. | Lestidae | *Lestes* sp. | Spread-winged Damsel flies |
| 16. | Coenagrionidae | *Argia fumipennis* | Narrow-winged Damsel flies |

(Source – Zoology Department of Bago University)

**Appendix 2.4**

**List of Aquatic Plants from Moeyingyi Wetland Wildlife Sanctuary**

| N0 | မြန်မာအမည် (Common Name) | ရုက္ခဗေဒအမည် (Scientific Name) |
|---|---|---|
| 1/ | ညံ့ | *Sesbania Javnia* |
| 2/ | ကျွဲခေါင်း | *Trapa bispinosa* |
| 3/ | ကြာပြာ | *Nymphaea stellata* |
| 4/ | ကြာလင်ပန်း | - |
| 5/ | ပကန်ကြမ်း | *Hydrilla Spp:* |
| 6/ | ပကန်နူး | *Ulricularia Spp:* |
| 7/ | မျောက်မီး | *Ceratophyllum Spp:* |
| 8/ | ပဒုမ္မာကြာနီ | *Nelumbo nucifera* |
| 9/ | ပဒုမ္မာကြာအဖြူ | / |
| 10/ | ဘဲစားမြက် | - |
| 11/ | ကညွတ် | *Ludwigia adscendens* |
| 12/ | ကျွဲလည်ချောင်း | *Polygonern Spp:* |
| 13/ | မြက်ချို | *Family Gramineae* |
| 14/ | မြက်ခါး | / |
| 15/ | နတ်စပါး | / |
| 16/ | မြက်ကလုံး | / |
| 17/ | မြက်ယား | / |
| 18/ | မြက်ခြင်းတောင်း | - |
| 19/ | မြက်ကျွတ် | - |
| 20/ | ဝိန်း | *Elephant grass* |
| 21/ | ကြက်ဖပင် | *Vallosneria* |
| 22/ | ဆစ်ပဒုံ | - |
| 23/ | မဲလေး | - |
| 24/ | မြေဇာမြက် | *Family Gramineae* |
| 25/ | ဗေဒါ | *Eichornia Crassipes* |
| 26/ | ဘဲခြေထောက် | - |
| 27/ | ရေကန်စွန်း | *Ipomaea aqua* |

| N0 | မြန်မာအမည် (**Common Name**) | ရုက္ခဗေဒအမည် **(Scientific Name)** |
|---|---|---|
| 28/ | ကြာဖြူ | *Nymphaea alba* |
| 29/ | မျက်ဝမ်းပူ | - |
| 30/ | ကုလားတက်မြား | *Hydrocharis* |
| 31/ | ကြာနီ | - |
| 32/ | မိုနတို | *Nymphaea Spp:* |
| 33/ | ပုဇွန်စာ | - |
| 34/ | ရေဆူးပုတ် | *Mimosa Pigna* |
| 35/ | ထိကရုန်း | - |
| 36/ | လယ်ပဒူ | - |
| 37/ | ကိုင်း | - |
| 38/ | ကျောက်ကညွတ် | - |
| 39/ | ကုလားမနို့သီး | - |
| 40/ | နွားထမင်းတုတ် | - |
| 41/ | ပုဇွန်မုတ်ဆိတ် | - |
| 42/ | ရေမှော်ကြီး | *Pistia* |
| 43/ | ရေမှော်လေး | *Salvinia* |
| 44/ | မြက်ထီးဆောင်း | *Cyperus* |
| 45/ | မိချောင်းကွမ်းဘတ် | - |
| 46/ | ဆင်နှာမောင်း | - |
| 47/ | ဗီးစပ်ရက် | - |
| 48/ | ကြိတ်မှန် | - |
| 49/ | ဆင်ငိုမြက် | - |

**Appendix 2.5**

**List of Amphibians and Reptiles from Moeyingyi Wildlife Sanctuary**

| No. | Family Name | pScientific Name | Common Name |
|---|---|---|---|
| 1 | Microhylidae | *Kaloula pulchra* | Common Bull Frog |
| 2 | Ranidae | *Occidozyga lima* | Common Floating Frog |
| 3 | Ranidae | *Rana erythraea* | Red-eared Frog |
| 4 | Ranidae | *Rana limnocharis* | Paddy Frog |
| 5 | Ranidae | *Rana macrodactyla* | Long-toed Frog |
| 6 | Ranidae | *Rana rugolosa* | Chinese Bullfrog |
| 7 | Rhacophoridae | *Polypedates leucomystax* | Common Tree Frog |
| 8 | Microhylidae | *Microhyla inornata* | Inornate Froglet |
| 9 | Trionychidae | *Morenia occellata* | Myanmar Eyed Turtle |
| 10 | Bataguridae | *Lissemys scutata* | Myanmar Flapshell Turtle |
| 11 | Agamidae | *Calotes versicolor* | Garden Lizard |
| 12 | Agamidae | *Calotes mystaceus* | Blue Forest Lizard |
| 13 | Gekkonidae | *Hemidactylus frenatus* | House Gecko |
| 14 | Scincidae | *Lygosoma bowringii* | Bowring's Supple Skink |
| 15 | Scincidae | *Mabuya multifasciata* | Common Sun Skink |
| 16 | Natricidae | *Amphiesma stolata* | Buff-striped Keelback |
| 17 | Natricidae | *Xenochrophis flavipunctatus* | Yellow-spotted Keelback Snake |
| 18 | Natricidae | *Xenochrophis piscator* | Chequered Keelback Water Snake |
| 19 | Homalopsidae | *Enhydris enhydris* | Rainbow Water Snake |
| 20 | Homalopsidae | *Homalopsis buccata* | Puff-faced Water Snake |
| 21 | Boondontidae | *Psammopsis condanansis* | Water Snake |
| 22 | Xenopeltidae | *Xenopeltis unicolor* | Sunbeam Snake |
| 23 | Elapidae | *Bungarus fasciatus* | Yellow-banded Krait |
| 24 | Elapidae | *Naja kaouthia* | Monocellate Cobra |
| 25 | Typhlopidae | *Ramphotyphlops braminus* | Common Blind Snake |
| 26 | Typhlopidae | *Typhlops diardi* | Diard's Blind Snake |
| 27 | Viperidae | *Daboia russellii siamensis* | Russell's Viper |

| No. | Family Name | pScientific Name | Common Name |
|---|---|---|---|
| 28 | Colubridae | *Ptyas korros* | Indo-chinese Rat Snake |

(Source – FD of Moeyingyi)

**List of Amphibians and Reptiles from Moeyingyi Wildlife Sanctuary (Bago University)**

| No. | Family Name | Scientific Name | Common Name |
|---|---|---|---|
| 1 | Bufonidae | *Bufo melanostictus* | True Frog |
| 2 | Ranidae | *Occidozyga lima* | Common Floating Frog |
| 3 | Ranidae | *Rana erythraea* | Red-eared Frog |
| 4 | Ranidae | *Rana limnocharis greanii* | Paddy Frog |
| 5 | Ranidae | *Rana limnocharis* | Paddy Frog |
| 6 | Ranidae | *Rana macrodactyla* | Long-toed Frog |
| 7 | Ranidae | *Rana rugolosa* | Chinese Bullfrog |
| 8 | Ranidae | *Rana tigerina* | Khaing Land Frog |
| 9 | Polypedatidae | *Polypedates leucomystax* | Common Tree Frog |
| 10 | Rhacophoridae | *Rhacophorus* sp | Flying Frog |
| 11 | Brevicipitidae | *Microhyla ornata* | Narrow-mouth Toad |
| 12 | Brevicipitidae | *Kaloula pulchra* | Narrow-mouth Toad |
| 13 | Emydidae | *Morenia occellata* | Eyed Turtle |
| 14 | Trionychidae | *Lissemys scutata* | Flapshell Turtle |
| 15 | Agamidae | *Calotes versicolor* | Changeable Lizard |
| 16 | Agamidae | *Calotes mystaceus* | Lizard |
| 17 | Gekkonidae | *Hemidactylus frenatus* | Common House Gecko |
| 18 | Scincidae | *Lygosoma bowringii* | Christmas Island Grass Skink |
| 19 | Scincidae | *Mabuya multifasciata* | East Indian Brown Mabuya |
| 20 | Natricidae | *Amphiesma stolata* | Buff-striped Keelback |
| 21 | Natricidae | *Xenochrophis flavipunctatus* | Yellow-spotted Keelback Snake |
| 22 | Natricidae | *Xenochrophis piscator* | Chequered Keelback Water Snake |
| 23 | Homalopsidae | *Enhydris enhydris* | Rainbow Water Snake |
| 24 | Homalopsidae | *Homalopsis buccata* | Rainbow Mud Snake |
| 25 | Xenopeltidae | *Xenopeltis unicolor* | Sunbeam Snake |

| No. | Family Name | Scientific Name | Common Name |
|---|---|---|---|
| 26 | Elapidae | *Bungarus fasciatus* | Banded Krait |
| 27 | Elapidae | *Naja kaouthia* | Monocellate Cobra |
| 28 | Typhlopidae | *Ramphotyphlops braminus* | Brahming Blind Snake |
| 29 | Typhlopidae | *Typhlops diardi* | Diard's Blind Snake |
| 30 | Viperidae | *Daboia russellii siamensis* | Easter Russell's Viper |
| 31 | Colubridae | *Ptyas korros* | Indo-chinese Rat Snake |
| 32 | Colubridae | *Psammopsis condanarus* | Sand Snake |

(Source – Zoology Department of Bago University)

>b

**List of mammal species of Moeyingyi from Zoology Department of Bago University**

| Sr. No. | Scientific Name | Myanmar Name | Common Name | Family |
|---|---|---|---|---|
| 1 | *Rhizomys pruinosus* | Pway Kywet | Hoary Bamboo Rat | Spalacidae |
| 2 | *Bandicota Indica* | Kywet Kalar | Greater Bandicoot Rat | Muridae |
| 3 | *Bandicota savilei* | Bamar Kywet | Savile's Bandicoot Rat | Muridae |
| 4 | *Niviventer fulvescens* | Kywet Wan Phyu | White volleyed Rat | Muridae |
| 5 | *Mus cervicolor* | Kywer Pha Laung | Fawn coloured Rat | Muridae |
| 6 | *Bibos gaurus* | Nwa | Eventoed Mammal | Bovidae |
| 7 | *Syncerus coffer* | Kywe | Buffalo | Bovidae |
| 8 | *Sus scrofa* | Wet | Pig | Suidae |
| 9 | *Nubin goat* | Seit | Africa Goat | Bovidae |

(Source - Zoology Department of Bago University)

