Title: **Conservation and Research on Mangroves in the Coastal Region of Myanmar**

Myanmar, Fauna & Flora International-FFI, 15/02/2020

Sponsoring institutions: Fondation Segré Conservation Fund at FFI - Conservation Leadership Programme

Overall aims: To train young conservation leader and researcher on the natural conservation for the future

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Executive Summary

This internship program included two main works such as socioeconomics and biodiversity surveys in Ye Gan Daung, Ye ae and Kyat Chaung villages, western part of Kan Maw I., Myeik Archipelago. According to socioeconomics data, the main source of incomes of all villages is from commercial fishing as for their livelihoods in inshore areas in front of mangrove forests near the villages and the current status of mangrove forests in the three villages were in bad conditions. In addition, biological data and some environmental parameters were recorded in 41 survey sites located along the coastal areas of Myeik and Kawthoung Districts, in collaboration with the FFI marine team, staffs of Myeik University and Marine Science Association Myanmar (MSAM). A total of 36 of true mangroves were recorded in survey sites. Webinars, meetings, workshops, trainings on conservation of mangroves and marine environments and activities of community tree planting activity in Myeik had been joined during the internship periods. Moreover, article competition of University Nature Club (UNC) in Myeik University had been organized. In addition, Biodiversity surveys in mangrove-covered areas had been presented in sharing and learning programme of FFI- Myanmar Programme.

Introduction

This internship program was mainly emphasized on the works for the sustainability of mangrove ecosystems and mudflats of Myeik and Kawthoung District, Tanintharyi coastal zone. Climate of the project area is influenced by south west monsoon. Survey areas are situated in the mouth of Tanintharyi and Laynyar Rivers. Main ecological characteristics of the survey areas are mangrove ecosystems. Majority of the population in survey areas are Bamar. Livelihoods of coastal communities are fisheries, depending upon the marine resources.

Main livelihoods of the communities in survey areas are fisheries together with the mariculture of blood cockles in the mudflats in front of the mangrove swamps. All heads and administrative members of the villages in the survey areas wanted the conservation of mangroves and enthusiastically agreed to establish community forests (CFs) in their areas. For this reason, the aerial photos and videos of mangrove swamps of each village were recorded for application of CFs in the future.

Aim and objectives

One of the main aims of this project will be to preserve the mangrove forest and reduce the mangrove exploitation.

The other primary objective of this project is to become a young leader and researcher on the conservation for the future.

Activities and Methodology

A total of 41 survey areas were selected to study the marine biodiversity of mangrove-covered areas (Table 1, Fig. 1). Among these, 3 survey areas located in the western part of Kan Maw Island: Ye Gan Daung (Lat 11.59541 N Long 98.42566 E), Ye ae (Lat 11.42231 N, Long 98.23118 E) and Kyat Chaung Villages (Lat 11.72945 N, Long 98.32279 E), in Kyunsu Township, Myeik District in Tanintharyi Region, were prioritize for socioeconomics surveys (Fig. 2).

During the internship period, the baseline assessment on socioeconomics of the coastal communities was conducted in three villages such as Ye ae, Kyat Chaung and Yae Gan Daung in the Myeik Archipelago, Southern part of Myanmar. The aims of socioeconomics survey were to understand the socioeconomics context of focus villages, to identify for monitoring the natural resources management strategies, to support the establishment of CFs, LMMAs, MPAs and Ramsars sites within the potential MaBs along the mangrove-covered coastal areas based on the collected biodiversity data (Fig. 1).

The household survey was conducted the key information of household interview in the village of Ye ae, Kyat Chaung and Yae Gan Daung in March, 2020. In this survey, socioeconomics data were collected by using the household interview sections. The data from interview questions were set with code uniformly for data entry purposes. The interview section was conducted with household head or member who is representative persons for household. A total of 10% of household were randomly collected among the villagers including fishermen, carpenters, private owners, casual labours and gardeners etc. Data were gathered from the result of interview and discussion with village leader, household interview and field observation notes. Finally, the collected data were systematically analyzed by using the Microsoft excel 2010 (Fig. 3-5).

The objectives of biodiversity surveys were to collect the current status of biotic factors and abiotic factors, controlling the sustainability of coastal living resources in the study areas, to support the designation of potential areas CFs, LMMAs, MPAs and Ramsars sites within the potential MaBs along the mangrove-covered coastal areas of the Myeik Archipelago by adding the biological data.

So far, biodiversity surveys on planktons, invertebrates such as corals, sponges, crustaceans, molluscs and echinoderms, fishes and mangroves were collected in the mangrove swamps have been conducted in 41 sites located in the Auckland Bay (North), Sakanthit I. and Kan Maw I. and mainland areas of Myeik District and Kawthaung District coastal waters especially in accord with the potential areas proposed by participants of Mangrove Forum Meeting held in 14-15 November, 2019 and MaBs and Ramsar sites proposed by Zockler (2016, 2019), in the mouth of Tanintharyi and Lay Nyar Rivers (Tables 1-3, Fig. 1). Soil samples and meiofaunas were collected from four tidal levels, upper, middle and lower intertidal zone and subtidal zone by using core samplers. All samples were preserved in buffered formaldehyde and deposited in the herbarium and museum of Department of Marine Science, Myeik University.

The relevant environmental parameters such as salinity by using refractometer, temperature by thermometer, soil pH by pH meter, transparency by using secchi disk , tidal levels by using transect method, were recorded in collaboration with staffs of Myeik University and Marine Science Association, Myanmar (MSAM) (English *et. al* 1997). This study follows the identification of planktons, living marine resources of Myanmar and mangroves by Conway *et al.* (2003), Giesen *et al.* (2006), Shin *et al.* (2015) and Psomadakis *et al*. (2019).

