



Challenges in Increasing Catch in Minamata Bay

Minamata H.S
Team M.B. Oysters Project



1 : Background

Fish Catch Decrease in Minamata

1 : Poor Sales ⇒ Decrease Fishermen

2 : Change of Marine Environment

Dredging (浚渫) & Reclamation (埋立) ⇒

Current(海流) & Mudflats(干潟) & Fish Kinds(魚種) ⇒ Change

3 : Decrease of Nutrients(栄養塩) in Water

= DIN(溶存無機三態窒素)

2. Our research (2016-2021)

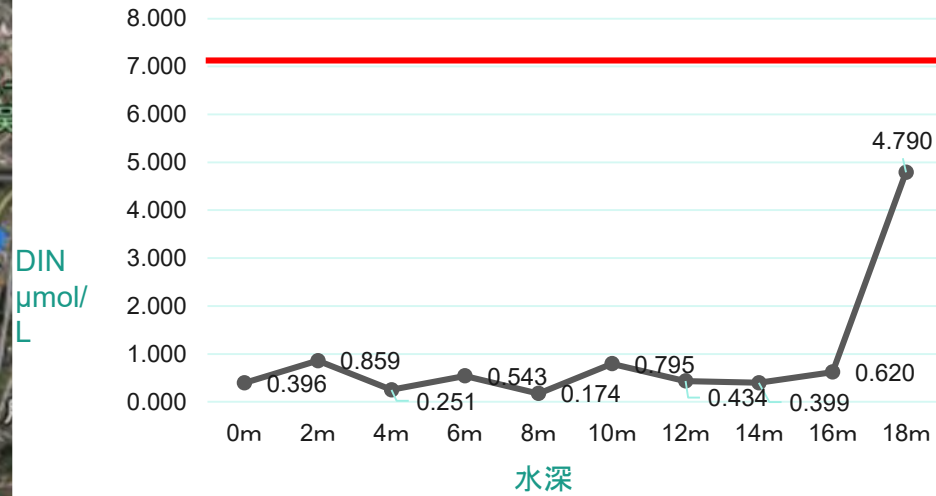
Hypothesis :

Shortage of Dissolved Inorganic Nitrogen in water Affects the Decrease in Fish Catch

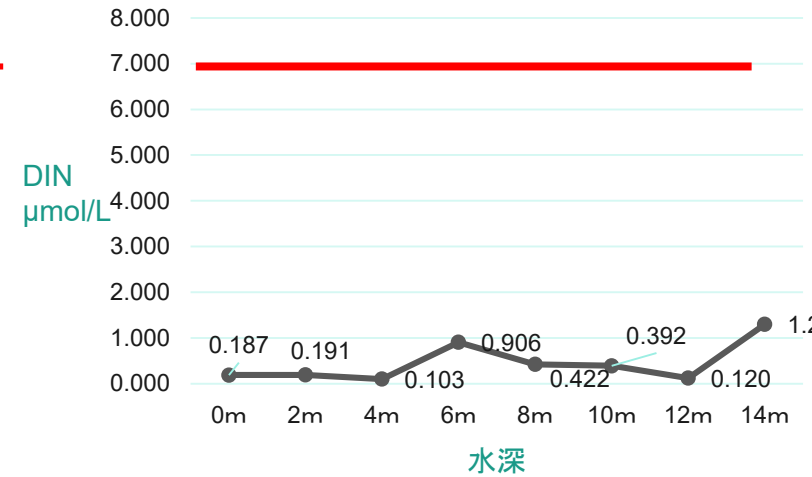
DIN Sampling Results (2019/7/29)



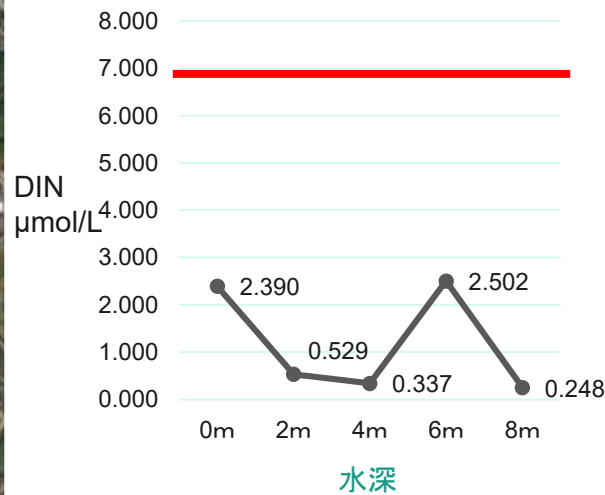
St.1 裸瀬



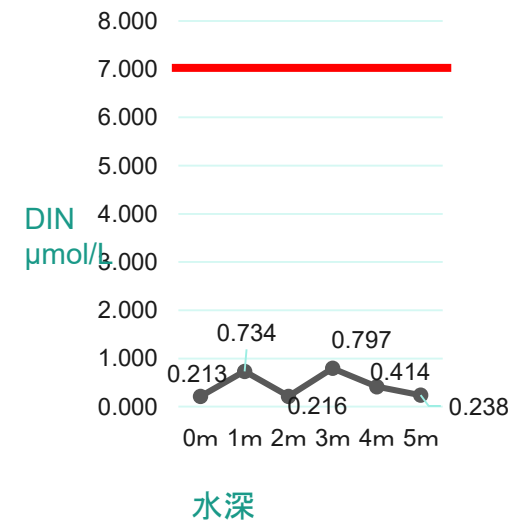
St.2 湾央



ST.3 恋路島



St.4 袋湾入口



Demonstration of Hypothesis #1:

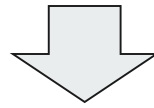
Decrease in **Fish Catch?**

Not Enough **Plankton Growth**

Shortage of **DIN**

Research Theme:

