Summary of the Fourth FishPhytO Project Science Team Meeting

The fourth meeting of the Project Science Team (PST) for the project on "Creating a phytoplankton-fishery observing program for sustaining local communities in Indonesian coastal waters" (FishPhytO) was convened from 14:00–17:00 on October 30, 2024, at the Hawaii Convention Center (Honolulu, USA), in conjunction with the 2024 PICES Annual Meeting (PICES-2024).

The main objectives of the meeting were to (1) discuss FishGIS application management, (2) review FishPhytO-related activities in Indonesia, and (3) exchange views on future activities and potential funding sources for their implementation.

1. Opening, introductions, adoption of the agenda and nomination of the rapporteur

The meeting began with welcoming remarks by Dr. Mitsutaku Makino, followed by introductions of participants (listed in *Appendix 1*). Three PST members, Dr. Vladimir Kulik (Russia), Dr. Moonho Son (Korea, representing MEQ), and Dr. Vera Trainer (USA, representing MEQ), were unable to attend this meeting. Invitees to the meeting were Dr. Minji Lee (National Institute of Fisheries Science, Korea), Mr. Arief Rachman (BRIN – National Research and Innovation Agency, Indonesia) and Dr. Suhendar I Sachoemar (BRIN and ITI – Institute Technology of Indonesia). The meeting was held in the hybrid format, and our Indonesian colleagues participated remotely.

The provisional agenda circulated prior to the meeting was modified in the order of discussion and approved (*Appendix 2*). Dr. Mark Wells served as the rapporteur.

Participants of the fourth FishPhytO PST meeting held October 30, 2024, in Honolulu, USA (left to right): Daisuke Ambe, Naoki Tojo, Minji Lee, Alexander Bychkov, Mitsutaku Makino, Shion Takemura, Mark Wells, Charles Trick, Pengbin Wang and Seung Ho Baek; on the screen: Arief Rachman (left) and Suhendar I Sachoemar (right).

2. FishGIS Application Management summary

As the project budget from the Ministry of Agriculture Forestry and Fisheries of Japan (MAFF) ended after completion of Year 1 (March 31, 2024), available financial resources were not sufficient for further modification/development of the FishGIS monitoring service. A half of the total amount required to maintain a FishGIS cloud server for Indonesia in 2024–2025 was paid in advance. Dr. Makino requested limited funding from the Fisheries Research and Education Agency of Japan (FRA) to continue maintaining the Indonesian server, but this request was unsuccessful. In response, a new 3-year project was developed between the Atmosphere and Ocean Research Institute (AORI) of the University of Tokyo and the National Federation of Fisheries Cooperative Association for the use of the FishGIS application to report unusual catches and phenomena in Japanese coastal waters. The project has been funded by the Nippon Foundation, and some funds from this grant are allocated to support the cloud server for Indonesia. In return, Dr. Makino would like to use images from the Indonesian FishPhytO-related projects for teaching AI identification of tropical species that are becoming present more frequently in Japanese waters. In the new project, fishers wait to upload their data until they return to shore. So data collections are more limited and do not include field positional information. Fishers also are not using HydroColor at this time, beginning instead with image data alone as a first step.

Mr. Rachman raised the issue of difficulty in downloading multiple images at a time. Although one can use the FishGIS Dashboard to download photos quickly, he suggested a new approach that would streamline the process, if funding is found to implement it.

Several minor changes in the FishGIS application were implemented (addition of logos, simplification of items, file attachment function, *etc*.) for its use in the AORI project. Specific details of these changes were not discussed at the meeting, and Dr. Naoki Tojo suggested that it would be valuable to include their description in the project report.

3. FishPhytO-related activities in Indonesia

Dr. Sachoemar reported on the Indonesian project titled "FishPhytO-Ecological Disaster Mitigation of CFP and HABs at Gili Matra Marine Tourism Park, Lombok, Indonesia" (*Appendix 3*). This project is the combination of the FishPhytO project and the Indonesian-funded BRIN-Ciguatera project. There are 15 personnel from BRIN and Mataram University associated with this project, which focuses on (1) developing a disaster mitigation model for Ciguatera Fish Poisoning (CFP) and Harmful Algae Blooms (HABs), (2) obtaining biophysical and chemical observations in the region using the FishGIS application, Hydrocolor, and Planktoscope, (3) the analysis of ocean health and eutrophication, (4) food safety and traceability of fish products, (5) social-economic and human dimensions studies, and (6) workshops and training for capacity building.

