For both Marine Ecosystems and Human Society

- Device and Method for Zostera marina Germination/Cultivation
- Microplastic Collection Boat Designed to Protect Small Fish

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Self-Introduction

*I was granted my first patent when I was in the 4th grade of elementary school.

*Received nine patents so far.

*Imperial Prize, Prime Minister's Prize, Minister of Education, Culture, Sports, Science and Technology Prize at the Concours of Schoolchildren's Inventions.

*At the International Exhibition for Young Inventors (IEYI), I received Gold Awards for four consecutive years.

*Through my inventions, I experienced the joy of seeing people's happiness, which continues to motivate me.

Device and Method for Zostera marina Germination/Cultivation

What is Zostera marina?

*A type of marine plant that absorbs CO_2 and releases oxygen

*Recognized as an important blue carbon resource

*Serves as a habitat for fish and is often called “the cradle of the sea”

Device and Method for Zostera marina Germination/Cultivation

Challenges of Zostera marina

The germination rate

in the ocean is only **1～3%**

We need to find ways to increase

Zostera marina populations

Device and Method for Zostera marina Germination/Cultivation

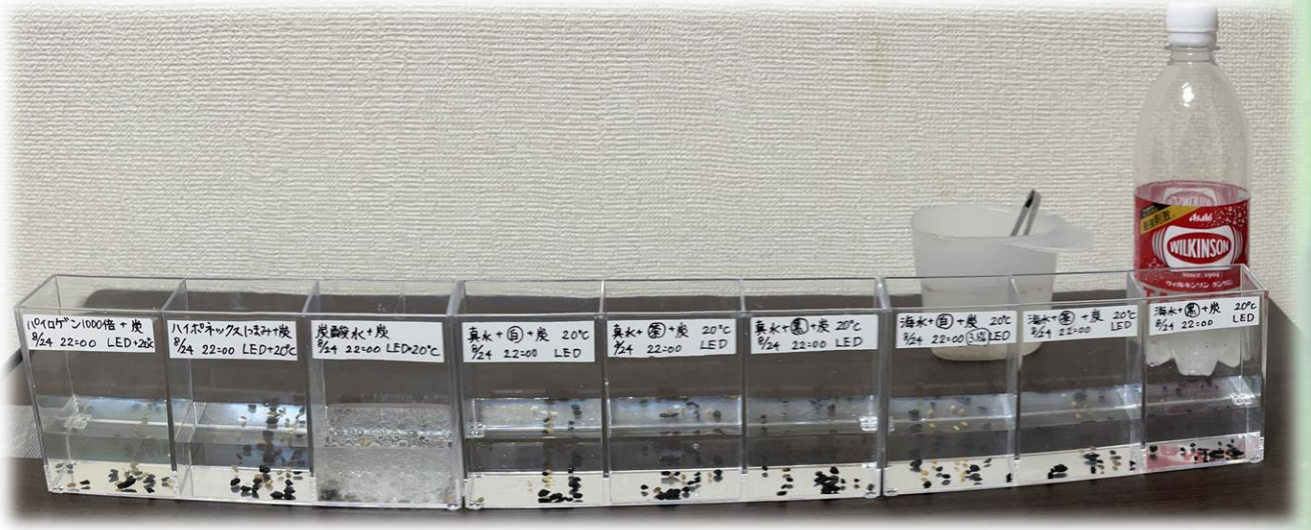
From Flowering Shoots to Seed Maturation

・My method does not harm wild Zostera marina

・Seeds are matured in seawater for two month

C

Research on Germination Water



Studied **20 different** types of germination water

I tested materials such as health drinks, fertilizers, vinegar, carbonated water, yogurt, and salted rice malt (shio-kōji)

Invented an **optimal germination water** for Zostera marina

Seeds successfully germinated in August

アマモの種の発芽記録　実験まとめ
2023/8/24　22：00実験開始

Summary of the Zostera marina Germination Experiments

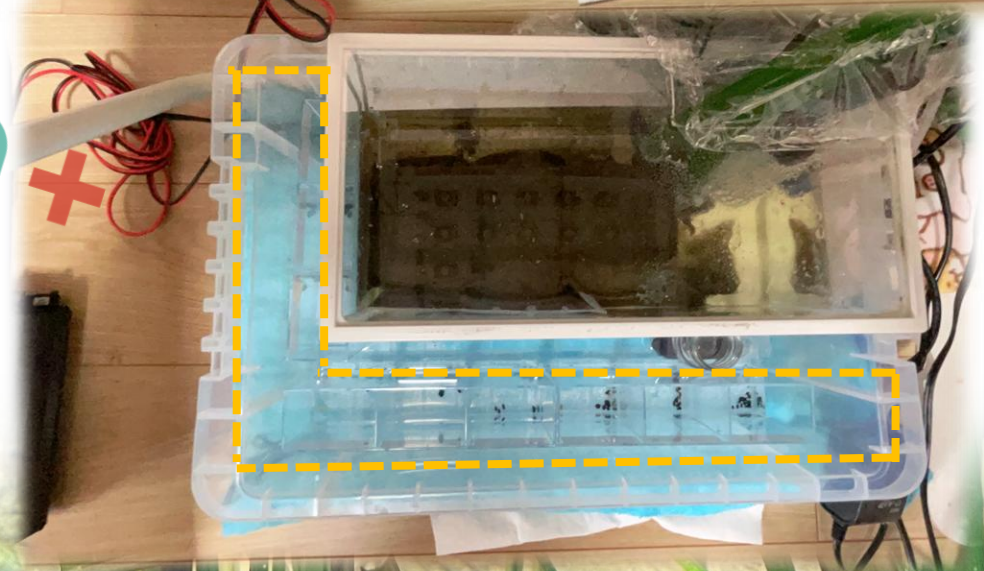
※はじめに健康ドリンクに漬けた種が数日で沢山発芽したを実験①とし、その結果に間違いがないかの確認及び、その他の液との比較実験として、実験②～スタート。

