



Marine Macrobenthic Algal Diversity in the Magyi Coastal Areas, Shwe Thaung Yan Township, Myanmar

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Abstract

A total of 32 species of marine benthic green, brown and red algae belonging to 21 families of 14 orders collected from Magyi Coastal Areas (Latitude 17° 04' N, Longitude 94° 27' E) in Shwe Thaung Yan Township were identified. The specimens were identified based on the external and internal characters of liquid-preserved materials and living specimens in the field. In the present study, 12 species, 8 genera of Chlorophyta, 7 species, 4 genera of Phaeophyta and 13 species, 11 genera of Rhodophyta were observed. Among these algae, *Anadyomene stellata* (Wulfen) C. Agardh, *Valoniopsis pachynema* (G. Martens) Boergesen, *Caulerpa taxifolia* (M. Vahl) C. Agardh, *C. sertularioides* (S.G. Gmelin) M. Howe, *Halimeda discoidea* Decaisne, *Halimeda opuntia* (Linnaeus) J.V. Lamouroux, *Codium edule* P.C. Silva, *Avrainvillea lacerata* J. Agardh, *Hydroclathrus clathratus* (C. Agardh) M. Howe, *Dictyota implexa* (Desfontaines) J.V. Lamouroux, *Padina antillarum* (Kützting) Piccone, *P. australis* Hauck, *Sargassum ilicifolium* (Turner) C. Agardh, *Melyonema erubescens* (Foslie) Athanasiadis & D.L. Ballantine, *Halymenia dilatata* Zanardini, *Titanophora pikeana* (Dickie) Feldmann, *Gracilaria textorii* (Suringar) Hariot, and *Palisada perforata* Bory (K.W. Nam) were newly recorded of Magyi Coastal Areas. A brief note on the potential uses of each algal was provided.

Keywords

Diversity, Magyi Coastal Areas, marine benthic algae, Shwe Thaung, Yan Township, taxonomy

1. Introduction

Magyi Coastal Areas (Latitude 17° 04' N, Longitude 94° 27' E), Shwe Thaung Yan Township is situated in the Rakhine coastal region, consisting of sandy and rocky shores, only 12 miles away from the famous Tourist Resort of Chaungtha Beach. Magyi Coastal Area is slightly sloping towards the sea at the upper level and is characterized by the enormous stretches of rocky substrata in the middle and lower zones. There are a wide variety of marine floras and faunas in the intertidal and subtidal regions. Moreover, numerous assemblages of marine algae provide as feeding, spawning and nursery grounds for marine invertebrates and vertebrates.

Kyaw and Win (1977) described a total of 6 species of marine benthic green, brown, and red algae belonging to 5 families of 5 orders collected from Magyi. Moreover, Htwe (2010) identified 7 species of marine red algae belonging to 6 families, and Win (2016) identified 29 species of marine benthic green, brown, and red algae belonging to 21 families of 15 orders from Magyi Coastal Areas. However, in the present study, a total of 32 species of marine benthic green, brown, and red algae belonging to 21 families of 14 orders were collected from Magyi Coastal Areas.

The purposes of this study are: (1) to document the diversity of seaweed species, (2) to compare the current seaweed



species composition with the previous study, and (3) to know the potential utilization of these algae for the benefit to the local people.

2. Materials and Methods

The marine benthic algae were collected in the forms of drifts or live materials growing in the natural beds from the Magyi coastal areas (Latitude 17° 04' N, Longitude 94° 27' E), Shwe Thaung Yan Township from September 2021 to March 2023 (Fig. 1). The specimens were preserved in 4-10 %

formaldehyde-seawater solution and then prepared as herbarium specimens. Some of the specimens were stored as air-drying.

In this study, seaweed specimens were identified based primarily on their external morphologies and internal anatomies. The potential uses of these algae were provided from the literature available. The systematics and nomenclature of the current study followed the system of Guiry and Guiry (2022).

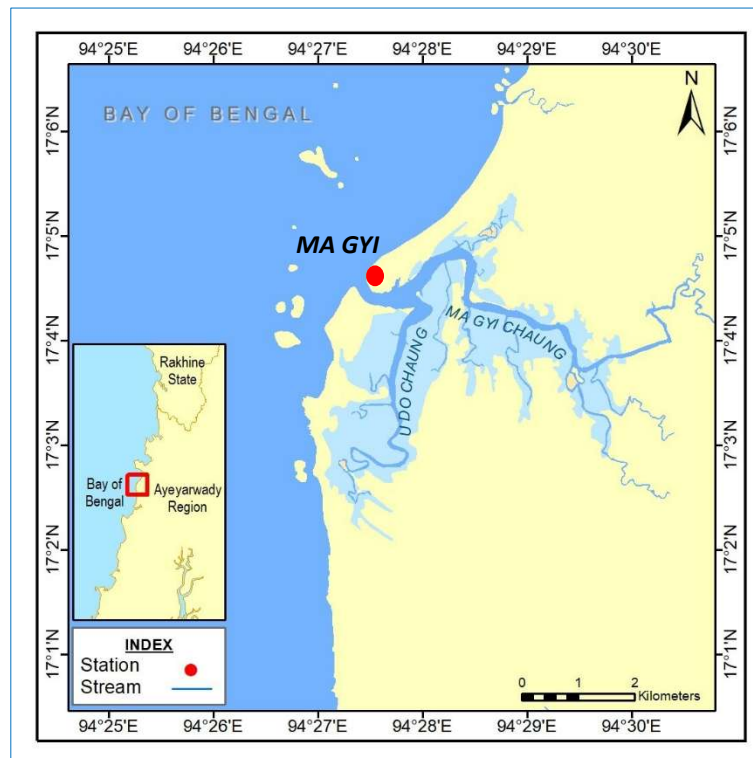


Fig. 1. Map showing the collection site of the marine benthic algae in Magyi Coastal Area

3. Results and Discussion

3.1. A Brief Note on Benthic Marine Algae Growing along Magyi Coastal Areas

Phylum- Chlorophyta
 Class- Ulvophyceae
 Order- Ulvales
 Family- Ulvaceae
 Genus- *Ulva* Linnaeus

3.1.1. *Ulva compressa* Linnaeus (Fig. 2)

Enteromorpha compressa (Linnaeus) Nees; Reine and Trono, 2002: 146, figs. 7-11; Huisman and Borowitzka, 2003: 296; Tsuda, 2003: 7; Abbott and Huisman, 2004: 48, fig. 5 D; Kyaw et al., 2009: 44, fig. 5; Guiry and Guiry 2022.

