



Mauritius Research and Innovation Council
INNOVATION FOR TECHNOLOGY

**REPORT ON
COMMUNITY-BASED
SEAWEED FARMING
AT GRAND SABLE**

Report

2014

Mauritius Research and Innovation Council

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1.0 Introduction

Seaweeds are a diverse group of large marine macroalgae that are as important to our nearshore coastal marine world as land plants are to our terrestrial world. Today seaweeds are a multi-billion dollar industry worldwide, providing food, fertilizers, nutritional supplementation, and valuable phycocolloid extracts including agar, carrageenan, and alginate. Although wild harvest supports a significant portion of seaweed industry, there is an ever increasing amount of seaweed production from aquaculture, principally in Asia and South America (Chile) (Redmond *et al*, 2014). Seaweed aquaculture makes up a significant portion of organisms cultured worldwide (~19 million metric tons) with a value of ~US \$5.65 billion (FAO, 2012).

The absence of Africa as a major player in this market is recognized, though seaweed production and commercialization has been reported in Zanzibar and Madagascar to some extent. This is an indication of a potential African niche market.

Mauritius is a Small Island Developing State with limited land resources but with an extensive Exclusive Economic Zone of about 2.3 million km². There are 435 reported seaweed species in Mauritius and Rodrigues but no local research has been conducted to investigate the commercial exploitation of these resources. Hence the initiative of the MRC is to set-up a research programme to investigate the potential of developing an economically, technically and environmentally viable seaweed industry in Mauritius and Rodrigues.

The National relevance of this programme is emphasized by section 195 of the Government Programme 2010-2015 which states that ‘the Cultivation of Seaweed with a view to developing an Industry based on Value-added transformation of seaweed for human consumption, cosmetic application, medical and pharmaceutical research’ will be conducted.

Community-Based Adaptation projects in Small Islands Developing States (SIDS CBA) is implemented through the UNDP Global Environment Facility Grants Programme (GEF SGP). Under this funding, the GEF SGP is currently supporting a project entitled “*Enhancing the livelihood of Women at Grand Sable in response to climate change impacts*”. The main objective of the project is to empower the women community on alternate income-generating activities.

2.0 Objectives

1. To provide hands-on training workshop on seaweed farming to stakeholders
2. To set-up a community-based seaweed farm in Grand Sable in collaboration with the Grand Sable Women Planters Farmers Entrepreneurs Association (GSWPFEA)
3. To cultivate *Gracilaria* species in the community- based farm and monitor the growth rate.
4. To implement and establish a PVC raft community-based Seaweed Farm for local seaweed production in the region of Grand Sable
5. To build up local capacity in seaweed farming and implement value addition activities
6. To sensitize the Mauritian population on the use of seaweeds

3.0 Permits and Approvals required

The permit was granted by the Prime Minister's Office to the MRC in 2011 for seaweed farming and the support from other major stakeholders such as the Ministry of Fisheries, the Ministry of Housing and Lands, the Mauritius Oceanography Institute and the Beach Authority indicate the commitment of local authorities towards this program. Following a request from Grand Sable Women Planters Farmers Entrepreneurs Association (GSWPFEA), it was decided that the subsequent activities would be conducted within the purview of that permit. Thereafter, the GSWPFEA would apply for a seaweed farming permit from the relevant authorities.

4.0 Methodology

The following activities were undertaken to achieve the objectives of the project, that is, setting up the experimental seaweed farm in Grand Sable:-

1. Community Mapping with Stakeholders
2. Bio Assessment
3. Hands-on Training Workshop and setting-up of the farm
4. Monitoring the Experimental Farm
5. Solar Drier Training
6. Harvesting
7. Community Involvement and intra group conflict resolution

4.1 Community Mapping

A meeting and community mapping was organised by the officials of the MRC and the Project Coordinator from UNDP with the Grand Sable Women Planters Farmers Entrepreneurs Association (GSWPFEA) and members from the Fisherman community of the region from Grand Sable/ Petit Sable who have shown interest in the Seaweed Farming project from Grand Sable area.

Community mapping was done in order to record all the activities, physical components and biodiversity that are present in a specific area like the lagoon, for instance, and to identify a specific site of the lagoon for setting up a community based seaweed farm. Community mapping was also done to identify a potential site for experimental seaweed farming and to seek background data on the marine environment.

4.2 Bio Assessment and site selection

The site selection was based on the Bio- Assessment survey carried out in December 2013 and on reports of past experts.



Figure 1: Location of Community- based Seaweed Farm in Grand Sable.