水温は約20℃　/　全ての液体に炭を入れ、LEDを照らした環境で、どの液体がいつ発芽するかを記録

		②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮	⑯	⑰	⑱	⑲	⑳
経過	液体	真水	真水	真水	海水	海水	海水	health drinks	肥料	carbonated water	ラ：N、P、Si、CO2	Black Rice Vinegar + Water	＋真水	ヨーグルト	水質改善セラミック	ハ：N、P、Si、CO2	健康ドリンク/ＬＥＤなし	りんご酢	梅酢	梅酢＋炭酸水
日数	種個数	白5個	茶5個	黒5個	白5個	茶5個	黒5個	MIX8個	MIX8個	MIX8個	MIX12個		MIX5個	MIX4個	MIX5個	MIX8個	MIX6個	MIX5個	MIX8個	MIX8個
0日											2	×	×	×	×	×		×	×	×
	22:00	×	×	×	×	×	×	×	×	×	2	×	×	腐敗	×	×	×	×	3	×
	12時間後	×	×	×	×	×	×	1	×	×	2	1	×	中止	×	1	2	×	3	×
	24時間後	×	×	×	×	×	×	3	×	×	3	2	×		×	1	2	×	3	×
1日目								38%			25%	40%				13%	33%		腐敗	腐敗
	36時間後	×	×	×	×	×	×	4	1	×	3	2	×		×	2	3	×	中止	中止
	48時間後	×	×	×	×	×	×	4	1	×	4	2	×		×	3	—	×		
2日目								50%	13%		33%	40%				38%	50%			
	60時間後	×	×	×	×	×	×	5	1	×	4	3	×		×	3	3	×		
	72時間後	×	×	×	×	×	×	5	1	1	4	3	×		×	4	4	×		
3日目								63%	13%	13%	33%					50%	67%			
	84時間後	×	×	×	×	×	×	6	3	2	5	3	×		×	4	4	×		
	96時間後	1	×	1	×	×	×	6	3	2	5	3	×		×	4	4	×		
4日目		20%		20%				75%	38%	25%	42%	60%				50%	67%			
	108時間後	1	×	2	×	×	×	6	3	2	5	3	×		×	6	4	×		
	120時間後	2	1	2	×	1	×	6	3	6	5	3	×		×	6	4	×		
5日目		40%	20%	40%		20%		75%	38%	75%	58%	60%				75%	67%	0%	0%	0%
	132時間後	2	1	3	×	1	×	7	4	6	7	3	×		×					
	144時間後	3	1	3	×	1	×	7	4	7	7	3	×		×					
6日目		60%	20%	60%		20%		**88%**	50%	**88%**	58%	60%								
	156時間後	3	1	3	×	1	×	7	4	7	7	4	×		×					
	168時間後	3	1	3	×	1	×	7	4	7	7	4	×		×					
7日目		60%	20%	60%	0%	20%	0%	88%	50%	88%	58%	80%	0%	0%	0%					

Device and Method for Zostera marina Germination/Cultivation

Water Temperature Control



- **Used an aquarium cooler and condensed water**

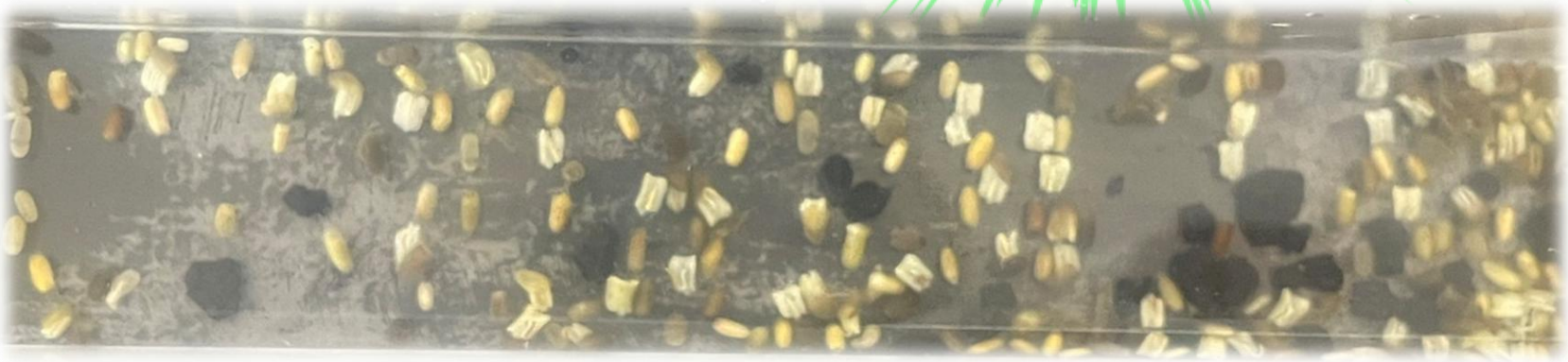
- Water temperature inside the tank: approx. 13°C
- Optimal germination temperature: approx. 20°C

