Research title:	Studying the growth and survival rate of oysters *(Crassostrea belcheri)* grown in various media.
Research Team:	Ms.Gunyakorn Chaiyakornrukdee, Ms.Davarika suphitak
Level:	Senior High School
Advisors:	Mrs. Sirikwan Nuphuti
School:	Princess Chulabhorn Science High School Trang

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Abstract

This science project aims to study the effect of different basket materials on the survival rate and growth of oysters (Crassostrea belcheri), which is a popular economic animal in Trang Province because it tastes good and can generate stable income for farmers. Raising oysters in baskets is a popular method, but there is still no clear information on how different basket materials affect the growth and survival rate of oysters. This experiment used 3 types of baskets: plastic baskets, woven wooden baskets, and iron baskets. Forty-five 5-month-old oysters of similar sizes were divided into 5 baskets each. The experiment was repeated 3 times. The average total weight of each basket was approximately 725 grams. The oysters were raised in a natural environment and their growth in terms of length, width, thickness, weight, and survival rate were measured. Water quality, such as temperature, salinity, pH, and TDS were also checked every 2 weeks for 3 months. The results showed that oysters raised in woven wooden baskets had the highest survival and growth rate, followed by those raised in plastic baskets, and those raised in iron baskets had the lowest survival rate. This may be due to the different properties of the materials that affect water flow, plankton adhesion, and sediment accumulation. The results of this research can be applied to select appropriate materials for oyster cultivation to increase the efficiency of cultivation and create sustainable income for farmers in the community.

Keyword: *Crassostrea belcheri*, survival rate, growth rate

Introduction

Oysters (Crassostrea belcheri) are widely popular bivalves because they are highly nutritious, tasty, and provide stable income for farmers. The increasing demand in the market has led to the rapid expansion of oyster farming. Various farming methods have been developed to increase farming efficiency, such as farming in cement ponds, wooden poles, ropes, and baskets.

Trang Province, one of the important oyster farming areas in Thailand, has various methods for farming oysters. In the past, farming was popular using wooden poles, ropes, or farming in cement ponds. However, there is another method that is popular among farmers, which is farming in baskets because it is convenient to manage and take care of. However, baskets used for farming are made from different materials, such as plastic, steel, and wood. Different materials can affect the farming environment, including the survival rate and growth of oysters. However, there is currently no clear research indicating whether different basket materials affect the growth and survival rate of oysters.

For this reason, researchers are interested in studying how different basket materials affect the survival rate and growth of oysters. The materials selected for this experiment were plastic baskets, iron baskets, and woven wooden baskets. In addition, the water quality in the cages used for oyster farming was studied to determine whether the water quality affects the survival rate and growth of oysters. The results of this study will help identify which materials are most suitable for commercial oyster farming, as well as whether the water quality in the cages affects the survival rate and growth of oysters. The data obtained can be used to support farmers in the community to farm oysters more efficiently and sustainably.

Objective

- Study the survival rate and growth of oysters grown in different materials
- Study the water quality values in the cages that affect the survival rate and growth of oysters

Research Questions

- Do oysters raised in different media have different survival and growth rates?
- Does the water quality in the cages affect the survival and growth rates of oysters?

hypothesis

- Oysters grown in different materials have different survival and growth rates. Oysters grown in woven baskets have the highest survival and growth rates.
- Water quality in the cages is within the standard range and allows the oysters to grow to their full potential.

Research Scope

1. Variable

Independent variables Type of oyster culture media

Dependent variables Survival rate and growth of oysters

Control variables Size and age of oysters at the beginning of the experiment

    2. Operation duration September 2567 - November 2567

Materials and Methods

1. Materials and equipments

       1.1 Oyster baskets (plastic/iron/woven wood) 3 baskets each

       1.2 Oysters of similar size and age, 45 pieces

       1.3 Oyster cages sized 2x3 meters

       1.4 Vernier caliper

       1.5 Electric scale

       1.6 Salinity meter

       1.7 TDS meter

       1.8 universal indicator

       1.9 Thermomiter

2.Study site

Figure 1 shows the study area of Ban Tae Ram, Kantang, Trang Province.

Coordinates 7°18'53"N 99°29'34"E

3. Operation duration

    Fieldwork was conducted to record data on the survival rate and growth of oysters by measuring the length, width, thickness and weight of the oysters every 2 weeks for a period of 3 months from September 2024 to November 2024.