Type locality. - "Habitat in Europae mari & tectis maritimis" [Probably Bognor, Sussex, England].

Specimens examined. - Magyi (Soe Pa Pa Kyaw and July Moe, 10.ix.2021; PMS 0244).

Habitat. - Plants grow on the exposed rocks in the upper intertidal zone.

Potential uses. - *Ulva compressa* Linnaeus is used as human foods, drugs and fish meal (Kyaw and Win, 1977). *Ulva*

compressa contains 13.6 g % water, 12.4 g % crude protein, 0 g % fat, carbohydrates (sugar 53.0 g % and fiber 10.6 g %) and 10.4 g % ash (Arasaki and Arasaki, 1983).

Order- Cladophorales
 Family- Anadyomenaceae
 Genus- *Anadyomene* J.V. Lamouroux

3.1.2. *Anadyomene stellata* (Wulfen) C. Agardh (Fig. 3)

Kyaw and Win 1977: 51, fig. 59, A 1-2; Silva et al., 1987: 94; Ortega et al., 2001: 27; Kyaw et al., 2009: 54, fig. 21; Guiry and Guiry, 2022; *Anadyomene flabellata* J.V. Lamouroux, 1812 (as cited in Guiry and Guiry 2022).

Type locality. - Adriatic Sea.

Specimens examined. - Magyi (Soe Pa Pa Kyaw and July Moe, 10.ix.2021; PMS 0245).

Habitat. - Plants grow in rock pools and exposed rocks of the intertidal zone.

Potential uses. - *Anadyomene stellata* (Wulfen) C. Agardh is used as human foods, fodder, fish meal and manure (Kyaw and Win 1977; Soe-Htun, 1998; Soe-Htun et al., 1998).

Family- Valoniaceae
 Genus- *Valoniopsis* Boergesen

3.1.3. *Valoniopsis pachynema* (G.Martens) Boergesen (Fig. 4)

Kyaw and Win 1977: 50, fig. 58; Guiry and Guiry, 2022. *Valonia pachynema* (G.Martens) Weber Boss 1913 (as cited in Guiry and Guiry, 2022).

Type locality. – Sumatra, Indonesia.

Specimens examined. - Magyi (Soe Pa Pa Kyaw and July Moe, 12.vi.2022; PMS 0246).

Habitat. – Plants grow on exposed rocks of the intertidal zone.

Potential uses. - *Valoniopsis pachynema* (G.Martens) Boergesen is used as human foods, fodder, fish meal and manure (Soe-Htun, 1998; Soe-Htun et al., 1998).

Order- Dasycladales

Family- Dasycladaceae

Genus- *Neomeris* J.V. Lamouroux

3.1.4. *Neomeris annulata* Dickie (Fig. 5)

Taylor 1967: 101, pl. 5, fig. 5, pl. 6, figs. 4-6; Womersley and Bailey, 1970: 287; Trono, 1978: 107, figs. 48 a-c; Silva et al., 1987: 121; Kyaw et al., 2009: 59, figs. 28-29; Guiry and Guiry, 2022; *Neomeris kelleri* Cramer (as cited in Guiry and Guiry, 2022).

Type locality.- Mauritius.

Specimens examined. - Magyi (Soe Pa Pa Kyaw and July Moe, 10.ix.2021; PMS 0247).

Habitat. - Plants grow in rock pools of the lower intertidal zone.

Potential uses. - *Neomeris annulata* Dickie is used as fodder, fish meal and manure (Kyaw and Win 1977; Soe-Htun 1998; Soe-Htun et al. 1998).

Order- Bryopsidales

Family- Caulerpaceae

Genus- *Caulerpa* J.V. Lamouroux

3.1.5. *Caulerpa racemosa* (Forsskal) J. Agardh (Fig. 6)

Womersley and Bailey, 1970: 275; Kyaw and Win, 1977: 62; Abbott and Huisman, 2004: 122, figs. 44B-C; Wai et al. 2009c: 6, fig. 4; Guiry and Guiry, 2022; *Caulerpa racemosa* var. *clavifera* (Turner) Weber Bosse 1898 (as cited in Guiry and Guiry, 2022).

Type locality. - Suez, Egypt.

Specimens examined. - Magyi (Soe Pa Pa Kyaw and July Moe, 10.ix.2021; PMS 0248).

Habitat. - Plants occurred in rock pools of the lower intertidal zone.

Potential uses. - *Caulerpa racemosa* (Forsskal) J. Agardh is used in human foods, drugs such as caulerpicin, and fish meal (Zaneveld, 1955; Soe-Htun, 2005).

6. *Caulerpa taxifolia* (M. Vahl) C. Agardh (Fig. 7)

Taylor 1967: 142, pl. 12, fig. 1; Kyaw and Win 1977: fig. 95; Lewmanomont and Ogawa, 1995: 39; Abbott and Huisman, 2004: 125, fig. A-B; Kyaw et al., 2009: 62, fig. 39; Braune and Guiry, 2011: 81, fig. 18.16; Chin et al. 2015: 120; Guiry and Guiry, 2022. *Caulerpa pennata* J.V. Lamouroux 1809 (as cited in Guiry and Guiry, 2022).

Type locality. - St. Croix, Virgin Islands.

Specimens examined. - Magyi (Soe Pa Pa Kyaw and July Moe, 1.i.2022; PMS 0249).

Habitat. - Plants occurred in rock pools of the lower intertidal zone.

Potential uses. - *Caulerpa taxifolia* (M. Vahl) C. Agardh is used in human foods, drugs, and fish meal (Soe-Htun, 2005).