4.2.1 Results obtained after Bio-Assessment

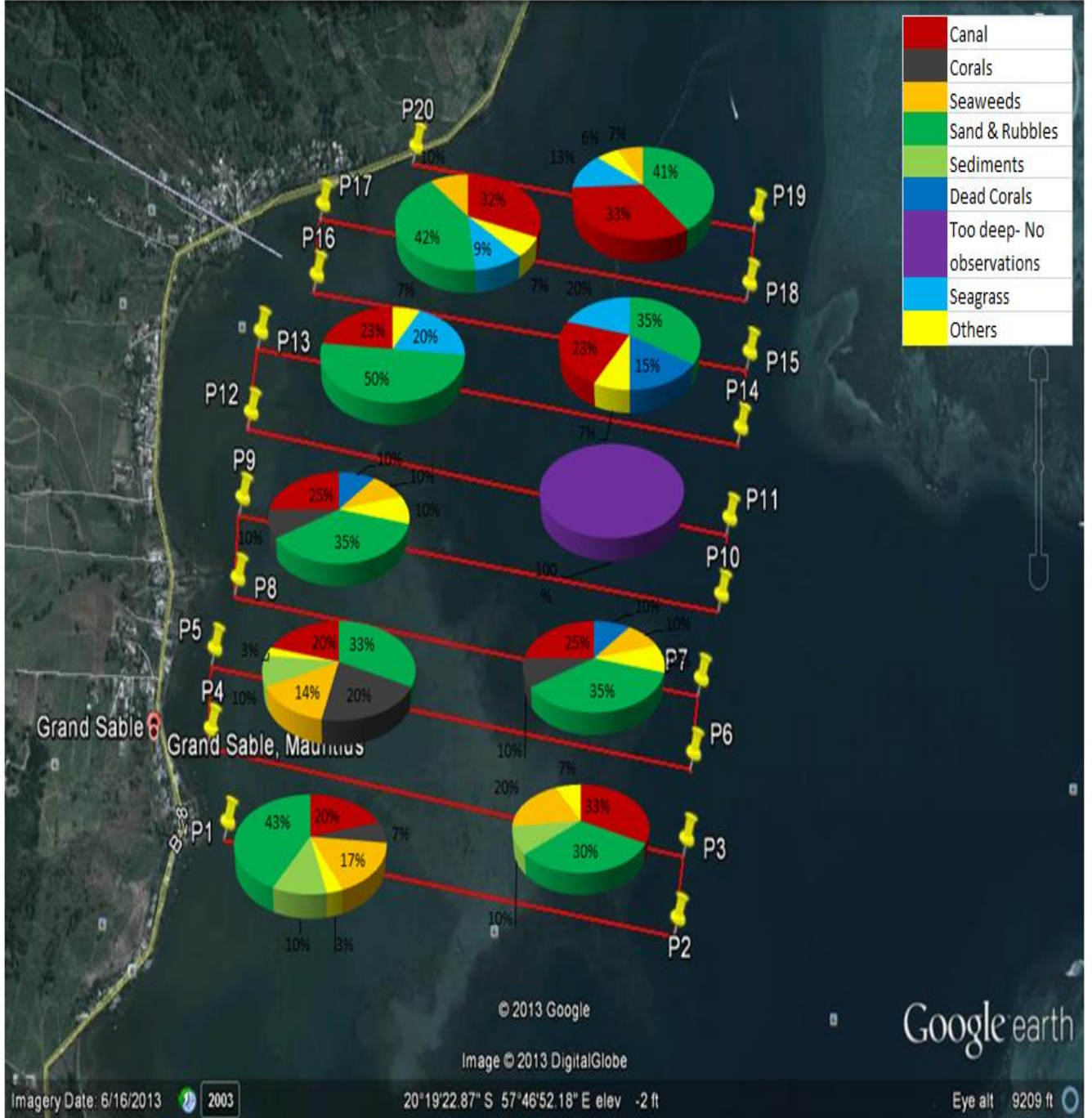


Figure 2- Main findings for Bio- Assessment

4.3 Hands-on Training and setting-up of the seaweed farm

A Hands- on training was organized at Grand Sable in March 2014 with the aim to equip the Grand Sable Women Planters Farmers Entrepreneurs Association (GSWPFEA) of Grand Sable with knowledge in seaweed farming and to set up Community Based farm in the Grand Sable/Petit Sable region.

During the workshop, members from the women association were trained on how to start, monitor and handle the seaweed farm by taking into account all the safety measures. Two PVC rafts were constructed, filled with seaweeds and placed in the sea. Two additional seaweed rafts were constructed and implemented in April 2014

After the implementation of the PVC Raft, a debriefing session was done with the women on the last day of training. In this session, they were briefed on the way to clean and maintain the farm. All the women present agreed to contribute voluntarily in this endeavour.

4.4 Monitoring of the Experimental Farm

The methodology for monitoring the water parameters was as followed:

Readings for salinity, temperature, pH, electrical conductivity and dissolved oxygen were taken around the seaweed farm sites.



Figure 3: GPS map for the four PVC rafts at the seaweed farm

Table 1: GPS coordinates of the PVC rafts.

Selected points for water parameters	Latitude	Longitude
Raft 1	S 20°18'59.29"	E 57°46'37.75"
Raft 2	S 20°18'59.18"	E 57°46'38.16"
Raft 3	S 20°19'00.28"	E 57°46'37.90"
Raft 4	S 20°19'00.20"	E 57°46'38.33"

4.4.1 Material used to measure water parameters:

1. Refractometer was used for salinity determination
2. HACH portable probe meter was used for pH, temperature, dissolved oxygen and electrical conductivity (EC) measurements.

4.5 Value addition activities

4.5.1 Solar dehydration of fruits & vegetables workshop

A workshop was organized by the University of Mauritius in collaboration with Mauritius Research Council and Prof Steele on “Solar dehydration of fruits & vegetables” on the 23rd-25th July. The workshop had as objectives to build a Solar Dryer so as to enable the drying of fruits and vegetables using solar energy and to teach the basics of dehydration and the importance of pre-treatment before drying. Four women from the Grand Sable Women Planters Farmers Entrepreneurs Association (GSWPFEA) were trained in this workshop.

4.5.2 Capacity building workshop on the manufacture of Seaweed-based jams & pickles

A capacity building workshop was organized by the Food and Agricultural Research Extension Unit for the Grand Sable Women Planters, Farmers & Entrepreneurs Association (GSWPFEA). The workshop had as objectives to transform seaweeds into seaweed-based food products (Pickles and Jams); to provide basic skills in food processing that can be extended to other products and to educate the participants on the nutritional value of seaweeds.