Outputs and results

According to socioeconomics data, the main source of incomes of all villages is from commercial fishing as for their livelihoods in inshore areas in front of mangrove forests near the villages and the current status of mangrove forests in the three villages were in seriously bad conditions. For this reason, all heads of the three villages are willingly agreed to establish community forests (CFs) in their areas. Moreover, socioeconomics data will use to support the development of new LMMAs, MPAs and MaBs in these villages. The main threats to mangrove forests are charcoal and firewood productions, home building and commercial uses in three survey sites. Charcoals are illegally produced from the mangrove forests in the villages of Yae Gan Daung and Kyat Chaung and exported commercially to Thailand and to other domestic cities while the local people at Ye ae village conserved the mangrove forests by themself to protect the village against the storms and huge waves, especially in the raining season.

Identification for the remaining biodiversity samples is still ongoing in collaboration with relevant experts from Department of Marine Science, Myeik University, FFI marine team and Marine Science Association, Myanmar (MSAM).

Achievements and impacts

So far, a total of 36 of true mangroves belonging to 17 genera from 14 families, namely *Acanthus ilicifolius*, *A. volubilis*, *A. aureum*, *Acrostichum aureum*, *A. speciosum*, *Rhizophora apiculata*, *R. mucronata*, *Bruguiera gymnorhiza*, *B. sexangula*, *B. cylindrica*,

B. parviflora, *Ceriops tagal*, *C. decandra*, *Avicennia alba*, *A. officinalis*, *A. marina*, *A. lanata*, *Xylocarpus granatum*, *X. moluccensis*, *Lumnitzera littorea*, *L. racemosa*, *Sonneratia alba*, *S. graffithii*, *S. apetala*, *S. caseolaris*, *S. ovata*, *Scyphiphora hydrophyllacea*, *Pemphis acidula*, *Heritiera formes*, *H. littoralis*, *Aegialitis rotundifolia*, *Aegiceras corniculatum*, *Excoecaria agallocha*, *E. indica*, *Brownliwia tersa* and *Nypa fruticans* were recorded in the present surveys. (Malar 2009, San Tha Tun *et al.*, 2008; 2014, Pyae Sone Aung 2015, Tin-Zar-Ni-Win *et al.* 2020, Zockler and Aung 2019, Tin Tin Kyu 2020 and the present surveys)(Tables 2-3, Figs. 6-8)

Among these, 2 species of *Ceriops decandra* and *Aegialitis rotundifolia* are near threatens (NT), 2 species of *Excoecaria indica* and *Heritiera formes* are Data Deficient IUCN Global, 1 species of *Sonneratia graffithii* is critically endangered (CR), 1 species of *Scyphiphora hydrophyllacea* is endangered (EN) and 1 species of *Avicennia lanata* is vulnerable (VU) and the rest of 30 species are recognized as least concern (LC)(Tables 2-3).

A total of two research papers regarding with the biodiversity of mangroves and socioeconomics of three survey areas in Myeik and Kawthoung coastal waters were prepared, with the experience of internship.

Among the survey sites, Ye ae Village, Min Gaung Sae Village, Oak Pho Maw Village, Kyauk Kar Village, Pyin Bu Gyi Village, Kann Taw Village and Kaw Ye Gyi (West) Village were designated as Locally Managed Marine Areas (LMMA), based on the fishery data. The heads of villages from Ye Gan Daung, Ye ae and Kyat Chaung recognized the important roles of mangrove forests and wanted to preserve as community forestry (CF) in their coastal areas. In addition, Min Gaung Sae Village, Kyauk Pone Chaung, Oak Pho Maw Village, Nga Man Cuaung Taung Point, Sakanthit I. (West), Thit Yar Wa, Kyauk Kar Village, Palaw Chaung, Pyin Bu Nyge Village, Pyin Bu Gyi Village, Mali Island, Thin Kann Aw, Aung Bar Chaung Wa, Kaw Ye Gyi Aw, Boat Pyin Chaung Wa, Chaung Gyi Wa is designated as important for biodiversity, based on biological data (Table 1).

The followings marine mammals can be encountered in the study sites: Indo-Pacific Humpbacked Dolphin (*Sousa chinensis*), Indo-Pacific Bottlenose Dolphin (*Tursiops aduncus*), Oriental Small-claw otter (*Aonyx cinerea*), Long-tailed Macaque (*Macaca facicularis*), Fishing Cat (*Prionailurus viverrinus*) (Expected) and Ayeyawady Dolphin (*Orcaella brevirostris*) (Expected).

Webinars, meetings, workshops, trainings on conservation of mangroves and marine environments and activities of community tree planting activity in Myeik, in collaboration with various departments and organizations such as Trash hero Myeik, FFI, Clean & Green Myeik, We Love Myeik, Department of Municipal and Department of Administration had been joined during the internship periods. Moreover, article competition of University Nature Club (UNC) in Myeik University had been organized.

Conclusion

Biodiversity surveys have been conducted in 41 survey areas of the Myeik Archipelago, Tanintharyi Coastal Zone, Myanmar, in collaboration with staffs of Myeik University and Marine Science Association, Myanmar (MSAM), to designate the potential areas of LMMAs, CFs, Ramsar sites and MaBs. Both biodiversity and socioeconomic surveys have been done in three villages, namely Yae Gan Daung, Ye ae and Kyat Chaung. Among the survey sites, Ye ae Village, Min Gaung Sae Village, Oak Pho Maw Village, Kyauk Kar Village, Pyin Bu Gyi Village, Samart Aw- Kann Taw Village and Kaw Ye Gyi (West) Village were designated as Locally Managed Marine Areas (LMMA), based on the fishery data. In addition, Min Gaung Sae Village, Kyauk Pone Chaung, Oak Pho Maw Village, Nga Man Cuaung Taung Point, Sakanthit I. (West), Thit Yar Wa, Kyauk Kar Village, Palaw Chaung, Pyin Bu Nyge Village, Pyin Bu Gyi Village, Mali Island, Thin Kann Aw, Aung Bar Chaung Wa, Kaw Ye Gyi Aw, Boat Pyin Chaung Wa, Chaung Gyi Wa is designated as important for biodiversity, based on biological data. All those surveys would be continued in the new areas suitable for the establishment of new potential LMMAs, CFs and Ramsar sites along the coastal and marine areas of the Myeik Archipelago after the internship period. I am available to serve as a staff of host organization, FFI-Myanmar Programme to apply the internship skills in the projects on the conservation and monitoring of the mangroves in future.