4. methodology

4.1. Preparing cages for oyster farming

   - Prepare 1 cage for oyster farming, size 2x3 meters.

   - Create a rail for hanging the oyster basket using PVC pipes, totaling 9 points, with each
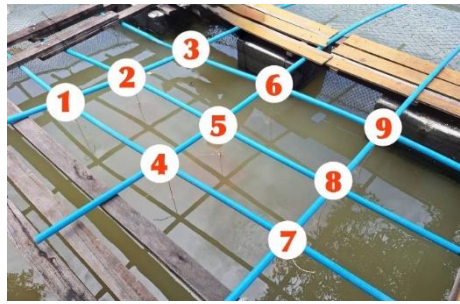
point having the same distance apart.

Figure 2 shows the characteristics of the cages used for oyster farming.

4.2. Preparing Oysters

- Select 45 oysters of 5 months old with similar size (each weighing approximately 145 grams)

- Measure the width, length, thickness and weight of the oysters at the beginning of the experiment and record them.

4.3. Preparing baskets for oyster farming

- Prepare plastic baskets, woven baskets, iron baskets, size 28.5 x 17 x 12 cm., 3 baskets of each type.

- Tie the prepared baskets with ropes at the 4 corners for hanging. Set the rope length to be approximately 60 cm. the same for each basket so that the bottom of each basket is at the same depth.

- Divide the selected oysters into baskets, 5 pieces per basket, 3 baskets of each type. On average, the weight of each basket is approximately 725 grams.

4.4. Oyster cultivation and growth data collection

- Place the prepared oyster basket into the cage and let the oysters grow naturally.

- Collect data on the number of oysters that survive, measure the length, width, thickness and weight of the oysters every 2 weeks for 3 months.

4.5. Water quality data collection

- Measure the temperature of the water in the cage using a thermometer. Collect data every 2 weeks.

- Measure the pH of the water in the cage using a universal indicator. Collect data every 2 weeks.

- Measure the salinity of the water in the cage using a salinity meter. Collect data every 2 weeks.

- Measure the TDS of the cage using a TDS meter. Collect data every 2 weeks.

4.6. Data Analysis

- After 3 months, calculate the weight, length, thickness and width of the oysters into volume and compare the volume at the beginning of the experiment with the volume after the experiment in each type of basket.

- Compare the survival rate of oysters in each basket material.

- Analyze the water quality values that affect the survival rate and growth of oysters.
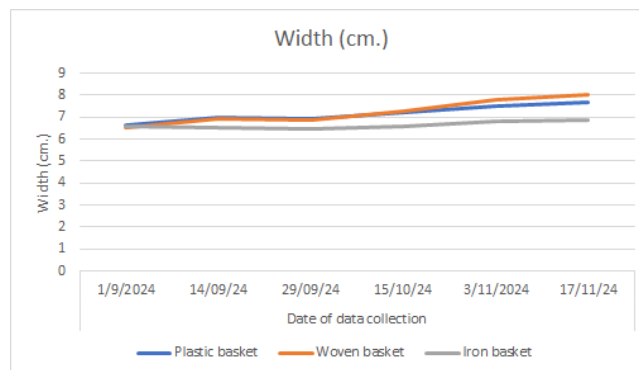
Result

1.Results of the study on the growth of oysters

Chart 1.1 shows the change in length of oysters in different baskets.
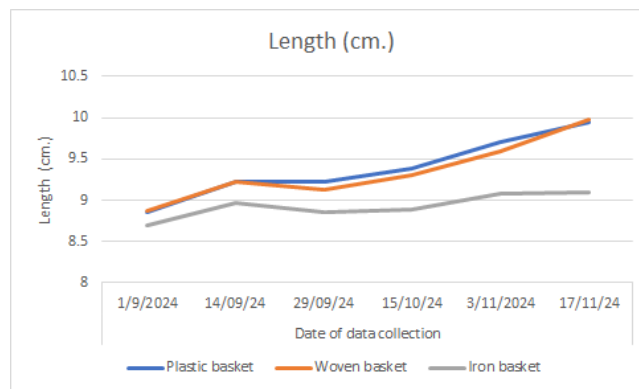
From Chart 1.1, it was found that oysters grown in woven baskets had the highest length increase, followed by oysters grown in plastic baskets and iron baskets, respectively.

Chart 1.2 shows the variation in width of oysters in different basket types.