During this workshop seven women were trained on the different aspects of food processing of seaweeds in Mauritius.

4.5.3 Coordination meeting

A coordination meeting was organised by the officials of the MRC and the Project Manager from UNDP with the Grand Sable Women Planters Farmers Entrepreneurs Association (GSWPFEA) on Wednesday 25th of June 2014 in the Community Centre of that region.

The coordination meeting was done resolve the conflicts between the executive members of the women association. During the discussion, a briefing on the seaweed potentials and the outcomes of the seaweed project was done. Following this meeting, the women agreed to work in collaboration and to successfully continue with the community based seaweed project.

4.6 Seaweed Harvest

The Mauritius Research Council in collaboration with the Grand Sable Women Planters Farmers Entrepreneurs Association (GSWPFEA) organized a harvest ceremony for community based Seaweed Farming in Mauritius in September 2014. The cultivated seaweed was harvested during the end of September 2014.

Table 2: Initial and final weight of cultivated seaweed

Initial weight of seaweed placed in each netbag	Initial weight of seaweed placed in 400 netbags	Final weight of harvested seaweed
~0.15kg	~ 60Kg	~ 115.2kg

The final yield was approximately twice much better upon the harvest. The cultivation rate was 0.185Kg/m^2 and the yield was 0.355 Kg/m^2 . It should be noted that some amounts of seaweed were stuck in the netbags and could therefore not be harvested and also a few amount of seaweed were grazed by fish found near the seaweed rafts.

5.0 Results and Discussions

5.1 Physico-chemical parameters

The physical parameters (Salinity, Temperature, pH, electrical conductivity and Dissolved oxygen) of Grand Sable were measured at a weekly basis from April 2014 to August 2014.

The ranges of the Physical Parameters for Grand Sable met more or less the range for the optimum growth of seaweed as prescribed by FAO (2010).

5.1.1 Temperature trend

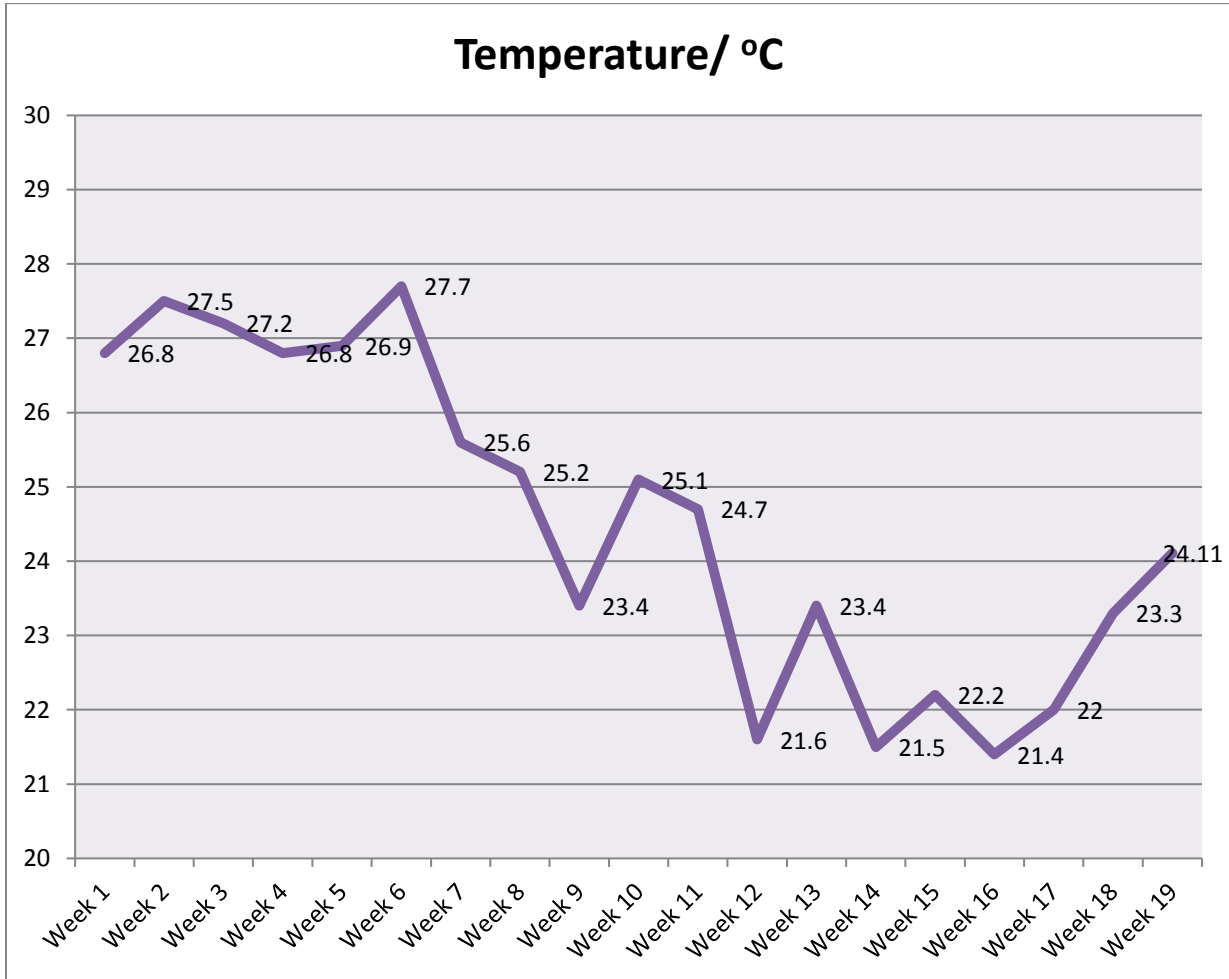


Figure 4: Temperature record for Grand Sable during the months of April to August 2014.