Acknowledgements

I would like to express my special thanks the “Conservation Leadership Programme (CLP)” for their kindness, permission and financial supporting. I am extremely grateful to Mark Grindley (Country Director, FFI-Myanmar Programme) for his valuable encouragement and helpful assistance for this internship programme. I wish to express my sincere gratitude to Nay Myo Shwe, PhD (Tanintharyi Programme Manager, FFI-Myanmar Programme) for his kind encouragement, permissions and supervisions during the period of CLP internship. I would like to acknowledge to U Soe Htun (Coastal and Mangroves Programme Manager, FFI-Myanmar Programme), and Chairman, Marine Science Association Myanmar (MSAM), for his valuable guidance and encouragement throughout the study period. I am greatly indebted to the staffs of FFI, Soe Thiha (LMMA Facilitator), Kyaw Zaya and Saw Arkar Tun and Hnin Set Wai for their helpful assistance in the field work. I am thankful to Sein Nilar and Htwe Su Aung (FFI Office) for their help and supports during this work. I would like to also express my sincerely thanks to the staffs from Myeik University and Marine Science Association Myanmar (MSAM) for their collaboration during the field trips.

Appendices

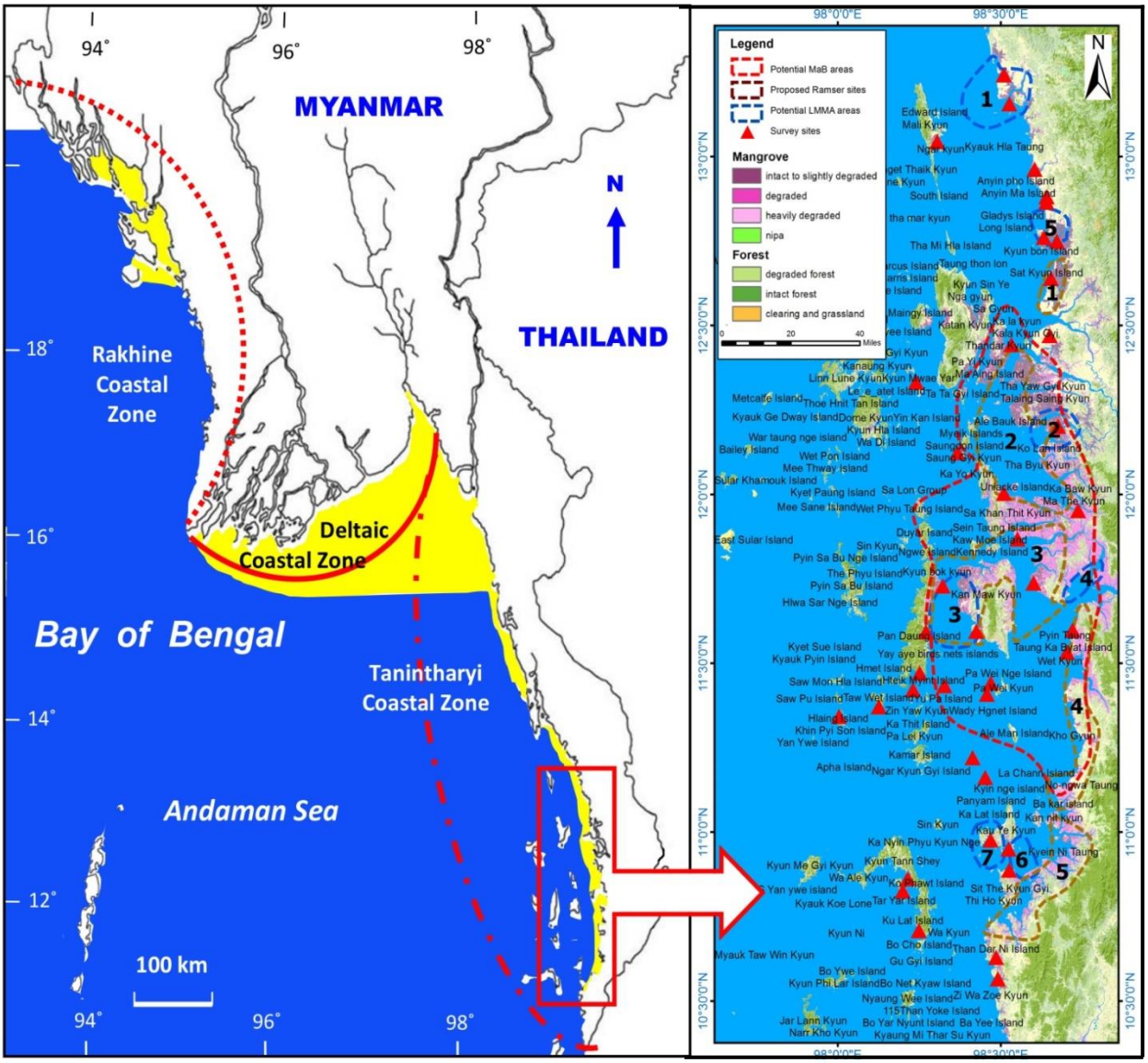

Figure 1. Map showing the survey sites (red triangle) along with the potential LMMAs (blue dotted line), Ramsar sites (brown dotted line) and MaB (red dotted line) in the Myeik Archipelago.

Figure 2. Map showing the study areas, Yae Gan Daung, Ye-ae and Kyat Chaung Villages (arrows in red color).

