

**Developing equipment to help anchor seagrass seedlings
to increase seagrass survival rates**

Tanaporn Numuean and Nichapa Thongrod

Patchara Pongmanawut and Pacharee Chaipetch
Princess Chulaborn Science High School Trang

Thailand

6 March 2024

Abstract

The study aims to create a device to help anchor seagrass seedlings to increase the survival rate of seagrass. The equipment is made from bamboo. There are 3 types of equipment created, Type 1 have prongs for resist water current, type 2 does not have prong and type 3 looks like an anchor. It is carried out by designing and building equipment and then testing its actual use by planting seagrass using equipment to hold seagrass seedlings in comparison with planting using natural methods (without equipment) and planting using biocups. Bunkong Bay is the study site for testing. Collect data on the survival rate of seagrass after planting for 1 month , collect water and soil quality data before and after planting seagrass. From the experiment, it was found that type 3 had the highest seagrass survival rate (33.33%), followed by type 1 (22.22%) and type 2 (11.11%). Seagrass grown using biocups and without equipment, had the same survival rate as type 1. Water quality values in the planted area before and after planting seagrass were not different, but before planting the temperature was slightly higher. The quality of the soil after planting, the nitrogen value increased in the experimental set that used all 3 types of planting equipment. The results show that type 3 of seagrass seedling planting equipment increased the survival rate of seedlings. This may cause the decomposition of bamboo to increase nitrogen in the soil. Therefore, this equipment can increase seagrass survival rates and we should plant it in an area that is appropriate. This will be beneficial in long terms of storing carbon. Including increasing food sources Habitat for aquatic animals and dugongs as well.

keywords: *Seagrass, Survival rate, Growth*

Research Question

1. Is there a difference in water quality before and after planting seagrass?
2. Is there a difference in soil quality before and after planting seagrass?
3. Equipment to help anchor seagrass seedlings can increase the survival rate of seagrass or not?

Hypothesis

1. Water quality before and after planting seagrass is difference.
2. Soil quality before and after planting seagrass is difference.
3. Equipment to help anchor seagrass seedlings can increase the survival rate of seagrass.

Introduction and Review of Literature

Nowadays, coastal resources tend to deteriorate. The seagrass ecosystem is one of the first ecosystems to be affected by various activities. Deterioration of seagrass is caused by natural factors and human actions. It affects the abundance of habitats, feeding grounds, and refuge for many marine life. (Marine Resources Research and Development Institute Coastal and mangrove forests Thailand, 2019)

Seagrass area in Trang Province, such as around Makhm Bay, Sukorn Island, Kangkoaw Island, Bunkong Bay, Thung Chin Bay and Libong Island has deteriorated. Over the past 10 years, seagrass ecosystems have been conserved and restored. By replanting and transplanting But it was found that seagrass had a low survival rate. Due to environmental limitations in nature in each area (Department of Marine and Coastal Resources, 2016)

The researchers studied the factors affecting the growth of seagrass. Both water quality and soil quality in the area of Bunkong Bay, Trang Province, which is an area where seagrass cultivation has been trialled. Both before planting and after planting seagrass. To compare the differences in soil and water quality. And also to see the suitability for the growth of seagrass.

The researchers want to increase the seagrass chances of survival. Therefore, we invented an equipment for fasten seagrasses to increase the survival rate of seagrasses .This

equipment made from bamboo that strong and biodegradable without having a negative effect on the marine ecosystem, it has pin for fasten seagrasses with soil and there is prong of bamboo to resist the violence of the water current.

The researchers are aware of the importance of the seagrass ecosystem therefore we developed an equipment for fasten seagrasses to increase the survival rate of seagrasses. This can help restore natural seagrass resources.