From Chart 1.2, it was found that oysters grown in woven baskets had the greatest increase in width, followed by oysters grown in plastic baskets and iron baskets, respectively.

Chart 1.3 shows the variation in thickness of oysters in different baskets.

Thickness (cm.)

From Chart 1.3, it was found that oysters grown in woven baskets had the grea test increase in width, followed by oysters grown in plastic baskets and iron baskets, respectively.

Chart 1.4 shows the change in volume of oysters in each type of basket.
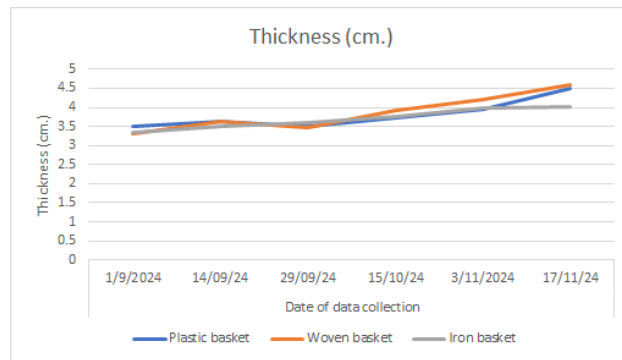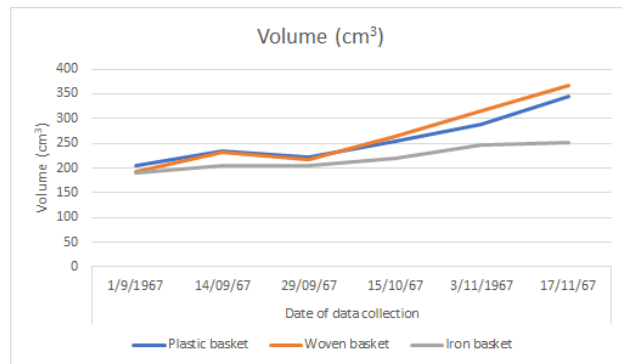

Volume (cm³)

From Chart 1.4, it was found that oysters grown in woven baskets had the highest volume increase, followed by oysters grown in plastic baskets and iron baskets, respectively.

Chart 1.5 shows the change in weight of oysters in each type of basket.

Volume (cm³)
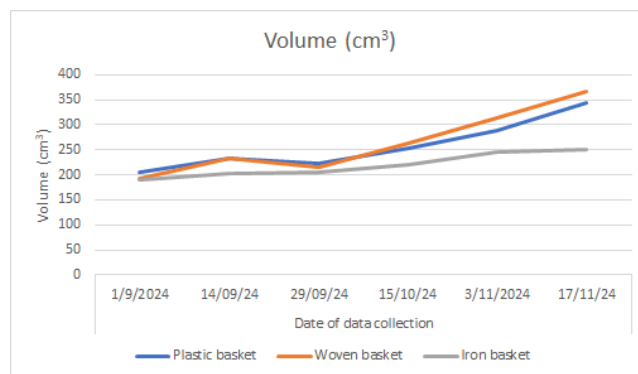
From Chart 1.5, it was found that oysters grown in woven baskets gained the most weight, followed by oysters grown in plastic baskets and iron baskets, respectively.

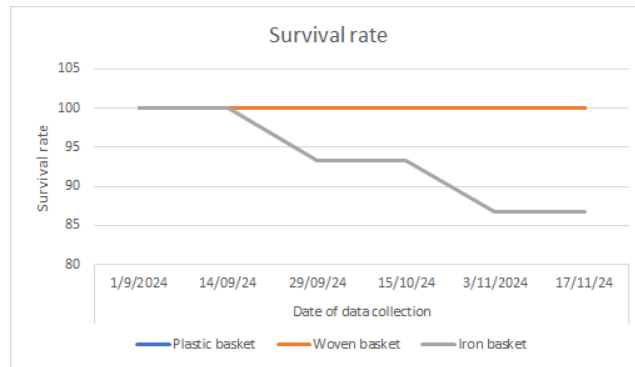**Chart 1.6 s**hows the survival rate of oysters in each type of basket.

From Chart 1.6, it was found that oysters grown in woven baskets and plastic baskets had a survival rate of 100%, while oysters grown in iron baskets had a survival rate of 86.67%.