# BIODIVERSITY DATA AND SOCIOECONOMIC DATA
# OF
# MOEYUNGY WETLAND WILDLIFE SANCTUARY
# (2014)

**Appendix 3.1**

## List of Avifauna from Survey Conducted in 2014

| Sr. | Family and Common Name | *Scientific name* | Water Birds | Terrestrial Birds | Range and Status |
|---|---|---|---|---|---|
| | **ANTIDAE: DENDROCYGNINAE: Whistling-ducks** | | | | |
| 1 | Lesser Whistling-Duck | *Dendrocygna javanica* | X | | R |
| | **ANATIDAE: ANATINAE: Typical ducks and pygmy-geese** | | | | |
| 2 | Indian Spot-billed Duck | *Anas poecilorhyncha* | X | | R |
| 3 | Northern Pintail | *Anas acuta* | X | | M |
| 4 | Garganey | *Anas querquedula* | X | | M |
| | **PODICIPEDIDAE: Grebes** | | | | |
| 5 | Little Grebe | *Tachybaptus ruficollis* | X | | R |
| | **CICONIIDAE: Storks** | | | | |
| 6 | Painted Stork | *Mycteria leucocephala* | X | | M |
| 7 | Asian Openbill | *Anastomus oscitans* | X | | M |
| 8 | Black Stork | *Ciconia nigra* | X | | M |
| | **THRESKIORNITHIDAE: THRESKIOGNITHINAE: Ibises** | | | | |
| 9 | Black-headed Ibis | *Threskiornis melanocephalus* | X | | R |
| 10 | Glossy Ibis | *Plegadis falcinellus* | X | | R |
| | **ARDEIDAE: BOTAURINAE: Bitterns** | | | | |
| 11 | Yellow Bittern | *Ixobrychus sinesis* | X | | R |
| 12 | Cwetlandamon Bittern | *Ixobrychus cwetlandamomeus* | X | | R |
| | **ARDEIDAE: ARIDEINAE: Herons & egrets** | | | | |
| 13 | Black-crowned Night-Heron | *Nycticorax nycticorax* | X | | R |
| 14 | Pond-Heron | *Ardeola speciosa* | X | | R |
| 15 | Eastern Cattle Egret | *Bubulcus coromandus* | X | | R |
| 16 | Grey Heron | *Ardea cinerea* | X | | R |
| 17 | Purple Heron | *Ardea purpurea* | X | | R |

| Sr. | Family and Common Name | *Scientific name* | Water Birds | Terrestrial Birds | Range and Status |
|---|---|---|---|---|---|
| **18** | Great Egret | *Ardea alba* | X | | R |
| **19** | Intermediate Egret | *Mesophoyx intermedia* | X | | R |
| **20** | Little Egret | *Egretta garzetta* | X | | R |
| | **PELECANIDAE: Pelicans** | | | | |
| **21** | Spot-billed Pelican | *Pelecanus philippensis* | X | | M |
| | **PHALACROCORACIDAE: Cormorants** | | | | |
| **22** | Little Cormorant | *Phalacrorax niger* | X | | R |
| | **ANHINGIDAE: Darters** | | | | |
| **23** | Oriental Dater | *Anhinga melanogaster* | X | | R |
| | **FALCONIDAE: FALCONINAE: Falcons** | | | | |
| **24** | Common Kestrel | *Falco twetlandunculus* | | X | R |
| | **FALCONIDAE: ACCIPITRINAE: Hawks, eagles & allies** | | | | |
| **25** | Oriental Honey-Buzzard | *Pernis ptilorhynchus* | | X | R |
| **26** | Black -shouldered Kite | *Elanus caeruleus* | | X | R |
| **27** | Black Kite | *Milvus migrans* | | X | M |
| **28** | Black-eared Kite | *Milvus lineatus* | | X | M |
| **29** | Crested Serpent-Eagle | *Spilornis cheela* | | X | R |
| **30** | Eastern Marsh-Harrier | *Circus spilonotus* | | X | M |
| **31** | Pied Harrier | *Circus melanoleuco* | | X | M |
| | **RALLIDAE: Rails, crakes, gallinules & coots** | | | | |
| **32** | White-breasted Waterhen | *Amaurornis phoenicurus* | X | | R |
| **33** | Ruddy-breasted Crake | *Porzana fusca* | X | | R |
| **34** | Watercock | *Gallicrex cinerea* | X | | R |
| **35** | Grey-headed Swamphen | *Porphyrio poliocehalus* | X | | R |
| **36** | Common Coot | *Fulica atra* | X | | M |
| | **GRUIDAE: GRUINAE: Typical cranes** | | | | |

| Sr. | Family and Common Name | *Scientific name* | Water Birds | Terrestrial Birds | Range and Status |
|---|---|---|---|---|---|
| **37** | Sarus Crane | *Grus antigone* | X | | R |
| | **PLUVIALIDAE: *Pluvialis* plovers** | | | | |
| **38** | Pacific Golden Plover | *Pluvialis fulva* | X | | M |
| | **RECURVIROSTRIDAE: Stilts & avocets** | | | | |
| **39** | Black-winged Stilt | *Hmantopus himantopus* | X | | R |
| | **VANELLIDAE: Lapwings & allies** | | | | |
| **40** | Grey-headed Lapwing | *Vanellus cinereus* | | X | M |
| **41** | Red-wattled Lapwing | *Vanellus indicus* | | X | R |
| | **CHARADRIIDAE: *Charadrius* plovers & allies** | | | | |
| **42** | Little Ringed Plover | *Charadrius dubius* | X | | M |
| **43** | Kentish Plover | *Charadrius alexandrinus* | X | | M |
| **44** | Lesser Sand-Plover | *Charadrius mongolus* | X | | M |
| | **JACANIDAE: Jacanas** | | | | |
| **45** | Pheasant-tailed Jacana | *Hydrophasianus chirurgus* | X | | R |
| **46** | Bronze-winged Jacana | *Metopidicus indicus* | X | | R |
| | **SCOLOPACIDAE: GALLINAGININAE: Snipes** | | | | |
| **47** | Snipe | *Gallinago spp* | X | | M |
| | **SCOLOPACIDAE: TRINGINAE: Godwits, dowitchers, curlews, sandpipers** | | | | |
| **48** | Common Sandpiper | *Actitis hypoleucos* | X | | M |
| **49** | Green Sandpiper | *Tringa ochropus* | X | | M |
| **50** | Spotted Redshank | *Tringa erythropus* | X | | M |
| **51** | Wood Sandpiper | *Tringa glareola* | X | | M |
| **52** | Common Redshank | *Tringa totanus* | X | | M |
| | **SCOLOPACIDAE: CALIDRIDNAE: *Calidris* sandpiper & allies** | | | | |
| **53** | Temminck's Stint | *Calidris temminckii* | X | | M |
| **54** | Long-toed Stint | *Calidris subminuta* | X | | M |

| Sr. | Family and Common Name | *Scientific name* | Water Birds | Terrestrial Birds | Range and Status |
|---|---|---|---|---|---|
| | **GLAREOLIDAE: GLAREOLINAE: Pratincoles** | | | | |
| **55** | Oriental Pratincole | *Glareola maldivarum* | X | | M |
| | **STERNIDAE: Noddies & terns** | | | | |
| **56** | White-winged Tern | *Chlidonias leucopterus* | X | | M |
| **57** | Whiskered Tern | *Chlidonias hybrida* | X | | M |
| **58** | Common Tern | *Sterna hirundo* | X | | M |
| | **COLUMBIDAE: COLUMBINAE: Typical pigeons & doves** | | | | |
| **59** | Rock Pigeon | *Columba livia* | | X | R |
| 60 | Red Collared-Dove | *Streptopelia tranquebarica* | | X | R |
| 61 | Spotted Dove | *Streptopelia chinensis* | | X | R |
| | CUCULIDAE: CUCULINAE: Old World cucukoos | | | | |
| 62 | Indian Cuckoo | *Cuculus micropterus* | | X | R |
| 63 | Plaintive Cuckoo | *Cacomantis merulimus* | | X | R |
| | CUCULIDAE: CENTROPODINAE: Coucals | | | | |
| 64 | Greater Coucal | *Centropus sinensis* | | X | R |
| 65 | Lesser Coucal | *Centropus bengalensis* | | X | R |
| | TYTONIDAE: TYTONINAE: Barn -and grass-owls | | | | |
| 66 | Eastern Grass-Owl | *Tyto longimembris* | | X | R |
| | STRIGIDAE: Typical owls | | | | |
| 67 | Collared Scops-Owl | *Otus lettia* | | X | R |
| 68 | Asian Barred Owlet | *Glaucidium cuculoides* | | X | R |
| 69 | Spotted Owlet | *Athene brama* | | X | R |
| | APODIAE: APODINAE: Typical swifts | | | | |
| 70 | Asian Palm-Swift | *Cypsiurus balas* | | X | R |
| 71 | House Swft | *Apus affinis* | | X | R |
| | CORACIIDAE: Rollers | | | | |

| Sr. | Family and Common Name | *Scientific name* | Water Birds | Terrestrial Birds | Range and Status |
|---|---|---|---|---|---|
| 72 | Indian Roller | *Coracias benghalensis* | | X | R |
| | ALCEDINIDAE: HELCYONINAE: Larger kingfishers | | | | |
| 73 | White-throated Kingfisher | *Halcyon smyrnensis* | | X | R |
| 74 | Black-capped Kingfisher | *Halcyon pileata* | | X | M |
| | ALCEDINIDAE: ALCEDININAE: Smaller kingfisher | | | | |
| 75 | Blue-eared Kingfisher | *Alcedo meninting* | | X | M |
| 76 | Common Kingfisher | *Alcedo atthis* | | X | R |
| | MEROPIDAE: Bee-eaters | | | | |
| 77 | Little Green Bee-eater | *Merops orientalis* | | X | R |
| 78 | Blue-tailed Bee-eater | *Mecops philippinus* | | X | R |
| | RAMPHASTIDAE: MEGALAIMINAE: Asian barbets | | | | |
| 79 | Coppersmith Barbet | *Megalaima haemaccephala* | | X | R |
| | PICIDAE: JYGNINAE: Wrynecks | | | | |
| 80 | Eurasian Wryneck | *Iynx torquilla* | | X | M |
| | PICIDAE: PICINAE: Typical woodpeckers | | | | |
| 81 | Fulvous-breasted Woodpecker | *Dendrocopos macei* | | X | M |
| | ORIOLIDAE: Orioles & allies | | | | |
| 82 | Black-naped Oriole | *Oriolus chinensis* | | X | M |
| | ARTAMIDAE: Woodswallows | | | | |
| 83 | Ashy Woodswallow | *Artamus fuscus* | | X | R |
| | AEGITHINIDAE: Ioras | | | | |
| 84 | Common Iora | *Aegithina tiphia* | | X | R |
| | DICRURIDAE: Drongos | | | | |
| 85 | Black Drongo | *Dicrurus macrocercus* | | X | M |
| | CORVIDAE: Crows, nutcrackers, magpies, jays, treepies & allies | | | | |
| 86 | House Crow | *Corvus splendens* | | X | R |

| Sr. | Family and Common Name | *Scientific name* | Water Birds | Terrestrial Birds | Range and Status |
|---|---|---|---|---|---|
| | LANIIDAE: Shrikes | | | | |
| 87 | Brown Shrike | *Lanius cristatus* | | X | M |
| 88 | Long-tailed Shrike | *Lanius schach* | | X | M |
| | NECTARINIIDAE: Sunbirds & spinderhunters | | | | |
| 89 | Olive-backed Sunbird | *Cwetlandyris jugularis* | | X | R |
| | PLOCEIDAE: Weavers & allies | | | | |
| 90 | Baya Weaver | *Ploceus philippinus* | | X | R |
| | ESTRILDIDAE: LONCHURINAE: Java Sparrow, munias, | | | | |
| 91 | White-rumped Munia | *Lonchura striata* | | X | R |
| 92 | Scaly-breasted Munia | *Lonchura punctulata* | | X | R |
| | PASSERIDAE: Sparrows & allies | | | | |
| 93 | House Sparrow | *Passer domesticus* | | X | R |
| 94 | Plain-backed Sparrow | *Passer flaveolus* | | X | R |
| 95 | Eurasian Tree-Sparrow | *Passer montanus* | | X | R |
| | MOTACILLIDAE: Wagtails & pipits | | | | |
| 96 | Red-throated Pipit | *Anthus cervinus* | | X | M |
| 97 | Richard's Pipit | *Anthus richardi* | | X | M |
| 98 | Paddyfied Pipit | *Anthus rufulus* | | X | R |
| 99 | White Wagtail | *Motacilla alba* | | X | M |
| 100 | Grey Wagtail | *Motacilla cinerea* | | X | M |
| 101 | Eastern Yellow Wagtail | *Motacilla tschutschensis* | | X | M |
| | EMBERIZIDAE: Buntings & allies | | | | |
| 102 | Chestnut-eared Bunting | *Emberiza fucata* | | X | M |
| | STURNIDAE: STURNINAE: Mynas, starlings & allies | | | | |
| 103 | Jungle Myna | *Acridotheres fuscus* | | X | R |
| 104 | Common Myna | *Acridotheres tristis* | | X | R |