Two field surveys were conducted in 2024: March 4–7 (wet season – Southeast Monsoon) and August 6–9 (dry season – Northwest Monsoon). Two more 4-day surveys are planned for May 2025 and October 2025 to capture the transition phases from wet to dry (spring) and dry to wet (fall) conditions. The discussion centered on the breadth of data collected during these surveys, and the design and methodologies for the social-economic surveys and sampling strategies. Dr. Tojo, though applauded the efforts in the social-economic surveys, pointed out the difficulties in obtaining unbiased and representative data. He suggested that PST members would be able to advise on improving the methodologies for the collection of these data and highlighted the importance of including the specifics of these methodologies in future PST reports. PST members also felt that it would be helpful to have more information about the HAB data, such as a breakdown in the phytoplankton community composition of HAB and non-HAB species.

There was specific discussion about the large differences in chlorophyll concentrations determined from *in-situ* sampling and that calculated from HydroColor data. HydroColor provides reflectance values for red, green and blue wavelengths, the same wavelengths that are used in satellite algorithms to calculate chlorophyll concentrations. These algorithm(s) have been validated in offshore waters, but they begin to fail in many nearshore waters due to optically active materials added from runoff, shore erosion, and bottom sediments. In these cases, remote optically-determined chlorophyll concentrations are artificially high, as is the case in the survey samples here. New constants in the algorithm have to be derived by comparing HydroColor optical measurements and *in-situ* determined chlorophyll concentrations. It was recommended that Dr. Sachoemar contact remote sensing experts in Indonesia and offer to share the data for this purpose. Those individuals likely will be keen to use the HydroColor data to calibrate their coastal chlorophyll algorithms, thus both validating the HydroColor chlorophyll measurements and enabling the use of satellite remote sensing to expand the chlorophyll survey to other regions of the study area.

In addition to the 2025 field surveys, the list of planned activities in the Indonesian project includes: (1) workshops and online general lectures in 2025 and 2026, each with a series of presentations by PST members and Indonesian scientists, to disseminate information about fisheries management and the hazards of benthic HABs in Indonesian coastal areas, and to communicate the background, principles and goals of the FishPhytO project and related Indonesian projects to the broad audience, (2) an in-person training workshop in Lombok in August 2026 (if a proposal submitted to IOC-WESTPAC is approved), (3) developing a disaster mitigation model for HAB and CFP, and (4) preparing a scientific manuscript on the survey findings.

Mr. Rachman provided a more detailed summary of the second phase of the BRIN-Ciguatera Indonesia project that links FishGIS, Hydrocolor and Planktoscope in the Gili Islands (*Appendix 3*). The station locations and numbers remained the same as in the first phase (see Chapter 5 in the Ciguatera project scientific report) to simplify the long-term assessment. Macroalgal samples were collected from each station through collaboration with University of Mataram individuals who are familiar with the sites and species. Six benthic HAB (BHAB) genera were identified, all in small numbers: *Amphidinium, Prorocentrum, Gambierdiscus, Synophysis, Ostreopsis,* and *Coolia*. Efforts to culture these isolates for further experimentation were unsuccessful.

Progress with using Planktoscopes in the sampling program has stopped for the moment. Two Planktoscopes (Plexiglas versions) have software issues that have not yet been solved, while the third Planktoscope has fungi growth in the lens. This newest version utilizes a wooden housing that appears to be prone to gaining moisture in the high-humidity environment of Indonesia. This information will be passed along to our collaborators at Stanford University.

Mr. Rachman will begin his PhD program later this project year. His dissertation research will focus on BHABs in Indonesian waters, and he asked for permission to use data collected during the Ciguatera and FishPhytO projects. This permission was happily granted.

All PST members commended the joint efforts of our Indonesian colleagues. Considering that it is difficult to fully appreciate these efforts from the slide presentations alone, the PST requested to provide a more detailed report/presentation of the objectives, goals, and the number of students they have incorporated in the projects using a more uniform format.

4. Budget report

The discussion of the financial report was straightforward – MAFF's contribution for the first year of the project was completely spent, and there are no remaining MAFF funds in the budget. There is ~$15,000 in the PICES Special Project Coordination Fund, a portion of which might be re-directed to some project goals, but this is uncertain.

One of the stated project goals is "to identify research needs for deploying the FishGIS application in PICES member countries", and this step, potentially, could open up further funding opportunities. Dr. Seung Ho Baek did not see many prospects for FishGIS application use in Korea, and its use by Canada and the USA is equally uncertain. Dr. Pengbin Wang has agreed to explore the possibility of deploying the FishGIS application in China, and Dr. Wells will introduce this tool at the International Training Program on Prevention, Control, and Mitigation of Harmful Algal Blooms (PCMHABs) to be held from December 1–11, 2024, in Nanning and Fangchenggang, China.