External appearance of oysters

Figure 3 shows the characteristics of oysters in plastic baskets. It was found that the oyster shells had moderate porosity.

Figure 4 shows the appearance of oysters in a woven basket. It was found that the oyster shells have few pores and are rather smooth.

Figure 5 shows the appearance of oysters in an iron basket. It was found that the oyster shells are very porous.

2. Water quality study results

Chart 2.1 shows the salinity of water around the cages.
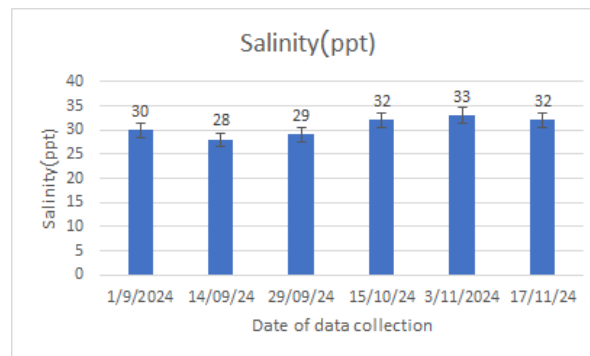
From Chart 2.1, it was found that the salinity of the water around the cages was within the standard range (28-33 ppt).

Chart 2.2 shows the TDS value of water in the cage area.
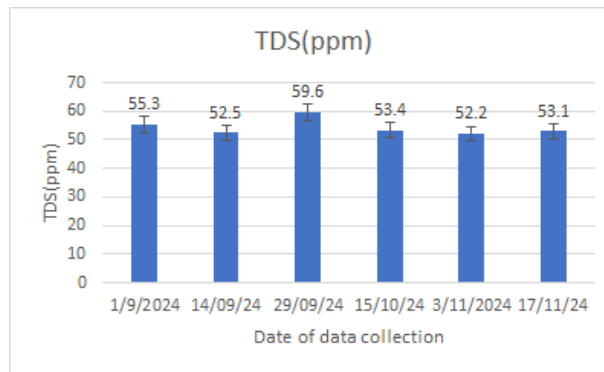
From Chart 2.2, the TDS value of the water in the cage area is low, indicating that the water in the cage area is of high quality.

Chart 2.3 shows the water and air temperature values around the cages.
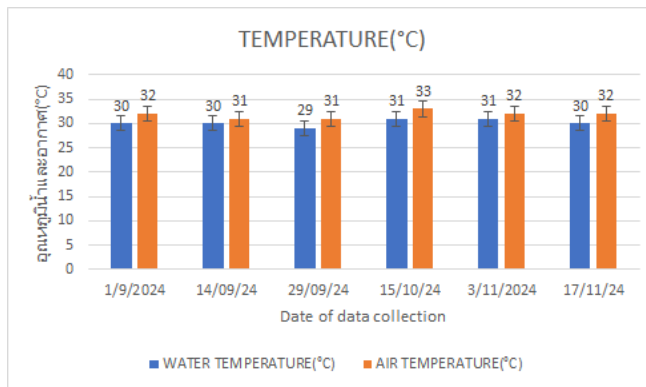
From Chart 2.3, it was found that the water temperature in the cage area was within the standard range (water temperature must not be more than 3 degrees Celsius different from natural air temperature).

Chart 2.4 shows the pH value of the water in the cage area.
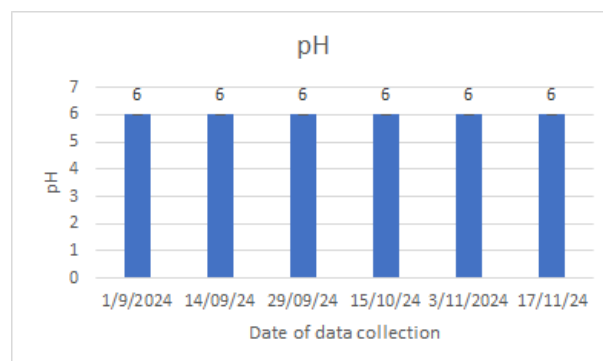
From Chart 2.4, it was found that the pH value of the water around the cages was within the standard range (5.0-9.0).