| Sr. | Family and Common Name | *Scientific name* | Water Birds | Terrestrial Birds | Range and Status |
|---|---|---|---|---|---|
| 105 | Asian Pied Starling | *Gracupica contra* | | X | R |
| | MUSCICAPIDAE: SAXICOLINAE: Shortwings, robins, redstarts, | | | | |
| 106 | Bluethroat | *Luscinia svecica* | | X | M |
| 107 | Eastern Stonechat | *Saxicola maurus* | | X | M |
| 108 | Pied Bushchat | *Saxicola caprata* | | X | R |
| | MUSCICAPIDAE: MUSCICAPINAE: Old World flycatchers & allies | | | | |
| 109 | Taiga Flycatcher | *Ficedula albicilla* | | X | M |
| 110 | Oriental Magpie-Robin | *Copsychus saularis* | | X | R |
| | ALAUDIDAE: Larks | | | | |
| 111 | Oriental Skylark | *Alauda gulaula* | | X | R |
| | PYCNONOTIDAE: Bulbuls | | | | |
| 112 | Streak-eared Bulbul | *Pycnonotus blanfordi* | | X | R |
| 113 | Red-whiskered Bulbul | *Pycnonotus jocosus* | | X | R |
| 114 | Red-vented Bulbul | *Pycnonotus cafer* | | X | R |
| | HIRUNDINIDAE: HIRUNDININAE: Martins, swallows & allies | | | | |
| 115 | Common Sand-Martin | *Riparia nipalense* | | X | M |
| 116 | Pale Sand-Martin | *Riparia diluta* | | X | M |
| 117 | Barn Swallow | *Hirundo rustica* | | X | M |
| 118 | Red-rumped Swallow | *Cecropis daurica* | | X | M |
| | PHYLLOSCOPIDAE: *Seicercus & Phylloscopus* warblers | | | | |
| **119** | Greenish Warbler | *Phylloscopus trochiloides* | | **X** | **M** |
| **120** | Yellow-browed Warbler | *Phylloscopus inornatus* | | **X** | **M** |
| **121** | Dusky Warbler | *Phylloscopus fuscatus* | | **X** | **M** |
| | **TIMALIIDAE: Babblers** | | | | |
| **122** | Yellow-eyed Babbler | *Chrysomma sinense* | | **X** | **R** |
| **123** | Oriental White-Eye | *Zosterops palpebrosus* | | **X** | **R** |

| Sr. | Family and Common Name | *Scientific name* | Water Birds | Terrestrial Birds | Range and Status |
|---|---|---|---|---|---|
| | **ACROCEPHALIDAE: *Acrocephalus* warblers & allies** | | | | |
| **124** | Black-Browed Reed-Warbler | *Acrocephalus bistrigiceps* | | **X** | **M** |
| **125** | Paddyfield Warbler | *Acrocephalus agricola* | | **X** | **M** |
| **126** | Oriental Reed-Warbler | *Acrocrphalus orientalis* | | **X** | **M** |
| **127** | Thick-billed Warbler | *Acrocrphalus aedon* | | **X** | |
| | **MEGALURIDAE: Grasshopper warblers, *Bradypterus* bush-warbler,** | | | | |
| **128** | Striated Grassbird | *Mengalurus palustris* | | **X** | **R** |
| | **CISTICOLIDAE: Cisticolas, tailorbirds, prinias & allies** | | | | |
| **129** | Zitting Cisticola | *Cisticola juncidis* | | **X** | **M** |
| **130** | Bright-headed Cisticola | *Cisticola exilis* | | **X** | **R** |
| **131** | Common Tailordbird | *Orthotomus sutorius* | | **X** | **R** |
| **132** | Yellow-bellied Prinia | *Prinia flaviventris* | | **X** | **R** |
| **133** | Plain Prinia | *Prinia inornata* | | **X** | **R** |

**Appendix 3.2**

## Aquatic Plant Species from Moyingyi Wetland Wildlife Sanctuary (2014)

| No. | Family | Scientifica name | Local name | Habit | Collection sites | |
|---|---|---|---|---|---|---|
| | | | | | Upland | Weland |
| 1 | Acanthaceae | *Hygnophila pllomoides* Nees. | Migyaung-kunbat | H=32 | + | + |
| 2 | Acanthaceae | *Rungia pectinata* (L.) Nees. | Nil | H | + | + |
| 3 | Acanthaceae | *Rungia* sp. | Nil | H | + | - |
| 4 | Aizoaceae | *Sesuvium* sp. | Nil | H | - | + |
| 5 | Amanrantaceae | *Alternanter sessilis* R. Br. | Pazun-sa | H | + | - |
| 6 | Apiaceae | *Sium latifolium* L. | Nil | H | - | + |
| 7 | Araceae | *Colocasia esculenta* (L.) Schott. | Pein | H | - | + |
| 8 | Araceae | *Homalomena truncata* Hk. F. | Nil | H | - | + |
| 9 | Araceae | *Lemna paucicostata* Hegelm.. | Duckweed | AH=12 | - | + |
| 10 | Asteraceae | *Acmella vliginosa* (Sw.) Cass. | Bizat | H | + | - |
| 11 | Asteraceae | *Blumea lacera* DC. | Kadu | H | + | + |
| 12 | Asteraceae | *Eclipta alba* (L.) Hassk. | Kyeikhman | H | + | - |
| 13 | Asteraceae | *Enhydra fluctuans* Lour. | Kanahpaw | H | - | + |
| 14 | Asteraceae | *Eupatorium odoratum* L. | Bizat | H | + | + |
| 15 | Asteraceae | *Laennecia coulteri* (A. Gray) G.L. Nesom | Nil | H | + | - |
| 16 | Asteraceae | *Mikania scandens* (L.) Willd. | Bizat-nwe | C=4 | + | + |
| 17 | Asteraceae | *Sphaeranthus indicus* L. | Mon-di | H | + | - |
| 18 | Azollaceae | *Azolla* sp. | Red fern | AH | - | + |
| 19 | Boraginaceae | *Heliotropium ovalifolium* Forsk. | Sin-let-maung-gale | H | + | - |
| 20 | Caesalpiniaceae | *Cassia italica* (Mill.) Lam. | Dan-gywe | S=5 | + | - |
| 21 | Cleomaceae | *Cleome burmani* W. & A. | Taw-hingala | H | + | - |
| | | | | | | |

| No. | Family | Scientifica name | Local name | Habit | Collection sites | |
|---|---|---|---|---|---|---|
| | | | | | Upland | Weland |
| 22 | Commelinaceae | *Commelina communis*L. | Wetkyok | H | + | + |
| 23 | Commelinaceae | *Commelina erecta* L | Wetkyok | H | + | + |
| 24 | Convolvulaceae | *Ipomaea aquatica*Forsk. | Ye-kazun | C | + | + |
| 25 | Convolvulaceae | *Ipomaea alba* L. | Nwe-kazun-byu | C | + | + |
| 26 | Cyperaceae | *Cyperus* sp. | Nil | MP=8 | - | + |
| 27 | Cyperaceae | *Cyperus alternifolius* L. | Hti-myet | MP | + | + |
| 28 | Cyperaceae | *Cyperus compressus* L. | Wetlar-myet | MP | + | + |
| 29 | Cyperaceae | *Kyllinga triceps* Rottb. | Thone-daunt-myet | MP | + | + |
| 30 | Cyperaceae | *Scirpus juncoides* Roxb. | Nil | MP | - | + |
| 31 | Cyperaceae | *Scirpus cespitosus* L. | Nil | MP | - | + |
| 32 | Fabaceae | *Caesalpinia* spp. | Hman | S | + | - |
| 33 | Fabaceae | *Canavalia ensiformis* DC. | Taw-pe | C | + | + |
| 34 | Fabaceae | *Crotalaria striata* Schrank. | Taw-pike-san | S | + | - |
| 35 | Fabaceae | *Sesbania cannabina* (Retz.) Pers. | Nyan | H | + | + |
| 36 | Hydrocharitaceae | *Hydrilla verticillata* (L. f) Royle | Ye-hnyi | AH | - | + |
| 37 | Hydrocharitaceae | *Ottelia ovalifolia* (R.Br.) Rich. | Nil | AH | - | + |
| 38 | Lamiaceae | *Ocimum sanetum* L. | Kala-pinsein | H | + | - |
| 39 | Lentibulariaceae | *Urticularia flexuosa* Vahl. | Bubaung- pin | H | - | + |
| 40 | Lentibulariaceae | *Urtricularia* sp. | Bubaung- pin | H | - | + |
| 41 | Limnocharitaceae | *Limnocharis flava* (L.) Buchenau | Tet-pya | H | - | + |
| 42 | Malvaceae | *Sida rhombifolia* Lwetland. | Tamyet-si-pin | H | + | - |
| 43 | Malvaceae | *Urena rigida* Wall. | Katsi-ne-pin | H | + | - |
| 44 | Menyanthaceae | *Nymphoides indicum* Ktze. | Kya-linban | AH | - | + |
| 45 | Mimosaceae | *Mimosa asperata* L. | Ye-suboke | S | + | + |
| 46 | Mimosaceae | *Mimosa pudica* L. | Tikayon | H | + | - |

| No. | Family | Scientifica name | Local name | Habit | Collection sites | |
|---|---|---|---|---|---|---|
| | | | | | Upland | Weland |
| 47 | Nelumbonaceae | *Nelumbo nucifera* Gaertn. | Padon-ma-kya | AH | - | + |
| 48 | Nymphaeaceae | *Nymphaea lotus* L. | Kya-phyu | AH | - | + |
| 49 | Nymphaeaceae | *Nymphaea rubra* Roxb. | Kya-ni | AH | - | + |
| 50 | Nymphaeaceae | *Nymphaea stellata* Willd. | Kya-pya | AH | - | + |
| 51 | Onagraceae | *Jussiaea repens* L. | Ye-tikayon | H | - | + |
| 52 | Onagraceae | *Ludwigia octovalvis* (Jacq.) P.H. | Nil | S | + | + |
| 53 | Oxalidaceae | *Oxalis corniculata* L. | Hmo-na-do | H | + | - |
| 54 | Poaceae | *Andropogon* sp. | Padaw-ni-myet | G=13 | + | - |
| 55 | Poaceae | *Chloris inflata* Link. | Sin-ngo-myet | G | + | - |
| 56 | Poaceae | *Imperata cylindrica* (L.) Beauv. | Thekke | G | + | + |
| 57 | Poaceae | *Imperata* sp. | Nil | G | - | + |
| 58 | Poaceae | *Catabrosa aquatica*(L.) Beauv. | Nil | G | + | - |
| 59 | Poaceae | *Cynodon dactylon* (L.) Pers. | Myaesa-myet | G | + | - |
| 60 | Poaceae | *Eulalia*sp. | Thekke-gale | G | + | + |
| 61 | Poaceae | *Hygroryza aristata* Nees. | Nil | G | - | + |
| 62 | Poaceae | *Hymenachne myosuroides* R. Br. | Bawh-myet | G | + | + |
| 63 | Poaceae | *Leptochloa neesii* (Thw.) Benth. | Myet-cho | G | + | - |
| 64 | Poaceae | *Oryza minuta* J. Presl. | Nat-saba | G | - | + |
| 65 | Poaceae | *Panicum repens* L. | Myet-kha | G | + | - |
| 66 | Poaceae | *Saccolepis interupta* (Willd.) Stapf. | Myet-win-poo | G | - | + |
| 67 | Polygonaceae | *Polygonum barbatum* L. | Kywe-lae-chaung | H | + | + |
| 68 | Polygonaceae | *Rheum nobile* Hk.f.& T. | Kala-chinbaung | H | + | - |
| 69 | Pontederiaceae | *Eichhornia crassipes* (Mart.) Solms. | Beda-pin | AH | - | + |
| 70 | Pteridaceae | *Adiatum* sp. | Nil | MP | - | + |
| 71 | Salviniaceae | *Salvinia natans* (L.) All. | Nil | AH | - | + |

| No. | Family | Scientifica name | Local name | Habit | Collection sites | |
|---|---|---|---|---|---|---|
| | | | | | Upland | Weland |
| 72 | Solanaceae | *Physalis minima* L. | Bauk-pin | H | + | |
| 73 | Trapaceae | *Trapa bispinosa* L. | Kywe-kaung | AH | - | + |
| 74 | Thelypteridaceae | *Thelypteris palustris*L. | Dayin-gauk-pin | MP | - | + |
| **Total observed species from both upland and wetland areas** | | | | | 44 | 50 |