5. Future activities (Plans for Year 2 and 3)

PST members all agreed with Dr. Tojo's assessment that we are at the stage to synthesize the project history, activities, and outputs. One product could be a paper in a peer-reviewed journal with focus on the cumulative scientific findings from a series of interconnected PICES-MAFF project across the past few years – FishGIS, Ciguatera and FishPhytO. An equally valuable output would be a manual published in the PICES Technical Report series that includes the case studies used in these projects. Such report would benefit PICES member countries by providing a summary on the successes/failures and lessons learned; a knowledge that will help to communicate a blueprint for other future projects focusing on actionable science. Another technical publication could be a manual that detail the operation of the FishGIS application/FishGIS monitoring service.

There also was discussion about how to go about keeping progress going in Indonesia, specifically the FishGIS application that has formed much of the basis for this and precious projects. The server maintenance is assured for the next two years but efforts now are needed to identify a funding mechanism beyond this timeframe. One of the questions raised was "who manages the outcome data moving forward, given the complex interaction among nations". Clarification of these issues will be an important segment of the technical publication.

The agreed tentative workplan for 2025–2026 includes:

Publications:

- Prepare a scientific manuscript for a peer-reviewed journal summarizing findings from this project along with findings from two previous PICES-MAFF project (FishGIS and Ciguatera);
- Prepare a publication, or publications, in the PICES Technical Report series detailing the operation of the FishGIS monitoring service along with broader insights gained from lessons learned on the implementation strategies for the FishPhytO project and preceding PICES-MAFF projects. The intent is to provide guidance for any future PICES projects planned for developing countries.

Observation tools:

- Provide technical, hands-on training on the use of smartphone-based tools for monitoring of fisheries resources (FishGIS) and environmental health conditions (HydroColor), and on the use of Planktoscope for quantifying benthic and pelagic phytoplankton during a practical workshop to be held by the Section on Harmful Algal Blooms at the 2025 PICES Annual Meeting in Yokohama, Japan (if approved by PICES Science Board);
- Seek potential users of the FishGIS application in PICES member countries and other developing Pacific nations;
- Explore potential funding sources for the continued maintenance of the FishGIS server.

Activities in Indonesia:

- Develop a series of presentations for online general lectures to be organized in 2025 and 2026;
- Play an active role in conducting an in-person training and knowledge dissemination workshop to be held in Lombok in August 2026 (if a proposal submitted to IOC-WESTPAC is approved);
- Assist in analysis of data collected during 2024–2026 field surveys in Gili Matra Marine Tourism Park, Lombok, Indonesia.

Appendix 1

Fourth Project Science Team meeting participants

Members
Daisuke Ambe (Japan, representing TCODE)
Seung Ho Baek (Korea, representing MEQ)
Mitsutaku Makino (Co-Chair; Japan, representing HD)
Shion Takemura (Japan, representing HD)
Naoki Tojo (Japan, representing FIS)
Charles Trick (Canada, representing MEQ)
Pengbin Wang (China, representing MEQ)
Mark Wells (Co-Chair; USA, representing MEQ)
Alexander Bychkov (PICES, *ex-officio*)

Other
Minji Lee (National Institute of Fisheries Science, Korea)
Arief Rachman (BRIN – National Research and Innovation Agency, Indonesia; remotely)
Suhendar I Sachoemar (BRIN and ITI – Institute Technology of Indonesia, Indonesia; remotely)

Appendix 2

Fourth Project Science Team meeting agenda

Wednesday, October 30, 2024 (14:00 – 17:30)

Hawaii Convention Center, Honolulu, USA

1. Opening, introductions, adoption of agenda and nomination of the rapporteur
2. FishGIS Application management
3. FishPhytO-related activities in Indonesia - BRIN-funded field surveys and online dissemination activities
4. Budget report and supports from PICES
5. Exchange of opinions on future activities

Appendix 3

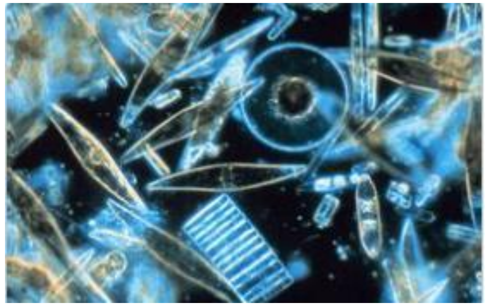
Presentations on Indonesian FishPhytO-related Projects