Summary and discussion

From the study of oyster farming in various basket materials, namely woven baskets, plastic baskets and iron baskets for 3 months (September-November 2024), it was found that the woven basket resulted in the highest growth and survival rate of oysters. The volume of the oysters in the woven basket increased by 175.17 sq. cm., the weight increased by 21.82 grams and the survival rate was 100%. The next was the plastic basket, which increased the volume by 139.73 sq. cm., the weight increased by 16.29 grams and the survival rate was 100% as well. The iron basket had the least growth, the volume increased by only 61.35 sq. cm., the weight increased by 10.17 grams and the survival rate was 86.67%. In terms of the properties of the basket material, the woven basket has the ability to absorb water, allowing the water to circulate well, reducing the reflection of water currents, resulting in the distribution of oxygen thoroughly, which helps the oysters grow fully. In addition, the surface of the wood has a suitable level of roughness, allowing the oysters to adhere well and reducing the loss of energy from movement. Plastic basket Although the survival rate is equal to that of the woven basket, the growth rate is lower because plastic is a material that cannot absorb water, causing the circulation of water and oxygen to be incomplete. In addition, the plastic is slippery, making it harder for the oysters to adhere. The iron basket has the lowest growth and survival rate because iron is a material that conducts high heat, causing the water temperature to change rapidly, which increases stress for the oysters. In addition, the smooth and slippery surface of the iron makes it difficult for the oysters to adhere, and rust can be harmful to the oysters.

Oyster appearance Oysters raised in woven baskets have smooth shells with slight porosity, indicating good growth and health. While oysters in plastic baskets have shells with moderate porosity, and oysters in iron baskets have rough shells with many porosity, indicating incomplete growth and possible stress from the environment.

The results of the water quality test showed that the salinity (30.6±1.9ppt), TDS (54.4±2.7ppm), water temperature (30.2±1.0℃), and pH (6) were within the standard range, suitable for oyster farming. However, the temperature changes caused by different basket materials affect the growth of the oysters. In particular, the iron basket, which causes rapid temperature changes, is detrimental to oysters. From the experimental results, it can be concluded that woven wooden baskets are the most suitable material for oyster farming because they promote the growth and

survival rate of oysters the best. Oysters have an average change in length, width and thickness of 3.5-4.5 millimeters per month, which is higher than the research of Manop Mitsomwang (1989) who studied the cultivation of white-lipped oysters using net cages. The results of the study found that oysters have a change in length, width and thickness of 2-3 millimeters per month, followed by plastic baskets. Iron baskets are not recommended for farming because they affect the health and growth of oysters. This information can be used to promote farmers to increase the efficiency of commercial oyster farming.

Acknowledgments

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Badge

I am a Collaborator: This research would not have been completed if we had done it alone. In this research, we collaborated with local oyster farmers to collect data directly from them, and the local farmers helped us with oyster farming methods. After we completed the data collection,

we talked to receive feedback from Ms. Siriwan Nooputthi, the project advisor, Ms. Patchara Phongmanawut, the special advisor, and many other experts. These feedbacks allowed us to further develop this research. With everyone's help, this project was completed.

I am a data Scientist: Throughout the operation period from September 2024 to November 2024, we collected data on the survival rate and growth of oysters every 2 weeks by measuring the width, length, thickness, and weight of the oysters. We also measured other factors that affected the growth of oysters, which was water quality. We measured the salinity, conductivity, pH, and water temperature. Using the GLOBE measurement method, measurements are made every 2 weeks. We record the water quality data studied on the GLOBE website every time we go to the field to collect data.

I make an Impact: Oyster farming Many times, farmers have to face the problem of oyster death or poor oyster growth. These problems have a great impact on farmers. However, our research has studied which materials give the best survival and growth rates for oysters. The results of the study found that woven wood gives the best survival and growth rates for oysters. This study can be further developed for local farmers to reduce losses for farmers and increase the efficiency of oyster farming.