3.17. *Caulerpa sertularioides* (S.G. Gmelin) M. Howe (Fig. 8)

Al-Yamani et.al. 2014: 16, pl. 3, figs. a-c. *Caulerpa sertularioides* f. *typica* Boergesen 1907 (as cited in Guiry and Guiry, 2022).

Type locality. - in coralliis americanis.

Specimens examined. - Magyi (Soe Pa Pa Kyaw and July Moe, 31.iii.2023; PMS 0250).

Habitat. - Plants grow in the subtidal zone.

Potential uses. - *Caulerpa sertularioides* (S.G. Gmelin) M. Howe is used as human foods, drugs, and fish meal (Zaneveld 1955; Soe-Htun 2005).

3.1.8. *Caulerpa chemnitzia* (Esper) J.V. Lamouroux (Fig. 9)

Kyaw and Win, 1977: fig. 93; Lewmanomont and Ogawa, 1995: 36; Jha et al., 2009: 40; Kyaw et al., 2009: 60, fig. 36; Braune and Guiry, 2011: 75, fig. 18.10; Chin et al., 2015: 124; Guiry and Guiry, 2022. *Caulerpa peltata* J.V. Lamouroux, 2014 (as cited in Guiry and Guiry, 2022).

Type locality. - Antilles, West Indies.

Specimens examined. - Magyi (Soe Pa Pa Kyaw and July Moe, 1.i.2022; PMS 0251).

Habitat. - Plants grow in the lower intertidal zone.

Potential uses. - *Caulerpa chemnitzia* (Esper) J.V. Lamouroux is used as human foods, drugs and fish meal (Soe-Htun, 2005).

Family- Halimedaceae

Genus- *Halimeda* J.V. Lamouroux

3.1.9. *Halimeda discoidea* Decaisne (Fig. 10)

Silva et al., 1987: 114; Reine and Trono, 2002: 201; Tsuda, 2003: 13; Abbott and Huisman, 2004: 131, fig. 49 B-E; Kyaw et al. 2009: 64, fig. 43; Kyaw et al. 2014: 177, figs. 31-46; Guiry and Guiry 2022. *Halimeda discoidea* var. *platyloba* Boergesen 1911 (as cited in Guiry and Guiry, 2022).

Type locality. - Kamtschatka.

Specimens examined. - Magyi (Soe Pa Pa Kyaw and July Moe, 1.i.2022; PMS 0252).

Habitat. - Plants occurred in rock pools of the lower intertidal zone.

Potential uses. - *Halimeda discoidea* Decaisne is used as fertilizer to recondition acidic soils. It is also used as animal feed.

3.1.10. *Halimeda opuntia* (Linnaeus) J.V. Lamouroux (Fig. 11)

Durairatnam, 1961: 129, pl. 6, fig. 1-2; Womersley and Bailey, 1970: 282; Kyaw and Win, 1977: fig. 105; Lewmanomont and Ogawa, 1995: 52; Abbott and Huisman, 2004: 134, fig. 50. C; Kyaw et al., 2009: 65, fig. 44; Kyaw et al., 2014: 171, figs. 1-14; Braune and Guiry, 2011: 95, fig. 21.5; Guiry and Guiry, 2022. *Halimeda opuntia* f. *triloba* (Decaisne) J. Agardh 1887, *Halimeda opuntia* f. *cordata* (J. Agardh) E.S.Barton 1901 (as cited in Guiry and Guiry, 2022).

Type locality. - Jamaica.

Specimens examined. - Magyi (Soe Pa Pa Kyaw and July Moe, 1.i.2022; PMS 0253).

Habitat. - Plants grow on rocks of the middle and lower intertidal zones.

Potential uses. - *Halimeda opuntia* (Linnaeus) J.V. Lamouroux is used as fodder, fish meal, manure and drugs (Soe-Htun, 2005). *H. opuntia* has shown diuretic and

hypotensive activities (Bhakuni and Rawat, 2005).
 Family- Codiaceae
 Genus- *Codium* Stackhouse



Figs. 2-13. Habit of marine benthic green algae of Magyi Coastal Area: Fig. 2. *Ulva compressa* Linnaeus, Fig. 3. *Anadyomene stellata* (Wulfen) C. Agardh, Fig. 4. *Valoniopsis pachynema* (G.Martens) Boergesen, Fig. 5. *Neomeris annulata* Dickie, Fig. 6. *Caulerpa racemosa* (Forsskal) J. Agardh, Fig. 7. *C. taxifolia* (M. Vahl) C. Agardh, Fig. 8. *C. sertularioides* (S.G. Gmelin) M. Howe, Fig. 9. *C. chemnitzia* (Esper) J.V. Lamouroux, Fig. 10. *Halimeda discoidea* Decaisne, Fig. 11. *H. opuntia* (Linnaeus) J.V. Lamouroux, Fig. 12. *Codium edule* P.C. Silva and Fig. 13. *Avrainvillea lacerata* J. Agardh. Scales: 2-13 = 1 mm

3.1.11. *Codium edule* P.C. Silva (Fig. 12)

Trono, 1978: 48-49, figs. 20A-C; Silva et al., 1987: 112; Abbott and Huisman, 2004: 105, figs. 36 C-D; Wai et al., 2009a: 186, figs. 4-5; Guiry and Guiry, 2022.

Type locality. - Waikiki, Oahu, Hawaiian Islands.

Specimens examined. - Magyi (Soe Pa Pa Kyaw and July

Moe, 1.i.2022; PMS 0254).

Habitat. - Plants grow at the intertidal zone.

Potential uses. - *Codium edule* Silva is used as human foods, drugs, fodder, fish meal and manure (Soe-Htun, 2005).

Family- Dichotomosiphonaceae

Genus- *Avrainvillea* Decaisne

3.1.12. *Avrainvillea lacerata* J. Agardh (Fig. 13)

Ho, 1969: 510; Womersley and Bailey, 1970: 280; Silva et al., 1987: 117; Lewmanomont and Ogawa, 1995: 24; Tsuda, 2003: 14; 2006: 21; Wai et al., 2009b: 202, figs. 2-8; Kyaw et al., 2009: 66, fig. 45; Guiry and Guiry, 2022.

Type locality. - Tonga.