FISHPHYTO-ECOLOGICAL DISASTER MITIGATION OF CFP AND HAB AT GILI MATRA MARINE TOURISM PARK LOMBOK-INDONESIA

PREPARED BY RIIM-4 CIGUATERA II INDONESIAN TEAM

SUHENDAR I SACHOEMAR





PICES PST MEETING, OCTOBER 30, 2024

INDONESIAN RESEARCH TEAM-RIIM4

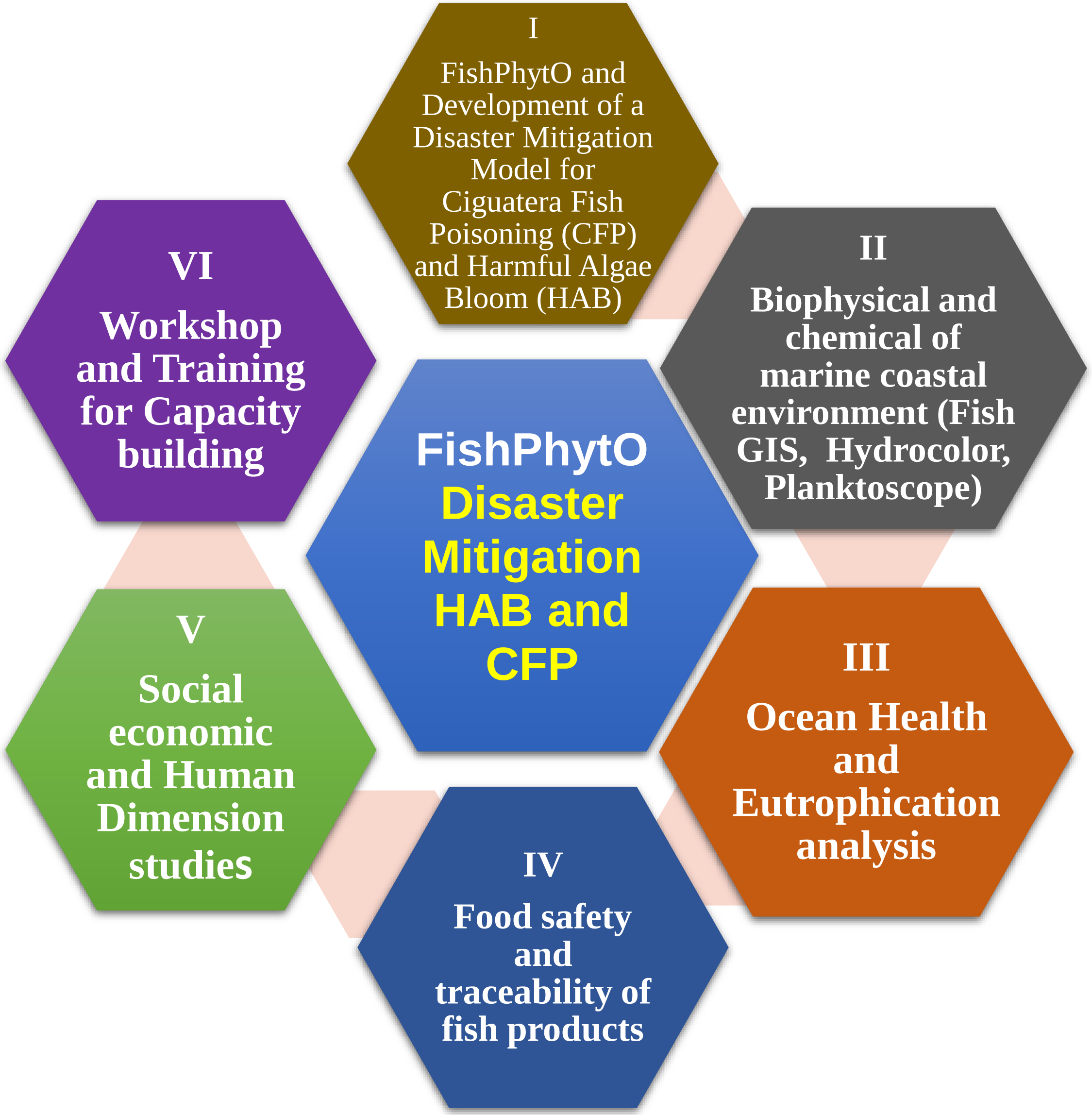
No.	Name	Institution
1	Prof. Suhendar I Sachoemar	RCECT-BRIN
2	Arief Rachman, M.Biol.Sc.	RCO- BRIN
3	Prof. Yudhi Soetrisno Garno	RCECT-BRIN
4	Dr. Joko Prayitno Susanto	RCECT-BRIN
5	Dr. Agung Riyadi	RCECT-BRIN
7	Dr. Ratu Siti Aliah	RCF- BRIN
8	Hilman Ahyadi, M.Si.	Mataram University
9	Diswandi, Ph.D	Mataram University
10	Dr. Yuliadi Zamroni	Mataram University
11	Setiarti Sukotjo, M.Sc	Institut Teknologi Indonesia (ITI)
12	Riardi Pratista Dewa, S.Kel, M.Env	RCECT-BRIN
13	Nurul Fitriya, M.Si.	RCO-BRIN
14	Rahman,SE,M.Par	Mataram University
15	Teguh Prayogo, MSc	RCECT-BRIN