Device and Method for Zostera marina Germination/Cultivation

Natural ocean: **Germination rate 1–3%**

My research: **Germination rate approx.** **88%**

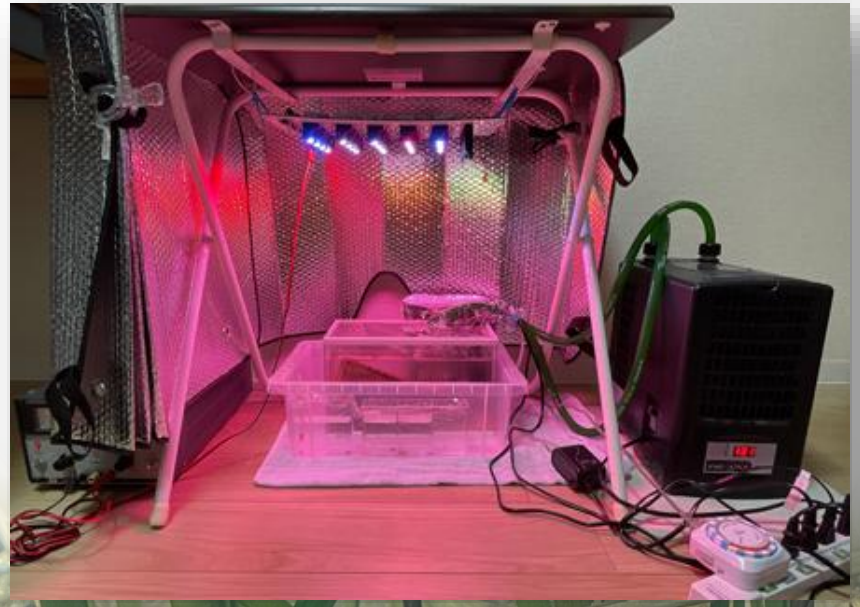
Fastest germination: **18 hours**



Device and Method for Zostera marina Germination/Cultivation

Cultivation Device

Using LED lights designed for hydroponic cultivation, the device supports photosynthesis through a 12-hour **light-**and-**dark** cycle.



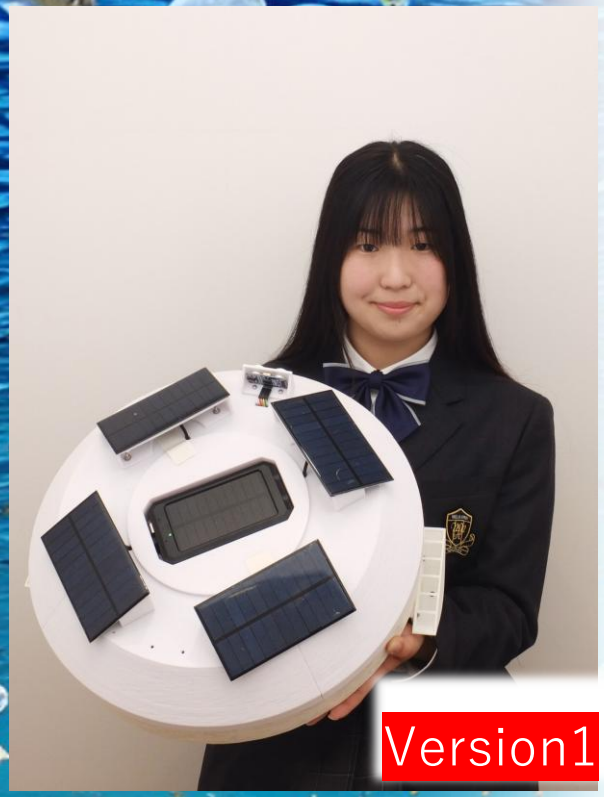
Device and Method for Zostera marina Germination/Cultivation

With guidance from Patent Attorney Shinichi Abe and Professor Shigekazu Yamada of Tokai University, I was able to turn my research memos directly into a patent application.

Patent Granted

Microplastic Collection Boat Designed to Protect Small Fish

Protecting Small Fish by Science!