The temperature ranged from 21.4 °C to 27.7 °C. The lowest temperature was obtained on 08th Aug 2014(week 16) while the highest temperature was recorded on 26th May 2014(week 6). The decline in temperature as from the month of May was due to the change of summer to winter season. Since the optimal temperature for *Gracilaria Salicornia* growth is from 20 °C - 30 °C, the water temperature of Grand Sable was ideal for seaweed cultivation. Temperature higher than 30oC will cause the seaweed to rot according to a training manual on *Gracilaria* culture and seaweed processing in China by the FAO.

5.1.2 Salinity trend

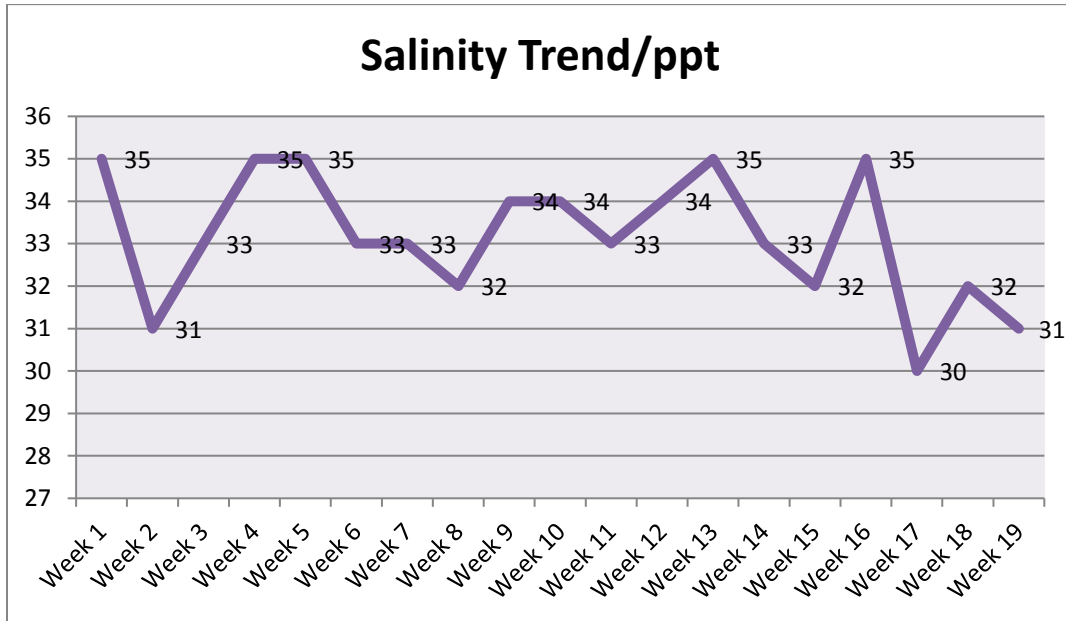


Figure 5: Salinity record for Grand Sable during the months of April to August 2014.

The salinity ranged from 30.0 ppt to 35.0 ppt. The lowest salinity was obtained on 14th August 2014 (week 17). The optimal range of salinity for *Gracilaria Salicornia* cultivation is from 30ppt to 40ppt, therefore the salinity range was suitable for the proper growth of the seaweed.

