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## **CHAPTER 6**

## **CONCLUSION**

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### CONCLUSION

The two *Sargassum* species are similar in the seasonal pattern of growth which consists of a growth phase, a reproductive phase and a decaying phase. This pattern is a common pattern reported for tropical *Sargassum* species.

Tagged plants of both *Sargassum* species show an unimodal pattern for growth rate, degenerative rate and mean thallus length. Tagged plants of *S. baccularia* attained the highest growth rate of  $3.01 \pm 3.36$  mm day<sup>-1</sup> in June 1995 and another high growth rate of  $1.48 \pm 1.40$  mm day<sup>-1</sup> in February 1996. A zero (the lowest) growth rate was recorded between November to December 1995. The plants attained the highest degenerative rate of  $-4.81 \pm 4.88$  mm day<sup>-1</sup> in July 1995.

Tagged plants of *S. swartzii* attained the highest growth rate of  $3.52 \pm 3.44$  mm day<sup>-1</sup> between February to March 1996 with another high growth rate of  $3.31 \pm 3.12$  mm day<sup>-1</sup> in June 1995. The plants attained the lowest growth rate of  $0.12 \pm 0.10$  mm day<sup>-1</sup> in November 1995. The highest degenerative rate was attained between September to October 1995 with a

value of  $-4.88 \pm 4.98 \text{ mm day}^{-1}$ . Another two high degenerative rates were recorded between March to April 1995 ( $-4.42 \pm 4.72 \text{ mm day}^{-1}$ ) and between June to July 1995 ( $-4.41 \pm 2.88 \text{ mm day}^{-1}$ ).

Tagged plants of both *Sargassum* species attained long thallus length three times during the monitoring period in January 1995, June 1995 and March 1996 with the longest thallus length attained in January 1995. A high growth rate is always followed by long thallus length. Tagged plants of *S. baccularia* attained the highest growth rate in June 1995 and this was followed by maximum thallus length. The lowest growth rate was attained between November to December 1995, with plants having the shortest length in December 1995. Tagged plants of *S. swartzii* exhibited a similar pattern. This pattern was also seen in the *Sargassum* species in Philippines (Ang 1985).

Both tagged plants of *Sargassum* species exhibited different periods of fertility. Tagged plants of *S. baccularia* produced receptacles twice over the 15-month monitoring period whereas tagged plants of *S. swartzii* produced receptacles three times over the 15-month monitoring period. Tagged plants of *S. swartzii* have a greater range of fertility (0.03% - 60%) compared to *S. baccularia* plants (1.35% - 15.62%). A positive

correlation was found between the number of plants producing receptacles with the thallus length for both the *Sargassum* species.

Two modes of reproductive are recorded. Vegetative reproduction is dominant, with only a small percentage of the plants bear receptacles as shown by *S. baccularia* plants and sexual reproduction being more common, with fertile, receptacles-bearing branches are produced and dispersed as shown in *S. swartzii* plants.

Tagged plants of *S. baccularia* attained average thallus length of 68 mm with 96% of the plants in the length classes of less than 199 mm. Whereas tagged plants of *S. swartzii* attained average thallus length of 93 mm with 90% of the plants in the length classes of less than 199 mm.

Quarterly destructive sampling was performed for both *Sargassum* species. Biomass for both *Sargassum* species showed an unimodal pattern. *S. baccularia* population recorded the highest biomass in July 1995 ( $501.98 \pm 341.05$  g WW  $m^{-2}$ ,  $64.92 \pm 40.99$  g DW  $m^{-2}$ ,  $14.00 \pm 9.65$  g AFDW  $m^{-2}$ ) with another high biomass recorded in January 1995 ( $520 \pm 724.37$  g WW  $m^{-2}$ ,  $47.88 \pm 65.47$  g DW  $m^{-2}$ ,  $13.35 \pm 16.69$  g AFDW  $m^{-2}$ ). The lowest biomass occurred in January 1996 ( $76.14 \pm 37.97$  g WW  $m^{-2}$ ,  $9.97 \pm 4.62$  g DW  $m^{-2}$ ,  $1.97 \pm 1.00$  g AFDW  $m^{-2}$ ).

*S. swartzii* population recorded the highest biomass in April 1995 (656.13±735.27 g WW m<sup>-2</sup>, 80.81±76.02 g DW m<sup>-2</sup>, 15.25±16.72 g AFDW m<sup>-2</sup>) with another high biomass recorded in July 1995 (429.28±385.64 g WW m<sup>-2</sup>, 54.30±50.25 g DW m<sup>-2</sup>, 11.20±11.43 g AFDW m<sup>-2</sup>). The lowest biomass recorded in January 1998 (68.21±33.08 g WW m<sup>-2</sup>, 8.36±4.07 g DW m<sup>-2</sup>, 1.68±0.89 g AFDW m<sup>-2</sup>). Biomass for both *Sargassum* species was strongly correlated to the thallus length.

*S. baccularia* plants (destructive sampling) attained the average thallus length of 66 mm with 96% of the plants in length classes less than 199 mm. Whereas, *S. swartzii* plants attained average thallus length of 107 mm with 89% of the plants in length classes less than 199 mm. Therefore, both *Sargassum* population are mainly young plants.

From the destructive sampling, *S. baccularia* population recorded extremely low percentage fertility; 0.54% in July 1995 and 0.44% in April 1996. Whereas, *S. swartzii* population recorded the lowest percentage fertility in January 1996 (4.17%) and the highest in April 1996 (59.70%). A significant positive correlation was found between the number of plants producing receptacles with biomass and mean thallus length for both *Sargassum* species.

Both *Sargassum* species are influenced by different environmental factors investigated in this study. For permanent quadrat studies, simple correlation analysis shows that the increase in growth rate of *S. baccularia* was significantly influenced by the increase in minimum ambient temperature and decrease in ammonia level whereas the increase in growth rate of *S. swartzii* was significantly influenced by the increase in maximum ambient temperature and sunshine, and decrease in ammonia level. The reproductive state for both species in permanent quadrat studies was not influenced by any of the environmental factors as shown by the simple correlation analysis. However, cross-correlation analysis shows that the reproductive state for *S. baccularia* and *S. swartzii* was influenced by the water temperature and radiation with a lag period.

In the destructive sampling, it was found that the most important factor that controlled the biomass production and reproduction for both *Sargassum* species was rainfall. Other environmental factors that had a significant influence (simple correlation analysis) on the biomass, mean thallus length and reproductive state of *S. baccularia* population were phosphate level, pH, radiation and ammonia. Whereas for *S. swartzii* population, water temperature played a role in determining the biomass production and reproductive state of the plants. Other than that, the ammonia and nitrate content also influenced the biomass production and mean thallus length of the plants. Again, cross-correlation analysis shows

most of the environmental factors had marked effect on the biomass production for both *Sargassum* species with a lag period.

As this is the first phenological study in Malaysia, the data generated from this study is very important and gives an insight into the life history of both *Sargassum* species. The study recorded the occurrence of seasonality in growth pattern, reproduction and biomass production for both *Sargassum* species. Besides, differences between the two *Sargassum* species investigated are observed. The study also showed that the environmental factors are important in governing the seasonality of the plants. But, the effect of biological effects is not investigated in this study. Therefore, further research should incorporate the ecological aspects into the studies where a clearer picture of the life history for both species can be obtained.