List of (10) plant species which occur constantly present (80-100%) from emergent macrophytes

| No. | Family | Scientific name | Local name |
|---|---|---|---|
| 1 | Araceae | *Colocasia esculenta* (L.) Schott. | Pein |
| 2 | Commelinaceae | *Commelina communis* L. | Wetkyok |
| 3 | Cyperaceae | *Cyperus* sp. | Nil |
| 4 | Cyperaceae | *Cyperus alternifolius* L. | Hti-myet |
| 5 | Cyperaceae | *Cyperus compressus* L. | Wetlar-myet |
| 6 | Cyperaceae | *Scirpus juncoides* Roxb. | Nil |
| 7 | Cyperaceae | *Eleocharis* sp. | Nil |
| 8 | Fabaceae | *Sesbania cannabina* (Retz.) Pers. | Nyan |
| 9 | Onagraceae | *Ludwigia octovalvis* (Jacq.) P.H. | Nil |
| 10 | Poaceae | *Eulalia* spp. | Thekke-gale |
| 11 | Poaceae | *Hymenachne myosuroides* R. Br. | Bawh-myet |

**List of (10) plant species which occur constantly present (80-100%) from floating-leaved macrophytes**

| No. | Family | Scientific name | Local name |
|---|---|---|---|
| 1 | Cyperaceae | *Eleocharis* sp. | Nil |
| 2 | Hydrocharitaceae | *Hydrilla verticillata* (L. f) Royle | Ye-hnyi |
| 3 | Lentibulariaceae | *Urticularia flexuosa* Vahl. | Bubaung-pin |
| 4 | Menyanthaceae | *Nymphoides indicum* Ktze. | Kya-linban |
| 5 | Nelumbonaceae | *Nelumbo nucifera* Gaertn. | Padon-ma-kya |
| 6 | Nymphaeaceae | *Nymphaea lotus* L. | Kya-phyu |
| 7 | Nymphaeaceae | *Nymphaea stellata* Willd. | Kya-pya |
| 8 | Poacea | *Hygroryza aristata* Nees. | Nil |
| 9 | Poaceae | *Saccolepis interupta* (Willd.) Stapf. | Myet-win-pu |
| 10 | Trapaceae | *Trapa bispinosa* L. | Kywe-kaung |

Appendix 3.3

**List of Observed Fish Species in Moyungyi Wetland Sanctuary (2014)**

| Sr | Scientific name | Local name | Common name | Thoneeinsu | Pyinpongyi | Wanbei wetland | Falauk | kapin | Pyun chanug | Htain pin | Targawa | lake | Total occurrence |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | *Amblyharynagodon mora*(Hamilton,1822) | Nga be phyu | Aspidoparia | | | | | ▲ | ▲ | | ▲ | | 3 |
| 2 | *Anabas testudineus* (Bloch,1792) | Nga bye ma | Climbing perch | ▲ | | ▲ | | | | ▲ | ▲ | | 4 |
| 3 | *Anguilla bicolor (*M'Clelland,1844) | Nga lin ban | Level fwetlanded eel | | | ▲ | | | | | | | 1 |
| 4 | *Badis ruber* (Schreitmuller,1923) | Nga mee laung | Red badis | ▲ | ▲ | | | | | | | | 2 |
| 5 | *Catla catla* (Hamilton,1822) | Nga own ton/ nga thine | Carp | | | | | | | | ▲ | | 1 |
| 6 | *Channa guchua* (Hamilton,1822) | Nga gaung toe | Dwarf snakehead | | ▲ | ▲ | | | | ▲ | ▲ | | 4 |
| 7 | *Channa punctatus* (Bloch,1793) | Nga pa naw | Spotted-snake head | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | | 8 |
| 8 | *Channa striata* (Bloch,1793) | Nga yant | Banded snakehead | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | | 8 |
| 9 | *Clarias batrachas* (Lwetlandaeus,1822) | Nga khu | Philippine catfish | | ▲ | | ▲ | ▲ | | | ▲ | | 4 |
| 10 | *Colisa lobiosus* (Day,1822) | Nga phyin tha lat | Thick-lipped gorame | ▲ | ▲ | | | | | | | | 2 |
| 11 | *Erethistes sp,(* Kottelat*)* | Nga kyuk pha | Burmese erethistes | | | | | | | | ▲ | | 1 |
| 12 | *Esomus altus* (Blyth,1860) | Nga maw tawt | Burmese flying barb | ▲ | | | | | | | | | 1 |

| Sr | Scientific name | Local name | Common name | Thoneeinsu | Pyinpongyi | Wanbei wetland | Falauk | kapin | Pyun chanug | Htain pin | Targawa | lake | Total occurrence |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 13 | *Glossogobius giuris* (Hamilton,1822) | Ka tha boe | Tank goby | ▲ | ▲ | | | | | | ▲ | | 3 |
| 14 | *Heteropnustes fossilis* (Bloch,1794) | Nga kyee | Stinging catfish | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | | 8 |
| 15 | *Labeo rohita* (Hamilton,1822) | Nga myet san ni/myit chin | Roho labeo | | | | | | | | ▲ | | 1 |
| 16 | *Lepidocephalichthys micropogon* (Blyth,1860) | Nga yaik kat/ tha le doe | loach | | | | | | | | ▲ | | 1 |
| 17 | *Macrognathus aral* (Bloch&Schneider,1801) | Nga mwe doe chaw | Onestripe spiny eel | | ▲ | ▲ | | | ▲ | ▲ | ▲ | ▲ | 6 |
| 18 | *Macrognathus zebrinus* (Blyth,1858) | Nga mwe doe kyan sit | Ophidian | ▲ | ▲ | ▲ | | | | | ▲ | | 4 |
| 19 | *Mastacembelus armatus* (Lecepede,1800) | Mwe na gar | Spiny ell | | ▲ | | | | | | ▲ | | 2 |
| 20 | *Monopterus albas* (Zuiew,1973) | Nga shint | Rice swamp eel | | ▲ | ▲ | | | | ▲ | | | 3 |
| 21 | *Mystus cavasius* (Hamilton,1822) | Nga zin yine kywe | River catfish | | ▲ | | | | | | | | 1 |
| 22 | *Mystus microphthalmus* (Day,1877) | Nga aike | Long-whisker catfish | | ▲ | | | | | | ▲ | | 2 |
| 23 | *Mystus pulcher* (Chaudhuri,1911) | Nga zin yine mee kwet | Dwarf catfish | ▲ | ▲ | | | | | | | | 2 |
| 24 | *Nandus nandus* (Hamilton) | Nga wet ma | Spotted field perch | | ▲ | | | | ▲ | ▲ | | | 3 |
| 25 | *Neotropius actriostris* (Day,1870) | Nga tan jate | Butter catfish | | ▲ | | | | | | ▲ | | 2 |
| 26 | *Notopterus notopterus* (Pallas,1760) | Nga la/nga phe | Bronze/Grey feather back | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | 9 |
| 27 | *Ompok bimaculatus* (Bloch,1794) | Nga nu than | Indian butter catfish | | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | | | 6 |

| Sr | Scientific name | Local name | Common name | Thoneeinsu | Pyinpongyi | Wanbei wetland | Falauk | kapin | Pyun chanug | Htain pin | Targawa | lake | Total occurrence |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 28 | *Ophisternon bengalensis* (M'clelland) | Nga shint | Mud eel | | ▲ | | | | | | | | 1 |
| 29 | *Osteobrama belangeri* (Valenciennes,1844) | Nga phan ma | Manipur osteobrama | | ▲ | ▲ | | ▲ | ▲ | ▲ | | ▲ | 6 |
| 30 | *Parambasis ranga* (Hamilton,1822) | Nga zin zut | Indian glass fish | ▲ | ▲ | | ▲ | ▲ | ▲ | ▲ | | ▲ | 7 |
| 31 | *Puntius chola* (Hamilton,1822) | Nga khone ma | Swamp barb | ▲ | ▲ | | ▲ | ▲ | ▲ | | | | 5 |
| 32 | *Puntius sophore* (Hamilton,1822) | Nga khone ma | Barb | ▲ | ▲ | | | ▲ | ▲ | | | | 4 |
| 33 | *Tetrodon cutcutia* (Hamilton,1822) | Nga pu tin | Globe fish/puffer | | | | | | | | | ▲ | 1 |
| 34 | *Tilapia mossambica* (Peter,1852) | Nga phe ma | Mozambique tilapia | | | | | ▲ | ▲ | | ▲ | | 3 |
| 35 | *Trichogaste pectoralis* (Regan,1910) | Ngaphyinthalat | Snakeskin gourami | ▲ | ▲ | | | | | | ▲ | | 3 |
| 36 | *Wallago attu* (Bloch &Schneider,1801) | Nga but | Sheat fish | ▲ | | ▲ | ▲ | | | | | ▲ | 4 |
| 37 | *Xenentodon cancila* (Hamilton,1822) | Nga phung yoe | Garfish | | ▲ | | | | ▲ | | ▲ | ▲ | 4 |

Near Threatened Fish Species of Moyungyi Wetland Wildlife Sanctuary.

| No | Family | Scientific name | Local name | IUCN status |
|---|---|---|---|---|
| 1 | Cichlidae | *Tilapia mossambica* (Peter,1852) | Tilapia/ Ngaphe ma | NT (2007) |
| 2 | Cyprinidae | *Osteobrama belangeri* (Valenciennes,1844) | Nga phe aung/ phan ma | NT (2010) |
| 3 | Cyprinidae | *Catla catla* (Hamilton,1822) | Nga own ton/ nga gaung pwa | NT (2010) |
| 4 | Siluridae | *Ompok bimaculatus* (Bloch,1794) | Nga nu than | NT (2010) |
| 5 | Siluridae | *Wallago attu* (Bloch &Schneider,1801) | Nga but | NT (2010) |