5.1.3 pH trend

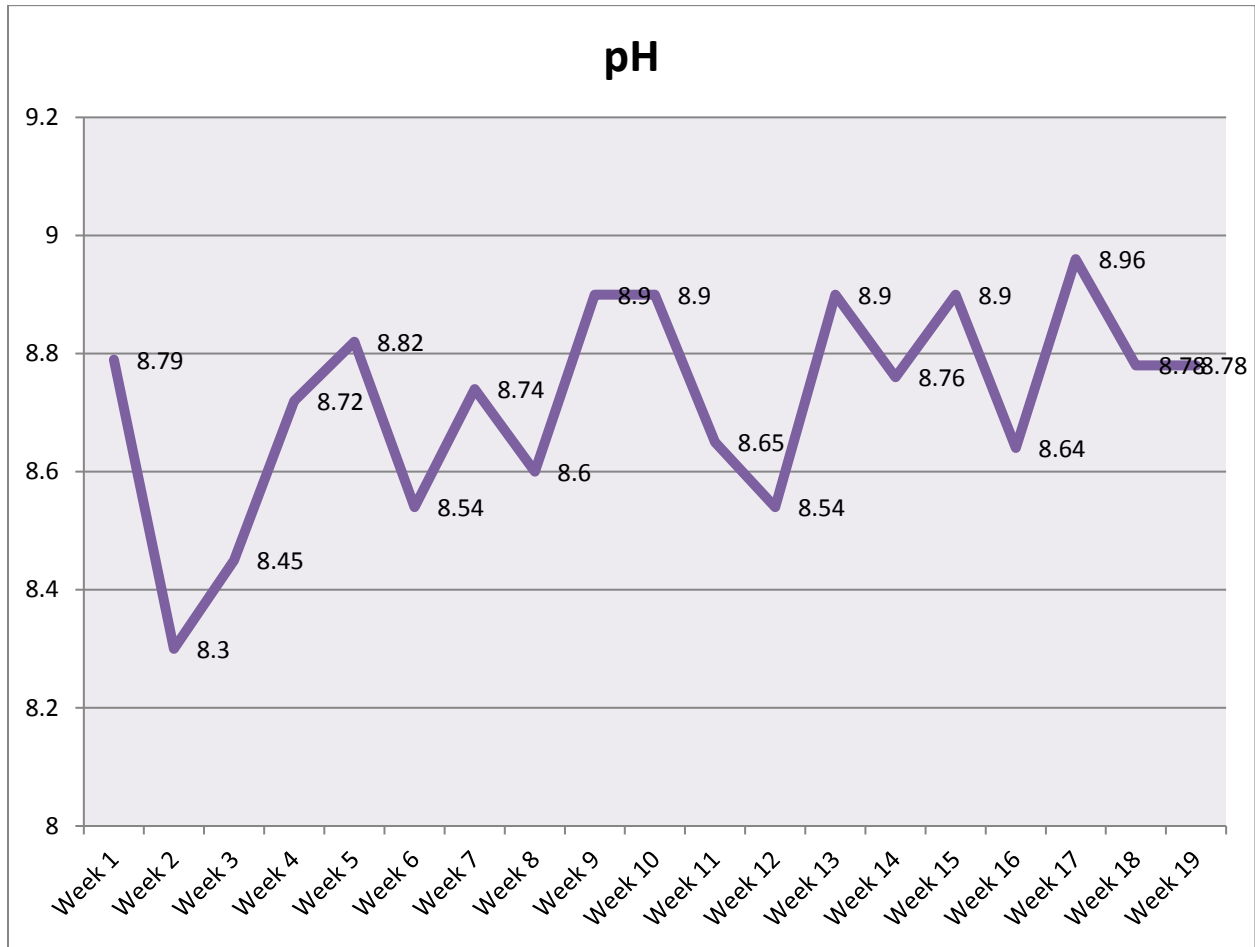


Figure 6: pH record for Grand Sable during the months of April to August 2014.

The pH ranged from 8.3 to 8.96. The lowest pH was obtained on 16th Apr 2014(week 2) while the highest pH was recorded on 14th Aug 2014(week 17). The optimal temperature is around 8 and the pH recorded at Grand Sable was suitable for the growth of the seaweed.

5.1.4 Dissolved Oxygen trend

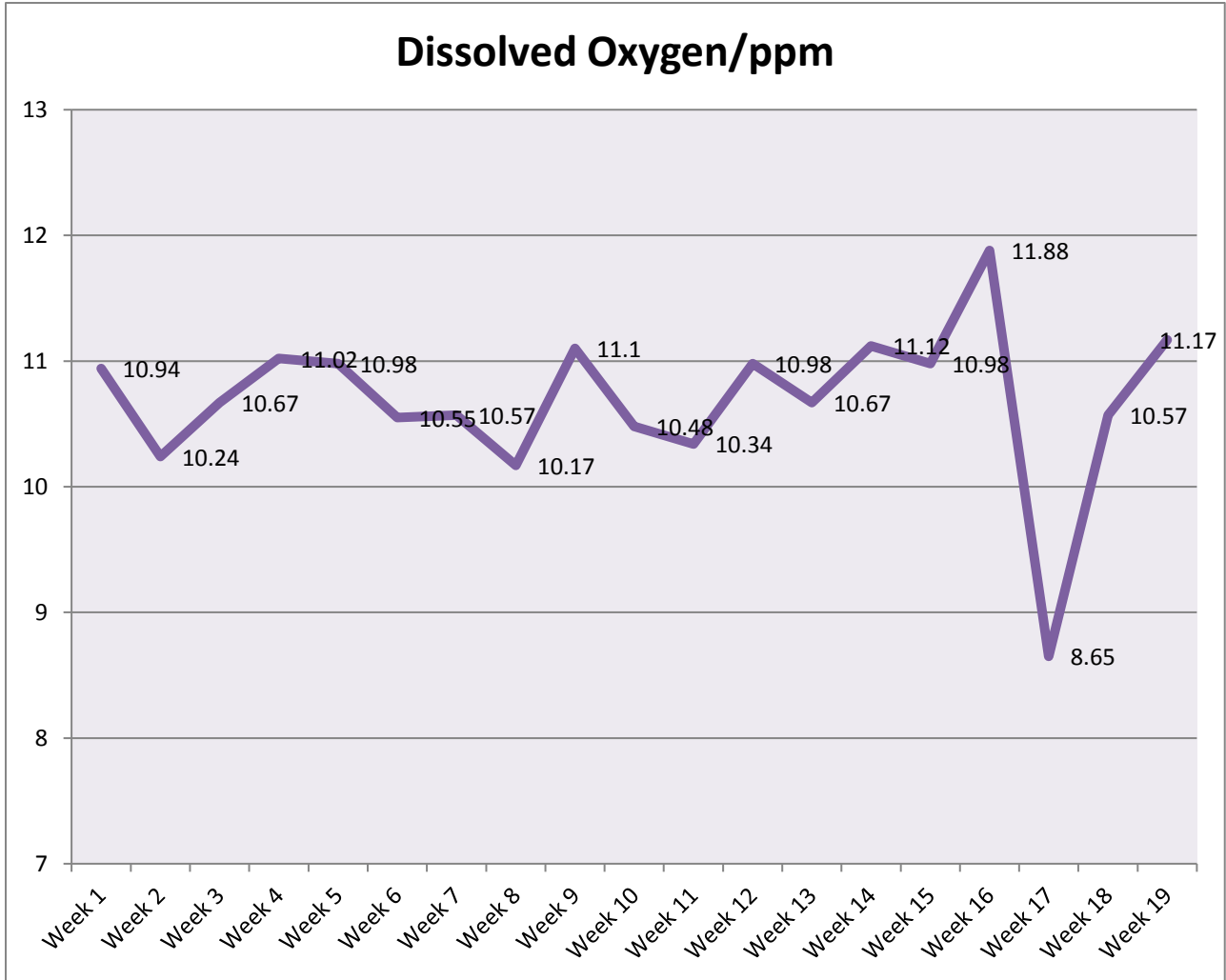


Figure 7: Dissolved Oxygen record for Grand Sable during the months of April to August 2014.