Specimens examined. - Magyi (Soe Pa Pa Kyaw and July Moe, 10.ix.2021; PMS 0255).

Habitat. - Plants grow in the subtidal zone, especially in sand.
Potential uses. - *Avrainvillea lacerata* Harvey ex J. Agardh is used as fodder and manure (Kyaw and Win 1977; Soe-Htun, 2005).
Phylum- Phaeophyta (= Ochrophyta)

Class- Phaeophyceae

Order- Ectocarpales

Family- Scytosiphonaceae

Genus- *Hydroclathrus* Bory



Figs. 14-20. Habit of marine benthic brown algae of Magyi Coastal Area: Fig. 14. *Hydroclathrus clathratus* (C. Agardh) M. Howe, Fig. 15. *Dictyota dichotoma* (Hudson) J.V. Lamouroux, Fig. 16. *D. implexa* (Desfontaines) J.V. Lamouroux, Fig. 17. *Padina antillarum* (Kützting) Piccone, Fig. 18. *P. australis* Hauck, Fig. 19. *Sargassum ilicifolium* (Turner) C. Agardh and Fig. 20. *S. polycystum* C. Agardh. Scales: 14-20 = 1 mm.

3.1.13. *Hydroclathrus clathratus* (C. Agardh) M. Howe (Fig. 14)

Taylor, 1967: 734, fig. 5; Chihara, 1975: 67; Kyaw and Win, 1977: fig. 139; Lewmanomont and Ogawa, 1995: 73; Wai et al., 2009c: 24, fig. 7; Coppejans et al., 2010: 167, fig. 103; Guiry and Guiry, 2022. *Asperococcus clathratus* (Bory) Sonder 1846 (as cited in Guiry and Guiry, 2022).

Type Locality. - In mari Australi.

Specimens examined. - Magyi (Soe Pa Pa Kyaw and July Moe, 1.i.2022; PMS 0256).

Habitat. - Plants grow at the lower mid-littoral zone.

Potential uses. - *Hydroclathrus clathratus* (C. Agardh) M. Howe is used as human foods, drugs, fodder, fish meal and manure (Soe-Htun, 2005).

Order- Dictyotales

Family- Dictyotaceae

Genus- *Dictyota* J.V. Lamouroux

3.1.14. *Dictyota dichotoma* (Hudson) J.V. Lamouroux (Fig. 15)

Kyaw and Win, 1977: fig. 117; Lewmanomont and Ogawa, 1995: 71; Kyaw, 2008: 92, figs. 76-84; Soe-Htun et al., 2009a: 92, fig. 6; Guiry and Guiry, 2022. *Dictyota dichotoma* f. *spiralis* Nizamuddin 1981 (as cited in Guiry and Guiry, 2022).

Type Locality. - Walney Island, Lancashire, England.

Specimens examined. - Magyi (Soe Pa Pa Kyaw and July Moe, 1.i.2022; PMS 0257).

Habitat. - Plants grow in the subtidal zone.

Potential uses. - *Dictyota dichotoma* (Hudson) J.V. Lamouroux is used as an alginate, drug, fish meal, and human foods (Soe-Htun, 2005).

3.1.15. *Dictyota implexa* (Desfontaines) J.V. Lamouroux (Fig. 16)

Magruder and Hunt, 1979: 43; Tseng, 1983: 192, pl. 97, fig. 4, Aisha and Maryam, 2019: 10-12, figs. 5a-f, 9D; Guiry and Guiry, 2022. *Dictyota divaricata* J.V. Lamouroux 1809 (as cited in Guiry and Guiry, 2022).

Type Locality. - Mediterranean coast of France.

Specimens examined. - Magyi (Soe Pa Pa Kyaw and July Moe, 23.i.2023; PMS 0258).

Habitat. - Plants grow in the lower intertidal region and are always submerged.

Potential uses. - *Dictyota implexa* (Desfontaines) J.V. Lamouroux has antibiotic activity (Levring et al., 1969) and can also be used as human foods (Michanek, 1975).

Genus- *Padina* Adanson

3.1.16. *Padina antillarum* (Kützting) Piccone (Fig. 17)

Wynne and De Clerck, 1999: 286-295, figs. 1-10; Trono, 2002: 233-234, figs. 2-4; Wai and Soe-Htun, 2009: 327, figs. 2-14; Soe-Htun et al., 2009a: 95, fig. 9. *Zonaria antillarum* Kützting 1859 (as cited in Guiry and Guiry, 2022).

Type Locality. - Trinidad.

Specimens examined. - Magyi (Soe Pa Pa Kyaw and July Moe, 1.i.2022; PMS 0259).

Habitat. - Plants grow in the middle to lower intertidal zones.
Potential uses. - *Padina antillarum* (Kützting) Piccone is eaten as a salad or used for the production of a jelly-like sweetmeat, fertilizer, and human food (Trono 2002).

3.1.17. *Padina australis* Hauck (Fig. 18)

Lewmanomont and Ogawa, 1995: 75; Wai et al., 2009c: 24, fig. 6; Coppejans et al., 2010: 163, fig. 100; Chin et al., 2015: 103; Guiry and Guiry, 2022.

Type Locality. - Cape York, Queensland, Australia.

Specimens examined. - Magyi (Soe Pa Pa Kyaw and July Moe, 1.i.2022; PMS 0260).

Habitat. - Plants grow at the middle to lower intertidal zone.
Potential uses. - *Padina australis* Hauck is used as human foods, fish meals, drugs and alginates (Soe-Htun, 2005).

Order- Fucales

Family- Sargassaceae

Genus- *Sargassum* C. Agardh

3.1.18. *Sargassum ilicifolium* (Turner) C. Agardh (Fig. 19)

Sargassum duplicatum Bory: Arasaki, 1964: 61, fig. 203; Chihara, 1975: 89; Wai et al., 2009c: 11, fig. 11; Guiry and Guiry, 2022. *Sargassum brevifolium* Kützting 1849 (cited in Guiry and Guiry, 2022).

Type Locality. - Pacific Ocean between Tahiti and New Zealand.

Specimens examined. - Magyi (Soe Pa Pa Kyaw and July Moe, 31.iii.2023; PMS 0261).