**Least Concern Fish Species of Moyungyi Wetland Wildlife Sanctuary.**

| No | Family | Scientific name | Local name | IUCN status |
|---|---|---|---|---|
| 1 | Ambassidae | *Parambasis ranga* (Hamilton,1822) | Nga zin zut | LC (2012) |
| 2 | Anguillidae | *Anguilla bicolor* (M'Clelland,1844) | Nga lin ban | LC (2009) |
| 3 | Badidae | *Badis ruber* | Nga mee laung | LC (2012) |
| 4 | Bagridae | *Mystus cavasius* (Hamilton,1822) | Nga zin yine kywe | LC (2010) |
| 5 | | *Mystus microphthalmus* (Day,1877) | Nga aike | LC (2010) |
| 6 | | *Mystus pulcher* (Chaudhuri,1911) | Nga zin yine mee kwet | LC (2010) |
| 7 | Belonidae | *Xenentodon cancila* (Hamilton,1822) | Nga phung yoe | LC (2010) |
| 8 | Belontidae | *Colisa lobiosus* (Day,1822) | Nga phyin tha lat | LC (2010) |
| 9 | | *Trichogaster pectoralis* (Regan,1910) | Nga phyin tha lat/Gorami | LC (2012) |
| 10 | Chandidae | *Nandus nandus* | Nga wet ma | LC (2010) |
| 11 | Channidae | *Channa guchua* (Hamilton,1822) | Nga gaung toe | LC (2010) |
| 12 | | *Channa striata* (Bloch,1793) | Nga yant | LC (2010) |
| 13 | Clarriidae | *Clarias batrachas* (Lwetlandaeus,1822) | Nga khu | LC (2011) |
| 14 | Cobitidae | *Lepidocephalichthys micropogon* (Blyth,1860) | Nga yaik kat/ Nga tha le doe | LC (2010) |
| 15 | Cyprinidae | *Amblyharynagodon mora* | Nga be phyu | LC (2010) |
| 16 | | *Esomus altus* (Blyth,1860) | Nga maw tawt | LC (2009) |
| 17 | | *Labeo rohita* (Hamilton,1822) | Nga myet san ni/ myit chin | LC (2010) |
| 18 | | *Puntius chola* (Hamilton,1822) | Nga khone ma / metapauk | LC (2010) |

| No | Family | Scientific name | Local name | IUCN status |
|---|---|---|---|---|
| 19 | | *Puntius sophore* (Hamilton,1822) | Nga khone ma | LC (2010) |
| 20 | Sisoridae | *Erethistes sp* | Nga kyuk pha | LC (2010) |
| 21 | Gobiidae | *Glossogobius giuris* (Hamilton,1822) | Ka tha boe | LC (2012) |
| 22 | Heteropneusiti | *Heteropnustes fossilis* (Bloch,1794) | Nga kyee | LC (2010) |
| 23 | Mastacembelid | *Macrognathus zebrinus* (Blyth,1858) | Nga mwe doe kyan sit | LC (2010) |
| 24 | | *Mastacembelus armatus* (Lecepede,1800) | Mwe na gar /nga mwe doe | LC (2010) |
| 25 | Notopteridae | *Notopterus notopterus* (Pallas,1760) | Nga la/nga phe | LC (2010) |
| 26 | Synbranchidae | *Monopterus albas* (Zuiew,1973 | Nga shint | LC (2010) |
| 27 | | *Ophisternon bengalensis* | Nga shint | LC (2010) |
| 28 | Tetraodontidae | *Tetrodon cutcutia* (Hamilton,1822) | Nga pu tin | LC (2010) |

**Data Deficient Fish Species of Moyungyi Wetland Wildlife Sanctuary.**

| No | Family | Scientific name | Local name | IUCN status |
|---|---|---|---|---|
| 1 | Anabassidae | *Anabas testudineus* (Bloch,1792) | Nga bye ma | DD |

**Not Evaluated Species of Moyungyi Wetland Wildlife Sanctuary.**

| No | Family | Scientific name | Local name | IUCN status |
|---|---|---|---|---|
| 1 | Schilbeidae | *Neotropius actriostris* (Day,1870) | Nga tan jate | Not Evaluated |
| 2 | Mastacembelidae | *Macrognathus aral* (Bloch &Schneider,1801) | Nga mwe doe chaw | Not Evaluated |
| 3 | Channidae | *Channa punctatus*(Bloch,1793) | Nga pa naw | Not evaluated |

**Type of Fishing gears in Moyungyi Wetland Wildlife SnctuaryArea.**

| Sr | Name | Measurement | | | Remark |
|---|---|---|---|---|---|
| | | Length(m) | Depth(m) | Mesh size(cm) | |
| 1 | Push net(yin ton) | Pole- 7<br>Net- 3.5 | 2.5 | 2 | Shrimp and small fishes |
| 2 | Set gill net(tar pike) | 25 - >1000 | 1.5-2.0 | 2.5 | Non target species<br>(Small size) |
| 3 | Set gill net(tar pike) | 50 - >1000 | 1.5- 2.0 | 5 – 5.5 | Non target species<br>(Medium size) |
| 4 | Set gill net(tar pike) | >60 | 15 | 10 - 11.5 | Nga but<br>(big size) |
| 5 | Longline<br>(Nga mya tann) | 400-800 | Hook-(200-400)nos | Hook no-16<br>Hook no-22<br>Bait –(life)<br>nga phyin tha lat | Nga Nu than,<br>Nga yant,<br>Nga gyee |
| 6 | Longline<br>(Nga mya tann) | 400-1000 | Hook (150 - 200)nos | Hook no-9<br>Bait-Nga phyin thalat/nga bye ma (life) | Nga but |
| 7 | Beach seine(Swe pike) | 100 | 3 | Float-80,<br>5cm Mz<br>Fisher- 4 | Variety species<br>(Several size) |
| 8 | Pole and line<br>(Nga myar tan) | 3-4 | Hook-1-2 | Hk-22/16/9<br>Bait-E-worm<br>Nga phyin thalat/<br>nga bye ma(life) | Nga gyee<br>Nga khu<br>Nga nu than<br>Nga but |
| 9 | Bamboo vaseTrap | H-0.5 | 0.4 m Ø | Earth worm/ | Swamp eel |

| Sr | Name | Measurement | | | Remark |
|---|---|---|---|---|---|
| | | Length(m) | Depth(m) | Mesh size(cm) | |
| | (Nga shint myone) | | | Small fish | |
| 10 | Trap( Myone kye) | 0.7 | 1-1.25 m Ø | | Non target fish |
| 11 | Stationary bush park (Chone cha) | 10 - 30m Ø | 1.5 – 2.5m | | Several fish ,most big fish |
| 12 | Cast net(Kun) | 3 - 7 | Weigh-4.5kg | 1.5-3.0 cm | Non target fish |
| 13 | Electro fishing | 1.5 – 2 | 6” dia –iron sieve | 35A battery | Non target fish |

**Appendix 3.4**

## Inventory list of Amphibians and Reptiles from Moeyungyi Wildlife Sanctuary (2014)

| No. | Family Name | Scientific Name | Common Name | IUCN |
|---|---|---|---|---|
| 1 | Microhylidae | *Kaloula pulchra* | Common Bull Frog | LC |
| 2 | Ranidae | *Occidozyga lima* | Common Floating Frog | LC |
| 3 | Ranidae | *Fejervarya limnocharis* | Paddy Frog | |
| 4 | Ranidae | *Fejervarya* cf. *limnocharis* | Paddy Frog | |
| 5 | Ranidae | *Hylorana macrodactyla* | Long-toed Frog | LC |
| 6 | Ranidae | *Rana rugolosa* | Chinese Bullfrog | |
| 7 | Emydidae | *Morenia occellata* | Myanmar Eyed Turtle | VU |
| 8 | Agamidae | *Calotes mystaceus* | Blue Forest Lizard | |
| 9 | Agamidae | *Calotes versicolor* | Garden Fence Lizard | |
| 10 | Gekkonidae | *Gehyra multilata* | Four-clawed Gecko | |
| 11 | Gekkonidae | *Gekko gecko* | Tockay Gecko | |
| 12 | Gekkonidae | *Hemidactylus brookii* | Brooke's House Gecko | |
| 13 | Gekkonidae | *Hemidactylus frenatus* | House Gecko | |
| 14 | Scincidae | *Eutropis multifasciata* | Common Sun Skink | |
| 15 | Scincidae | *Lygosoma bowringii* | Bowring's Supple Skink | |
| 16 | Colubridae | *Ptyas korros* | Indo-chinese Rat Snake | |
| 17 | Elapidae | *Bungarus fasciatus* | Yellow-banded Krait | LC |
| 18 | Elapidae | *Naja kaouthia* | Monocellate Cobra | LC |
| 19 | Homalopsidae | *Enhydris enhydris* | Rainbow Water Snake | LC |
| 20 | Homalopsidae | *Homalopsis buccata* | Puff-faced Water Snake | LC |
| 21 | Natricidae | *Amphiesma stolata* | Buff-striped Keelback | |
| 22 | Natricidae | *Xenochrophis flavipunctatus* | Yellow-spotted Keelback Snake | |
| 23 | Natricidae | *Xenochrophis piscator* | ChequeredKeelback Water Snake | |
| 24 | Xenopeltidae | *Xenopeltis unicolor* | Sunbeam Snake | LC |

**Species found only in desk survey**

| No. | Family Name | Scientific Name | Common Name |
|---|---|---|---|
| 1 | Bufonidae | *Bufo melanostictus* | True Frog |
| 2 | Ranidae | *Rana erythraea* | Red-eared Frog |
| 3 | Ranidae | *Rana tigerina* | Khaing Land Frog |
| 4 | Polypedatidae | *Polypedates leucomystax* | Common Tree Frog |

| No. | Family Name | Scientific Name | Common Name |
|---|---|---|---|
| 5 | Rhacophoridae | *Rhacophorus* sp | Flying Frog |
| 6 | Microhylidae | *Microhyla ornata* | Narrow-mouth Toad |
| 7 | Microhylidae | *Microhyla inornata* | Narrow-mouth Toad |
| 8 | Trionychidae | *Lissemys scutata* | Flapshell Turtle |
| 9 | Typhlopidae | *Ramphotyphlops braminus* | Brahming Blind Snake |
| 10 | Typhlopidae | *Typhlops diardi* | Diard's Blind Snake |
| 11 | Viperidae | *Daboia russellii* | Russell's Viper |
| 12 | Colubridae | *Psammopsis condanarus* | Sand Snake |

**Species found only in field survey**

| No. | Family Name | Scientific Name | Common Name |
|---|---|---|---|
| 1 | Gekkonidae | *Gehyra multilata* | Four-clawed Gecko |
| 2 | Gekkonidae | *Gekko gecko* | Tockay Gecko |
| 3 | Gekkonidae | *Hemidactylus brookii* | Brooke's House Gecko |

**List of Herpetofauna Species from Moeyungyi Wildlife Sanctuary (2014)**

| No. | Family Name | Scientific Name | Common Name | Desk survey | Field survey |
|---|---|---|---|---|---|
| 1 | Bufonidae | *Bufo melanostictus* | True Frog | √ | |
| 2 | Ranidae | *Occidozyga lima* | Common Floating Frog | √ | √ |
| 3 | Ranidae | *Rana erythraea* | Red-eared Frog | √ | |
| 4 | Ranidae | *Fejervarya limnocharis* | Paddy Frog | √ | √ |
| 5 | Ranidae | *Fejervarya* cf. *limnocharis* | Paddy Frog | √ | √ |
| 6 | Ranidae | *Hlylorana macrodactyla* | Long-toed Frog | √ | √ |
| 7 | Ranidae | *Rana rugolosa* | Chinese Bullfrog | √ | √ |
| 8 | Ranidae | *Rana tigerina* | Khaing Land Frog | √ | |
| 9 | Polypedatidae | *Polypedates leucomystax* | Common Tree Frog | √ | |
| 10 | Rhacophoridae | *Rhacophorus* sp | Flying Frog | √ | |
| 11 | Mircohylidae | *Microhyla ornata* | Narrow-mouth Toad | √ | |
| 12 | Mircohylidae | *Microhyla inornata* | Narrow-mouth Toad | √ | |
| 13 | Mircohylidae | *Kaloula pulchra* | Narrow-mouth Toad | √ | √ |