The dissolved Oxygen was mostly constant. The DO ranged from 8.65ppm to 11.88 ppm. The lowest value was obtained on 14th Aug 2014(week 17) while the highest value was recorded on 8th Aug 2014(week 16).

5.1.5 Electrical Conductivity trend

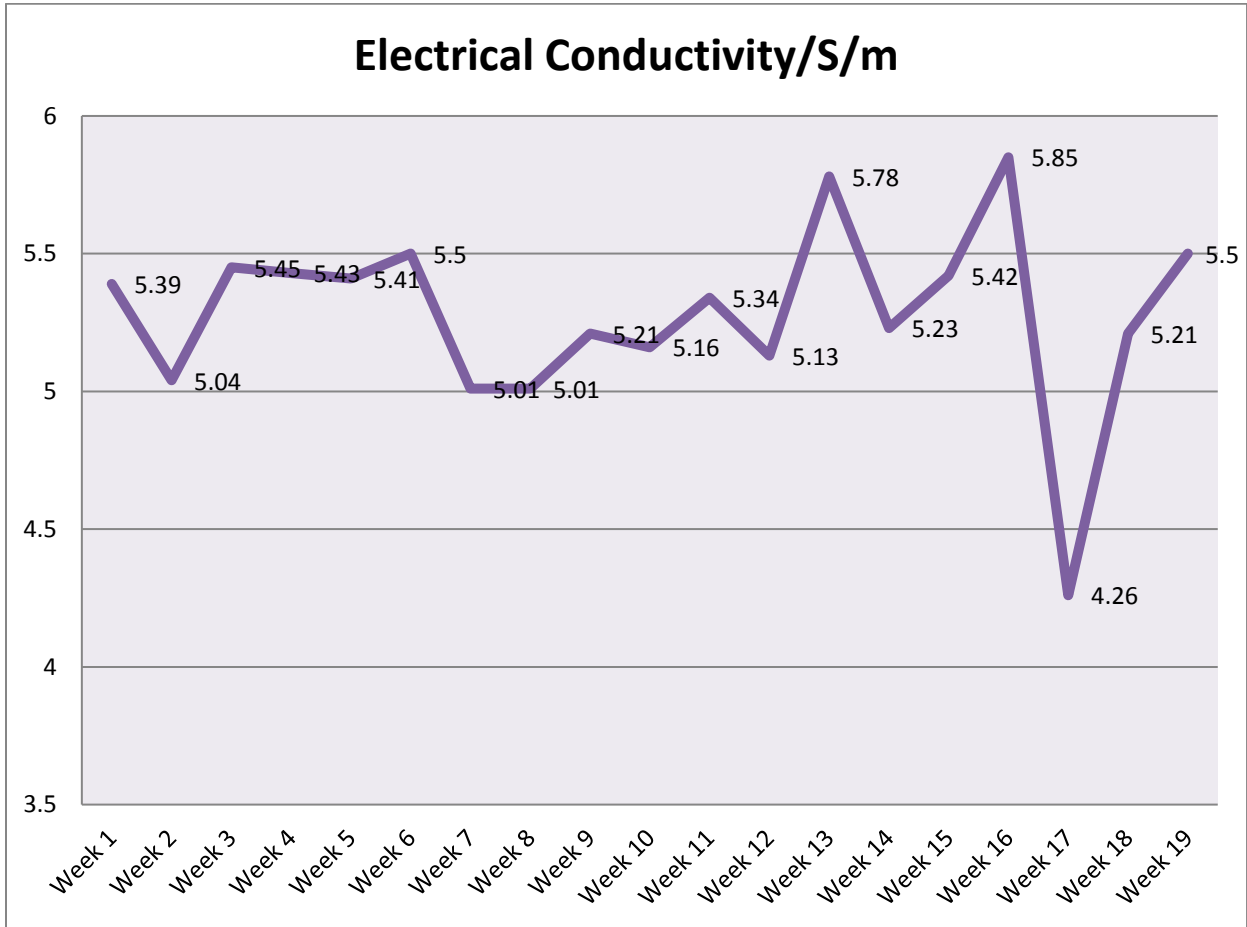


Figure 8: Electrical Conductivity record for Grand Sable during the months of April to August 2014.

The Electrical Conductivity was mostly constant with a decline in August. The Electrical Conductivity ranged from 4.26 S/m to 5.85 S/m. The lowest EC value was obtained on 14th Aug 2014 (week 17) while the highest EC value was recorded on 8th Aug 2014 (week 16). The values of dissolved oxygen and electrical conductivity changed simultaneously as they are co-related. Electrical conductivity also estimates the amount of total dissolved salts (TDS), or the total amount of dissolved ions in the water.

As seen from the graphs of physical parameters, the lowest values of salinity, dissolved oxygen and electrical conductivity were obtained on the 14th Aug 2014(week17) while the highest value of pH was recorded on that particular day. This may have been due an excessive amount of land runoff and pollutants that occurred on that particular week due to bad weather conditions and the heavy rainfall. Otherwise, the environmental and physical parameters were suitable for the cultivation of the seaweed *Gracilaria Salicornia* in Grand Sable.