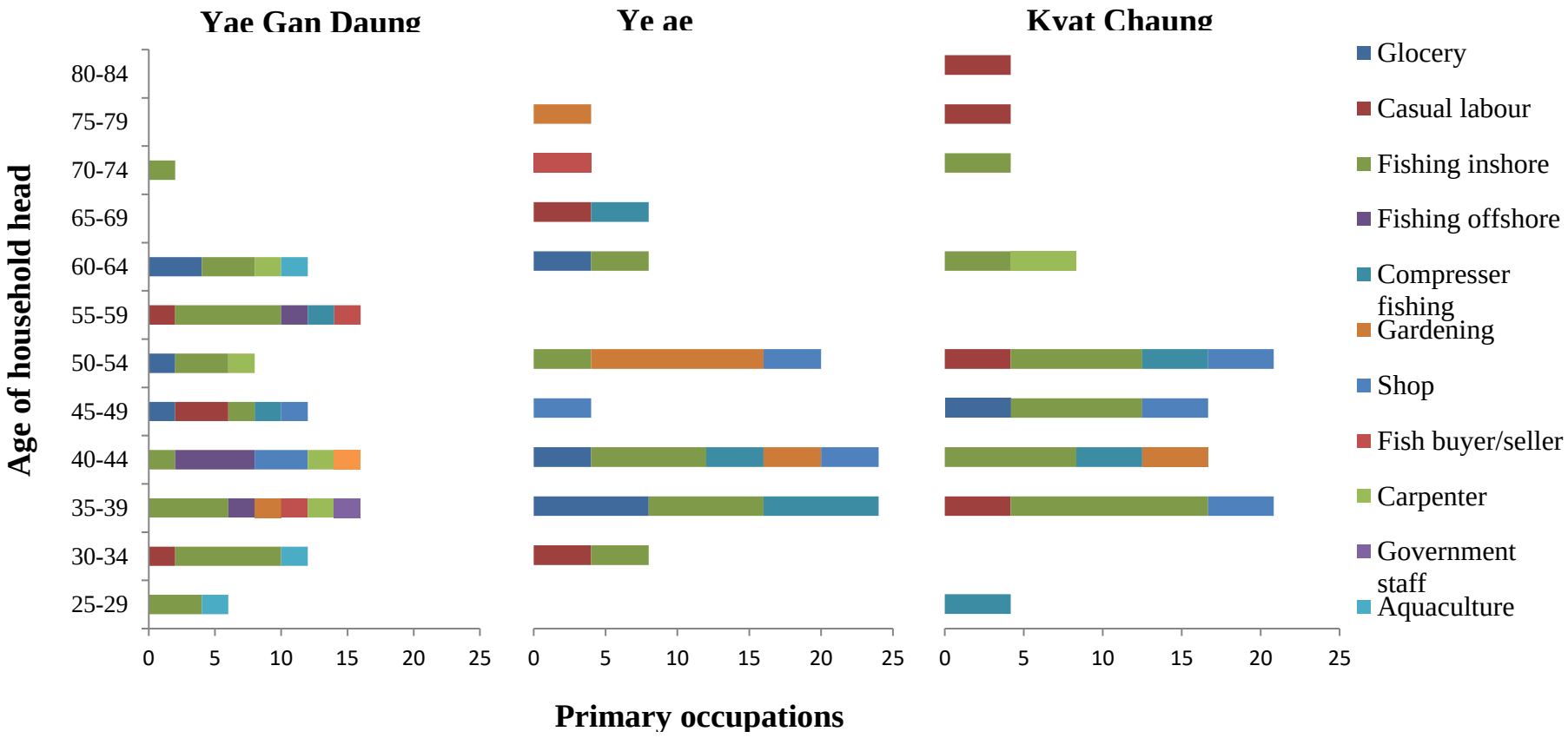

Figure 3. Household heads' age and primary occupations in three villages

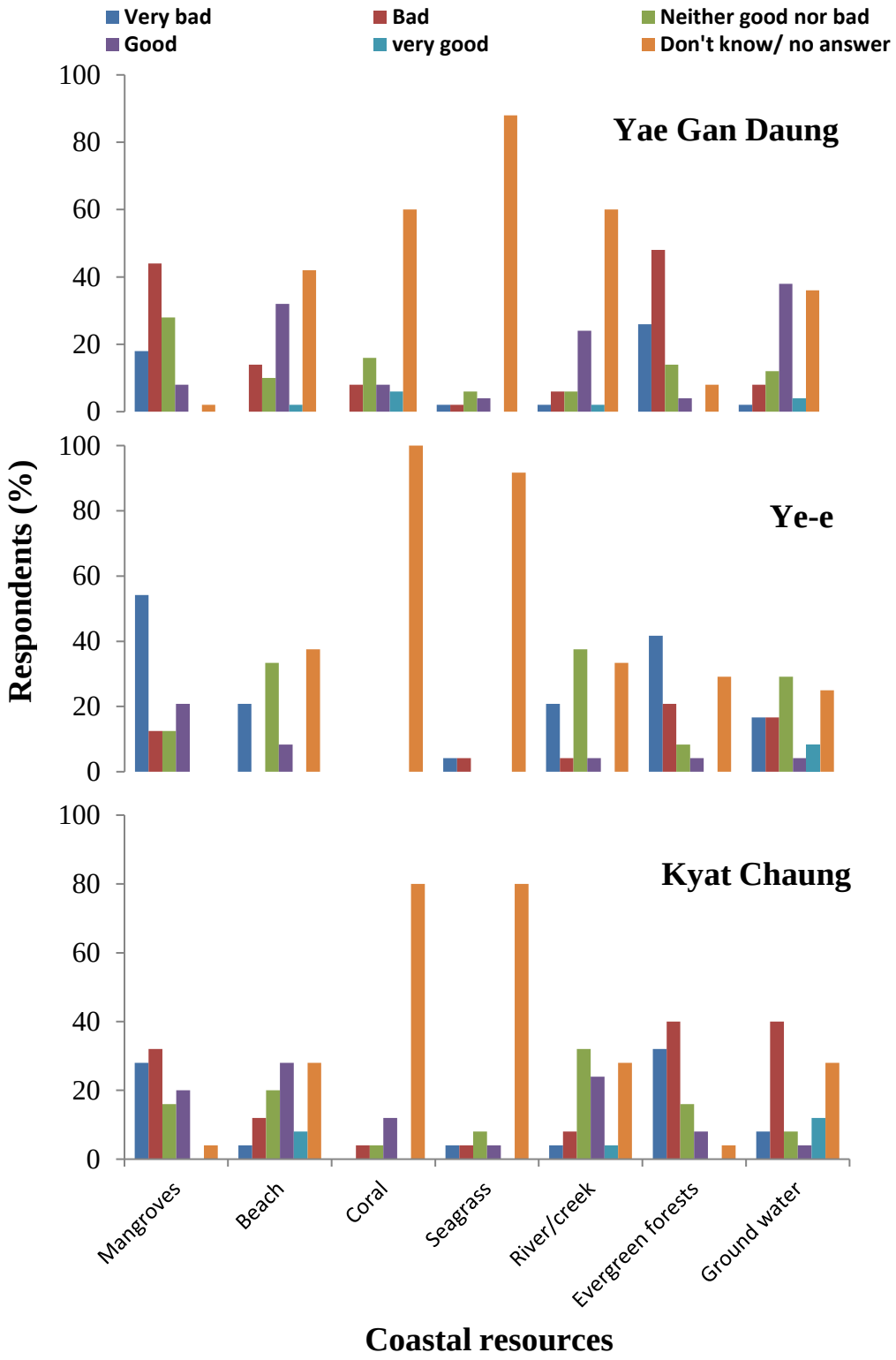

Figure 4. A comparison of perceived conditions of coastal resources in three survey sites, Yae Gan Daung, Ye ae and Kyat Chaung Villages.