| No. | Family Name | Scientific Name | Common Name | Desk survey | Field survey |
|---|---|---|---|---|---|
| 14 | Emydidae | **Morenia occellata* | Myanmar Eyed Turtle | √ | √ |
| 15 | Trionychidae | **Lissemys scutata* | Myanmar Flapshell Turtle | √ | |
| 16 | Agamidae | *Calotes versicolor* | Garden Fence Lizard | √ | √ |
| 17 | Agamidae | *Calotesmystaceus* | Lizard | √ | √ |
| 18 | Gekkonidae | *Gehyramultilata* | Four-clawed Gecko | | √ |
| 19 | Gekkonidae | *Gekko gecko* | Tockay Gecko | | √ |
| 20 | Gekkonidae | *Hemidactylus brookii* | Brooke's House Gecko | | √ |
| 21 | Gekkonidae | *Hemidactylus frenatus* | Common House Gecko | √ | √ |
| 22 | Scincidae | *Lygosoma bowringii* | Christmas Island Grass Skink | √ | √ |
| 23 | Scincidae | *Eutropis multifasciata* | East Indian Brown Mabuya | √ | √ |
| 24 | Natricidae | *Amphiesma stolata* | Buff-striped Keelback | √ | √ |
| 25 | Natricidae | *Xenochrophis flavipunctatus* | Yellow-spotted Keelback Snake | √ | √ |
| 26 | Natricidae | *Xenochrophis piscator* | ChequeredKeelback Water Snake | √ | √ |
| 27 | Homalopsidae | *Enhydris enhydris* | Rainbow Water Snake | √ | √ |
| 28 | Homalopsidae | *Homalopsis buccata* | Rainbow Mud Snake | √ | √ |
| 29 | Xenopeltidae | *Xenopeltis unicolor* | Sunbeam Snake | √ | √ |
| 30 | Elapidae | *Bungarus fasciatus* | Banded Krait | √ | √ |
| 31 | Elapidae | *Naja kaouthia* | Monocellate Cobra | √ | √ |
| 32 | Typhlopidae | *Ramphotyphlops braminus* | Brahming Blind Snake | √ | |
| 33 | Typhlopidae | *Typhlops diardi* | Diard's Blind Snake | √ | |
| 34 | Viperidae | *Daboia russellii siamensis* | Easter Russell's Viper | √ | |
| 35 | Colubridae | *Ptyas korros* | Indo-chinese Rat Snake | √ | √ |
| 36 | Colubridae | *Psammopsis condanarus* | Sand Snake | √ | |

(*) = endemic species

**Appendix 3.5**

## Inventory List of Butterfly in Moeyungyi Wildlife Sanctuary

| No | Family name | Scientific name |
|---|---|---|
| 1 | Papilionidae | *Papilio polytes* |
| 2 | Papilionidae | *Graphium cloanthus* |
| 3 | Pieridae | *Leptosia nina* |
| 4 | Pieridae | *Delias hyparete* |
| 5 | Pieridae | *Dercas lycorias* |
| 6 | Pieridae | *Hebomoia glaucippe* |
| 7 | Pieridae | *Catopsilia pyranthe* |
| 8 | Pieridae | *Catopsilia florea* |
| 9 | Pieridae | *Catopsilia pomona* |
| 10 | Pieridae | *Pareronia valeria* |
| 11 | Pieridae | *Gandaca harina* |
| 12 | Pieridae | *Eurema ada* |
| 13 | Pieridae | *Eurema brigitia* |
| 14 | Pieridae | *Eurema hecabe* |
| 15 | Pieridae | *Eurema andersoni* |
| 16 | Pieridae | *Eurema blanda* |
| 17 | Pieridae | *Eurema sari* |
| 18 | Pieridae | *Eurema simulatrix* |
| 19 | Danaidae | *Danaus chrysippus* |
| 20 | Danaidae | *Danaus genutia* |
| 21 | Danaidae | *Danaus limniace* |
| 22 | Danaidae | *Euploea sylvester* |
| 23 | Danaidae | *Euploea klugii* |
| 24 | Danaidae | *Euploea core* |
| 25 | Satyridae | *Melanitis zitenius* |
| 26 | Satyridae | *Ypthima asterope* |
| 27 | Nymphalidae | *Phalanta phalanta* |
| 28 | Nymphalidae | *Cirrochroa* sp. |
| 29 | Nymphalidae | *Junonia lemonias* |
| 30 | Nymphalidae | *Junonia almana* |
| 31 | Nymphalidae | *Junonia atlites* |
| 32 | Nymphalidae | *Athyma perius* |
| 33 | Riodinidae | *Zemeros flegyas* |

| No | Family name | Scientific name |
|---|---|---|
| 34 | Riodinidae | *Abisara fylla* |
| 35 | Lycaenidae | *Loxura atymnus* |
| 36 | Lycaenidae | *Rapala refulgens* |
| 37 | Lycaenidae | *Rapala* sp. |
| 38 | Lycaenidae | *Anthene lycaenina* |
| 39 | Lycaenidae | *Catochrysops strabo* |
| 40 | Hesperiidae | *Telicota augius* |
| 41 | Hesperiidae | *Telicota bambusae* |

**Inventory List of Beetle in Moeyungyi Wetland Wildlife Sanctuary**

| No | Family name | Scientific name |
|---|---|---|
| 1 | Hydrophalidae | *Hydrophilus triangularis* |
| 2 | Scarabaeidae | *Copris magicus* |
| 3 | Scarabaeidae | *Parastasia* sp. |
| 4 | Scarabaeidae | *Heliocopris bucephalus* |
| 5 | Cicinedelidae | *Calochroa cariana* |
| 6 | Cicinedelidae | *Cicindela aurulenta* |
| 7 | Cerambycidae | *Xystrocera globosa* |
| 8 | Lucanidae | *Velutinodorcus velutinus* |
| 9 | Passalidae | *Aceraius* sp. |
| 10 | Buprestidae | *Mastogenius taoi* |
| 11 | Coccinelidae | *Coccinella septempunctata* |
| 12 | Coccinelidae | *Hippodamia convergens* |
| 13 | Carabaeidae | *Calosoma scrutator* |
| 14 | Carabaeidae | *Carabus violaceus* |

**Inventory List of Dragon flies in Moeyungyi Wetland Wildlife Sanctuary**

| No | Scientific name | Common name |
|---|---|---|
| 1 | *Neurothemis fluctuant* | Obligue Banded Widow |
| 2 | *Neurothemis intermedia* | Pale Yellow Widow |
| 3 | *Neurothemis fulla* | Black Spot Widow |
| 4 | *Crocothemis servilla* | Greater Red Skimmer |
| 5 | *Pantala flavesscens* | Wandering Glider |

**Inventory List of Other Insects in Moeyungyi Wetland Wildlife Sanctuary**

| No | Scientific name | Common name |
|---|---|---|
| 1 | *Lethocerus americanus* | Giant Water Bug |
| 2 | *Lygaeus hesperus* | Red Cotton Bug |
| 3 | *Astota plana* | Pale Fig Moth |
| 4 | *Dysphania militaris* | Military Dysphania |
| 5 | *Gryllotaipa africana* | Oriental More Cricket |
| 6 | *Argiope mangai* | Mangrove Argiope Spider |
| 7 | *Oecophylla smaragdina* | Red Ant |

**Appendix 3.6**

**List of Mammals Documented during 2014 Survey.**

| No. | Scientific name | Common name | Local Name | Type of evidence |
|---|---|---|---|---|
| | **Insectivora (Soricidae)** | **Shrews** | | |
| 1 | *Suncusmurinus* | House Shrew | KywetSote | A |
| | **Chiroptera (Pteropodidae)** | **Fruit Bats** | | |
| 2 | *Rousettusleschenaultii* | Leschenault'sRousette | Lin Nay Kywet | Db |
| | **Chiroptera (Emballonuridae)** | **Sheath-tailed and Tomb Bats** | | |
| 3 | *Taphozouslongimanus* | Long-winged Tomb Bat | Lin Nay Kywet | Db, A |
| | **Chiroptera (Vespertilionidae)** | **Common Bats** | | |
| 4 | *Myotismuricola* | Asian Whiskered Myotis | Lin Nay Kywet | A |
| 5 | *Scotophilusheathii* | Greater Asian House Bat | Lin Nay Kywet | Db, A |
| | **Carnivora (Herpestidae)** | **Mongooses** | | |
| 6 | *Herpestesjavanicus* | Small Asian Mongoose | Mway Bar | Db, A |
| | **Rodentia (Muridae)** | **Rats and Mice** | | |
| 7 | *Rattusrattus* | House Rat | EainKywet | A |
| 8 | *Rattusnorvegicus* | Norway Rat | LalKywetKyi | A |
| 9 | *Bandicotaindica* | Greater Bandicoot Rat | KywetKalar | A |
| 10 | *Bandicotasavilei* | Savile's Bandicoot Rat | Kywet Wan Bu | A |
| 11 | *Bandicotabengalensis* | Lesser Bandicoot Rat | LalKywet | A |
| 12 | *Muscervicolor* | Fawn-coloured Mouse | KywetPhaLaung | A |

**Abbreviations; A = alive specimen, Db = dead body**

# ANNEXES

## Socio-economic Data of Moeyungyi Wetland Wildlife Sanctuary

**Annex 1. Some Social factors of the 8 Selected Villages at the Study Area (2014)**

| Sr. | Name of Village | Housing Condition | | | | Total Houshold | Population | | | Ethnicity | Religion | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Brick | Wooden | Bamboo | Total Housing | | Male | Female | Total | | | |
| 1 | Targwa | 0 | 2 | 16 | 18 | 18 | 20 | 35 | 55 | Bamar | Buddish | Temporary Settlement |
| 2 | Phalauk | 0 | 2 | 45 | 47 | 47 | 107 | 157 | 264 | Bamar | Buddish | |
| 3 | Kabin | 4 | 200 | 83 | 287 | 287 | 859 | 882 | 1741 | Bamar | Buddish | |
| 4 | Pyunechaung | 4 | 50 | 146 | 200 | 200 | 400 | 680 | 1080 | Bamar | Buddish | |
| 5 | Pauktaw ( Hlayseik ) | 0 | 2 | 35 | 37 | 37 | 40 | 45 | 85 | Bamar | Buddish | Temporary Settlement |
| 6 | Phalauktan | 7 | 30 | 25 | 62 | 62 | 120 | 140 | 260 | Bamar | Buddish | |
| 7 | Thoneeainsu | 20 | 30 | 178 | 228 | 228 | 552 | 591 | 1143 | Bamar | Buddish | |
| 8 | Tarsone | 30 | 100 | 95 | 238 | 238 | 520 | 579 | 1099 | Bamar | Buddish | |
| | Total | 65 | 416 | 623 | 1117 | 1117 | 2618 | 3109 | 5727 | Bamar | Buddish | |

**Source: Interview for Local Administrators & Local People of the Study Area ( 2014** )

**Annex 2. Comparison of Farming and Fishing Household in the Study Area (2014)**

| Sr No. | Name of Village | TotalHH | Farming | % | Fishing | % | Boat | Traditional fishing | % | Electric fishing | % | % of total | Others | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Targwa | 18 | 2 | 11 | 14 | 78 | 25 | 11 | 61 | 3 | 17 | 21.00 | 2 | 11 |
| 2 | Phalauk | 47 | 15 | 32 | 28 | 60 | 170 | 23 | 49 | 5 | 11 | 18.00 | 4 | 9 |
| 3 | Kabin | 287 | 174 | 61 | 113 | 39 | 300 | 73 | 25 | 35 | 12 | 31.00 | 0 | 0 |
| 4 | Pyune Chaung | 200 | 20 | 10 | 170 | 85 | 170 | 145 | 73 | 30 | 15 | 18.00 | 10 | 5 |
| 5 | Pauk Taw (Hlay Seik ) | 37 | 2 | 5 | 32 | 81 | 35 | 27 | 73 | 3 | 5 | 9.00 | 3 | 8 |
| 6 | Phalauk Tan | 62 | 10 | 16 | 47 | 76 | 50 | 42 | 68 | 5 | 8 | 11.00 | 5 | 8 |
| 7 | Thone Eain Su | 228 | 30 | 13 | 50 | 22 | 35 | 46 | 20 | 4 | 2 | 8.00 | 148 | 65 |
| 8 | Tar Zone | 238 | 50 | 21 | 34 | 14 | 20 | 31 | 14 | 3 | 1 | 9.00 | 154 | 65 |
| | Total | 1117 | 303 | 27 | 488 | 44 | 805 | 398 | 36 | 88 | 8 | 18.00 | 326 | 29 |