Habitat. - Plants grow in the intertidal and subtidal zones. Potential uses. - *Sargassum ilicifolium* (Turner) C. Agardh is used as human foods, drugs, fodder, fish meal and alginates (Soe-Htun, 2005).

3.1.19. *Sargassum polycystum* C. Agardh (Fig. 20)

Yamada 1950: 193; Durairatnam 1961: 46, pl. x, figs. 14-18; Krishnamurthy and Joshi 1970: 140; Womersley and Baily 1970: 300; Silva et al., 1987: 87; Yoshida 1988: 17, fig. 14; Lewmanomont and Ogawa 1995: 84; Soe-Htun et al. 2009a: 99, fig. 14; Soe-Htun et al. 2012: 217, figs. 1-2; Guiry and Guiry 2022. *Sargassum polycystum* var. *horridulum* Grunow 1874 (as cited in Guiry and Guiry 2022).

Type Locality. - Sunda Strait, Indonesia.

Specimens examined. - Magyi (Soe Pa Pa Kyaw and July Moe, 1.i.2022; PMS 0262).

Habitat. - Plants grow in the subtidal zone.

Potential uses. - *Sargassum polycystum* C. Agardh is used as human food, drugs, fodder, fish meal, manure and alginates (Soe-Htun 2005).

Phylum- Rhodophyta

Class- Florideophyceae

Order- Nemaliales

Family- Liagoraceae

Genus- *Liagora* J.V. Lamouroux

3.1.20. *Liagora ceranoides* J.V. Lamouroux (Fig. 21)

Silva et al., 1987: 26, 1996: 123; Lewmanomont and Ogawa, 1995: 130; Huisman and Borowitzka, 2003: 313; Wai et al., 2009c: 14, fig. 16; Htay and Soe-Htun, 2010: 136, figs. 2-5;

Guiry and Guiry, 2022.

Liagora ceranoides var. *leprosa* (J. Agardh) Boergesen 1942 (as cited in Guiry and Guiry, 2022).

Type Locality. - St Thomas, Virgin Islands.

Specimens examined. - Magyi (Soe Pa Pa Kyaw and Zue Zue Me Ko Min, 1.i.2022; PMS 0263).

Habitat. - Plants grow in the low intertidal rock pools.

Potential uses. - *Liagora ceranoides* J.V. Lamouroux is used in the pharmaceutical industry (Diaz-Piferrer, 1979).

Family- Galaxauraceae

Genus- *Galaxaura* J.V. Lamouroux

3.1.21. *Galaxaura rugosa* (J. Ellis & Solander) J.V. Lamouroux (Fig. 22)

Durairatnam, 1961: 49; Silva et al., 1987: 24, Littler et al., 2000: 174; Lipkin and Silva 2002: 8; Huisman and Borowitzka, 2003: 312; De Clerck et al., 2004: 3024; Nyunt and Soe-Htun, 2013: 236, figs. 5-12; Guiry and Guiry, 2022.

Type Locality. - Jamaica.

Specimens examined. - Magyi (Soe Pa Pa Kyaw and Zue Zue Me Ko Min, 1.i.2022; PMS 0264).

Habitat. - Plants grow on rocks and old corals in shallow water.

Potential uses. - *Galaxaura rugosa* (Ellis and Solander) J.V. Lamouroux is used as fodder, fish meal and manure and organic fertilizer (Soe-Htun, 2005).

Family- Scinaiceae

Genus- *Scinaia* Bivona-Bernardi

3.1.22. *Scinaia furcellata* (Turner) J. Agardh (Fig. 23)

Durairatnam, 1961: 48, pl. XI, fig. 6; pl. XXVIII, fig. 2; Taylor, 1969: 229, pl. 53, fig. 1; Kyaw and Win, 1975: 103, fig. 178, A. 1-2; Lewmanomont and Ogawa, 1995: p.137; Wai et al. 2009c: 17, fig. 21; Guiry and Guiry, 2022. *Chondria furcellata* (Turner) C. Agardh 1817 (as cited in Guiry and Guiry, 2022).

Type locality. - Sheringham, Norfolk, England.

Specimens examined. - Magyi (Soe Pa Pa Kyaw and Zue Zue Me Ko Min, 12.vi.2022; PMS 0265).

Habitat. - Plants occurred in the subtidal zone.

Potential uses. - *Scinaia furcellata* (Turner) J. Agardh is used as fodder, fish meal, and manures (Soe-Htun, 2005).

Order- Corallinales

Family- Mesophylumaceae

Genus- *Melyvonnea* Athanasiadis & D.L. Ballantine

3.1.23. *Melyvonnea erubescens* (Foslie) Athanasiadis & D.L. Ballantine (Fig. 24)

Mesophyllum erubescens (Fosile) Lemoine: Taylor, 1967: 384; Soe-Htun et al., 2009b: 122, fig. 10; Guiry and Guiry, 2022. *Lithothamnion erubescens* Folise 1900 (as cited in Guiry and Guiry, 2022).

Type locality. - Brazil: Fernando de Noronha.

Specimens examined. - Magyi (Soe Pa Pa Kyaw and Zue Zue Me Ko Min, 12.vi.2022; PMS 0266).

Habitat. - Plants grow in coral reef habits at the intertidal to the subtidal zones.

Potential uses. - Uses of *Melyvonnea erubescens* (Foslie) Athanasiadis & D.L. Ballantine are not recorded.