Research Methods and Materials

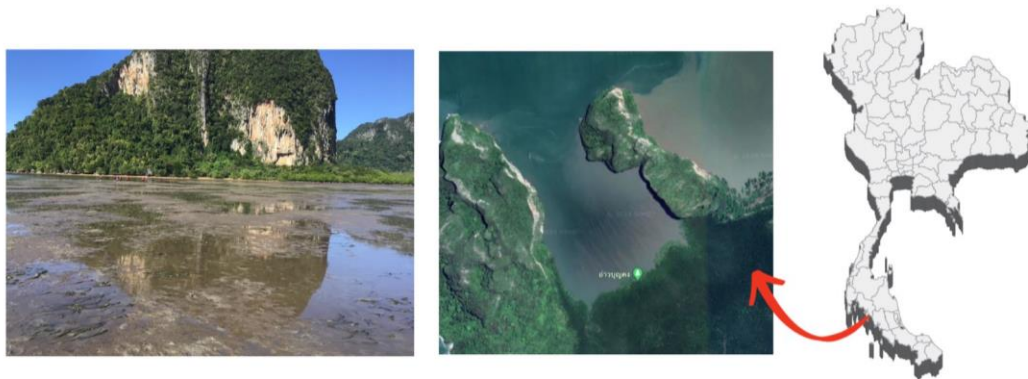
Materials

- | | |
|-----------------|-------------------|
| 1. Thermometer | 8. PVC shovel |
| 2. DO meter | 9. Turbidity tube |
| 3. NPK test kit | 10. pH meter |
| 4. Biocups | 12. Oven |
| 5. Kiln | 13. Digital scale |
| 6. Bamboo | 14. Epoxy glue |
| 7. Seagrass | 15. Plastic rope |

Research Methods

1. Study sites

Researchers appoint study site at Boon Kong bay , Trang



Bunkong bay ,Trang

2. Surveying the area

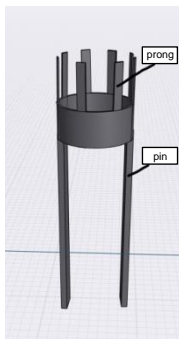
1. Study water quality before planting seagrass. Collects data on water temperature, turbidity, water surface temperature, pH and DO of the water.
2. Study soil quality before planting seagrass .Collects data on nitrogen potassium phosphorus and organic matter in the soil.
- 3.Sent data of water quality and soil quality to GLOBE data.

3. Study factors

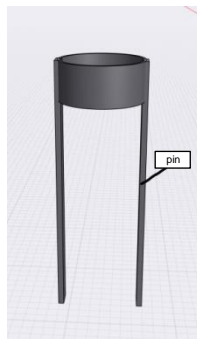
1. Factors affecting seagrass survival
2. How long can seagrass plants survive on their own
3. Materials with properties suitable for equipment creation.
- 4.How to plant seagrass

4.Design equipment for anchor seagrasses

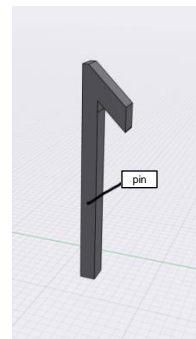
We use shapr3D application for design all type of equipment



type 1



type 2



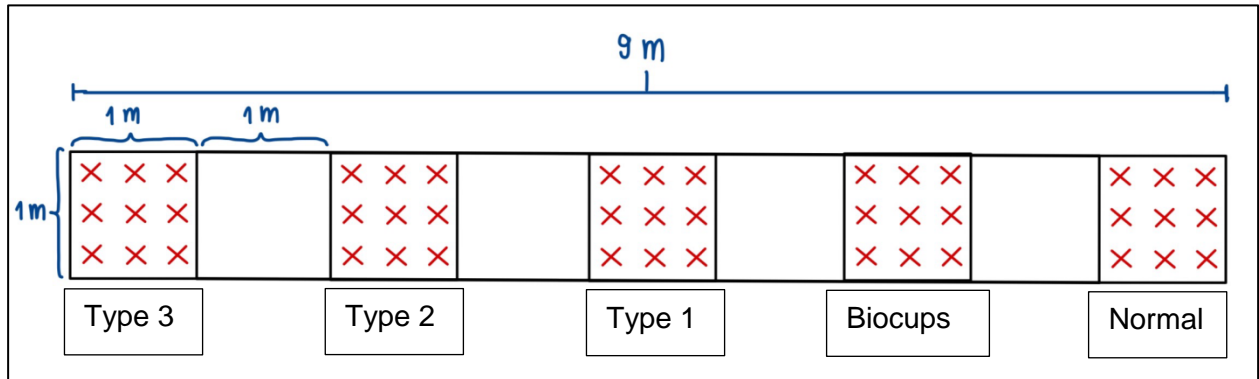
type 3

5. Create equipment for anchor seagrass

1. Create equipment that including by prongs and pins.
2. Cut bamboo into 1-inch cylinders.
3. Create pins, Length 5 inch and width 0.6 inch
4. Create prongs
5. Create equipment 9 piece/type

6. Test the innovation

1. Planting seagrass in the area of Bunkhong Bay at 47 N (x = 532580 , y = 83088)
2. Specify the planting area to be 1x1 meter per plot, totaling 5 plots and in each plot plant 9 seagrass as shown in the picture.