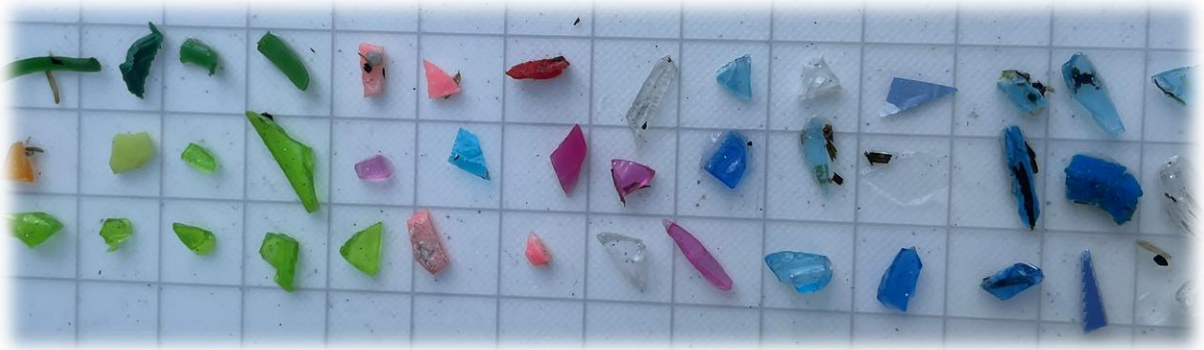

Version1


Version3

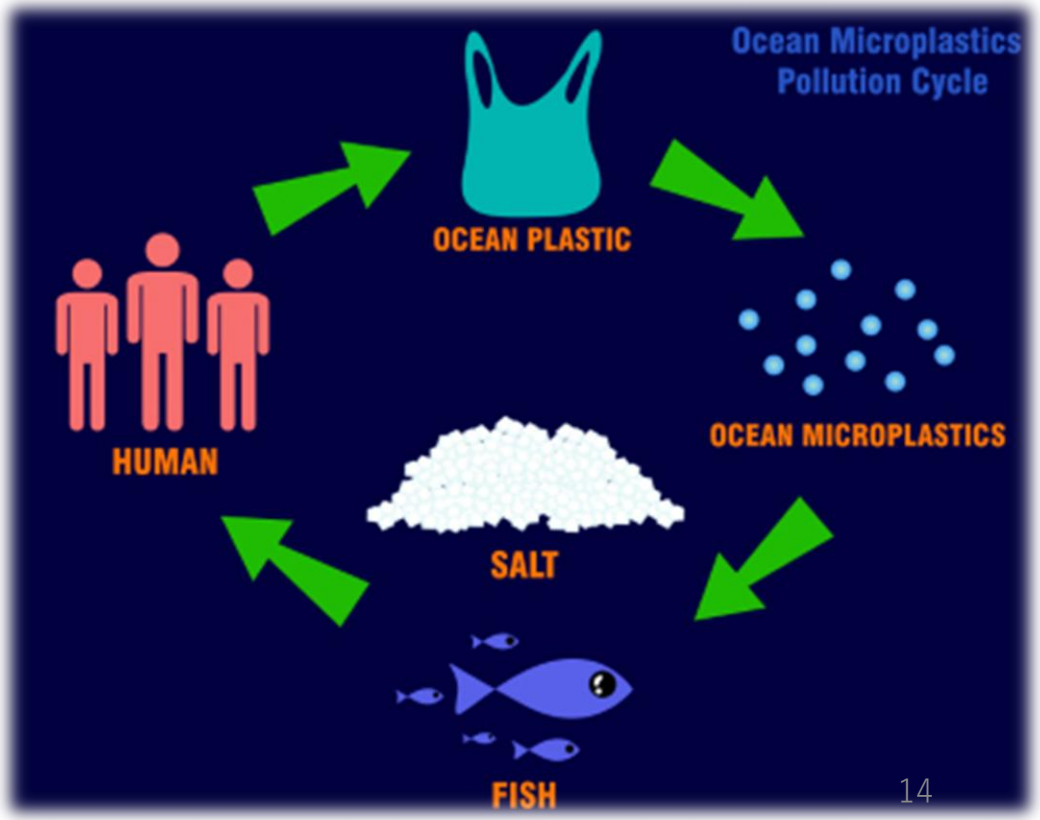

Version 2

Microplastics in Real World

Real microplastics collected from the ocean

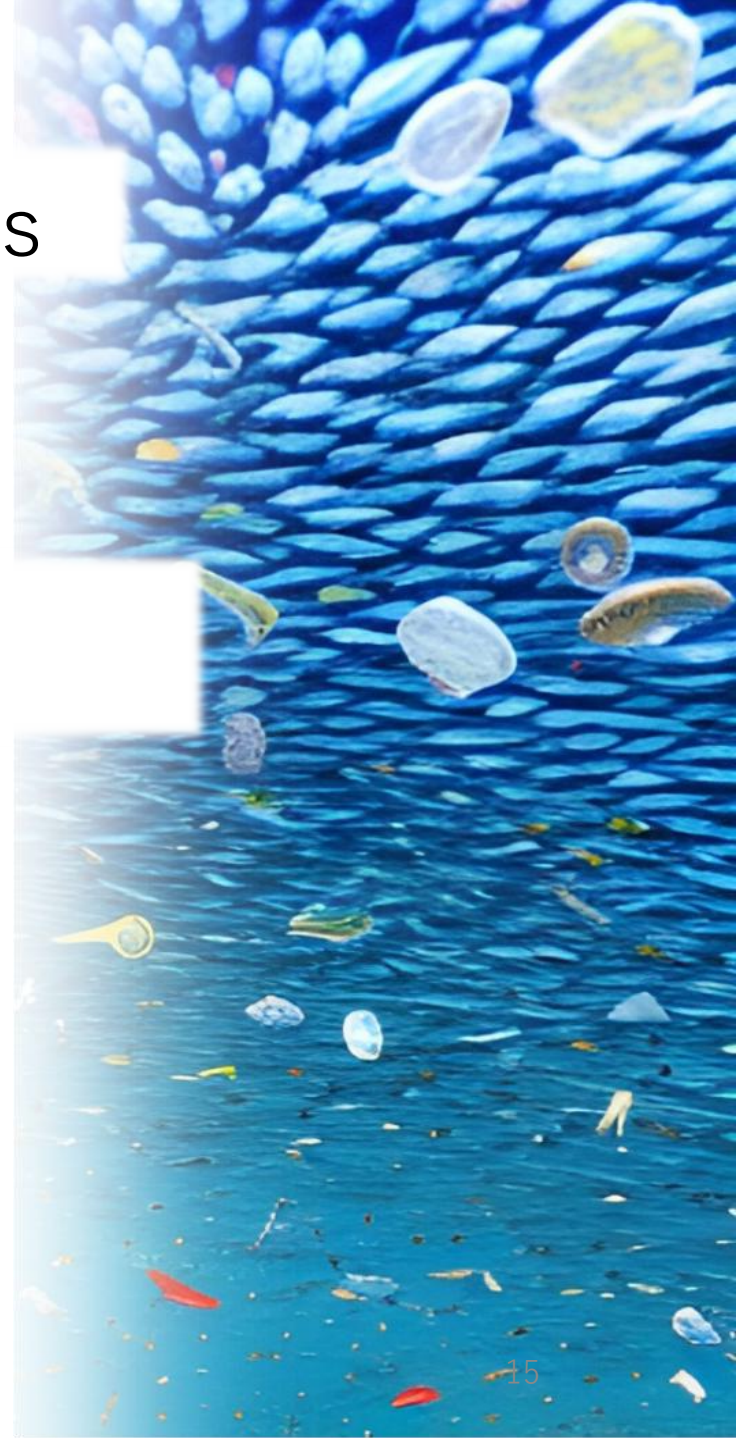


Negative food chain effect



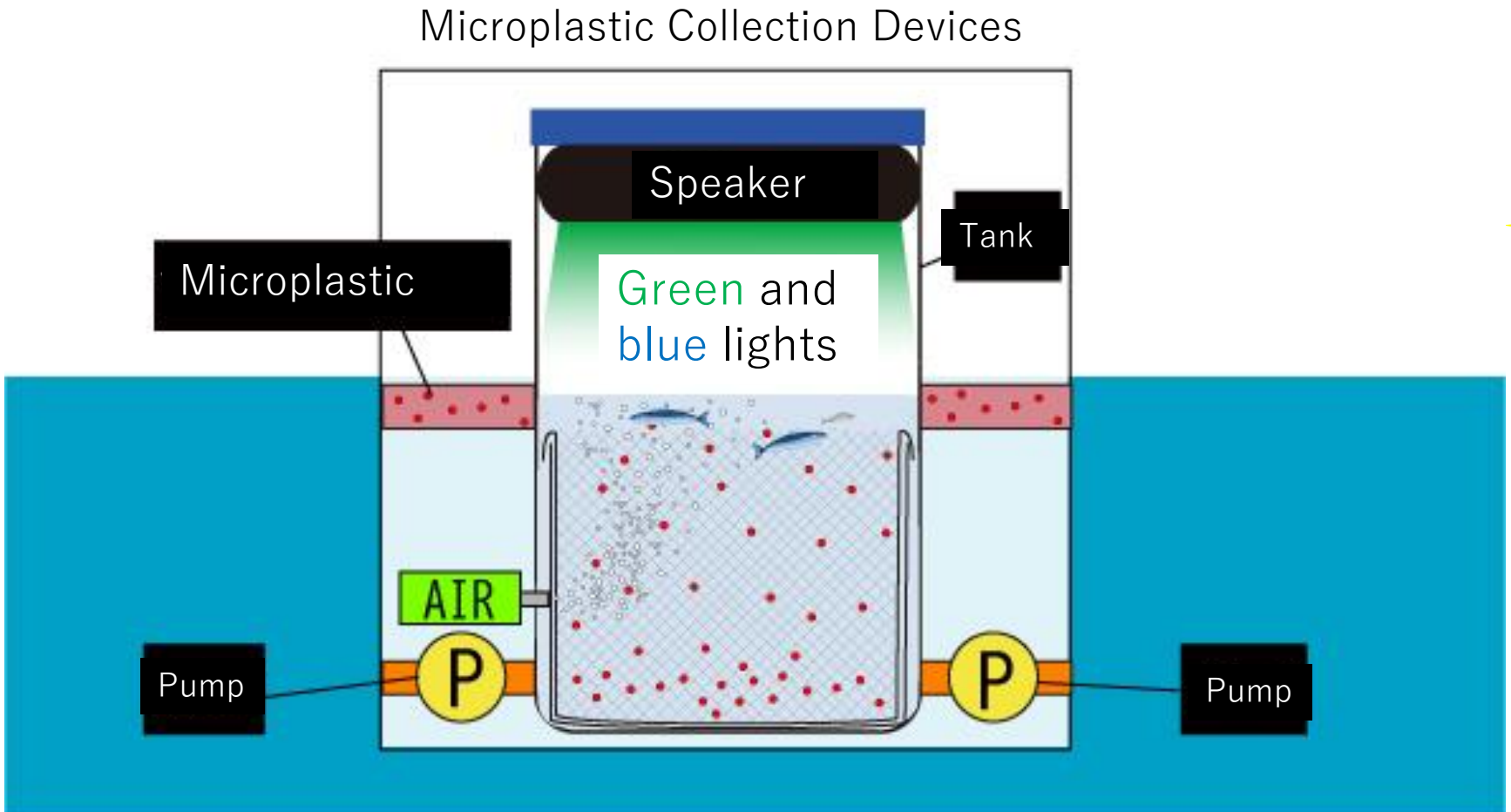
Conventional Microplastic Collection Devices

Major issue:
they may **accidentally suck** in small fish!!



With my invention, even if small fish enter, they can escape safely!

A system that uses sound and light to help fish find their way out.



実験した小魚：　4cmと3cmのカクレクマノミ2匹、2.0cm～2.5cmのデバスズメダイ4匹
実験日：　2024年9月16日

	100Hz	500Hz	1000Hz	5000Hz	7500Hz
1回目	△			△	○
2回目	○				×
3回目	△	○	△		△

3回目	△	△	○	△	△

	男性のいびき音	バイクの音	トントントントン ドアのノック音	蚊が飛ぶ音	高い鳥の鳴き声
		×	×		
		△	×		
3回目	×	△	×	○	○

5000Hz

Chime sounds

Children's voices

Snorir

100Hz

Alarm sounds

7500Hz

1000Hz

Humpback whale calls

Mot

500Hz

whale calls

Seagull calls

Female speaking voices

10000Hz

①Identifying Sounds That Small Fish Dislike!