Family- Lithophyllaceae

Genus- *Amphiroa* J.V. Lamouroux



Figs. 21-33. Habit of marine benthic red algae of Magyi Coastal Area: Fig. 21. *Liagora ceranoides* J.V. Lamouroux, Fig. 22. *Galaxaura rugosa* (J.Ellis & Solander) J.V. Lamouroux, Fig. 23. *Scinaia furcellata* (Turner) J. Agardh, Fig. 24. *Melyvomea erubescens* (Foslie) Athanasiadis & D.L. Ballantine, Fig. 25. *Amphiroa fragillissima* Linnaeus (J.V. Lamouroux), Fig. 26. *Halymenia dilatata* Zanardini, Fig. 27. *H. durvillaei* Bory, Fig. 28. *Titanophora pikeana* (Dickie) Feldmann, Fig. 29. *Hypnea spinella* (C. Agardh) Kützing, Fig. 30. *Gracilaria canaliculata* Sonder, Fig. 31. *G. textorii* (Suringar) Hariot, Fig. 32. *Laurencia* sp and Fig. 33. *Palisada perforata* Bory (K.W. Nam). Scales: 21-33 = 1mm

3.1.24. *Amphiroa fragillissima* Linnaeus (J.V. Lamouroux) (Fig. 25)
Silva et al., 1987: 33; Lewmanomount and Ogawa, 1995: 92; Tsuda, 2003: 27; 2006: 30; Soe-Htun et al., 2009b: 124, figs. 15-16; Guiry and Guiry, 2022. *Amphiroa cuspidata* J.V. Lamouroux 1816, *Amphiroa debilis* Kutzing 1849 (as cited in Guiry and Guiry, 2022).

Type locality. - Jamaica.

Specimens examined. - Magyi (Soe Pa Pa Kyaw and Zue Zue Me Ko Min, 1.i.2022; PMS 0267).

Habitat. - Plants grow on tide pools in the mid-lower intertidal zone.

Potential uses. - *Amphiroa fragillissima* Linnaeus (J.V. Lamouroux) is used as fodder, fish meal, manure and organic fertilizer (Soe-Htun 2005).

Order- Halymeniales

Family- Halymeniaceae

Genus- *Halymenia* C. Agardh

3.1.25. *Halymenia dilatata* Zanardini (Fig. 26)

Kyaw and Win, 1977: 116, fig. 203; De Smedt et al., 2001: 305, fig. 7a-c; Guiry and Guiry, 2022. *Sebdenia dilatata* (Zanardini) De Toni, 1900 (as cited in Guiry and Guiry,

2022).

Type locality. - Red Sea.

Specimens examined. - Magyi (Soe Pa Pa Kyaw and Zue Zue Me Ko Min, 1.i.2022; PMS 0268).

Habitat. - Plants grow in the lower intertidal zone.

Potential uses. - *Halymenia dilatata* Zanardini is used as human food (Kyaw and Win, 1977).

3.1.26. *Halymenia durvillei* Bory (Fig. 27)

Silva et al., 1987: 30; Lewmanomont and Ogawa, 1995: 121; De Smedt et al., 2001: 297, fig. 1A-B; Kawaguchi et al., 2006: 203-205, figs. 1-20; Wai et al., 2009c: 18, fig. 22; Guiry and Guiry, 2022. *Halymenia durvillei* var. *ceylanica* (Harvey ex Kützing) Weber Bosse 1921, *Halymenia microcarpa* (Montagne) P.C. Silva 1987 (as cited in Guiry and Guiry, 2022).

Type locality. - New Ireland, Papua New Guinea.

Specimens examined. - Magyi (Soe Pa Pa Kyaw and Zue Zue Me Ko Min, 1.i.2022; PMS 0269).

Habitat. - Plants grow in the lower intertidal zone.

Potential uses. - *Halymenia durvillei* Bory is used as human food (Soe-Htun, 2005).

Order- Nemastomatales

Family- Schizymeniaceae

Genus- *Titanophora* (J. Agardh) Feldmann

3.1.27. *Titanophora pikeana* (Dickie) Feldmann (Fig. 28)

Coppejans et al., 2000: 51, fig. 18; Schils and Coppejans 2002: 261-265, fig. 36-44; De Clerck et al., 2004: 3034, fig. 4; Guiry and Guiry, 2022. *Galaxaura pikeana* Dickie 1874, *Halymenia pickeana* (Dickie) J. Agardh 1885, *Platoma pikeanum* (Dickie) Weber Bosse 1921 (as cited in Guiry and Guiry, 2022).

Type locality. - Mauritius.

Specimens examined. - Magyi (Soe Pa Pa Kyaw and Zue Zue Me Ko Min, 12.vi.2022; PMS 0270).

Habitat. - Plants grow in the lower intertidal and subtidal zones.

Potential uses. - Unknown.

Order- Gigartinales

Family- Cystocloniaceae

Genus- *Hypnea* J.V. Lamouroux

3.1.28. *Hypnea spinella* (C. Agardh) Kützing (Fig. 29)

Kyaw and Win, 1977: 133, fig. 236; Silva et al., 1987: 50; Enomoto et al., 1996: Vol. 4, No. 116, Ser. No. 168; Ortega et al., 2001: 13; Reine and Trono, 2002: 208; Tsuda, 2003: 30; 2006: 31; Guiry and Guiry, 2022. *Gigartina spinella* (C. Agardh) Greville 1830 (as cited in Guiry and Guiry, 2022).

Type locality. - Indiae occidentalis (West Indies).

Specimens examined. - Magyi (Soe Pa Pa Kyaw and Zue Zue Me Ko Min, 12.vi.2022; PMS 0271).

Habitat. - Plants grow in tide pools of the intertidal zone.

Potential uses. - *Hypnea spinella* (C. Agardh) Kützing is used as human foods and carrageenan (Soe-Htun, 2005).

Order- Gracilariales

Family- Gracilariaceae

Genus- *Gracilaria* Greville

3.1.29. *Gracilaria canaliculata* Sonder (Fig. 30)

Gracilaria crassa (Harvey) J. Agardh; Durairatnam, 1961: 59,

pl. XIV, fig. 6; 1962: 12; Ho, 1969: 186, fig. 2.117; Cho, 1975: 48, figs. 10-15, 41, 42; Cordero, 1977: 127, figs. 108-110; Kyaw and Win, 1977: 134, fig. 239, A 1-2; Tsuda, 2006: 28; Kyaw et al., 2009: 337, fig. 3; Guiry and Guiry, 2022.

Type locality. - Sri Lanka, Wagap, New Caledonia.

Specimens examined. - Magyi (Soe Pa Pa Kyaw and Zue Zue Me Ko Min, 1.i.2022; PMS 0272).

Habitat. - Plants grow in tidal pools or on exposed rocks of lower and middle intertidal zones.