**Unstable Oyster Catch by Minamata
Fishery Co-op**



**Where is the most suitable place
for oyster farming in Minamata
Bay?**

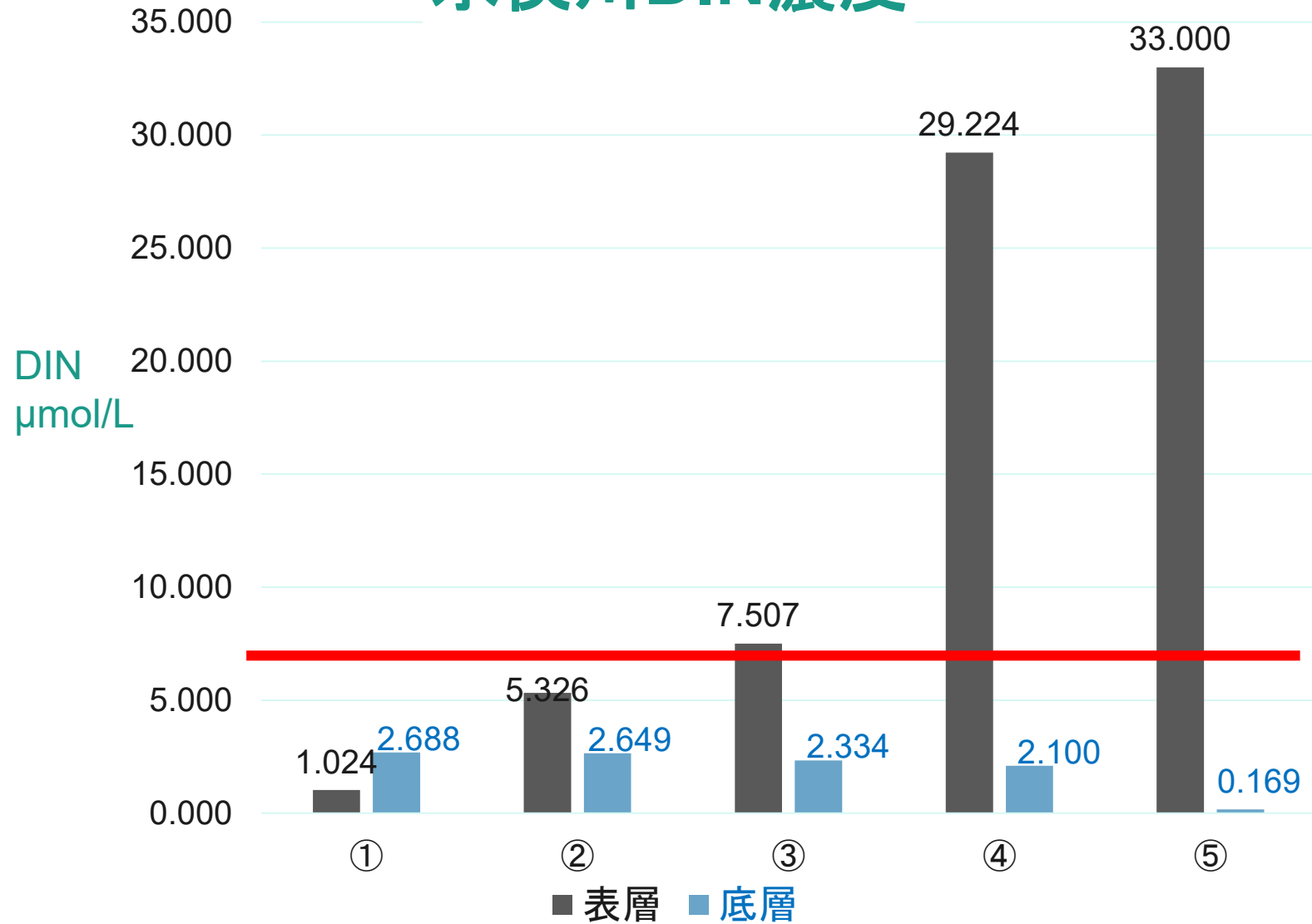
DIN Sampling in Minamata River (2019/10/11)

水俣川DIN濃度



Depth;

- ① 2 m
- ② 1.5 m
- ③ 1.2 m
- ④ 3 m



< 3 Possible Oyster Farms >

M. River (Expected High DIN)

Marushima

Fukuro (M. Coop Oyster Farm)



Procedures :



Oyster Basket

Randomly Selecting Oysters





Count Dead Oysters



Remove Barnacles



Size Measurement



Size Measurement



Period :

every month May, '21 - Feb, '22

(5/17 6/11 7/9 8/20 9/10 10/15)

Feb: Shucked Shellfish Weight Measurement

(殻なし)

**Final
Assessment:**

Shucked Weight (g)
Total Weight(g)

Mid Term Assessment:

(May~Oct. 2021)