**Annex 3. The Educational Status of Some Villages at the Study Area (2014**

| Sr No. | Name of Village | Primary Student | | | Teacher | Teacher : Student | Remark |
|---|---|---|---|---|---|---|---|
| | | Male | Female | Total | | | |
| 1 | Targwa | 0 | 0 | 0 | 0 | | No School |
| 2 | Phalauk | 27 | 23 | 50 | 1 | 1:50 | |
| 3 | Kabin | 127 | 131 | 258 | 4 | 01:65 | |
| 4 | Pyune Chaung | 87 | 68 | 155 | 4 | 1:38 | |
| 5 | Pauk Taw ( Hlay Seik ) | 0 | 0 | 0 | 0 | | No School |
| 6 | Phalauk Tan | 0 | 0 | 0 | 0 | | No School |
| 7 | Thone Eain Su | 62 | 70 | 132 | 6 | 1:22 | |

| Sr No. | Name of Village | Primary Student | | | Teacher | Teacher : Student | Remark |
|---|---|---|---|---|---|---|---|
| | | Male | Female | Total | | | |
| *** 8 | Tar Zone | 50 | 65 | 115 | 5 | 1:23 | |
| | Total | 353 | 357 | 710 | 20 | 1:35 | |

**Source: Interview for Local Primary Teachers from the Field Survey of the Study Area ( 2014 )**

**Annex 4. Some Economic Factors of the Study Area (2014)**

| Sr No. | Name of Village | Land encroment (Acres) | Main Occupation | Main Crop | Main Transportation | | Livestock Breeding | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Cycle | Boat | Cattle | Buffalo | Goat | Pig | Pourltry | Duck |
| 1 | Targwa | 0 | Fishery | Paddy | 2 | 25 | 0 | 11 | 15 | 3 | 15 | 50 |
| 2 | Phalauk | 20 | Fishery | Paddy | 0 | 170 | 0 | 30 | 0 | 6 | 25 | 500 |
| 3 | Kabin | 10 | Fishery | Paddy | 61 | 300 | 30 | 200 | 0 | 10 | 1000 | 500 |
| 4 | Pyune Chaung | 100 | Fishery | Paddy | 20 | 170 | 40 | 150 | 10 | 10 | 150 | 5000 |
| 5 | Pauk Taw ( Hlay Seik ) | 0 | Fishery | Paddy | 3 | 35 | 0 | 2 | 0 | 3 | 15 | 2000 |
| 6 | Phalauk Tan | 89 | Fishery/other | Paddy | 12 | 50 | 15 | 60 | 0 | 10 | 200 | 30 |
| 7 | Thone Eain Su | 10 | Fishery/others | Paddy | 25 | 35 | 20 | 65 | 0 | 15 | 250 | 80 |
| 8 | Tar Zone | 0 | Fishery/others | Paddy | 50 | 20 | 30 | 50 | 0 | 20 | 300 | 100 |
| | Total | 229 | Fishery | Paddy | 173 | 805 | 135 | 568 | 25 | 77 | 1955 | 8260 |

Source Interview for Local Administrators & Local People of the Study Area ( 2014)

**Annex 5a: Status of Socioeconomic Conditions of the Study Area (2014)**

| Sr. | Name of Village | 1.Family Life | | | | | | | | 2.Education | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Happiness & Satisfaction | | | | Public Safety | | | | Literacy | | | | Graduate condition | |
| | | Yes | % | No | % | Yes | % | No | % | Yes | % | No | % | f | % |
| 1 | Targwa | 8 | 80 | 2 | 20 | 10 | 100 | 0 | 0 | 8 | 80 | 2 | 20 | 0 | 0 |
| 2 | Phalauk | 9 | 90 | 1 | 10 | 9 | 90 | 1 | 10 | 7 | 70 | 3 | 30 | 0 | 0 |
| 3 | Kabin | 18 | 90 | 2 | 10 | 20 | 100 | 0 | 0 | 18 | 80 | 2 | 20 | 2 | 10% |
| 4 | Pyune Chaung | 20 | 100 | 0 | 0 | 19 | 95 | 1 | 5 | 16 | 80 | 4 | 20 | 1 | 5% |
| 5 | Pauk Taw ( Hlay Seik ) | 7 | 70 | 3 | 30 | 8 | 80 | 2 | 20 | 6 | 60 | 4 | 40 | 0 | 0 |
| 6 | Phalauk Tan | 10 | 100 | 0 | 0 | 10 | 100 | 0 | 0 | 8 | 80 | 2 | 20 | 1 | 10% |
| 7 | Thone Eain Su | 19 | 95 | 1 | 5 | 20 | 100 | 0 | 0 | 17 | 85 | 3 | 15 | 2 | 5% |
| 8 | Tar Zone | 18 | 90 | 2 | 10 | 20 | 100 | 0 | 0 | 18 | 90 | 2 | 10 | 2 | 10% |
| | Total | 109 | 90.811 | 11 | 9.2 | 116 | 97 | 4 | 3.3 | 98 | 73 | 22 | 18 | 8 | 7% |

**Annex 5b: Status of Socioeconomic Conditions of the Study Area (2014)**

| Sr. | Name of Village | 3.Health | | | | | 4.Material Possession | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Fly Proof Toilet | | | | Medical staff: Population | Owned House | | | | Owned Telephone | | | |
| | | Yes | % | No | % | Ratio | Yes | % | No | % | Yes | % | No | % |
| 1 | Targwa | 0 | 0 | 10 | 100 | 0 | 10 | 100 | 0 | 0 | 1 | 10 | 9 | 90 |
| 2 | Phalauk | 0 | 0 | 10 | 100 | 0 | 10 | 100 | 0 | 0 | 2 | 20 | 8 | 80 |
| 3 | Kabin | 0 | 0 | 20 | 100 | 1:580 | 19 | 95 | 1 | 5 | 3 | 15 | 17 | 85 |
| 4 | Pyune Chaung | 4 | 20 | 16 | 80 | 1:540 | 20 | 100 | 0 | 0 | 4 | 20 | 16 | 80 |
| 5 | Pauk Taw ( Hlay Seik ) | 0 | 0 | 10 | 100 | 0 | 10 | 100 | 0 | 0 | 0 | 0 | 10 | 100 |
| 6 | Phalauk Tan | 6 | 60 | 4 | 40 | 0 | 10 | 100 | 0 | 0 | 2 | 20 | 8 | 80 |
| 7 | Thone Eain Su | 14 | 70 | 6 | 30 | 0 | 20 | 100 | 0 | 0 | 3 | 15 | 17 | 85 |
| 8 | Tar Zone | 10 | 50 | 10 | 50 | 0 | 20 | 100 | 0 | 0 | 5 | 25 | 15 | 75 |
| | Total | 34 | 28 | 86 | 71.7 | 1:716 | 119 | 99 | 1 | 1 | 20 | 17 | 100 | 83.3 |

**Annex 5c: Status of Socioeconomic Conditions of the Study Area (2014)**

| Sr.. | Name of Village | 5.Major Occupation | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Depend on Wetland (Livelihood ) | | | | Main Job function | | | | | | | |
| | | Yes | % | No | % | Agriculture | % | fishing | % | services | % | others | % |
| 1 | Targwa | 10 | 100 | 0 | 0 | 2 | 20 | 7 | 70 | 0 | 0 | 1 | 10 |
| 2 | Phalauk | 9 | 90 | 1 | 10 | 3 | 30 | 6 | 60 | 0 | 0 | 1 | 10 |
| 3 | Kabin | 17 | 85 | 3 | 15 | 4 | 20 | 12 | 60 | 2 | 10 | 2 | 10 |
| 4 | Pyune Chaung | 18 | 90 | 2 | 10 | 5 | 25 | 13 | 65 | 0 | 0 | 2 | 10 |
| 5 | Pauk Taw ( Hlay Seik ) | 10 | 100 | 0 | 0 | 2 | 20 | 7 | 70 | 0 | 0 | 1 | 10 |
| 6 | Phalauk Tan | 6 | 60 | 4 | 40 | 3 | 30 | 3 | 30 | 3 | 30 | 1 | 10 |
| 7 | Thone Eain Su | 11 | 55 | 9 | 45 | 5 | 25 | 6 | 30 | 6 | 30 | 3 | 15 |
| 8 | Tar Zone | 10 | 50 | 10 | 50 | 6 | 30 | 4 | 20 | 5 | 25 | 5 | 25 |
| | Total | 91 | 75.8 | 29 | 24 | 30 | 25 | 58 | 49 | 16 | 13 | 16 | 13 |

**Annex 6: Status of Socioeconomic Conditions of the Study Area (2014)**

| Sr. | Component | Indicator | | Responded conditions | | | | | | | | | Expression |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Yes(F) | | | | | | % | No(F) | % | |
| 1 | Occupation Status | 1 | Livelihood depend on Wetland | | | | | | 91 | **76** | 9 | 24 | Fairly |
| | | 2 | Main Job Function | | | | | | 58 | **49** | - | - | Fairly |
| 2 | Finance | 1 | Income ( Per Day ) | < K3000 | | K3000 ~ 6000 | | > K6000 | | | | | |
| | | | | hh | % | hh | % | hh | % | | | | |
| | | | | 31 | 25 | 70 | **58** | 19 | 16 | | | | Fairly |
| | | 2 | Expense ( Per Day ) | < K2000 | | K2000 ~ 4000 | | > K4000 | | | | | |
| | | | | hh | % | hh | % | hh | % | | | | |
| | | | | 21 | 18 | 77 | **64** | 22 | 18 | | | | Fairly |
| 3 | Human Activity | 1 | Positive Impact (ELF ) | | | | | 111 | | **93** | 9 | 7 | Strong |
| | | 2 | Negative Impact ( UCF & PHH ) | | | | | 23 | | **72** | 7 | 23 | Fairly |

**Note:**

ELF: Effectiveness Livelihood of Household fishing

UCF & PHH - Utility of chemical fertilizer & pesticides of farming household

**Annex 7: Income and Expenditure in the Study Area (2014)**

| Sr. | Name of Village | Finance | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Income | | | | | | Expense | | | | | |
| | | Quantity ( per day ) | | | Percentage | | | Quantity ( per day ) | | | Percentage | | |
| | | < K3000 | K 3001 ~ 6000 | >K 6001 | % | % | % | < K2000 | K 2001 ~ 4000 | > K 4001 | % | % | % |
| 1 | Targwa | 1 | 9 | 0 | 10 | 90 | 0 | 1 | 8 | 1 | 10 | 80 | 10 |
| 2 | Phalauk | 1 | 9 | 0 | 10 | 90 | 0 | 0 | 10 | 0 | 0 | 100 | 0 |
| 3 | Kabin | 5 | 12 | 3 | 25 | 60 | 15 | 4 | 14 | 2 | 20 | 70 | 10 |
| 4 | Pyune Chaung | 5 | 11 | 4 | 25 | 55 | 20 | 3 | 13 | 4 | 15 | 65 | 20 |
| 5 | Pauk Taw ( Hlay Seik ) | 5 | 4 | 1 | 50 | 40 | 10 | 3 | 4 | 3 | 15 | 70 | 15 |
| 6 | Phalauk Tan | 3 | 5 | 2 | 30 | 50 | 20 | 2 | 5 | 3 | 20 | 50 | 30 |
| 7 | Thone Eain Su | 5 | 11 | 4 | 25 | 55 | 20 | 4 | 13 | 3 | 20 | 65 | 15 |
| 8 | Tar Zone | 6 | 9 | 5 | 30 | 45 | 25 | 4 | 10 | 6 | 20 | 50 | 30 |
| | Total | 31 | 70 | 19 | 26 | 58 | 16 | 21 | 77 | 22 | 18 | 64 | 18 |