The “splashing water sound”

(9)


(13)


(10)


(14)


(11)


(15)


(12)


(16)


実験した小魚： 4cmと3cmのカクレクマノミ2匹、2.0cm～2.5cmのデバスズメダイ4匹
実験日： 2024年9月16日、9月23日

6匹共に同じ行動をしたのでひとつの表にまとめました。

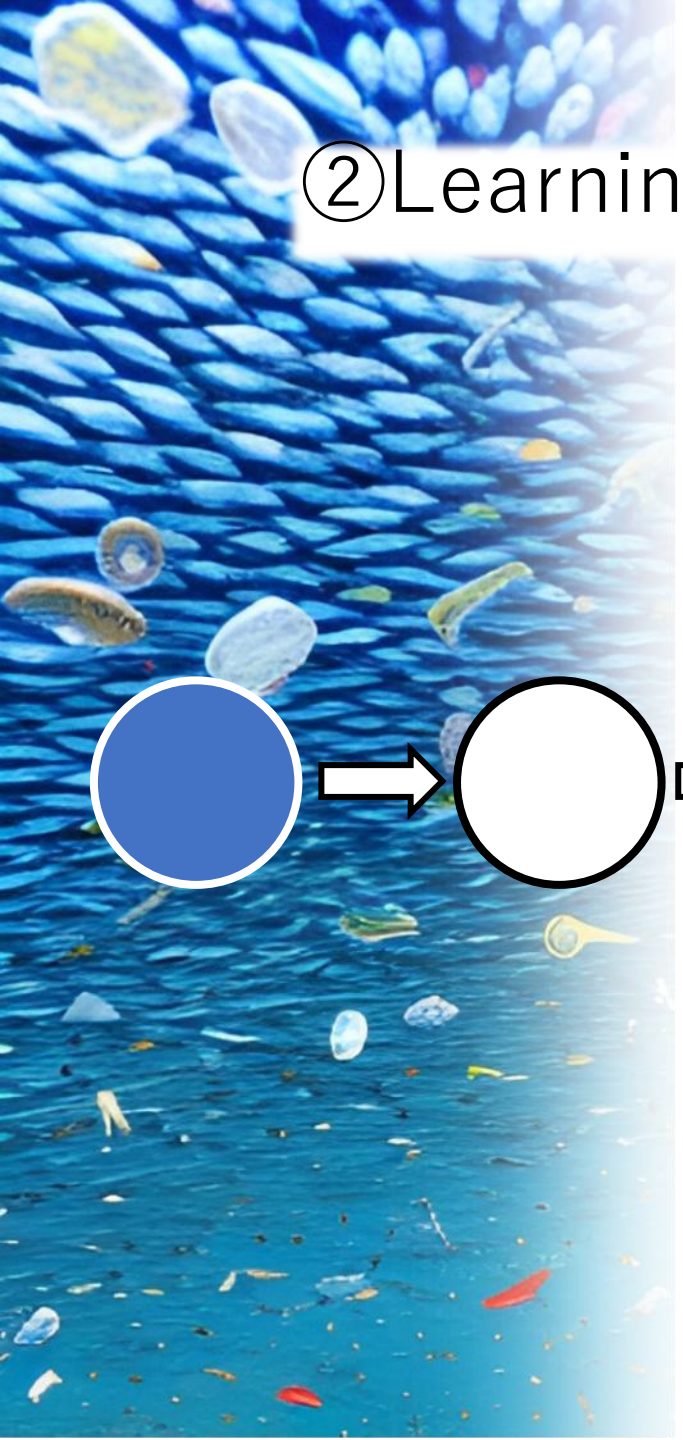
◎=明らかに効果的(小魚が嫌がった) ○=効果的(小魚が嫌がった) △=特に変化なし ×=スピーカーに寄ってきた

	100Hz	500Hz	1000Hz	5000Hz	7500Hz
1回目	△	×	○	△	○
2回目	○	△	△	△	×
3回目	△	○	△	△	△

	10000Hz (10KHz)	水が跳ねる音	カモメの声	アラーム音	男性の声
1回目	×	◎	△	△	△
2回目	×	◎	△	×	△
3回目	△	◎	△	△	△

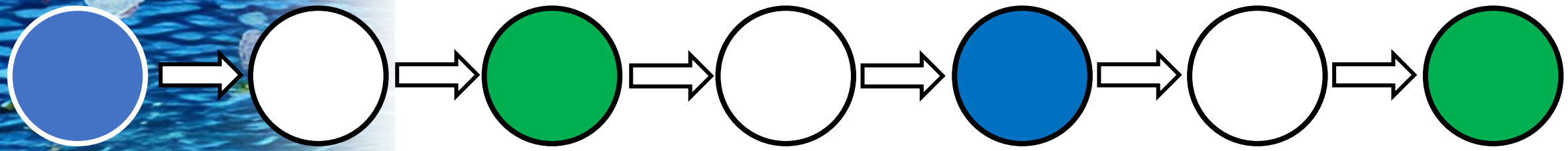
	女性の声 (子供)	女性の声 (大人)	ザトウクジラの鳴き声	機械音	チャイム音
1回目	△	△	◎	△	△
2回目	△	△	○	△	△
3回目	△	△	○	△	△

	男性のいびき音	バイクの音	トントントントン ドアのノック音	蚊が飛ぶ音	高い鳥の鳴き声
1回目	×	×	×	◎	○
2回目	×	△	×	○	○
3回目	×	△	×	○	○