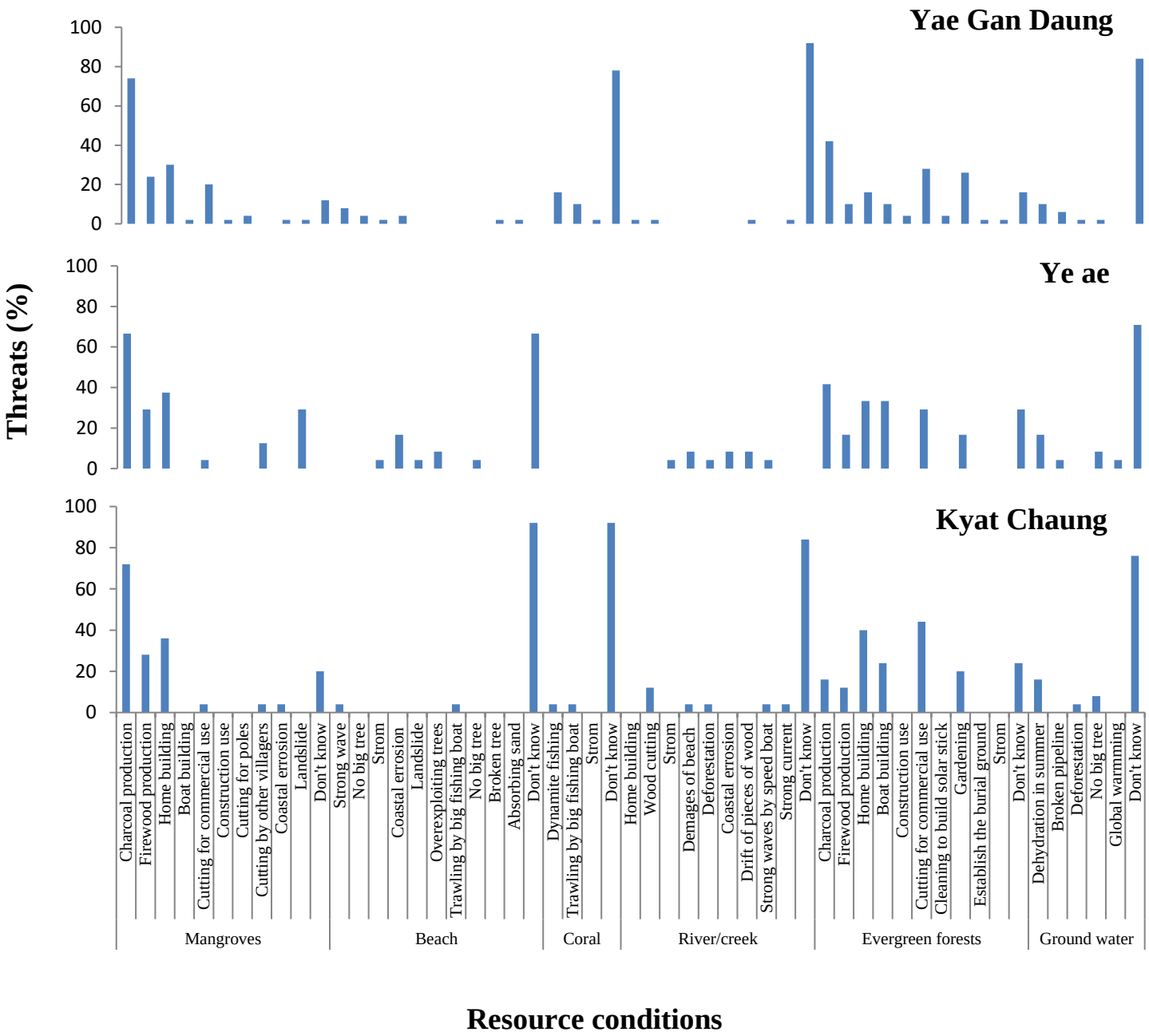

Figure 5. A comparison of perceived threats to coastal resources in three survey sites, Yae Gan Daung, Ye ae and Kyat Chaung Villages.

Table 1. Survey sites in mangroves-covered areas along in the Myeik Archipelago.