3. Use PVC shovel dig soil
4. lay seagrass in the hole
5. cover with soil
6. cover with the innovation

7. Data collection

1. Study water quality after planting seagrass. Collects data on water temperature, turbidity, water surface temperature, pH and DO of the water.
2. Study soil quality after planting seagrass. Collects data on nitrogen potassium phosphorus and organic matter in the soil.
3. Sent data of water quality and soil quality to GLOBE data.
4. Collect data of survival rate of seagrass after plant for 1 month

Results

1. Study of water quality

The results of water quality before and after planting seagrass in Boon Kong Bay were not different much, but before planting the temperature was slightly higher as shown in table 1

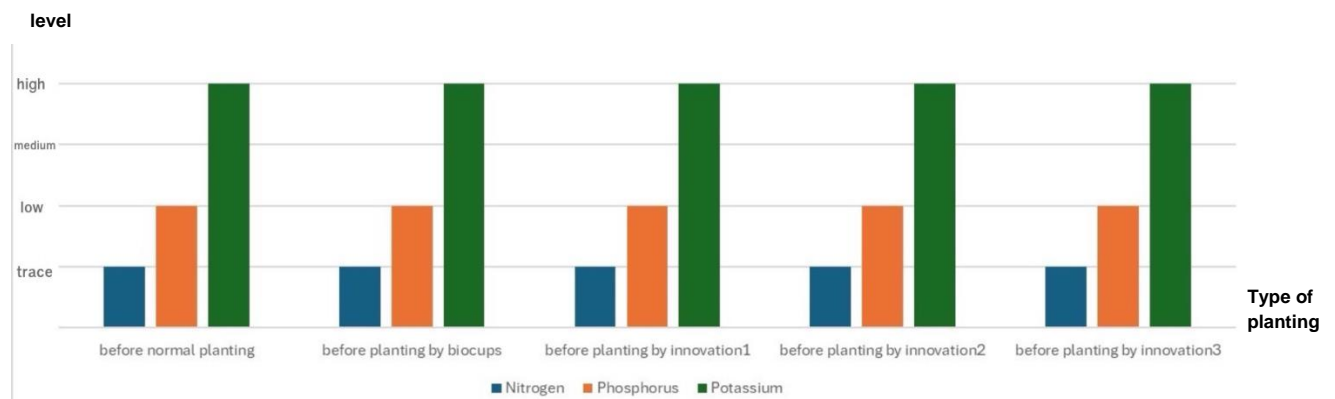
Table 1: results of water quality before and after planting seagrass in Boon Kong Bay.

factors time	Water temperature	Surface water temperature	DO	pH	Turbidity
Before planting	29 ± 00	28.5 ± 00	5.3 ± 0.20	7.8 ± 0.10	9.33±1.52
After planting	27± 00	27.5± 00	5.4 ± 0.50	7.4 ± 0.38	15.66± 4.04

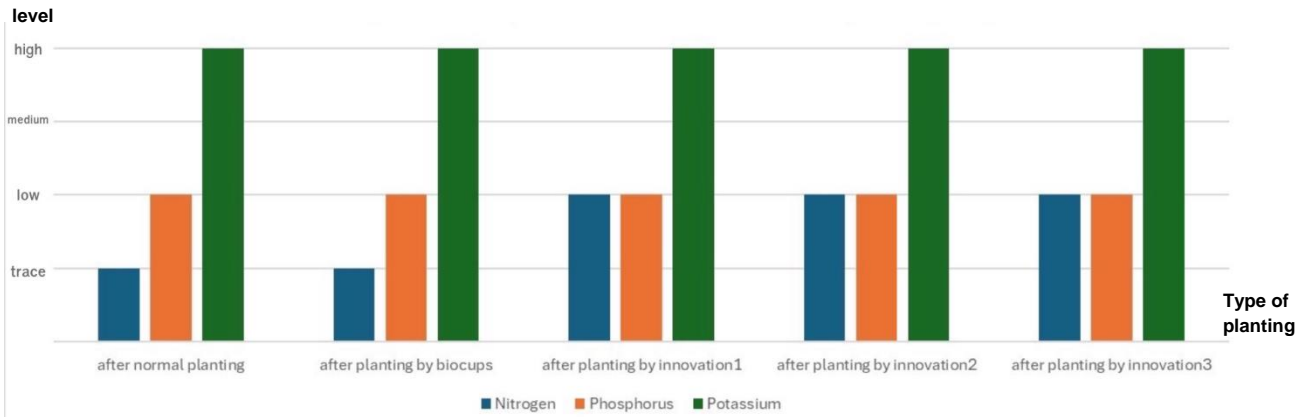
2. Study of soil quality

The quality of the soil after planting, the nitrogen value increased in the experimental set that used all 3 types of planting equipment but organic matter before and after planting seagrass were not different much as shown in graph 1 , graph 2 and graph 3

Graph 1: result of nitrogen phosphorus and potassium values before planting seagrass.