Potential uses. - *Gracilaria canaliculata* Sonder is used as human foods, agar, fodder, fish meal and drugs (Soe-Htun, 2005).

3.1.30. *Gracilaria textorii* (Suringar) Hariot (Fig. 31)

Lemanomont, 1994: 145, fig. 15; Le and Nguyen, 2006: 217, fig. 5.j; Phang, 2006: 192; Chirapart, 2008: 45-61, fig. 8; Jha et al., 2009: 123; Guiry and Guiry, 2022.

Type locality. - Japan.

Specimens examined. - Magyi (Soe Pa Pa Kyaw and Zue Zue Me Ko Min, 1.i.2022; PMS 0273).

Habitat. - Plants grow in the intertidal zone and abundantly in shallow lagoons and tide pools.

Potential uses. - *Gracilaria textorii* (Suringar) De Toni is used as agar, human food, fodder, fish meal and drugs (Kyaw and Win, 1997).

Order- Ceramiales

Family- Rhodomelaceae

Genus- *Laurencia* J.V. Lamouroux

3.1.31. *Laurencia* sp. (Fig. 32)

Fronds, prostrate, 3-6 cm in diameter, entangled with stoloniferous branches, greenish-brown, and cartilaginous in texture, attached to the substratum by discoid holdfasts; main axes, terete with blunt tips, not percurrent; branches cylindrical, 2-8 mm long, irregularly alternate at intervals of 0.5-1.0 mm and at angles of 30-70°.

Type locality. - Unknown.

Specimens examined. - Magyi (Soe Pa Pa Kyaw and Zue Zue Me Ko Min, 6.vi.2023; PMS 0274).

Habitat. - Plants grow on rocks covered with sand in the upper to lower intertidal zones. This species is attached to the substratum by stoloniferous holdfast.

Potential uses. - Unknown.

Genus- *Palisada* K.W. Nam

3.1.32. *Palisada perforata* Bory (K.W. Nam) (Fig. 33)

Laurencia papillosa (Forsk.) Greville: Cordero and Modelo, 1989: 14; Lewmanomont and Ogawa, 1995: 128; Silva et al., 1996: 517-518; Littler et al., 2000: 181-182; Reine and Trono, 2002: 223-224, figs. 1-2; Phang, 2006: 196; Jha et al., 2009: 199; Guiry and Guiry, 2022; *Chondrophyucus papillosus* (C. Agardh) Garbary and Harper: Furnari et al., 2001: 343-344, figs. 4-6; Bolton, Oyieke and Gwada 2007: 84; *Palisada papillosa* (C. Agardh) K.W. Nam: Nam 2007: 54. *Laurencia papillosa* (C. Agardh) Greville 1830, *Chondrophyucus papillosus* (C. Agardh) D.J. Garbary & J.T. Harper 1998, *Palisada papillosa* (C. Agardh) K.W. Nam 2007 (as cited in Guiry and Guiry, 2022).

Type locality. - "rade de Sainte-Croix" (Sant Cruz de Tenerife), Islas Canarias.

Specimens examined. - Magyi (Soe Pa Pa Kyaw and Zue Zue Me Ko Min, 6.vi.2023; PMS 0275).

Habitat. - Plants grow on rocks in the lower intertidal or

subtidal zone and attached to the substratum by discoid holdfast with stolon-like branches.

Potential uses. - Plant is used as human food, drugs (Levring

et al., 1969; Trono, 1977; Soe-Htun et al., 1997), and in agriculture (Zemke-White and Ohno, 1999). It contains protein, fat and carbohydrates (Khalil and El-Tawil, 1982).

Table 1. A comparison of the species diversity of the marine benthic algal flora from Magyi Coastal Area

No	Species	Present records (September 2021-March 2023)	Previous records	
			Kway and Win, 1997	Htwe, 2010; Win, 2016
Green algae				
1	<i>Ulva compressa</i> Linnaeus	+	+	+
2	<i>Anadyomene stellata</i> (Wulfen) C. Agardh	+	–	–
3	<i>Valoniopsis pachynema</i> (G. Martens) Boergesen	+	–	–
4	<i>Neomeris annulata</i> Dickie	+	–	+
5	<i>Caulerpa racemosa</i> (Forsskal) J. Agardh	+	+	+
6	<i>Caulerpa taxifolia</i> (M. Vahl) C. Agardh	+	–	–
7	<i>Caulerpa sertularioides</i> (S.G. Gmelin) M. Howe	+	–	–
8	<i>Caulerpa chemnitzia</i> (Esper) J.V. Lamouroux	+	+	–
9	<i>Halimeda discoidea</i> Decaisne	+	–	–
10	<i>Halimeda opuntia</i> (Linnaeus) J.V. Lamouroux	+	–	–
11	<i>Codium edule</i> P.C. Silva	+	–	–
12	<i>Avrainvillea lacerata</i> J. Agardh	+	–	–
	Total	12	3	3
Brown algae				
13	<i>Hydroclathrus clathratus</i> (C. Agardh) M. Howe	+	–	–
14	<i>Dictyota dichotoma</i> (Hudson) J.V. Lamouroux	+	+	–
15	<i>Dictyota implexa</i> (Desfontaines) J.V. Lamouroux	+	–	–
16	<i>Padina antillarum</i> (Kützting) Piccone	+	–	–
17	<i>Padina australis</i> Hauck	+	–	–
18	<i>Sargassum ilicifolium</i> (Turner) C. Agardh	+	–	–
19	<i>Sargassum polycystum</i> C. Agardh	+	–	+
	Total	7	1	1
Red Algae				
20	<i>Liagora ceranoides</i> J.V. Lamouroux	+	–	+
21	<i>Galaxaura rugosa</i> (J. Ellis & Solander) J.V. Lamouroux	+	–	+
22	<i>Scinaia furcellata</i> (Turner) J. Agardh	+	+	–
23	<i>Melyvonnea erubescens</i> (Foslie) Athanasiadis & D.L. Ballantine	+	–	–
24	<i>Amphiroa fragillissima</i> Linnaeus (J.V. Lamouroux)	+	–	+
25	<i>Halymenia dilatata</i> Zanardini	+	–	–
26	<i>Halymenia durvillaei</i> Bory	+	–	+
27	<i>Titanophora pikeana</i> (Dickie) Feldmann	+	–	–
28	<i>Hypnea spinella</i> (C. Agardh) Kützting	+	–	+
29	<i>Gracilaria canaliculata</i> Sonder	+	+	+
30	<i>Gracilaria textorii</i> (Suringar) Hariot	+	–	–
31	<i>Laurencia</i> sp.	+	–	+
32	<i>Palisada perforata</i> Bory (K.W. Nam)	+	–	–
	Total	13	2	7