Sr. No.	Dates	Survey areas	Geographic Coordinates		No. of true mangrove species	Potential LMMAs (Ecosystem based)	Remark
			Latitude (N)	Longitude (E)			
1.	First (5-17 March, 2020), second trips (4-10 July, 2020) and third Trip (24 July, 2020- 5 August, 2020)	1.Yae Gan Daung Village	11.59541	98.42566	27	-	Kan Maw I. (West)
		2.Ye ae Village	11.42231	98.23118	20	LMMA (Mangroves)	Ditto
		3.Kyat Chaung Village	11.72945	98.32279	20	-	Ditto
2.	Fourth Trip (12-21 October, 2020)	1. Min Gaung Sae Village	12.12490	98.36810	22	LMMA (Mangroves)	Auckland Bay (North)
		2. Pae Taing Village	12.20220	98.67670	22	-	Mainland coastline
		3. Kyauk Pone Chaung	12.00433	98.51019	9	-	Sakanthit I.
		4. Oak Pho Maw Village	12.44420	98.53310	12	LMMA (Mangroves)	Mainland coastline
		5. Kaw Ka Nin Point	11.44222	98.47043	18	-	Ditto
		6. Shwe Gel Nyo Village	11.40890	98.45864	21	-	Ditto
		7. Be Ma Kyauk	11.43462	98.32828	12	-	Kan Maw I. (East)
		8. Nga Man Cuaung Taung Point	11.47196	98.25152	18	-	Kan Maw I. (North)

		9. Sakanthit I. (West)	11.59350	98.27120	20	-	Sakanthit I.
3.	Fifth Trip (12-21 November, 2020)	1. Thit Yar Wa	12.47100	98.65090	23	-	Mainland coastline
		2. Panadaung	12.64063	98.65476	24	-	Ditto
		3. Kyauk Kar Village	12.76169	98.63330	22	LMMA (Mangroves)	Mainland coastline
		4. Kyauk Kar (East)	12.75052	98.67330	18	-	Ditto
		5. Petat Village	12.88253	98.64132	18	-	Ditto
		6. Pala Chaung	12.86631	98.64097	23	-	Ditto
		7. Palaw Chaung	12.96333	98.60438	21	-	Ditto
		8. Pyin Bu Nyge Village	13.15725	98.52715	22	-	Ditto
		9. Pyin Bu Gyi Village	13.24336	98.51066	21	LMMA (Mangroves)	Mainland coastline
		10. Mali I.	13.04524	98.30541	19	-	Mali I.
		11. Thin Kann Aw	12.33422	98.24054	18	-	Katan Kyun
4.	Sixth Trip (8-17 December, 2020)	1. Lampi Chaung	10.7096	98.2492	13	-	Lampi I.
		2. Ko Phawt I.	10.82697	98.20001	7	-	Lampi Group I.
		3. Mi Gyaung Aw	10.86305	98.21555	10	-	Ditto

		4. Aung Bar Chaung	10.56650	98.49142	20	-	Mainland coastline
		5. Aung Zabu Village	10.63020	98.48633	17	-	Ditto
		6. Kann Taw Village	10.88895	98.52640	16	LMMA (Mangroves)	Sit The Kyunn Gyi
		7. Sedain Island	11.22162	98.41455	15	-	Mainland coastline
		8. Thel Tan Gyi	11.53380	98.70391	12	-	Ditto
5.	Seventh Trip (17-26 January, 2021)	1. Ma Htay Aw	11.34380	98.004112	-	-	Sister Group I.
		2. Taw Wet I.	11.371815	98.126171	8	-	Taw Wet I.
		3. Langann I.	10.977084	98.469104	-	-	Sister Group I.
		4. Kaw Ye Gyi (West)	10.977084	98.469104	15	LMMA (Mangroves)	Kaw Ye I.
		5. Kaw Ye Gyi Aw	10.95112	98.524658	23		Ditto
		6. Bokpyin Chaung Wa	11.162659	98.452900	12	-	Mainland coastline
		7. Nyin Sone	11.599562	98.720881	17	-	Ditto
		8. Chaung Gyi Wa	11.953041	98.738059	7	-	Ditto
		9. Sandar Nge	11.738417	98.601097	19	-	Ditto
		10. Kho Taung Chaung	11.869158	98.551971	18	-	Ditto

Table 2. Occurrence of true mangroves in the survey areas.

Sr. No.	Species name	Family	IUCN red list	Survey areas																			
				* Yae Gan Daung	Ye-e	Kyat Chaung	Min Kong Sae	* Pae Taing	Kyauk Chaung Pone	Oak Pho Maw	Kaw Ka Nin	Shwe Gel Nyo	Be Ma Kyauk	Nga Man Chaung Taung (Point)	Sakanthit (Wes)	* Thit Yar Wa	* Panadaung	Kyauk Kar	Kyauk Kar (East)	Pala	Petat	* Palaw	Pyin Bu Nge
1.	*Rhizophora apiculata*	Rhizophoraceae	LC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
2.	*R. mucronata*	Ditto	LC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
3.	*Bruguiera gymnorrhiza*	Ditto	LC	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	-	-	+
4.	*B. sexangular*	Ditto	LC	+	+	-	+	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-
5.	*B. cylindrica*	Ditto	LC	+	+	+	+	+	-	+	+	+	+	+	+	+	-	+	+	+	+	+	+
6.	*B. parviflora*	Ditto	LC	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	-	-	+
7.	*Ceriops tagal*	Ditto	LC	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	-	-	+
8.	*C. decandra*	Ditto	NT	+	+	+	+	+	-	-	+	+	-	+	+	+	+	+	+	+	-	+	+
9.	*Avicennia alba*	Avicenniaceae	LC	+	+	+	+	+	+	+	-	+	+	-	+	+	+	+	+	+	+	+	+
10.	*A. officinalis*	Ditto	LC	+	+	+	+	+	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+
11.	*A. marina*	Ditto	LC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
12.	*A. lanata*	Ditto	VU	-	-	-	-	-	-	-	-	+	+	-	+	+	+	+	-	+	+	-	+
13.	*Xylocarpus granatum*	Meliaceae	LC	+	+	+	+	+	-	+	+	+	-	+	+	+	+	+	+	+	+	+	+

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Table 2. Occurrence of true mangroves in the survey areas. (Continued):