**Annex 7a: Energy Source of the Study Area (2014)**

| Sr. | Name of Village | Energy Utility for Cooking | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Electricity | | Charcol | | Wood | | Others | |
| | | F | % | F | % | F | % | F | % |
| 1 | Targwa | 0 | 0 | 1 | 10 | 9 | 90 | 0 | 0 |
| 2 | Phalauk | 0 | 0 | 0 | 0 | 10 | 100 | 0 | 0 |
| 3 | Kabin | 0 | 0 | 2 | 10 | 18 | 90 | 0 | 0 |
| 4 | Pyune Chaung | 0 | 0 | 1 | 5 | 19 | 95 | 0 | 0 |
| 5 | Pauk Taw ( Hlay Seik ) | 0 | 0 | 0 | 0 | 10 | 100 | 0 | 0 |
| 6 | Phalauk Tan | 2 | 20 | 2 | 20 | 4 | 40 | 2 | 20 |
| 7 | Thone Eain Su | 4 | 20 | 3 | 15 | 10 | 50 | 3 | 15 |
| 8 | Tar Zone | 3 | 15 | 3 | 15 | 12 | 60 | 2 | 10 |
| | Total | 9 | 8 | 12 | 10 | 92 | 76 | 7 | 6 |

**Annex 8: Water Consumption in the Study Area (2014)**

| Sr. | Name of Village | Utility of Water | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Purified | Tube | Lake | Wetland | % | % | % | % |
| 1 | Targwa | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 100 |
| 2 | Phalauk | 0 | 0 | 3 | 7 | 0 | 0 | 30 | 70 |
| 3 | Kabin | 0 | 0 | 2 | 18 | 0 | 0 | 10 | 90 |
| 4 | Pyune Chaung | 0 | 0 | 3 | 17 | 0 | 0 | 15 | 85 |
| 5 | Pauk Taw( Hlay Seik ) | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 100 |
| 6 | Phalauk Tan | 0 | 10 | 0 | 0 | 0 | 100 | 0 | 0 |
| 7 | Thone Eain Su | 0 | 16 | 4 | 0 | 0 | 80 | 20 | 0 |
| 8 | Tar Zone | 0 | 17 | 3 | 0 | 0 | 85 | 15 | 0 |
| | Total | 0 | 43 | 15 | 62 | 0 | 35 | 13 | 52 |

**Annex 8a. Some Socioeconomic Conditions of the Study Area (2014)**

| Sr. | Name of Village | Seasonal Migration for Job | | | | Human Positive Impact | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Effectiveness Fishery for the natives | | | |
| | | Yes | % | No | % | Yes | % | No | % |
| 1 | Targwa | 0 | 0 | 10 | 100 | 10 | 100 | 0 | 0 |
| 2 | Phalauk | 0 | 0 | 10 | 100 | 8 | 80 | 2 | 20 |
| 3 | Kabin | 2 | 10 | 18 | 90 | 19 | 95 | 1 | 5 |
| 4 | Pyune Chaung | 2 | 10 | 18 | 90 | 17 | 85 | 3 | 15 |
| 5 | Pauk Taw( Hlay Seik ) | 0 | 0 | 10 | 100 | 10 | 100 | 0 | 0 |
| 6 | Phalauk Tan | 1 | 10 | 9 | 90 | 10 | 100 | 0 | 0 |
| 7 | Thone Eain Su | 1 | 5 | 19 | 95 | 20 | 100 | 0 | 0 |
| 8 | Tar Zone | 2 | 10 | 18 | 90 | 17 | 85 | 3 | 15 |
| | Total | 8 | 7 | 112 | 93 | 111 | 93 | 9 | 8 |

**Annex 9. The Agricultural Conditions of Some Villages at the Study Area (2014)**

| Sr. | Name of Village | Paddy Cultivation | | | | Type of Paddy | | | | | | Cultivated Acreage | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Y | N | % | % | L | M | S | % | % | % | < 5 | 5 to 10 | > 10 | % | % | % |
| 1 | Targwa | 2 | 0 | 7 | 0 | 0 | 1 | 1 | 0 | 50 | 50 | 1 | 0 | 1 | 50 | 0 | 50 |
| 2 | Phalauk | 3 | 0 | 10 | 0 | 0 | 2 | 1 | 0 | 67 | 33 | 1 | 1 | 1 | 33 | 33 | 34 |
| 3 | Kabin | 5 | 0 | 17 | 0 | 0 | 2 | 3 | 0 | 40 | 60 | 0 | 3 | 2 | 0 | 60 | 40 |
| 4 | Pyune Chaung | 5 | 0 | 17 | 0 | 0 | 1 | 4 | 0 | 20 | 80 | 0 | 2 | 3 | 0 | 40 | 60 |
| 5 | Pauk Taw(Hlay Seik) | 2 | 0 | 7 | 0 | 0 | 1 | 1 | 0 | 50 | 50 | 1 | 1 | 0 | 50 | 50 | 0 |
| 6 | Phalauk Tan | 3 | 0 | 10 | 0 | 0 | 2 | 1 | 0 | 67 | 33 | 0 | 1 | 2 | 0 | 33 | 67 |
| 7 | Thone Eain Su | 5 | 0 | 16 | 0 | 0 | 3 | 2 | 0 | 60 | 40 | 0 | 1 | 4 | 0 | 20 | 80 |
| 8 | Tar Zone | 5 | 0 | 16 | 0 | 0 | 2 | 3 | 0 | 40 | 60 | 0 | 3 | 2 | 0 | 60 | 40 |
| | Total | 30 | 0 | 25 | 0 | 0 | 14 | 16 | 0 | 47 | 53 | 3 | 12 | 15 | 10 | 40 | 50 |

**Annex 9a. The Agricultural Conditions of Some Villages at the Study Area (2014)**

| Sr. | Name of Village | Output ( Basket ) | | | | | | Cultivated Experiences ( Years ) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | <25 | 25 to 50 | > 50 | % | % | % | < 5 | 5 to 10 | > 10 | % | % | % |
| 1 | Targwa | 0 | 1 | 1 | 0 | 50 | 50 | 0 | 0 | 2 | 0 | 0 | 100 |
| 2 | Phalauk | 0 | 1 | 2 | 0 | 33 | 67 | 0 | 1 | 2 | 0 | 33 | 67 |
| 3 | Kabin | 0 | 2 | 3 | 0 | 40 | 60 | 0 | 2 | 3 | 0 | 40 | 60 |
| 4 | Pyune Chaung | 0 | 3 | 2 | 0 | 60 | 40 | 0 | 1 | 4 | 0 | 20 | 80 |
| 5 | Pauk Taw(Hlay Seik) | 0 | 1 | 1 | 0 | 50 | 50 | 0 | 1 | 1 | 0 | 50 | 50 |
| 6 | Phalauk Tan | 0 | 1 | 2 | 0 | 33 | 67 | 0 | 1 | 2 | 0 | 33 | 67 |
| 7 | Thone Eain Su | 0 | 0 | 5 | 0 | 0 | | 0 | 1 | 4 | 0 | 20 | 80 |
| 8 | Tar Zone | 0 | 1 | 4 | 0 | 20 | 80 | 0 | 0 | 5 | 0 | 0 | 100 |
| | Total | 0 | 10 | 20 | 0 | 33 | 67 | 0 | 7 | 23 | 0 | 23 | 77 |

**Annex 10. General Conditions of Some Villages at the Study Area (2014)**

| Sr. | Name of Village | Effectiveness Livelihood for natives | | | | Local natives interest for Environmental conservation | | | | Other distinguished Industries or Services | Local People's Main Suggestions |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Yes | % | No | % | Yes | % | No | % | | |
| 1 | Targwa | 10 | 100 | 0 | 0 | 7 | 70 | 3 | 30 | Ngapi industry | need to smooth transportation |
| 2 | Phalauk | 9 | 90 | 1 | 10 | 6 | 60 | 4 | 40 | Duck Livestock breeding | need to get Lighting & Smooth Transport |
| 3 | Kabin | 18 | 90 | 2 | 10 | 14 | 70 | 6 | 30 | Ngapi , dry fish & bamboo selling | need to get Lighting & Smooth Transport |
| 4 | Pyune Chaung | 20 | 100 | 0 | 0 | 17 | 85 | 3 | 15 | Horse-shoe Chief selling & Ngapi industry | need to smooth transportation |
| 5 | Pauk Taw(Hlay Seik) | 8 | 80 | 2 | 20 | 4 | 40 | 6 | 60 | Dried Pain plant Selling & Duck Livestock Breeding | need to get Lighting |
| 6 | Phalauk Tan | 9 | 90 | 1 | 10 | 8 | 80 | 2 | 20 | cherrot service | need to get Lighting |
| *** 7 | Thone Eain Su | 18 | 90 | 2 | 10 | 16 | 80 | 4 | 20 | Rice milling & Charrot service | need to get Lighting |
| *** 8 | Tar Zone | 17 | 85 | 3 | 15 | 15 | 75 | 5 | 25 | Sub central Fish Selling Area | need to supply water Problem |
| | Total | 109 | 91 | 11 | 9 | 87 | 73 | 33 | 28 | | Reginal development Program |

**Annex 11. The Utility of Fertilizer Conditions of the Study Area ( 2014 )**

| Sr. | Name of Village | Fertilizer Utility | | | | | | | | | | | Pesticide Condition | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Natural Fertilizer | | | | Chemical Fertilizer | | | | Quantity Fertilizer ( Per Bag ) | | | Pesticide Use | | | | Quantity of Pesticide (0.25mm Per bottle for an acre) | | |
| | | | | | | | | | | < 1 | 2 to 3 | > 3 & above | | | | | < 1 | 2 to 3 | > 3 & above |
| | | Yes | % | No | % | Yes | % | No | % | f | f | f | Yes | % | No | % | f | f | f |
| 1 | Targwa | 1 | 50 | 1 | 50 | 1 | 50 | 1 | 50 | 0 | 1 | 0 | 2 | 100 | 0 | 0 | 2 | 0 | 0 |
| 2 | Phalauk | 1 | 33 | 2 | 67 | 2 | 67 | 1 | 33 | 3 | 0 | 0 | 2 | 67 | 1 | 33 | 2 | 1 | 0 |
| 3 | Kabin | 1 | 20 | 4 | 80 | 4 | 80 | 1 | 20 | 2 | 1 | 2 | 3 | 60 | 2 | 40 | 2 | 2 | 0 |
| 4 | Pyune Chaung | 1 | 20 | 4 | 80 | 4 | 80 | 1 | 20 | 2 | 3 | 1 | 3 | 60 | 2 | 40 | 3 | 3 | 0 |
| 5 | Pauk Taw(Hlay Seik) | 1 | 50 | 1 | 50 | 1 | 50 | 1 | 50 | 2 | 1 | 0 | 2 | 100 | 0 | 0 | 2 | 0 | 0 |
| 6 | Phalauk Tan | 1 | 33 | 2 | 67 | 2 | 67 | 1 | 33 | 1 | 2 | 1 | 3 | 100 | 0 | 0 | 0 | 3 | 0 |
| 7 | Thone Eain Su | 1 | 20 | 4 | 80 | 4 | 80 | 1 | 20 | 0 | 2 | 3 | 4 | 80 | 1 | 20 | 2 | 3 | 0 |
| 8 | Tar Zone | 2 | 40 | 3 | 60 | 3 | 60 | 2 | 40 | 1 | 2 | 0 | 3 | 60 | 2 | 40 | 3 | 2 | 0 |
| | Total | 9 | 30 | 21 | 70 | 21 | 70 | 9 | 30 | 11 | 12 | 7 | 22 | 73 | 8 | 27 | 16 | 14 | 0 |