Symbols: +: Presence and -: Absence

In this study, Magyi Coastal Areas, is estuarine and marine with a salinity range of 15-30‰, at the water temperature of 26-29°C. Table 1 reveals a comparison of the species diversity of the marine benthic algal flora from the Magyi Coastal Area. In the present study, the diversity of a total of 32 species of marine benthic green, brown and red algae belonging to 21 families from 14 orders were identified. Of these algae, *Anadyomene stellata* (Wulfen) C. Agardh, *Valoniopsis pachynema* (G. Martens) Boergesen, *Caulerpa taxifolia* (M. Vahl) C. Agardh, *C. sertularioides* (S.G. Gmelin) M. Howe, *Halimeda discoidea* Decaisne, *H. opuntia* (Linnaeus) J.V. Lamouroux, *Codium edule* P.C. Silva, *Avrainvillea lacerata* J. Agardh, *Hydroclathrus clathratus* (C. Agardh) M. Howe, *Dictyota implexa* (Desfontaines) J.V. Lamouroux, *Padina antillarum* (Kützting) Piccone, *P. australis* Hauck, *Sargassum ilicifolium* (Turner) C. Agardh, *Melyvonnea erubescens* (Foslie) Athanasiadis & D.L. Ballantine, *Halymenia dilatata* Zanardini, *Titanophora pikeana* (Dickie) Feldmann, *Gracilaria textorii* (Suringar) Hariot, and *Palisada perforata* Bory (K.W. Nam) were newly recorded for Magyi Coastal Areas.

However, the marine benthic algae, viz., *Chaetomorpha spiralis* Okamura, *Struvea elegans* Boergesen, *Codium adhaerens* C. Agardh, *Canistrocarpus cervicornis* (Kützting) De Paula et De Clerck, *Padina minor* Yamada, *P. japonica* Yamada, *Liagora boergesenii* Yamada, *Galaxaura filamentosa* R.C.Y. Chou, *Tricleocarpa fragilis* (Linnaeus) Huisman & Townsend, *Amphiroa foliacea* Lamouroux, *Jania capillacea* Harvey, *Gelidiella acerosa* (Forsskal) Feldmann & Hamel, *Gracilaria foliifera* Fosskal, *Acanthophora spicifera* (Vahl) Boergesen, and *Hypnea boergesenii* Tanaka described in the previous study (Htwe, 2010; Win, 2016) were absent in the present study for Magyi Coastal Areas.

Among the 32 species of marine benthic algae of Magyi, green algae such as *Neomeris annulata* Dickie, *Codium edule* P.C. Silva, and *Avrainvillea lacerata* J. Agardh, brown algae, namely, *Hydroclathrus clathratus* (C. Agardh) M. Howe, *Dictyota dichotoma* (Hudson) J.V. Lamouroux, *Sargassum ilicifolium* (Turner) C. Agardh, and *S. polycystum* C. Agardh, and red algae, viz., *Liagora ceranoides* J.V. Lamouroux,

Scinaia furcellata (Turner) J. Agardh, *Melyvonnea erubescens* (Foslie) Athanasiadis & D.L. Ballantine, *Amphioroa fragillissima* Linnaeus (J.V. Lamouroux), *Halymenia dilatata* Zanardini, and *Titanophora pikeana* (Dickie) Feldmann which are uniquely distributed along the Rakhine Coastal Region. Moreover, green algae such as *Anadyomene stellata* (Wulfen) C. Agardh, *Valoniopsis pachynema* (G.Martens) Boergesen, *Caulerpa racemosa* (Forsskal) J. Agardh, *C. taxifolia* (M. Vahl) C. Agardh, *C. sertularioides* (S.G. Gmelin) M. Howe, *C. chemnitzia* (Esper) J.V. Lamouroux, *Halimeda discoidea* Decaisne, and *H. opuntia* (Linnaeus) J.V. Lamouroux, brown algae, namely, *Dictyota implexa* (Desfontaines) J.V. Lamouroux, *Padina antillarum* (Kützting) Piccone, and *P. australis* Hauck, and red algae, viz., *Galaxaura rugosa* (J.Ellis & Solander) J.V. Lamouroux, *Halymenia durvillaei* Bory, *Gracilaria textorii* (Suringar) Hariot, and *Palisada perforata* Bory (K.W. Nam) distribute along both the Rakhine and Tanintharyi Coastal Regions. Whereas the remaining three species, *Ulva compressa* Linnaeus, *Hypnea spinella* (C. Agardh) Kützting, and *Gracilaria canaliculata* Sonder, generally distribute along the three Coastal Regions.

The above-mentioned marine alga, the marine green alga *Ulva compressa*, and *Caulerpa spp.* from Magyi can also be used as sea vegetables. Furthermore, *Sargassum spp.*, *Halymenia spp.*, *Gracilaria spp.*, *Laurencia spp.* grown in Magyi can be utilized as for the extraction of alginates, agar-agar and carrageenan. Additionally, benthic marine algae play a critical role in the ocean's ecosystem by providing habitat for various marine species. The conservation of natural marine algal beds in Magyi is still necessary.

4. Conclusion

The present study contributes information to the diversity of seaweed taxa in the Magyi Coastal Area. A survey of seaweed in the Magyi Coastal Area was conducted from September 2021 to March 2023. The samplings recorded a total of 32 macroalgal taxa. At the present time, sea surface temperature is gradually rising annually, changing macroalgal composition in Magyi. In addition, further environmental problems can threaten the marine ecosystem in the future.

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