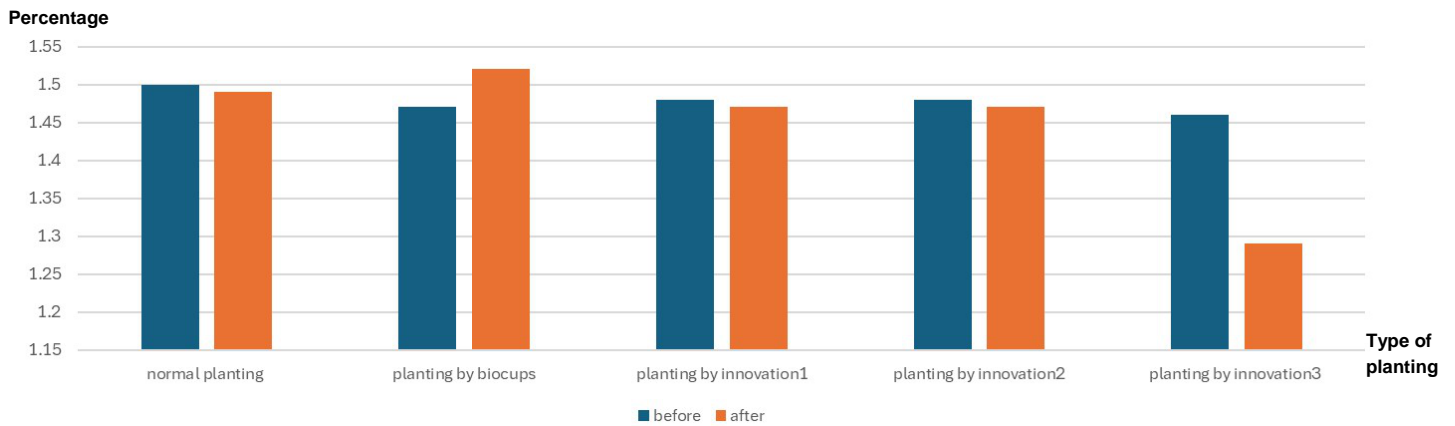


Graph 2: result of nitrogen phosphorus and potassium values after planting seagrass.



note: The soil in the area planted using equipment type 2 has become darker.

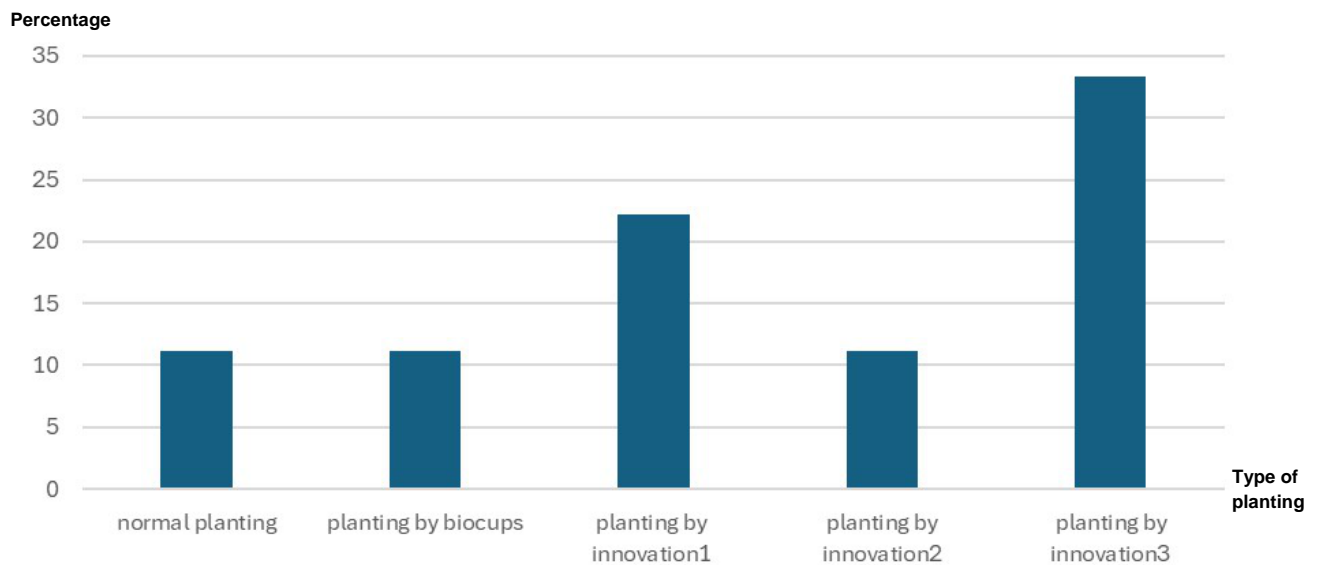
Graph 3 : results of organic matter in the soil before and after planting seagrass.