INTRODUCTION

FishPhytO (PICES). The overall objective of the new PICES-MAFF project, entitled "*Creating a phytoplankton-fishery observing program for sustaining local communities in Indonesian coastal waters*" (FishPhytO), is to establish, in collaboration with local fishers, research institutes and universities, a phytoplankton-fishery observing program in the Lombok Island region (Indonesia) using tools developed and modified/refined during the previous two PICES-MAFF projects (2017–2023) to enable the detection of toxic benthic Harmful Algal Bloom (HAB) species that can threaten tropical reef fisheries, and to record images of the fishery catches for enumeration of fish species and sizes. The long-term objectives are to: (1) provide local communities with the capacity and knowledge to sustainably manage their fisheries resources and ensure seafood safety, and (2) identify research needs for deploying these tools in PICES member countries.

BRIN Ciguatera. In general, the objectives: (1) Continuing the study and completing data related to benthic dinoflagellate communities that have the potential to cause environmental disasters in the form of HAB and CFP. (2) Studying in more depth the level of pressure from human activities, especially tourism and recreational fisheries on the Gili Matra islands that have the potential to cause environmental damage or trigger HAB or CFP, and calculating the potential economic losses due to these incidents. (3) Continuing the process of disseminating information and efforts to increase public awareness regarding the potential dangers of HAB and CFP environmental disasters4. Building a mitigation model/independent monitoring method with the Citizen Scientist concept by implementing smartphone-based technology and environmental quality monitoring applications that have been developed by partners (PICES) since 2018, namely Hydrocolor and FishGIS.

SCOPE OF ACTIVITIES



The scope of activities cover :

1. Development of a Disaster Mitigation Model for Ciguatera Fish Poisoning (CFP) and Harmful Algae Bloom (HAB)
2. Biophysical and chemical of marine coastal environment (Fish GIS,Hydrocolor, Planktoscope)
3. Ocean Health and Eutrophication analysis
4. Food safety and traceability of fish products
5. Social economic and Human Dimension studies
6. Workshop and Training for Capacity building

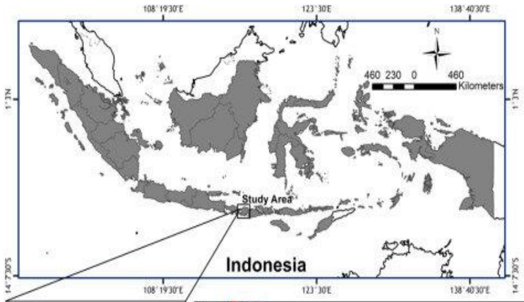
RESEARCH ACTIVITIES ON HAB AND CFP AT GILI MATRA LOMBOK

I. 2023/2024-2025/2026 (3 Years) : Research and Innovation for Advanced Indonesia RIIM) Development of a Disaster Mitigation Model for CFP and HAB-9 Stations

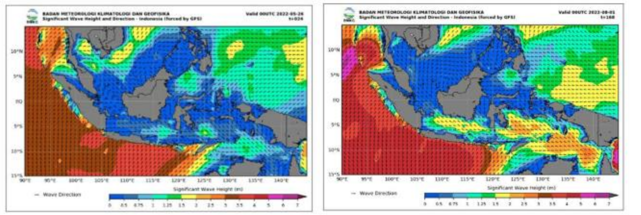
1. 4-7 March 2024 (Wet Season) - Southeast Monsoon
2. 6-9 August 2024 (Dry Season) - Northwest Monsoon
3. 4-8 May 2025 (Transition from Wet to Dry Season)
4. 6-9 October 2025 (Transition from Dry to Wet Season)
5. Workshop/General Lecture online (2024 and 2025)
6. Workshop/Training at Lombok in August 2026 (Budget and program proposed to IoC WESTPAC)

II. 2023/2024 (1 Year) : Utilization of Oceanographic Satellite and Landsat Data for Monitoring Eutrophication and Fisheries Resources Abundance