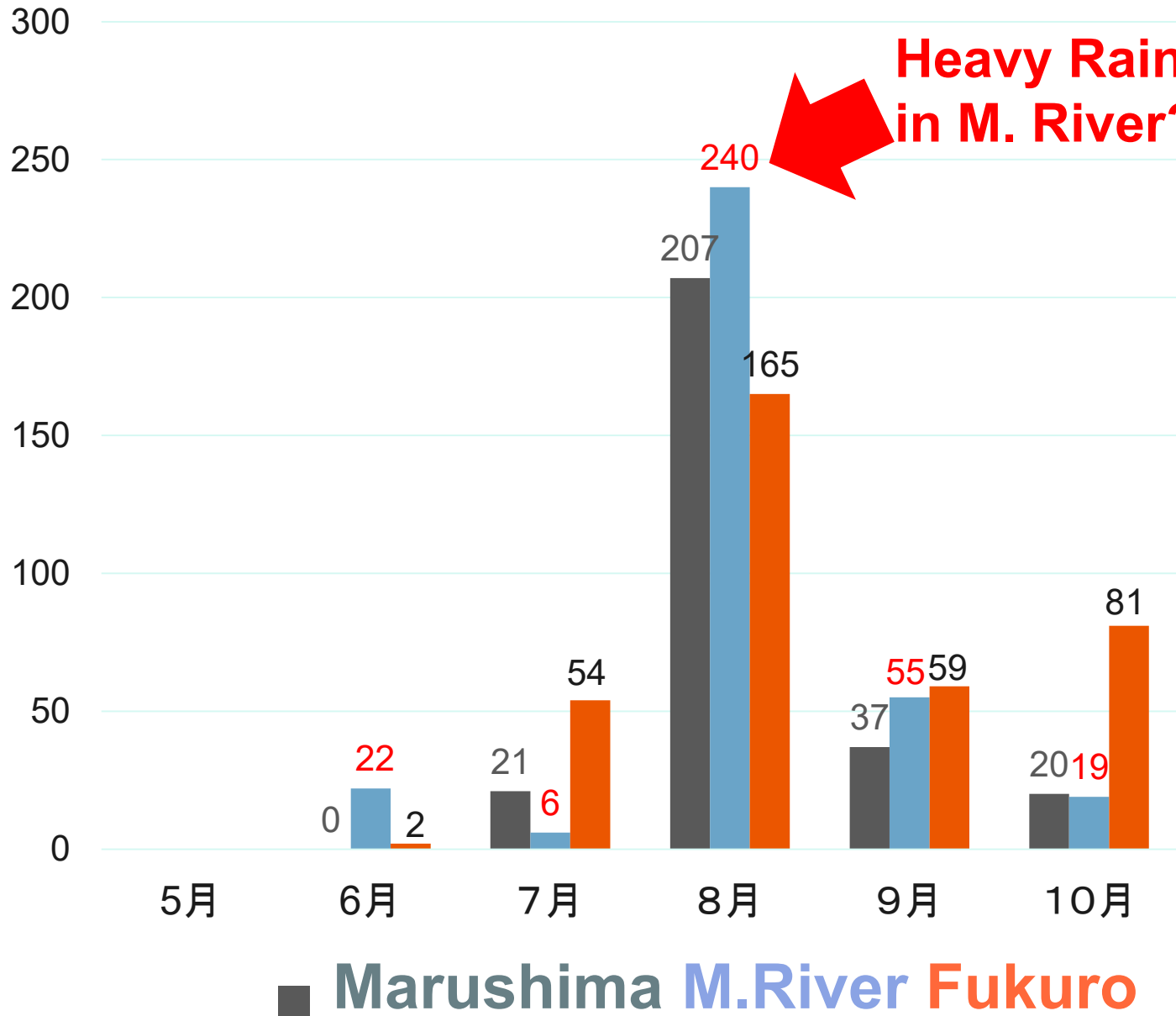
Size

【L(cm) · W(cm) · T(cm) + Weight】

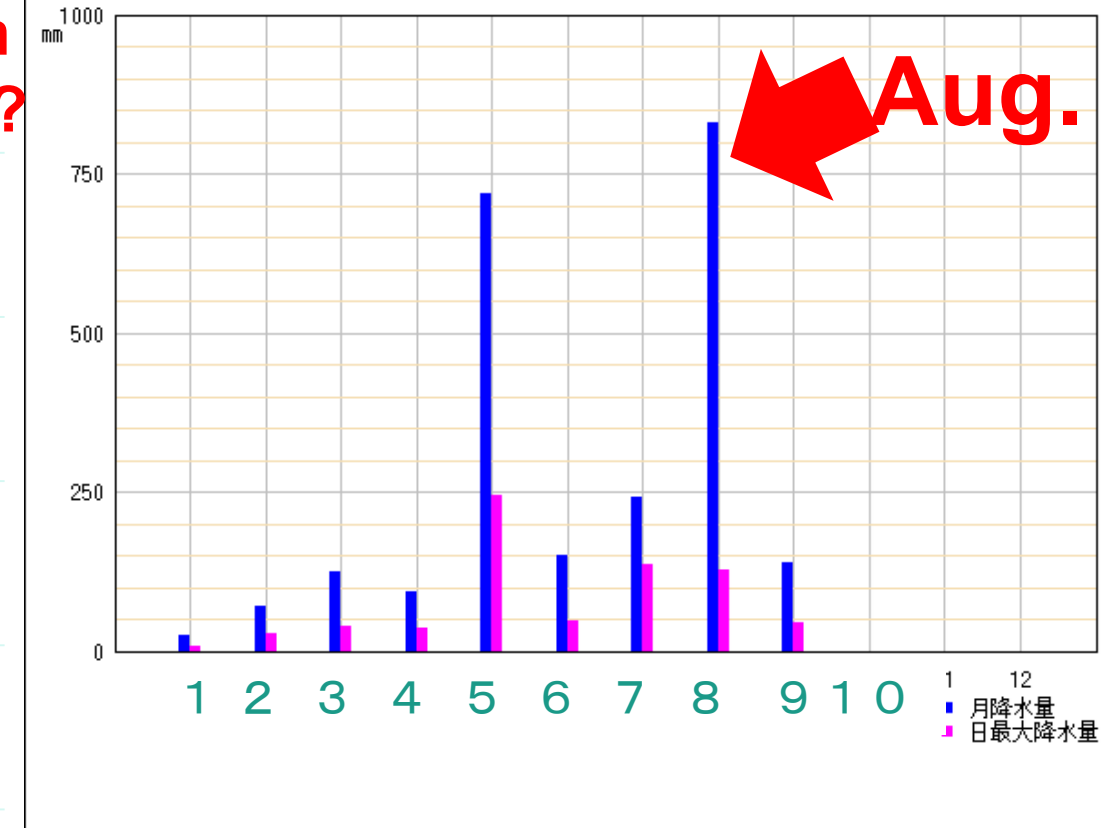
※Welch's t-test Assessment

Results of Research

Number of Dead Oysters



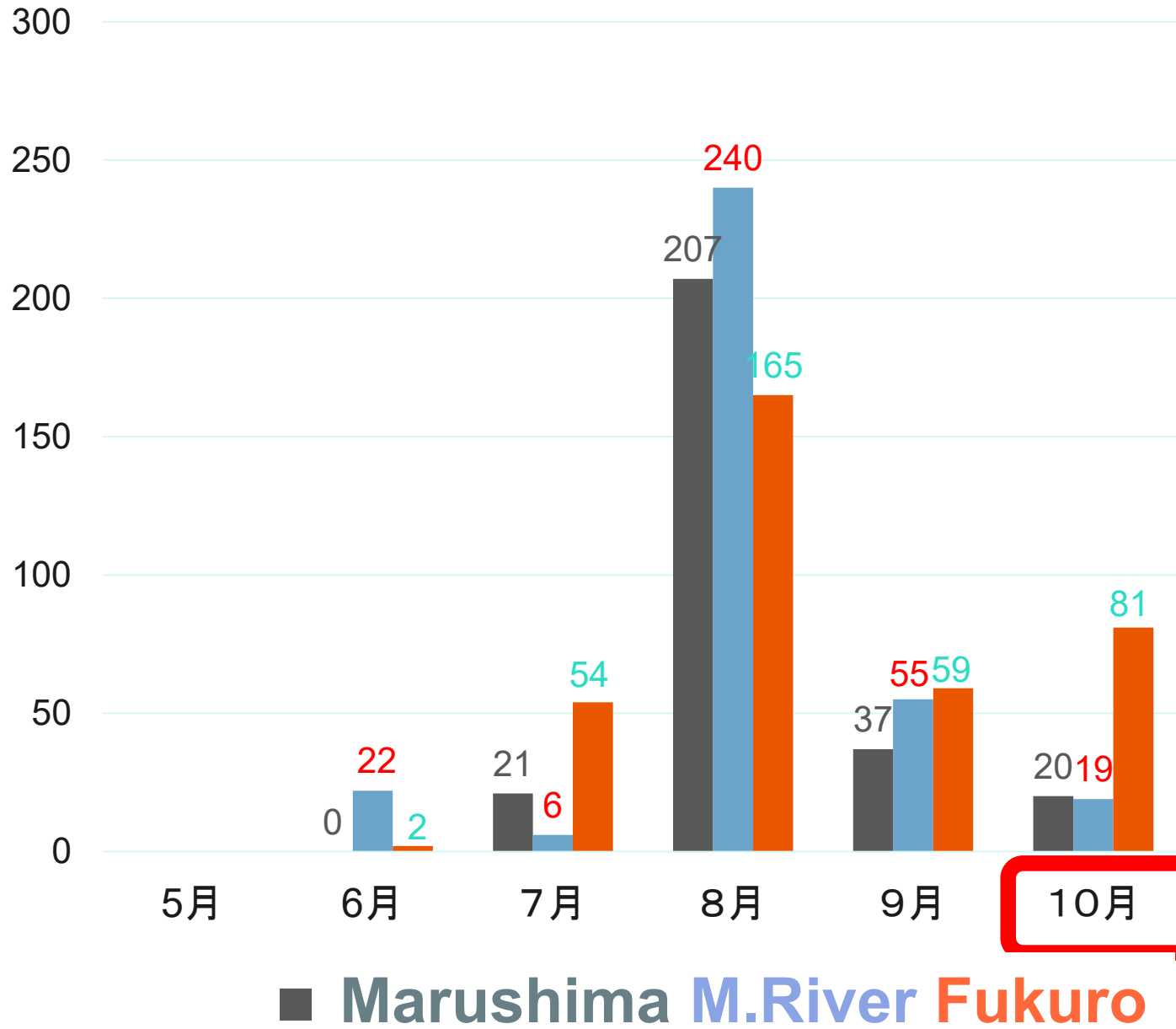
Monthly Rainfalls 2021



出典：気象庁HP過去の気象データ（水俣）

+ **Sediment(土砂)**
prevented breathing.

Number of Dead Oysters