5.1.6 Percentage Relative Growth Rate Curve

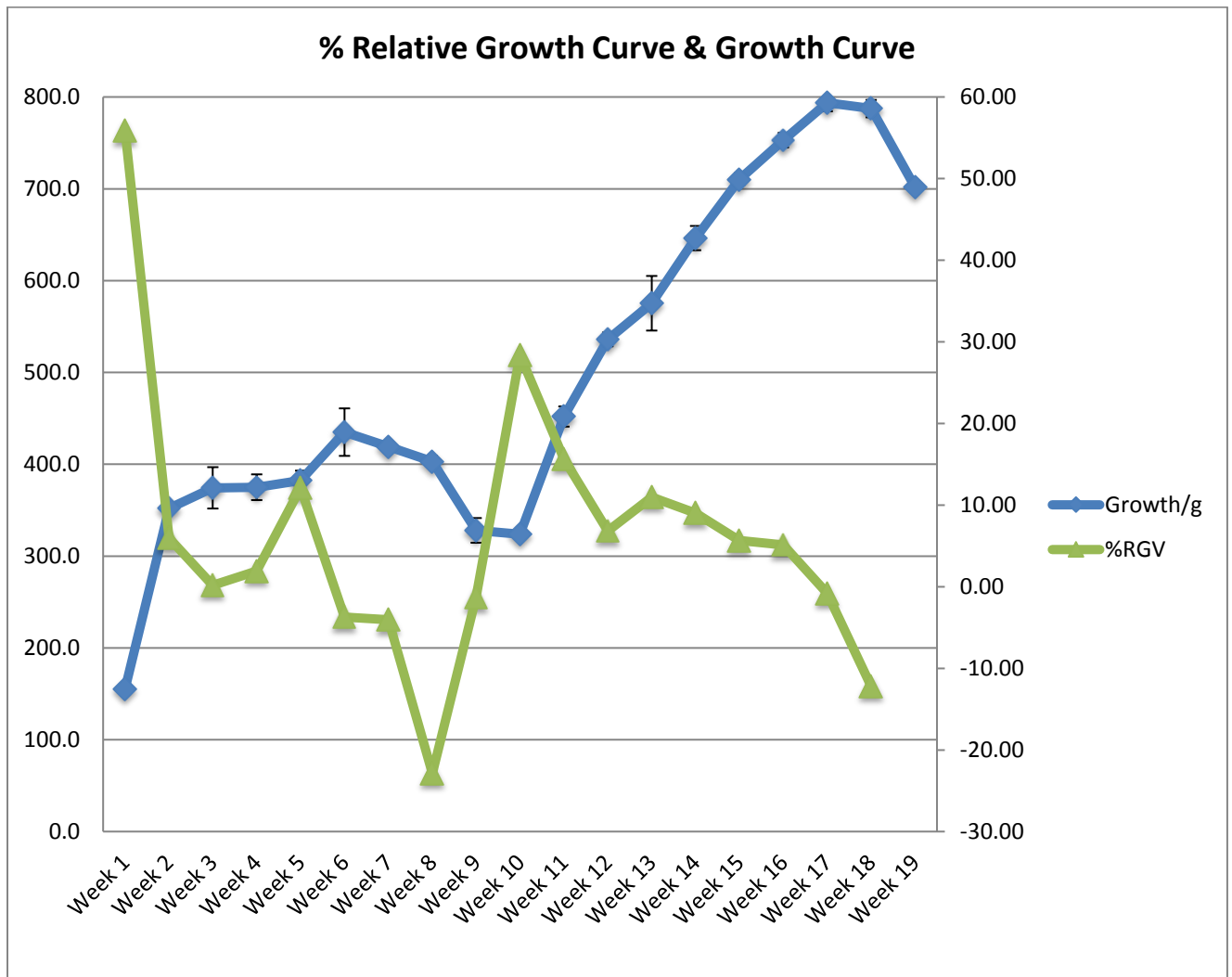


Figure 9a: shows the Percentage Relative Growth Rate Curve and the Yield Curve of *Gracilaria salicornia* in Grand Sable during the months of April to August 2014 for the first two implemented raft. Data represents Mean \pm SD.

Figure 9a above demonstrates the growth potential of *Gracilaria salicornia* in the lagoon of Grand Sable. The greatest increase in biomass was observed during the initial stages of cultivation. The negative percentage RGR obtained and the decline in growth at week 8 was due to improper maintenance and adverse weather conditions which damaged the net bags consequently causing a loss in seaweed. The highest average mass of seaweed obtained per average net bag was 793g.