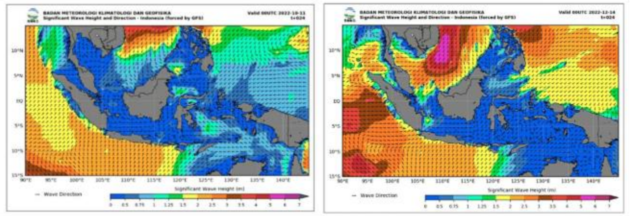
Data analysis of Aqua MODIS, SeaWiFs satellite imagery of Sea Surface Temperature (SST) and Sea Surface Chlorophyll-a (SSC), and Landsat/Sentinel Data



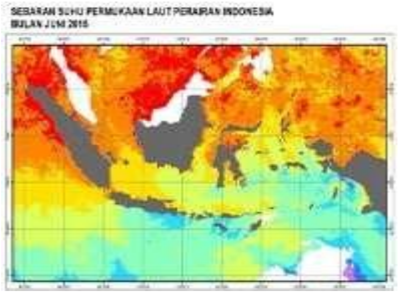
- Gili Matra Marine Tourism Park is located in Northern Coastal of Lombok and consists of three small islands : Gili Ayer, Gili Meno, and Gili Trawangan.
- Gili Matra Marine Tourism Park, hereinafter referred to as MTP Gili Matra, has an area of 2,954 Ha, consisting of 665 Ha of land and the rest is marine waters

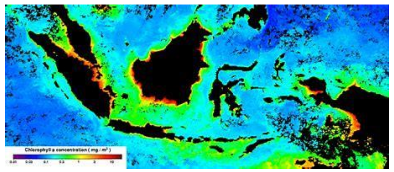


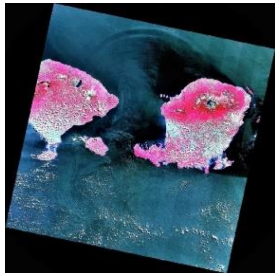
May 2022 (Transition I) | August 2022 (Dry Season/Southeast Monsoon)

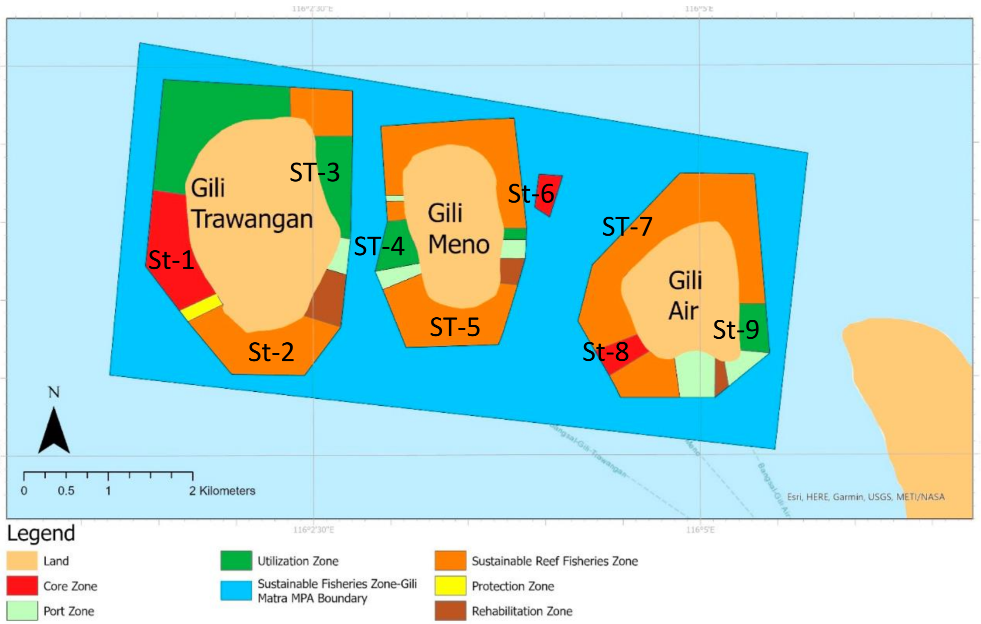


October 2022 (Transition II) | December 2022 (WetSeason/Northwest Monsoon)









OBSERVATION RESULT-Biophysical-chemical-Hydrocolor

WATER QUALITY DATA OF GILI MATRA MARINE PARK TOURISM AREA-LOMBOK

Sea Water Sampling (March 04-07, 2024)