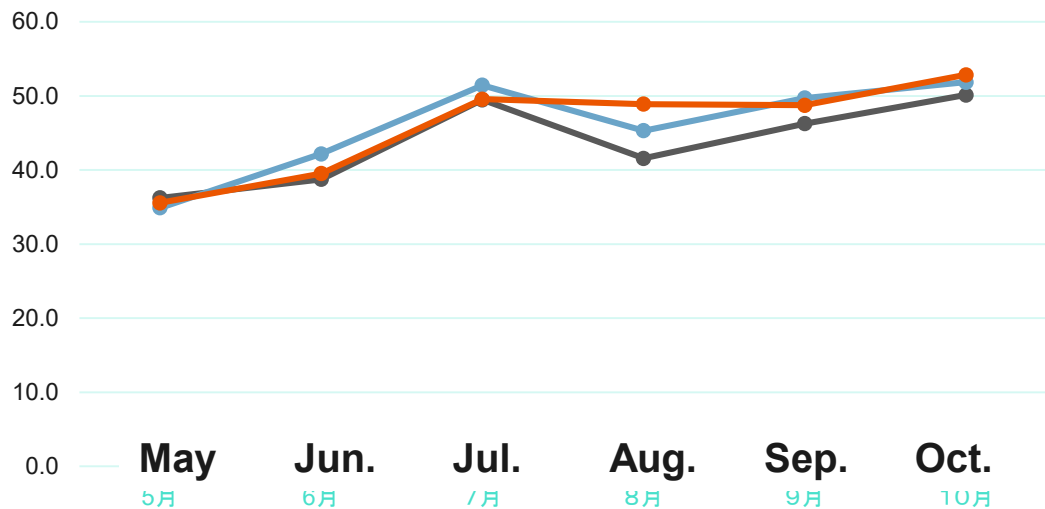


Water Temperature (Upper Layer)(°C) 【Sep.-Oct, 2021】

Water Tem.(Upper Layer)(°C)	September (2021/9/10)	October (2021/10/14)
Fukuro	28.5	27.5
Marushima	27.8	26.4
M.River	27.7	26.2

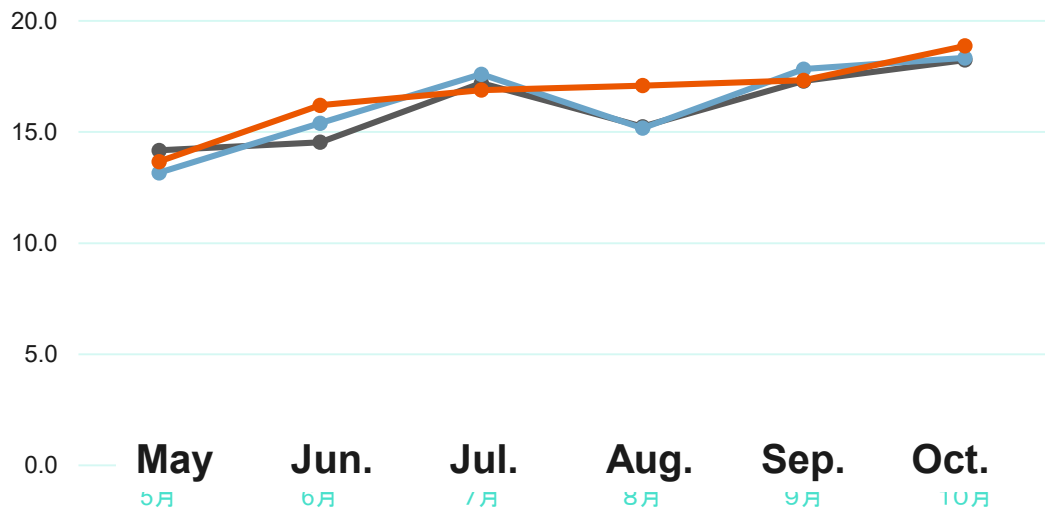
High Temp. in Fukuro?

Length (mm)



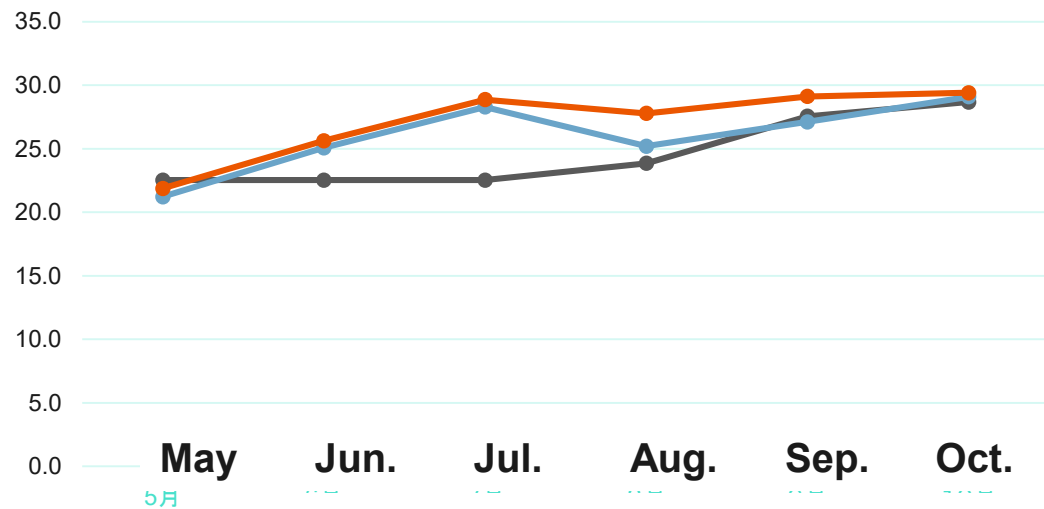
Marushima M.River Fukuro

Thickness (mm)