②Learning About Light That Small Fish Avoid

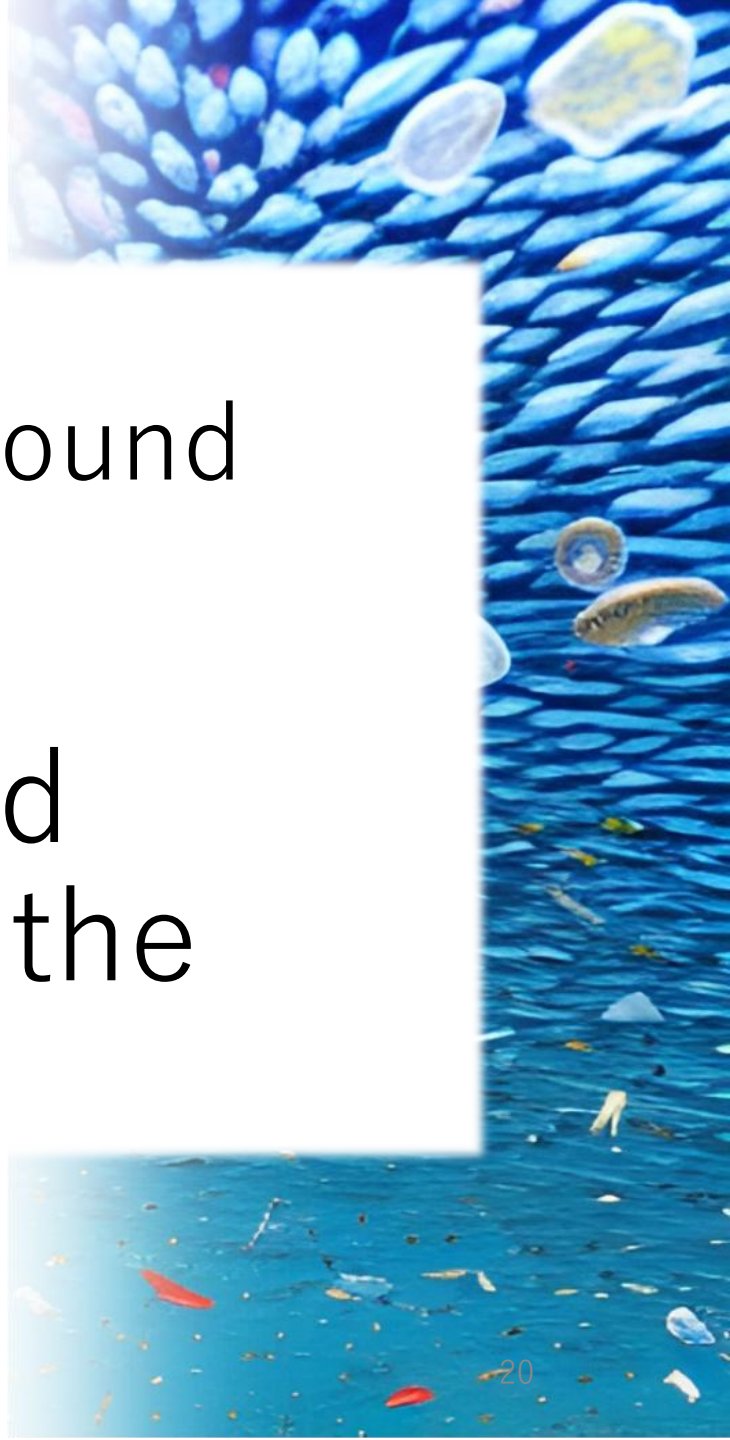
“**blue** and **green** light”



These lights are used in random patterns so the fish do not become accustomed to them.