No.	Parameters	Unit	Sampling Stations (9 points)								
			1	5	16	6	9	10	12	14	15
I	**Physical Parameters**										
1	Temperature	°C	30.17	30.25	30.46	30.44	30.37	30.45	30.47	30.37	30.29
2	Turbidity	NTU	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	TDS	g/L	28.37	28.30	28.15	28.28	28.39	28.33	28.40	28.29	28.11
4	Spesific Gravity		18.24	18.13	17.93	18.08	18.17	18.10	18.16	18.10	17.96
5	Depth	m	5.19	5.48	5.48	5.24	5.48	4.94	5.03	5.50	5.60
6	TSS	mg/L	0.199	0.213	0.212	0.198	0.199	0.196	0.213	0.221	0.198
7	Transparency	%	100	100	100	100	100	100	100	100	100
II	**Chemical Parameters**										
1	pH		8.25	8.44	8.37	8.85	8.94	8.79	8.41	8.64	8.87
2	ORP	mV	227.82	196.93	193.10	157.90	137.57	213.33	123.54	130.73	155.66
3	Conductivity	mS/cm	46.51	46.37	46.11	46.36	46.52	46.47	46.51	46.36	46.09
4	Salinity	ppt	30.20	30.10	29.90	30.08	30.21	30.15	30.21	30.07	29.88
5	DO	mg/L	7.07	6.13	6.28	5.90	6.39	7.00	5.87	6.89	10.63
6	Phosphate	mg/L	0.14	0.25	0.1	0.06	0.29	0.04	0.03	0.09	0.17
7	Nitrite	mg/L	0.009	0.002	0.007	0.003	0.004	0.001	0.001	0.003	0.006
8	Nitrate	mg/L	0.02	0.01	0.01	0.01	0.03	0.01	0.01	0.01	0.01
9	Ammonia	mg/L	0.07	0.21	0.11	0.18	0.24	0.1	0.18	0.2	0.17
10	Total Organic Matter (TOM)	mg/L	17.696	29.072	31.6	25.28	41.712	45.504	40.45	36.656	32.864
III	**Biological Parameters**										
1	Chlorophyll-a	µg/L	8.307	3.263	9.197	7.417	0.297	9.493	7.120	8.307	7.417
2	Plankton	Cell/l	315,000	177,000	116,000	115,000	82,000	129,000	82,000	35,000	178,000
IV	**Hydrocolor**										
1	Turbidity (NTU)		80	80	80	80	0	80	80	9	80
2	SPM (mg/l)		80	80	80	80	0	80	80	9	80
3	Chlorophyll-a (µg/l)		1.197	1.175	1.032	1.366	1.188	1.293	1.522	1.470	1.504
	Ref. Red		0.078	0.0995	0.052	0.0364	0.0008	0.265	0.2271	0.0123	0.0674
	Ref. Green		0.1571	0.1423	0.1208	0.075	0.0696	0.3956	0.4687	0.0186	0.1462
	Ref. Blue		0.203	0.1685	0.1778	0.0889	0.1104	0.4546	0.5123	0.0201	0.162
	BB- Red		3.68	9.96	1.53	0	-2.25	-3.13	0.89	0.09	2.54
	(Blue-Red)/(Green-Red)		1.580278	1.61215	1.828488	1.360104	1.593023	1.451761	1.180464	1.238095	1.200508

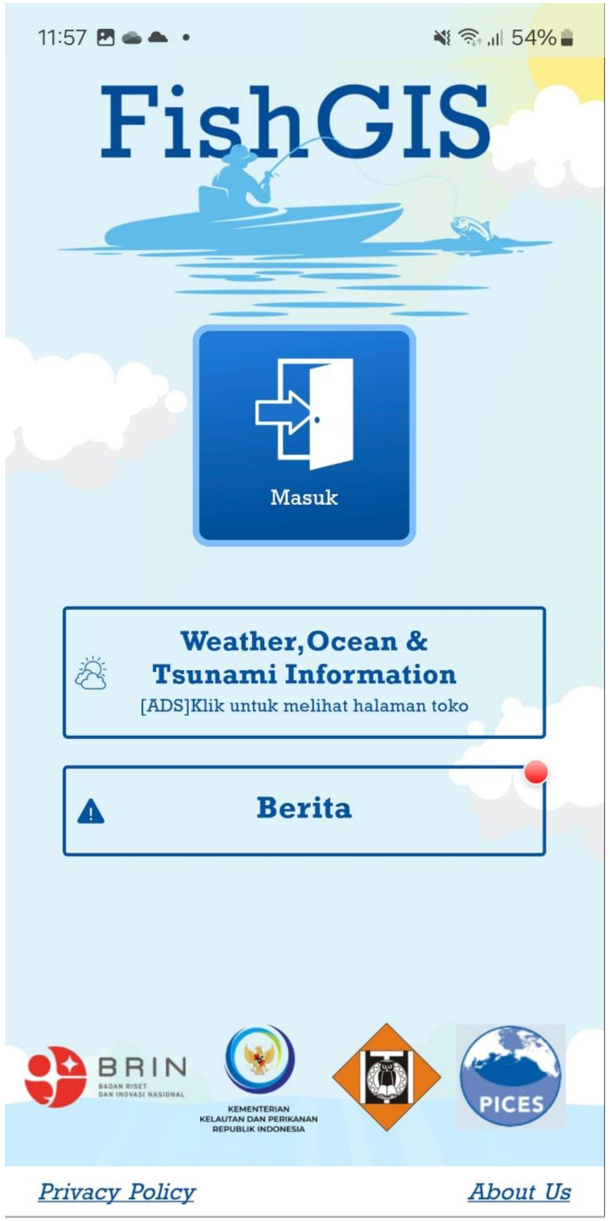
OBSERVATION RESULT-Biophysical-chemical-Hydrocolor