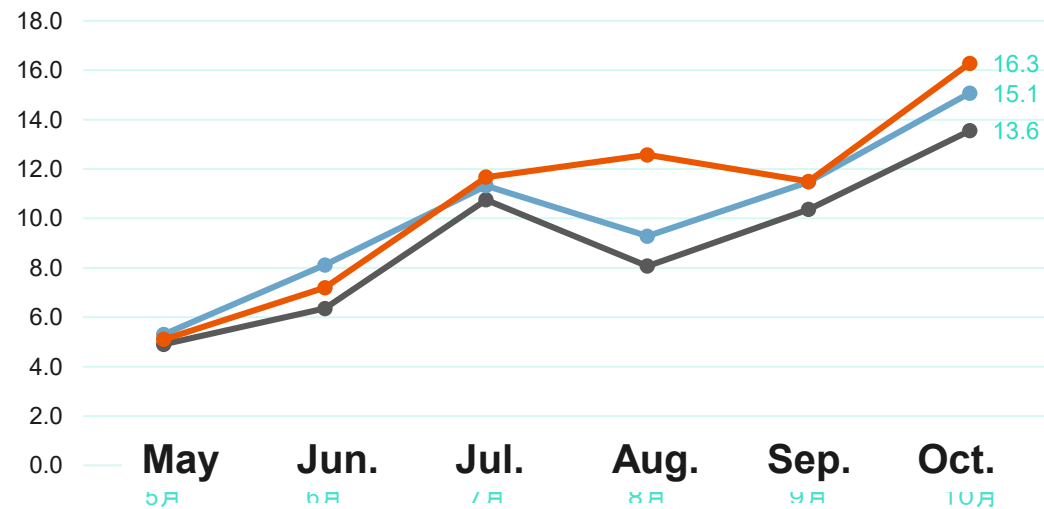
Marushima M.River Fukuro

Width (mm)



Marushima M.River Fukuro

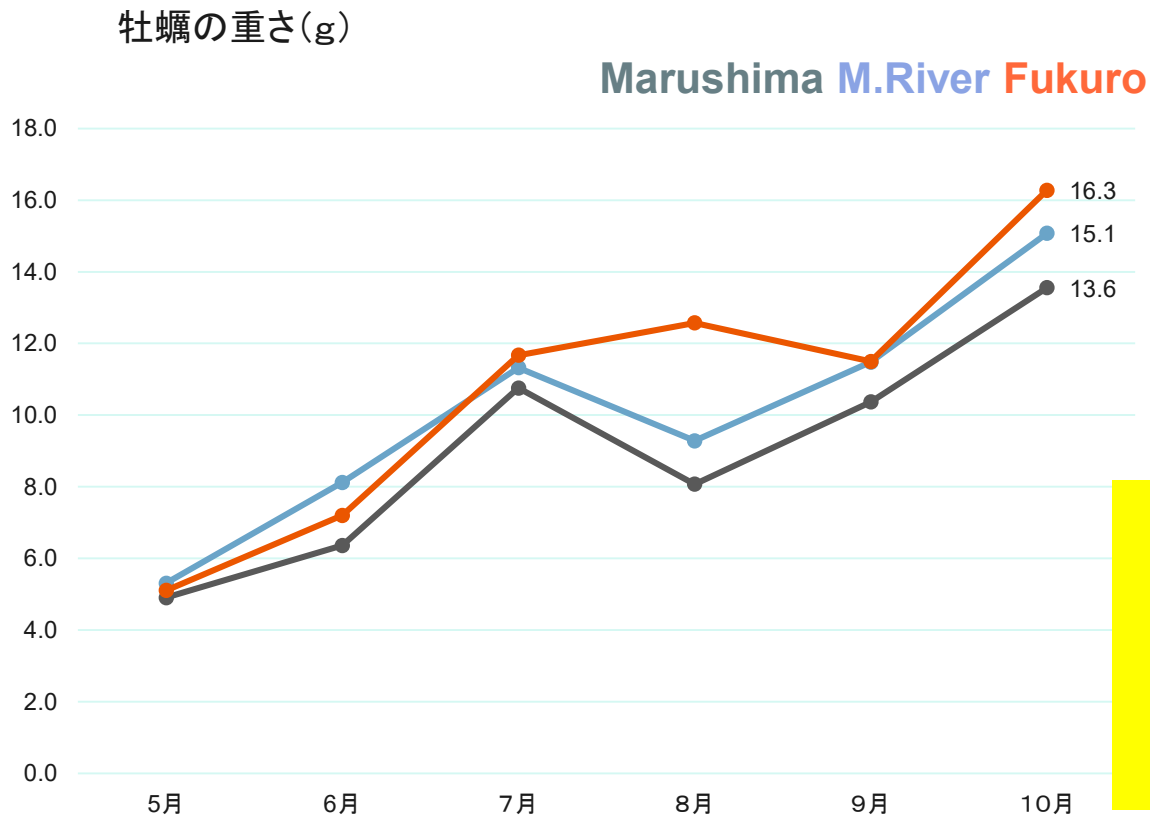
Weight (g)



Marushima M.River Fukuro

Welch's t-test: Result for Oyster Sizes (Oct. 2021)

		L (cm)	W (cm)	T (cm)	W (g)
Welch's t-testing	Marushima : M.River	0.32	0.66	0.90	0.17
	Marushima : Fukuro	0.1372	0.4874	0.41	0.03993
	M.River : Fukuro	0.61	0.73	0.427	0.3332



Fukuro
(16.3 g)

M.River
(15.1 g)

Marushima
(13.6 g)