Appendix A

Oyster growth data

Table A.1 Oyster size data as of 01/09/2024

No.	Plastic basket			Woven basket			Iron basket		
	length	Width	Thickness	length	Width	Thickness	length	Width	Thickness
1	8.7	6.6	3.1	8.7	7.2	3.5	7.8	7.2	2.7
2	8.2	7.2	3.4	8.6	6.4	2.7	7.6	6.3	3
3	8.5	7.3	4.1	8.9	6.1	2.9	8.7	6.5	3.6
4	9.3	6.5	3.5	8.9	6.3	3.2	8.2	6	4
5	9.3	5.8	4	9	7.1	2.7	9.6	7.3	4.7
6	9.7	5.6	3.6	9	6.3	3.2	8.5	6.1	4
7	7.6	5.4	4.4	7.9	6.3	2.8	8.4	6.2	3.7
8	9	7.1	3.8	8.9	6.2	2.9	9.4	6.5	3.4
9	9.3	6	3.6	8.9	5.8	3.2	8.9	6	2.2
10	9.5	7.6	2.8	9.4	6.6	2.9	8.6	6.2	4.1
11	8.5	7.6	2.2	8.4	6.8	3.1	8.9	8.2	2.8
12	7.9	6.9	2.4	8.3	6.5	3.3	10.2	5.8	4.6
13	8.9	6.7	4.4	8.7	6.5	2.9	8.7	7.7	2.4
14	9.2	6.5	4.5	9.3	6.2	3.4	9.5	6.7	2.2
15	9.3	6.6	2.6	10.1	7.4	3.3	7.5	5.5	2.7

Table A.2 Oyster size data as of 14/09/2024

No.	Plastic basket			Woven basket			Iron basket		
	length	Width	Thickness	length	Width	Thickness	length	Width	Thickness
1	8.7	7	2.5	9.4	7.1	3.7	7.9	7.2	3.3
2	8.7	8	3.3	9.2	6.9	3.6	7.6	5.5	2.8
3	9.2	8.5	5	9.5	6.6	3.2	8.9	6.7	3.5
4	10	7.4	4	8.7	6.7	3.6	8.5	6.1	4.5
5	9.4	5.8	3.7	8.7	6.9	3.2	10.7	6.8	4.7
6	10.5	6	3.5	9.8	6.8	3.6	8.9	5.4	3.8
7	7.8	6	4.1	8.4	6.4	3.3	8.6	6.4	4.2
8	8.9	7.2	4.3	8.3	6.7	3.6	9.8	6.9	3.3
9	9.8	6.4	3.7	8.6	6.7	3.9	9.1	6.2	2.4
10	9.7	8	2.9	9.8	6.1	3.2	8.9	6.1	3.8
11	8.6	7.1	2.7	9.3	7.1	3.7	9.1	8.6	2.7
12	8.2	6.8	2.5	8.7	7.2	3.4	10.7	6.1	5
13	9.9	6.8	5.2	8.8	7.5	3.4	8.6	6.8	2.7
14	9.3	6.7	3.9	9.7	6.7	3.3	9.5	6.7	2.8
15	9.7	6.1	3.2	10.2	7.4	3.6	7.8	6.1	2.8

Table A.3 Oyster size data as of 29/09/2024

No.	Plastic basket			Woven basket			Iron basket		
	length	Width	Thickness	length	Width	Thickness	length	Width	Thickness
1	8.4	6.8	2.3	9.3	7.3	3.5	8.7	7.2	3.1
2	8.4	8.2	4.1	9.4	6.8	4	7.8	5.6	3.6
3	9.3	7.3	5.7	9	6.9	3.5	9.3	6.3	5.6
4	9.9	6.9	3	8.6	6.3	3.4	9.2	6	4.2
5	9.2	5.4	3.8	8.2	7	2.5			
6	10.5	5.8	4	9.2	6.5	3.2	8.9	6.1	3.8
7	7.8	6	2.9	8.7	6.2	3.9	8.6	6.6	4
8	9.6	7.1	4.9	8.5	6.4	3.2	9.8	6.7	3.3
9	9.9	6.3	3.4	9.1	6.7	3.7	9.7	6	3.4
10	10.3	8.5	2.8	9.8	6.6	3.3	9.4	6.4	3.5
11	8.7	7.3	2.4	8.7	6.3	3.5	9.3	7.9	3.4
12	9.6	6.8	3.9	8.9	7.1	3.2	10.9	6.5	5
13	7.8	7.4	2.4	9.7	6.9	3.6	9.2	7.4	3.5
14	9.5	7	3.8	9.5	7.2	3.4	9.7	5.9	3.5
15	9.6	6.7	3.1	10.2	7.4	3.1	8.9	5.5	3.7

Note: Red boxes are dead oysters.