Sr. No.	Species name	Family	IUCN red list	Survey areas																			
				* Yae Gan Daung	Ye-e	Kyat Chaung	Min Kong Sae	* Pae Taing	Kyauk Pone Chaung	Oak Pho Maw	Kaw Ka Nin	Shwe Gel Nyo	Be Ma Kyauk	Nga Man Chaung (Point)	Sakanthit (Wes)	* Thit Yar Wa	* Panadaung	Kyauk Kar	Kyauk Kar (East)	Pala	Petat	* Palaw	Pyin Bu Nge
14.	*X. moluccensis*	Ditto	LC	+	+	-	+	+	+	+	+	+	-	+	+	+	+	-	-	+	-	+	+
15.	*Lumnitzera littoraea*	Combretaceae	LC	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
16.	*L. racemosa*	Ditto	LC	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17.	*Sonneratia graffithii*	Ditto	CR	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	+	-
18.	*S. alba*	Sonneratiaceae	LC	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
19.	*S. apetala*	Ditto	LC	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
20.	*S. caseolaris*	Ditto	LC	-	-	+	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	-	+
21.	*S. ovata*	Ditto	LC	-	-	-	+	+	-	-	-	+	-	+	-	-	-	-	+	+	+	+	-
22.	*Heritiera formes*	Sterculiaceae	DDIG	+	+	+	-	+	-	-	+	-	-	-	+	+	+	-	-	+	+	+	+
23.	*H. littoralis*	Ditto	LC	+	-	-	+	-	-	-	-	-	-	-	-	+	+	-	-	-	+	-	-
24.	*Aegialitis rotundifolia*	Ditto	NT	+	-	-	+	+	-	-	-	+	+	+	+	+	+	+	+	+	-	+	+
25.	*Aegiceras corniculatum*	Myrsinaceae	LC	+	+	+	+	+	-	+	+	-	+	+	+	+	+	+	+	+	+	+	+
26.	*Excoecaria agallocha*	Euphorbiaceae	LC	+	+	+	-	+	-	-	+	+	-	+	+	+	+	+	-	+	+	-	+

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Table 2. Occurrence of true mangroves in the survey areas. (Continued):

Sr. No.	Species name	Family	IUCN red	Survey areas																			
				* Yae Gan Daung	Ye-e	Kyat Chaung	Min Kong Sae	* Pae Taing	Kyauk Pone Chaung	Oak Pho Maw	Kaw Ka Nin	Shwe Gel Nyo	Be Ma Kyauk	Nga Man Chaung Taung (Point)	Sakanthit (Wes)	* Thit Yar Wa	* Panadaung	Kyauk Kar	Kyauk Kar (East)	Pala	Petat	* Palaw	Pyin Bu Nge
27.	*E.indica*	Ditto	DDIG	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
28.	*Brownliwia tersa*	Tiliaceae	LC	-	-	-	+	+	-	-	-	-	-	-	-	-	+	-	-	-	+	-	-
29.	*Acanthus ebracteatus*	Acanthaceae	LC	-	-	-	-	-	-	-	+	-	-	-	-	+	+	+	+	+	+	+	+
30.	*A. ilicifolius*	Ditto	LC	+	+	+	+	+	-	-	+	+	+	+	-	+	+	+	+	+	+	+	+
31.	*A. volubilis*	Ditto	LC	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-
32.	*Nypa fruticans*	Aracaceae	LC	+	+	+	+	+	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+
33.	*Ascrosticum aureum*	Pteridaceae	LC	+	-	+	-	-	-	-	-	+	-	-	-	-	+	-	-	-	-	-	-
34.	*A. speciosum*	Ditto	LC	+	+	+	-	-	-	-	-	+	-	-	-	-	-	+	-	-	-	+	-
35.	*Pemphis acidula*	Lythraceae	LC	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
36.	*Scyphiphora hydrophyllacea*	Rubiaceae	EN	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total				27	20	21	22	22	9	12	18	21	12	18	20	23	25	22	18	23	18	21	22

Symbols: Present, +; Presence, -; LC, Least Concern; NT, Near Threatened; VU, Vulnerable; EN, Endangered; CR, Critically Endangered; DDIG, Data Deficient IUCN Global.

Table 3. Occurrence of true mangroves in the survey areas.

Sr. No.	Species name	Family	IUCN red list	Survey areas																		
				* Pyin Bu Gyi	Mali Island	Thin Kan Aw	Lampi Chaung	Ko Phawt	Mi Gyaing Aww	Aung Bar	Aung Zabu	Kann Taw	Sadein	* Thel Tan Gyi	Taw Wet	Kaw Ye Nge	* Kaw Ye Gyi	Boat Pyin Chaung Wa	Nyin Sone	Chaung Gyi Wa	San Dar Nge	Kho Taung Chaung
1.	*Rhizophora apiculata*	Rhizophoraceae	LC	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+
2.	*R. mucronata*	Ditto	LC	+	+	+	+	+	+	-	+	+	+	+	-	-	-	+	+	+	+	+
3.	*Bruguiera gymnorrhiza*	Ditto	LC	-	-	+	-	+	+	+	+	-	+	+	-	+	+	+	+	-	+	+
4.	*B. sexangular*	Ditto	LC	+	-	-	-	+	-	+	-	-	-	-	-	-	+	-	+	-	+	+
5.	*B. cylindrica*	Ditto	LC	+	+	+	-	-	-	+	+	+	-	-	-	-	+	+	+	-	+	+
6.	*B. parviflora*	Ditto	LC	-	+	+	-	-	-	+	+	+	-	-	-	+	-	+	-	-	+	+
7.	*Ceriops tagal*	Ditto	LC	+	-	+	+	-	-	+	+	+	-	+	-	+	+	-	+	-	+	+
8.	*C. decandra*	Ditto	NT	+	-	-	-	-	-	+	+	+	+	-	-	+	+	-	+	-	+	+
9.	*Avicennia alba*	Avicenniaceae	LC	+	+	+	-	-	-	+	-	+	-	+	-	+	+	+	+	+	+	-
10.	*A. officinalis*	Ditto	LC	+	+	+	+	-	-	+	+	-	+	-	-	-	+	+	-	-	+	+
11.	*A. marina*	Ditto	LC	+	-	+	-	-	-	+	-	+	+	+	-	+	+	+	+	-	+	+
12.	*A. lanata*	Ditto	VU	+	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
13.	*Xylocarpus granatum*	Meliaceae	LC	+	+	+	+	+	+	+	+	-	+	+	+	+	+	-	-	-	+	+