【Weight in October】

▪ Clear Difference

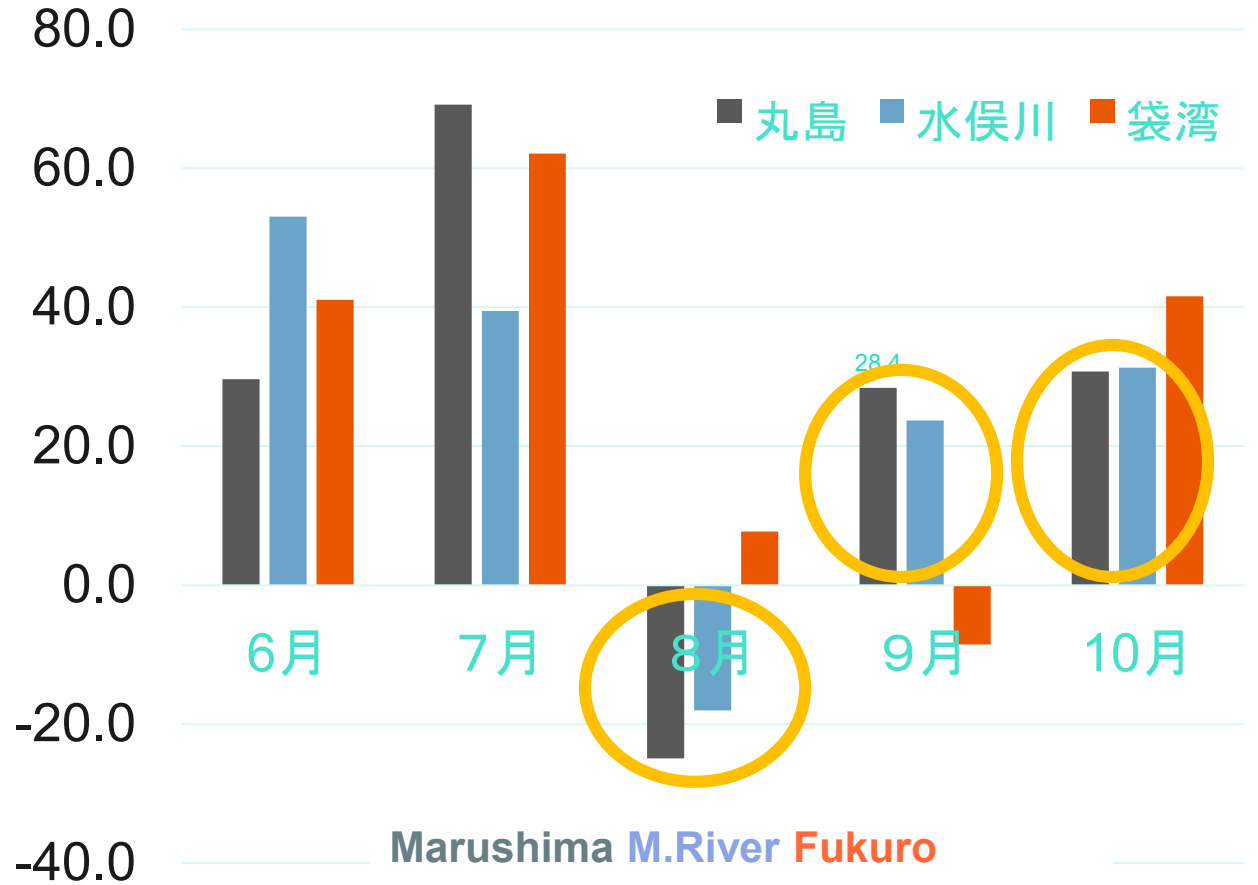
Fukuro(○) ⇔ Marushima(△)

Weight (g)



Marushima M.River Fukuro

Change in Growth Rate (%)

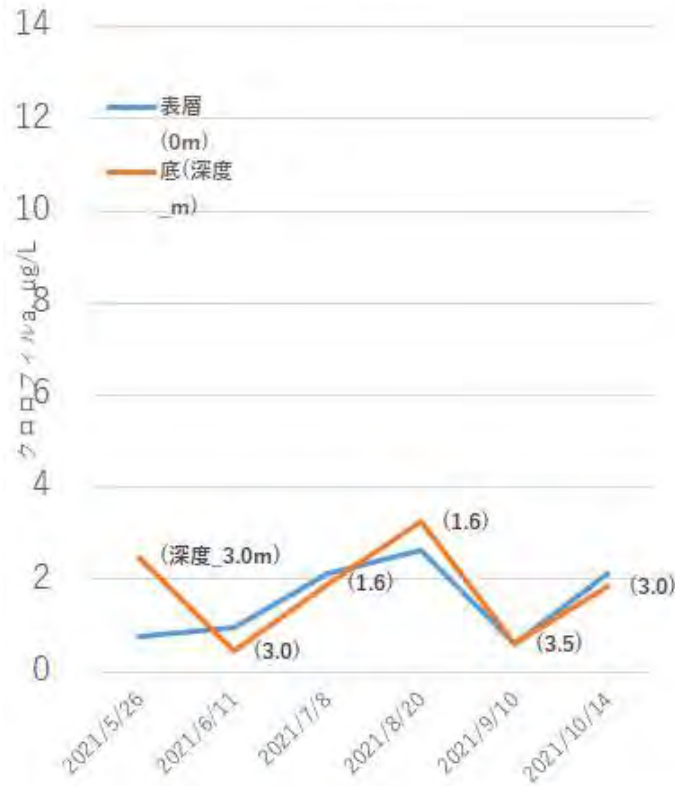


Marushima M.River Fukuro

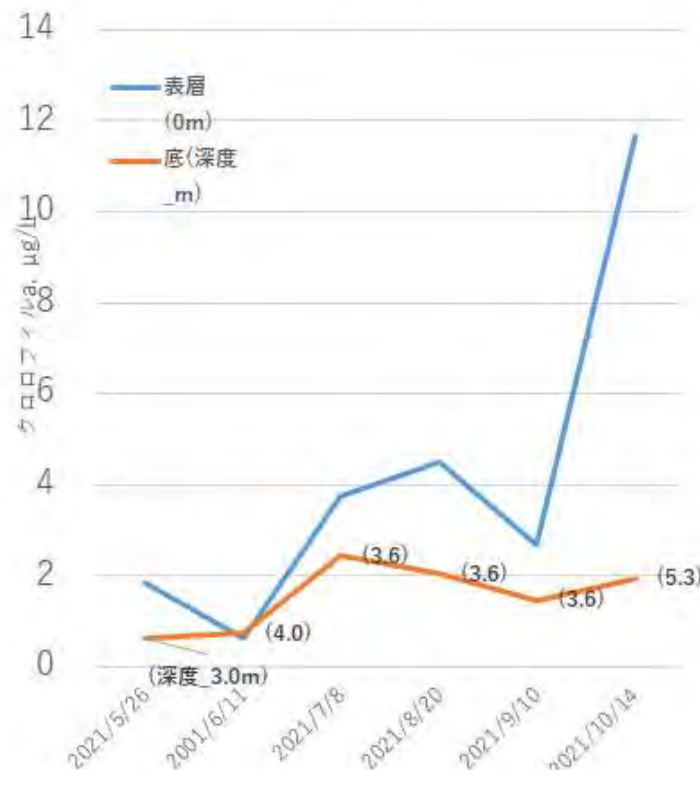
After the heavy rain in Aug. oysters in Marushima and M.River had a quick recovery