Table A.4 Oyster size data as of 15/10/2024

No.	Plastic basket			Woven basket			Iron basket		
	length	Width	Thickness	length	Width	Thickness	length	Width	Thickness
1	8.3	7.4	2.5	9.8	7.5	3.7	8.5	6	4.6
2	9.7	8.5	4.6	8.9	7.2	4.2	7.7	6.2	3.3
3	9.5	9.3	5.5	8.9	7.1	3.6	8.8	6.3	5.6
4	10.7	7	4.7	8.4	7.9	3.9	8.3	8	3
5	9.5	6	4.2	8.7	7.5	3.6			
6	10.5	5.4	4	9.7	6.8	3.5	9	6.1	3.9
7	8	6.1	3	8.6	6.9	4.2	8.5	6.3	4.1
8	9.3	7.7	4.9	8.8	6.7	3.6	9.8	6.9	2.5
9	9.7	6.2	3.5	8.9	6.4	3.5	9	6.1	4.4
10	9.7	8.8	3	10.3	7.3	3.7	8.7	6.3	2.8
11	8.7	7.7	2.6	8.8	6.9	3.2	8.6	8.4	6
12	9.4	6.4	4.3	8.9	7.2	3.4	10.8	6.2	2.8
13	8.1	7	2.3	8.9	7.5	3.5	9.5	7.6	2.9
14	10.1	8	3.9	10.2	7.6	2.9	9.4	6.3	3.7
15	9.6	7.1	2.8	10.1	7.5	3.9	7.8	5.3	2.9

Note: Red boxes are dead oysters.

Table A.5 Oyster size data as of 3/11/2024

No.	Plastic basket			Woven basket			Iron basket		
	length	Width	Thickness	length	Width	Thickness	length	Width	Thickness
1	9.2	8.4	3.6	10.4	7.8	4	8.8	6.1	4.7
2	9.7	8.5	4.6	9.3	7.6	4.5	7.7	6.2	3.7
3	9.6	9.3	5	9.6	7.4	4.1	8.8	6.8	5.9
4	10.8	7.3	4.7	9.6	8.2	4.4	8.4	7.3	3.1
5	9.5	6	4.2	8.8	7.7	4.3	RED	RED	RED
6	10.5	5.8	4	10.4	7.2	3.8	9	6.2	4.3
7	8	6.2	3	8.8	7.1	4.6	9.1	6.6	4.1
8	10	8	5.4	9.1	7.1	3.9	10	7.2	2.7
9	10	6.3	3.5	9.3	6.8	4.2	RED	RED	RED
10	10	9.1	3	10.7	7.8	4.1	8.7	6.4	2.9
11	9.2	7.7	2.8	9.4	7.2	3.6	9	8.6	6.4
12	9.5	6.7	5	9.3	7.5	3.7	11.1	6.2	3.2
13	8.5	7.2	2.5	9.4	8	3.8	10	8.6	3.4
14	11	9	4.4	10.7	7.8	3.4	9.7	6.8	3.9
15	10.1	7.3	3.4	10.8	7.6	4.5	7.8	5.4	3.5

Note: Red boxes are dead oysters.

Table A.6 Oyster size data as of 17 /11/2024

No.	Plastic basket			Woven basket			Iron basket		
	length	Width	Thickness	length	Width	Thickness	length	Width	Thickness
1	9.3	8.2	3.7	10.6	8.2	4.4	8.7	6.1	4.8
2	10.2	9.2	5.3	9.6	7.9	4.9	7.6	6.3	3.5
3	9.4	9.5	4.9	10	7.9	4.6	8.9	6.7	5.7
4	11.5	7.5	5	9.9	8.6	4.8	8.2	7.5	3.2
5	10.1	6.3	4.5	10.1	8.1	4.7	RED	RED	RED
6	10.7	6.1	4.3	10.6	7.4	4.3	9.1	6	4.5
7	8.2	6.5	3.1	8.9	7.5	5.1	9.2	6.5	4.2
8	10.2	8.3	5.6	9.3	7.9	4.2	10.1	7.3	3
9	10.3	6.2	3.7	9.3	7.4	4.6	RED	RED	RED
10	10.2	9.3	3.3	10.8	8.3	4.6	8.6	6.5	2.8
11	9.4	7.9	3	9.6	7.7	4	9.2	8.8	6.3
12	9.7	6.9	5.2	9.5	8.2	4.3	11	6.4	3.2
13	8.6	7.1	2.8	9.6	8.5	4.4	10.1	8.9	3.5
14	11.1	9.2	4.5	10.7	8.2	3.9	9.6	6.9	3.9
15	10.2	7.2	3.5	11	8.2	4.5	8	5.5	3.6

Note: Red boxes are dead oysters.