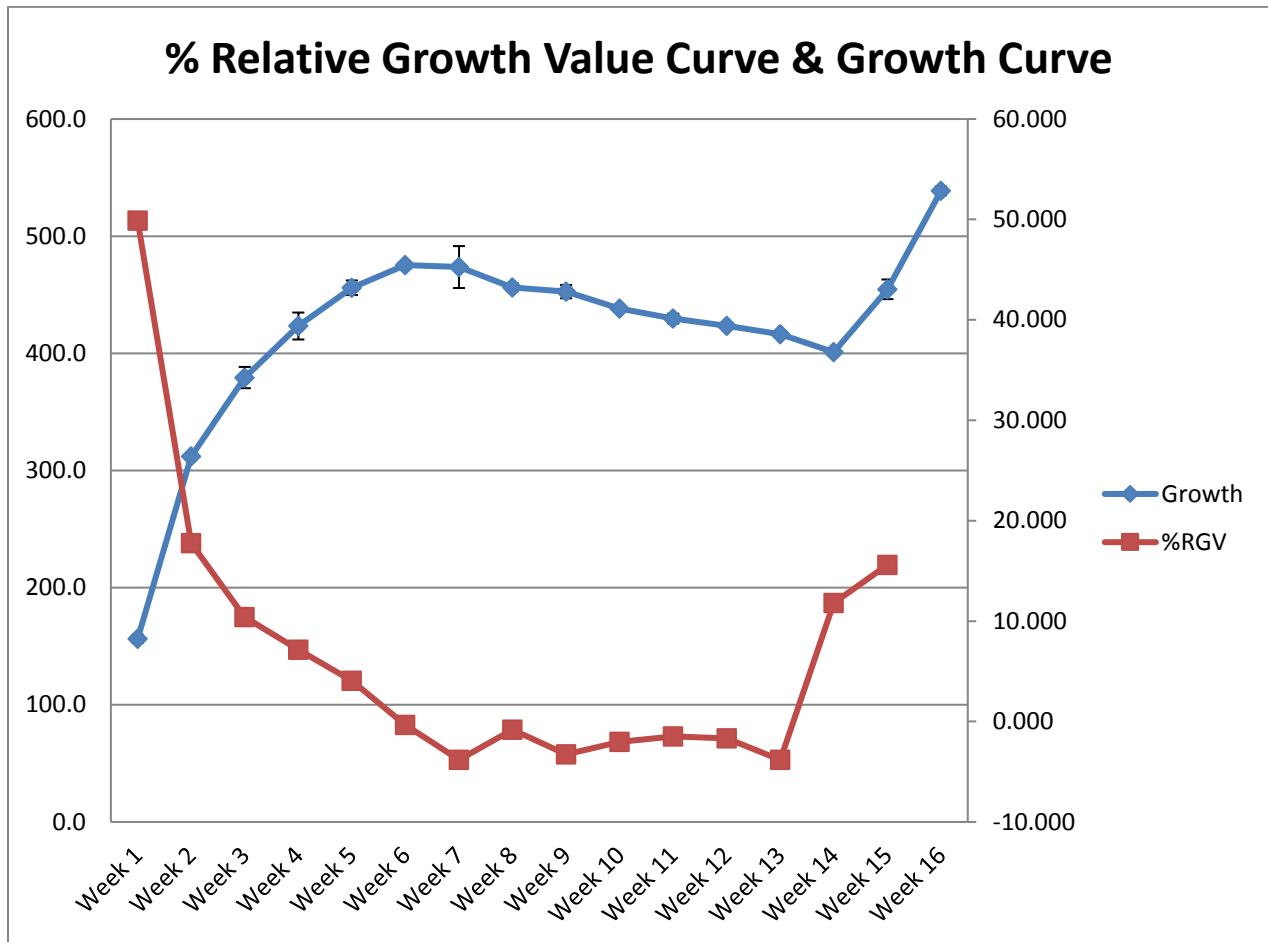


Figure 9b: shows the Percentage Relative Growth Rate Curve and the Yield Curve of *Gracilaria salicornia* in Grand Sable during the months of April to August 2014 for the two additional rafts. Data represents Mean \pm SD.

Figure 9b demonstrates the growth potential of *Gracilaria salicornia* in the lagoon of Grand Sable for the second implemented rafts (as from 24th April 2014). The greatest increase in biomass was observed during the initial stages of cultivation with a peak decline in growth at week 14. There was a better growth for these rafts as compared to the firstly implemented rafts. This is due to the better cultivation location as these rafts were placed in deeper waters and they were least exposed to the muddy water conditions. The highest average mass of seaweed obtained per average net bag was 539g.

6.0 Conclusion

In conclusion, it was seen that the salinity and the off bottom type of the cultivation site play a major role in the growth of the seaweed. The presence of a clean bottom type gives a better growth. The cultivated seaweed did respond in accordance with the environmental conditions. To summarize with, the cultivation of *Gracilaria Salicornia* demands great attention and a lot of manual work. This cultivation could promote the production of adequate raw material for producing agar and thus further develop the seaweed industry.

7.0 Problems encountered on site:

A few problems were encountered during the course of the experiments. These problems are described below:

- There were conflicts between the fishermen of the region and the members of the women association in the beginning of the project. During the month of April, a few seaweed net bags were damaged and seaweed was removed from the net bags. One anchor rope supporting the rafts was detached and the anchors holding the rafts were removed. Following this, the GSWPFEA decided to lodge a complaint at the nearest police station. After the enquiry, they advised to report the case to the Fisheries Protection Service of Bambous. The officers from the Fisheries Protection Service office took note of the problems encountered and stated that they would do proper patrols on the site and asked the members from the GSWPFEA to immediately notify them if they see any person pilfering the seaweed rafts.
- There were numerous conflicts among the members of the women association. At some point they were not willing to collaborate and work together for the project. Following these issues, a coordination meeting was organized by the officials of the MRC and the Project Manager from UNDP with the Grand Sable Women Planters Farmers Entrepreneurs Association (GSWPFEA). After this meeting, the women agreed to work in collaboration and to successfully move on with community based seaweed project.
- Initially the rafts were placed in shallow waters where the off bottom was not very clean. This resulted in a slow growth of the seaweed, therefore the raft were moved to deeper water. This gave a better quality and quantity of seaweed and subsequently enhanced the seaweed growth.

8.0 Way forward

The Grand Sable Women Planters Farmers Entrepreneurs Association (GSWPFEA) is trying to obtain a permit from the Ministry of Fisheries so as to start seaweed cultivation on their own. Furthermore, these women will be trained on the techniques of manufacturing seaweed soaps.

9.0 References

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