3. Study of survival rate

From the experiment, it was found that type 3 had the highest seagrass survival rate (33.33%), followed by type 1 (22.22%) and type 2 (11.11%). Seagrass grown using biocups and without equipment, had the same survival rate as type 1, as shown in graph 4

Graph 4 : Comparison survival rates of seagrass grown using different types of equipment and normal planting.



Note : Seagrass have yellow leaf, survival rate is average of each planting plot

Discussion

After planting for 1 month. It was found that seagrass was grown normally, planted with biocups and equipment type 2 has a survival rate of 11.11 percent. Seagrass grown using equipment type 1 has a survival rate of 22.22 percent and seagrass grown using equipment type 3 has a survival rate of 33.33 percent. The soil quality of Bunkong Bay, is an area that plant seagrass in this experiment. The nitrogen content is very low. Low phosphorus content and high potassium content. Very low nitrogen can cause seagrass have yellow leaves. And it was found that the amount of nitrogen grown using all three type of equipment increased. In addition, the water quality and organic matter in the soil before and after planting were not different that much.

Conclusion

Seagrass grown using equipment type 3 has the most survival rate of 33.33 percent, seagrass grown using equipment type 1 has a survival rate of 22.22 percent and seagrass that was grown normally, planted with biocups and equipment type 2 has a survival rate of 11.11 percent. Therefore this equipment can increase the survival rate of seagrass. By the way, should select the area that have environment, water quality and soil quality that suitable for planting seagrass for the most survival rate.

Acknowledgement

We would like to thank Mrs.Patchara Pongmanawut and Mrs.Pacharee Chaipetch for being advisors. Thank you for their suggestions on data collection and experimental design. Thank you for the facilities, equipment provided and information collection are made easier by Bohin's farmstay. And this work was supported by our advisors Princess Chulabhorn Science High School Trang.

Bibliography/Citations

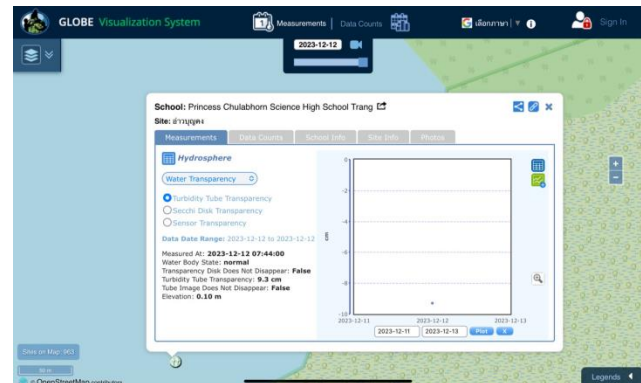
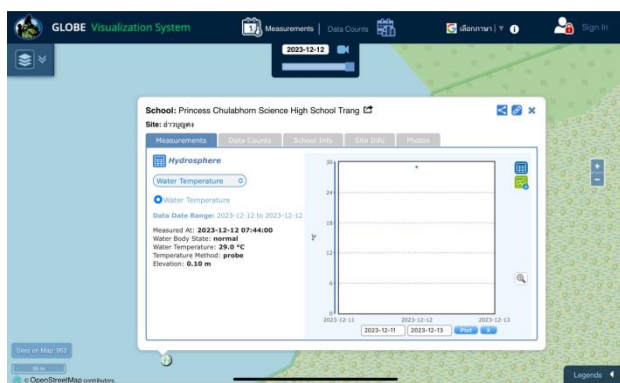
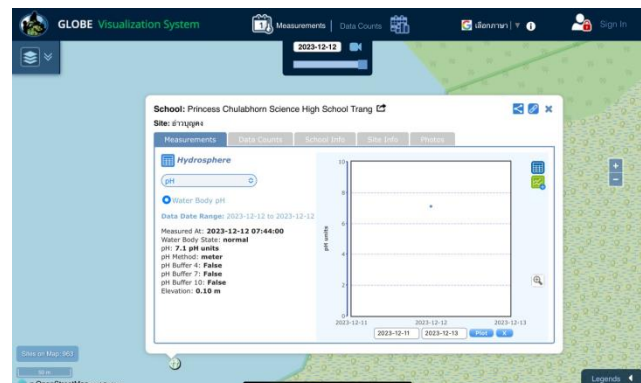
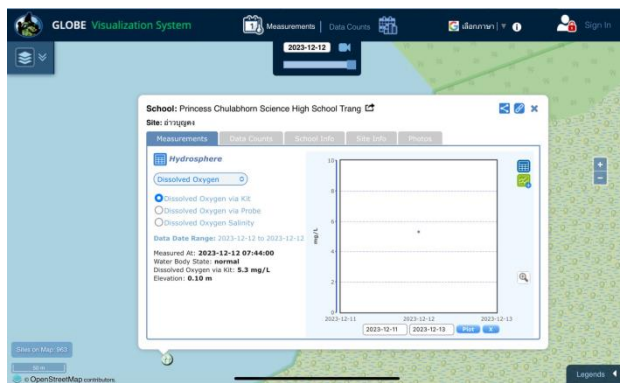
Department of Marine and Coastal Resources. (2014). *Breeding 'seagrass' to revive the degraded area of Phang Nga Bay*. Retrieved on 10 June 2023, from <https://km.dmcr.go.th>