Table A.7 Oyster weight data as of 01/09/24-29/09/24

No.	1/9/2024			14/09/2024			29/09/2024		
	Plastic basket	Woven basket	Iron basket	Plastic basket	Woven basket	Iron basket	Plastic basket	Woven basket	Iron basket
1	134.76	128.59	132.45	136.34	130.78	133.54	135.67	131.22	132.45
2	148.17	142.34	122.3	144.23	145.66	123.56	144.22	142.33	121.33
3	166.2	131.22	139.43	164.86	133.39	141.22	162.34	131.23	140.97
4	140.96	137.85	146.92	141.58	140.98	147.89	142.39	139.87	144.53
5	159.55	143.58	143	155.39	147.94	144.89	156.78	148.65	145.67
6	145.67	143.56	144.57	143.58	145.65	142.67	140.12	143.22	143.56
7	135.41	137.85	140.71	132.09	141.33	139.42	133.78	139.97	138.76
8	150.34	148.77	137.5	147.31	151.23	137.89	145.79	150.98	135.24
9	136.7	131.24	151.78	134.31	135.32	152.33	135.86	133.42	154.79
10	140.93	142.5	141.25	138.76	144.3	142.37	138.9	134.22	145.67
11	146.7	151.32	131.24	144.34	156.4	133.4	142.34	157.78	134.29
12	138.98	142.22	153.46	133.2	144.55	152.57	131.57	144.55	151.78
13	147.88	143.34	128.26	143.21	146.43	130.23	144.17	148.53	132.67
14	152.33	141.37	143.22	149.22	143.54	141.67	148.91	147.86	138.97
15	157.89	151.34	145.67	159.2	157.65	147.38	157.32	159.32	150.78

Note: Red boxes are dead oysters.

Table A.8 Oyster weight data as of 15/10/24-17/11/24

No.	15/10/2024			3/11/2024			17/11/2024		
	Plastic basket	Woven basket	Iron basket	Plastic basket	Woven basket	Iron basket	Plastic basket	Woven basket	Iron basket
1	136.78	133.56	134.89	138.78	138.67	138.76	143.57	143.56	136.78
2	143.22	144.57	123.67	144.32	147.88	125.34	151.23	153.23	125.67
3	163.78	135.67	141.23	165.78	139.97	142.34	168.23	143.79	143.22
4	144.35	137.67	147.89	146.52	145.63	146.78	155.78	152.44	144.32
5	153.24	146.89	🟥	155.44	149.08	🟥	157.85	146.78	🟥
6	141.23	144.56	147.89	142.38	149.51	149.78	145.57	155.67	152.3
7	133.98	140.76	143.44	135.89	147.64	145.67	140.98	152.89	142.3
8	147.67	151.32	139.8	148.67	155.64	143.23	153.46	154.32	140.25
9	133.34	135.89	159.76	135.63	139.87	🟥	137.89	138.78	🟥
10	139.9	137.76	149.67	140.32	143.57	152.32	143.65	145.67	151.32
11	144.67	155.67	136.75	146.78	162.31	143.23	150.98	160.76	141.22
12	130.98	147.86	147.54	133.24	152.31	152.13	139.67	154.32	150.67
13	144.67	150.98	130.54	146.97	156.76	134.23	148.76	155.78	134.87
14	149.87	145.23	137.54	151.23	149.76	139.87	156.76	153.67	136.8
15	156.43	161.21	152.5	159.67	165.43	154.23	164.54	169.8	153.98

Note: Red boxes are dead oysters.

Appendix B

Operational Image
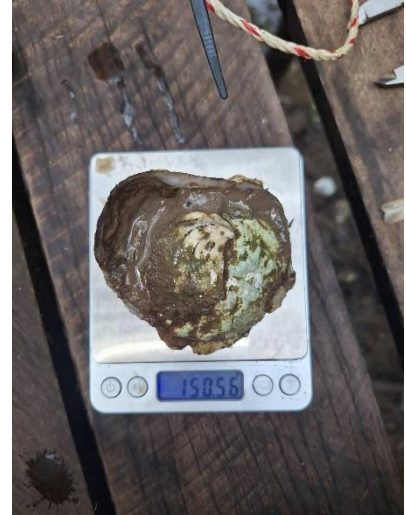
Data transmission using GLOBE data entry