Monthly Change of Chlorophyll-a Concentration

Minamata River



Marushima



Fukuro



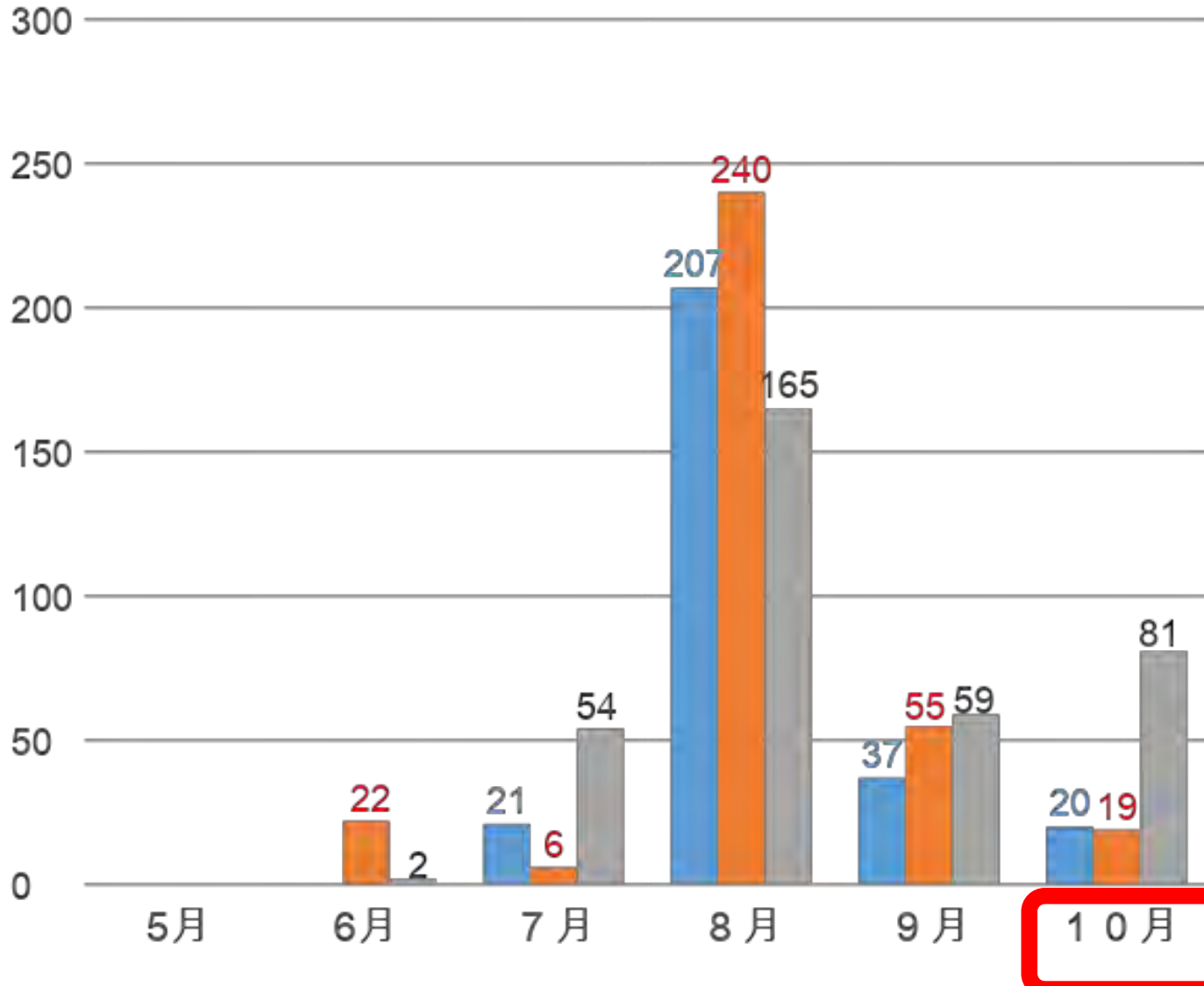
Mid Layer:
High
Chlorophyll-a
Concentration

Upper Layer Middle Layer Bottom Layer

【Reports on Relationship between Chlorophyll-a and Growth of Oysters】

- Between 2~10µg/L ⇒ Positive Correlation with Weight
- Less than 1µg/L ⇒ No Correlation with Weight

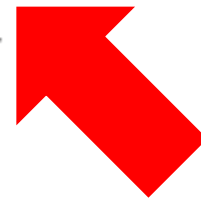
Number of Dead Oysters



▫ Marushima M.River Fukuro

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High Temp.
in Fukuro?