Knowledge base on marine and coastal resources.(2013). Seagrass. Department of Marine and Coastal Resources, Ministry.Natural resources and the environment. Retrieved on 8 June 2023, from <https://km.dmcr.go.th>

Office of the Environment and Pollution Control No. 13 (Chonburi) .(2017). Seagrass in Thailand. Retrieved on 8 June 2023, from <https://www.mnre.go.th>

GLOBE's databases

Hydrosphere data on GLOBE DATA ENTRY



Dissolved Oxygen	
Measured Date:	2023-12-12
Organization Name:	Princess Chulabhorn Science High School Trang
Site ID:	336720
Site Name:	ฮาร์โมนิค
Latitude:	7.51413
Longitude:	99.29629
Elevation:	0.1m
Measured At:	2023-12-12T07:44:00
Water Body State:	normal
Dissolved Oxygen via Kit:	5.3 mg/L

pH	
Measured Date:	2023-12-12
Organization Name:	Princess Chulabhorn Science High School Trang
Site ID:	336720
Site Name:	ฮาร์โมนิค
Latitude:	7.51413
Longitude:	99.29629
Elevation:	0.1m
Measured At:	2023-12-12T07:44:00
Water Body pH:	7.1 pH units
Water Body State:	normal
pH Method:	meter

Water Temperature	
Measured Date:	2023-12-12
Organization Name:	Princess Chulabhorn Science High School Trang
Site ID:	336720
Site Name:	ฮาร์โมนิค
Latitude:	7.51413
Longitude:	99.29629
Elevation:	0.1m
Measured At:	2023-12-12T07:44:00
Water Temperature:	29 °C
Water Body State:	normal
Temperature Method:	probe

Water Transparency	
Measured Date:	2023-12-12
Organization Name:	Princess Chulabhorn Science High School Trang
Site ID:	336720
Site Name:	ฮาร์โมนิค
Latitude:	7.51413
Longitude:	99.29629
Elevation:	0.1m
Measured At:	2023-12-12T07:44:00
Water Body State:	normal
Turbidity Tube Transparency:	9.3 cm

(Optional) Badge Descriptions/Justifications

I am an engineer : This project has used engineering processes in its design and create three types of equipment . Starting from identifying the problem , find a solution , equipment design , create equipment and test equipment .To solve the problem of degradation of seagrass resources and increase the survival rate of seagrass .The increased amount of seagrass can help increase carbon storage and help reduce global warming.

I am a collaborator : Doing this project received cooperation from the community in the planting for restore seagrass .In addition, we received cooperation from schools, teachers, and friends as well.

I make an impact : This project helps to increase the amount of seagrass. Therefore, it is beneficial to help reduce global warming because seagrass can store carbon well. seagrass is also a source of food and habitats for marine animals.