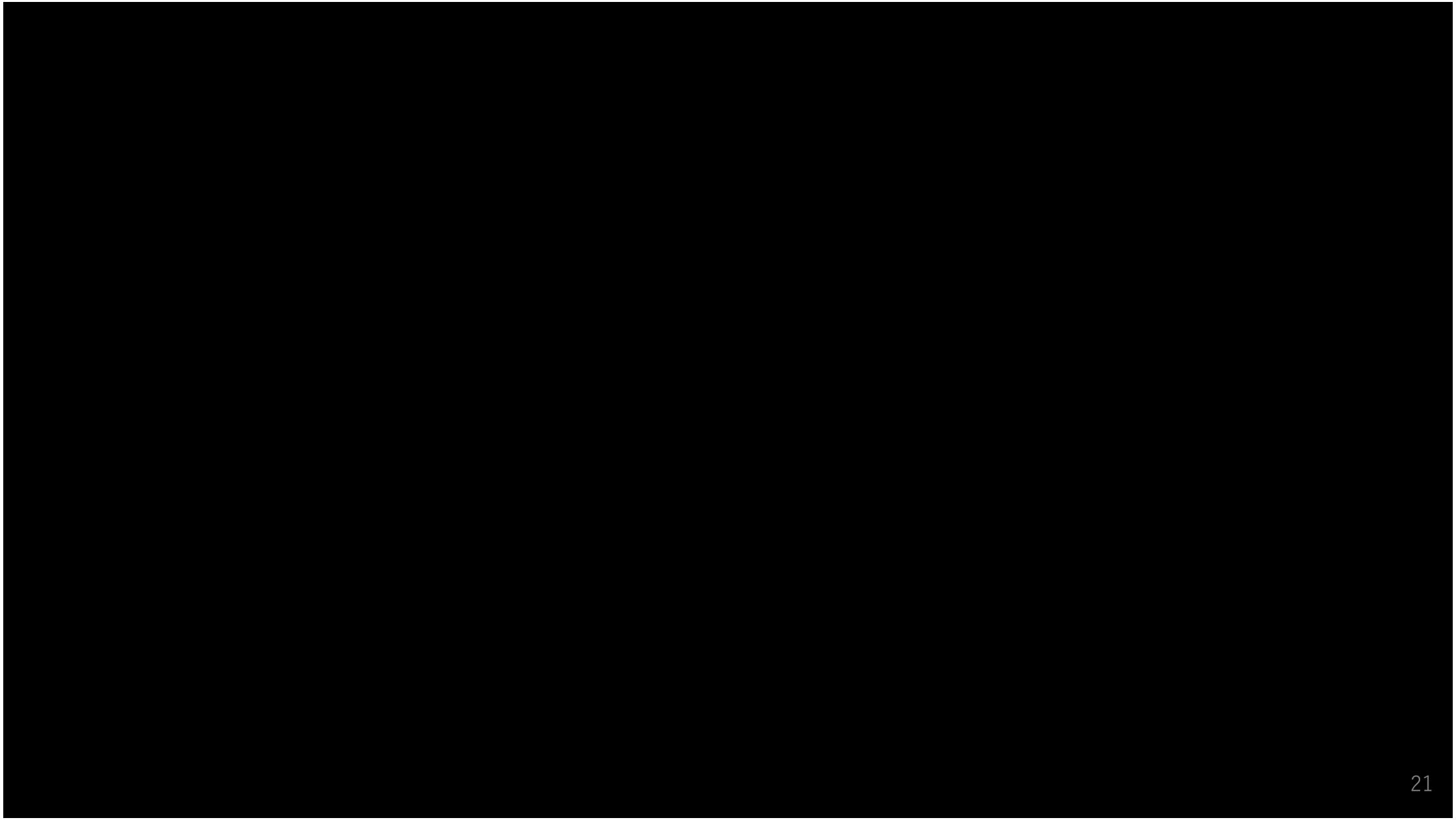
Adding **Aeration** to Light + Sound

The **light reflections** and **sound echoes** increase the overall effect.



Integrating Sound and Light Research into the Device!

Patent No. 7623781 Granted



Field Experiments in Yokohama and Enoshima

Successfully collected microplastics without pulling in any small fish!

November 10 (Sun)

Building on Guidance from My Mentors and My Award Experiences

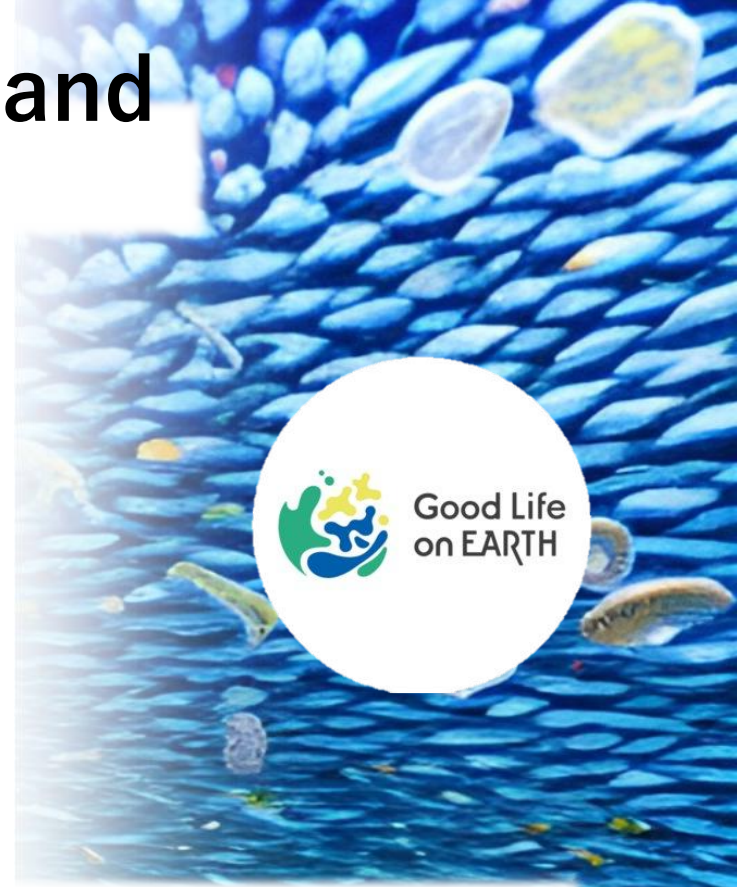
I have now begun new research through the program

jointly conducted by the Toyota Mobility Foundation

University of Tokyo Good Life on Earth

— For a Planet Where All Life Can Coexist

SDG 14: Life Below Water
— Conserving and sustainably using the oceans.



References

• Academic Articles / News
Prof. Akiyoshi Takahashi at Kitasato University, “Green LED Light Increases the Growth Rate of Flounder and Flatfish by 1.6 Times, Developed by Kitasato University Researchers” Japan Topics (nippon.com). URL: https://www.nippon.com/ja/japan-topics/g02083/(Accessed: March 29, 2022)

• Patent Literature
[Patent Document 1] JP 2022-66030 A, [Patent Document 2] JP 2022-108255 A, [Patent Document 3] JP 2024-42846 A, [Patent Document 4] JP 2014-171411 A, [Patent Document 5] JP 2016-111943 A, [Patent Document 6] JP 2024-20706 A, [Patent Document 7] JP S62-239935 A

• Seminar Participation
Seminar by Professor Akiyoshi Takahashi, Hosted by the Kitasato Environmental Science Center, Attended on November 9, 2024