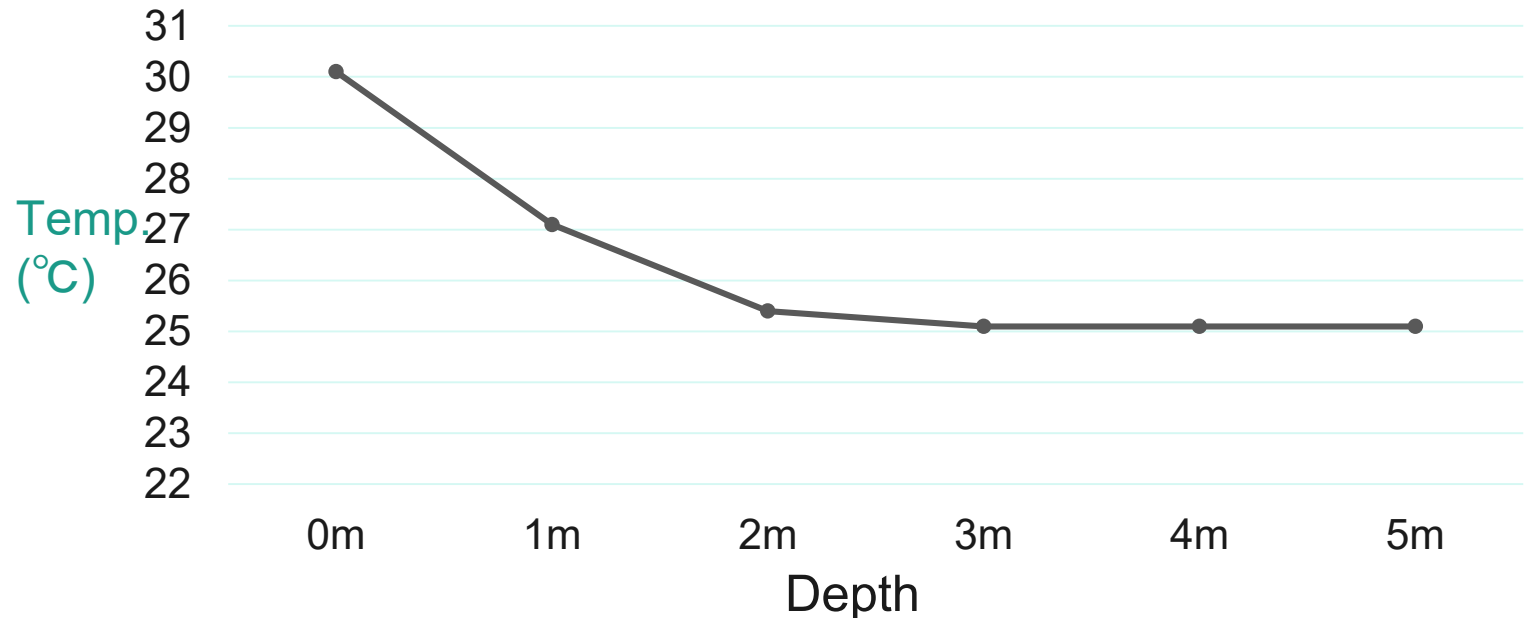
Water Temperature in Minamata Bay (2019/7/29)



Temp.Upper Layer (°C)	
St.1裸瀬	29.2
St2.湾央	28.6
St.3恋路島	28.6
St.4袋湾	30.1

Highest Temp.
33.9°C

Water Temperature in Each Layer in Fukuro (°C)



An Idea of Oyster Farming in Fukuro

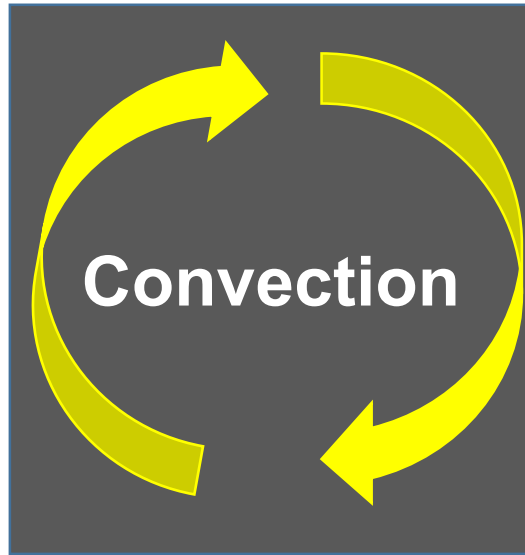
【Winter to Spring】

Cold Air (DIN Shortage)

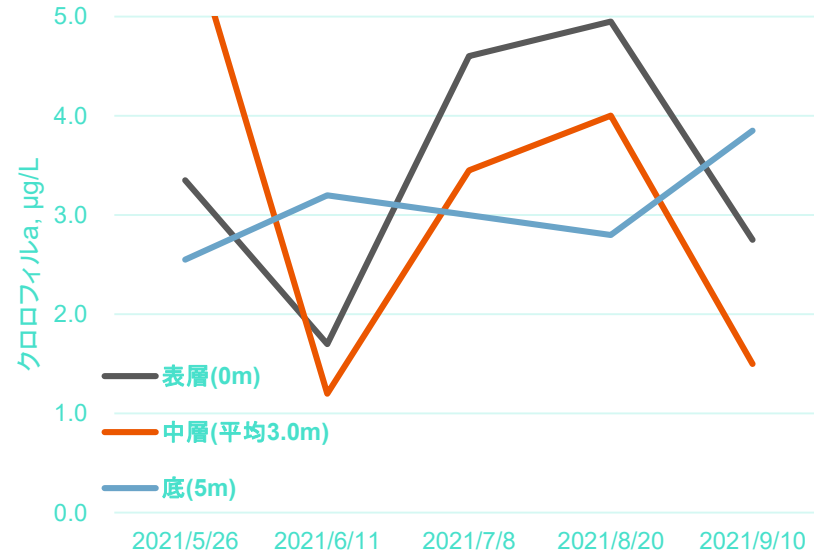
【Summer to Autumn】

袋湾

Upper Layer
Bottom



Farming in Middle Layer
(DIN Supply from Bottom)



Farming in Upper Layer
(High Density of Chlorophyll-a)
*Careful of Water Temp. and CO2 Density

Summary

- Ave. Weight **Fukuro ⇒ Heaviest**
 Marushima Least Heavy
- Growth Rate after Heavy Rain in August
 Marushima=Minamata River
- M. River needs Countermeasures against Rain
- Fukuro has High DIN(Btm.) & Chlorophyll-a(Mid.)

FUKURO = Appropriate Place for Oyster Farming

-*if* we are careful of the water temperature & CO2
Concentration in Upper Layer

3: Future Prospects

- 1 Find Proportion of weight of inside meat to outer shell
- 2 Add DIN Sufficient Water from Pond in Winter
(Supports of NIMD, Minamata City, and Kyushu University)



References

(1)「水俣病—その歴史と教訓—2015」 編集・発行 水俣病資料館 p. 3、5

(2)統計情報/水俣市HPの国勢調査 <https://www.city.minamata.lg.jp/kiji00315/index.html>

(3)水俣市農林水産課作成の「水俣市漁獲量推移」

(4)朝日新聞 2021年10月3日朝刊「プレミアムA MINAMATA 水俣病は、過去ではない」

(5)朝日新聞 2021年6月16日社説「改正瀬戸内法 豊かな海へ運用慎重に」

(6)厚生労働省HP「各都道府県知事・各政令市市長あて厚生省環境衛生局長通知」
https://www.mhlw.go.jp/web/t_doc?dataId=00ta5730&dataType=1&pageNo=1

(7)気象庁 過去の気象データ 水俣
https://www.data.jma.go.jp/obd/stats/etrn/view/monthly_a1.php?prec_no=86&block_no=0924&year=2021&month=10&day=29&view=g_tem

(8)栄養塩環境とマガキの生育との関係解明 岡山県農林水産総合センター水産研究所2020年5月13日

(9)マガキの身入り向上試験について 富川なす美 宮城水産研報 第19号,2019