(*Continued on the next page*)

Table 3. Occurrence of true mangroves in the survey areas. (Continued):

Sr. No.	Species name	Family	IUCN red list	Survey areas																		
				* Pyin Bu Gyi	Mali Island	Thin Kan Aw	Lampi Chaung	Ko Phawt	Mi Gyaing Aww	Aung Bar	Aung Zabu	Kann Taw	Sadein	* Thel Tan Gyi	Taw Wet	Kaw Ye Nge	* Kaw Ye Gyi	Boat Pyin Chaung Wa	Nyin Sone	Chaung Gyi Wa	San Dar Nge	Kho Taung Chaung
14.	*X. moluccensis*	Ditto	LC	-	+	-	-	-	-	+	+	+	+	-	-	-	-	-	-	-	+	+
15.	*Lumnitzera littoraea*	Combretaceae	LC	-	-	-	+	-	-	+	-	-	-	+	-	+	+	-	+	-	-	-
16.	*L. racemosa*	Ditto	LC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17.	*Sonneratia graffithii*	Ditto	CR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18.	*S. alba*	Sonneratiaceae	LC	+	+	+	+	-	-	-	-	+	+	-	+	+	+	+	+	+	+	+
19.	*S. apetala*	Ditto	LC	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20.	*S. caseolaris*	Ditto	LC	+	+	-	+	-	+	+	+	+	-	+	-	+	+	+	+	+	+	+
21.	*S. ovata*	Ditto	LC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22.	*Heritiera formes*	Sterculiaceae	DDIG	+	-	-	-	-	-	-	-	-	+	-	-	-	+	-	-	-	-	-
23.	*H. littoralis*	Ditto	LC	-	-	-	+	+	+	-	-	-	-	+	+	+		-	-	-	-	-
24.	*Aegialitis rotundifolia*	Ditto	NT	+	+	+	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	+
25.	*Aegiceras corniculatum*	Myrsinaceae	LC	+	+	+	+	-	+	+	+	+	+	-	+	+	+	+	+	+	+	+
26.	*Excoecaria agallocha*	Euphorbiaceae	LC	+	+	+	+	-	+	+	-	-	+	-	+	+	+	-	+	-	-	-

(*Continued on the next page*)

Table 3. Occurrence of true mangroves in the survey areas. (Continued):

Sr. No.	Species name	Family	IUCN red list	Survey areas																		
				* Pyin Bu Gyi	Mali Island	Thin Kan Aw	Lampi Chaung	Ko Phawt	Mi Gyaing Aww	Aung Bar	Aung Zabu	Kann Taw	Sadein	* Thel Tan Gyi	Taw Wet	Kaw Ye Nge	* Kaw Ye Gyi	Boat Pyin Chaung Wa	Nyin Sone	Chaung Gyi Wa	San Dar Nge	Kho Taung Chaung
27.	*E. indica*	Ditto	DDIG	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
28.	*Brownliwia tersa*	Tiliaceae	LC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29.	*Acanthus ebracteatus*	Acanthaceae	LC	+	+	+	-	-	-	-	+	+	-	-	-	-	+	-	-	-	+	-
30.	*A. ilicifolius*	Ditto	LC	+	+	+	-	-	-	+	+	-	+	-	-	-	+	-	+	-	+	+
31.	*A. volubilis*	Ditto	LC	-	+	-	-	-	-	+	+	-	-	-	-	-	-	-	+	-	+	+
32.	*Nypa fruticans*	Aracaceae	LC	+	+	+	-	-	-	+	+	+	+	-	+	+	+	-	+	-	-	-
33.	*Ascrosticum aureum*	Pteridaceae	LC	-	+	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
34.	*A. speciosum*	Ditto	LC	-	+	-	+	-	-	-	-	+	-	-	+	-	+	-	-	-	-	-
35.	*Pemphis acidula*	Lythraceae	LC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
36.	*Scyphiphora hydrophyllacea*	Rubiaceae	EN	-	-	-	-	-	-	-	-	-	-	+	-	-	+	-	-	-	-	-
	Total			21	20	17	13	7	10	20	17	16	15	12	8	15	23	12	17	7	19	18

Symbols: Present, +; Presence, -; LC, Least Concern; NT, Near Threatened; VU, Vulnerable; EN, Endangered; CR, Critically Endangered; DDIG, Data Deficient IUCN Global.

Figure 6 A-L. A. *Rhizophora apiculata*. B. *R. mucronata*. C. *Bruguiera gymnorrhiza*. D. *B. sexangular*. E. *B. cylindrical*. F. *B. parviflora*. G. *Ceriops tagal*. H. *C. decandra*. I. *Avicennia alba*. J. *A. officinalis*. K. *A. marina*. L. *A. lanata*

Figure 7 A-L. A. *Xylocarpus granatum*. B. *X. moluccensis*. C. *Lumnitzera littoraea*. D. *L. racemosa*. E. *Sonneratia graffithii*. F. *S. alba*. G. *S. apetala*. H. *S.* caseolaris. I. *S. ovata*. J. *Heritiera formes*. K. *H. littoralis*. L. *Aegialitis rotundifolia*.

Figure 8 A-L. A. *Aegiceras corniculatum*. B. *Excoecaria agallocha*. C. *E. indica*. D. *Brownliwia tersa*. E. *Acanthus ebracteatus*. F. *A. ilicifolius*. G. *A. volubilis*. H. *Nypa fruticans*. I. *Ascrosticum aureum*. J. *A. speciosum*. K. *Pemphis acidula*. L. *Scyphiphora hydrophyllacea*.

Activity photos















Section 4:

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