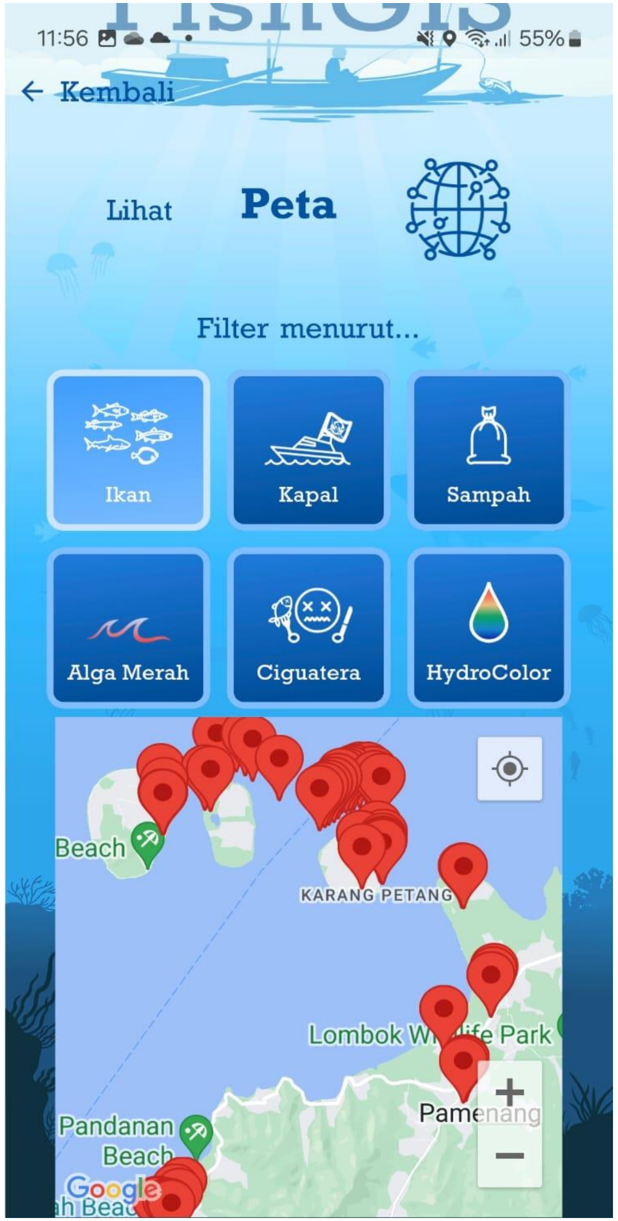
WATER QUALITY DATA OF GILI MATRA MARINE PARK TOURISM AREA-LOMBOK

Sea Water Sampling (Agustus 06-09, 2024)

No.	Parameters	Unit	Sampling Stations (9 points)								
			1	5	16	6	9	10	12	14	15
I	**Parameter Fisika**										
1	Temperatur	°C	28.23	28.46	28.68	28.41	28.41	28.50	28.49	28.63	28.57
2	Turbidity	NTU	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.76	0.00
3	TDS	g/L	31.01	31.09	31.20	30.96	31.20	31.15	31.30	30.23	31.30
4	Spesific Gravity		21.71	21.71	21.78	21.59	21.80	21.75	21.90	21.05	21.86
5	Depth	m	2.00	1.26	2.52	5.22	2.40	2.68	4.31	4.66	5.35
6	TSS	mg/L	28.00	32.00	24.00	64.00	36.00	40.00	28.00	38.00	48.00
7	Transparency	%	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
II	**Parameter Kimia**										
1	pH		8.31	8.52	8.59	8.76	8.74	8.66	8.83	8.80	8.87
2	ORP	mV	98.00	101.00	108.32	69.15	104.00	91.00	94.54	116.28	90.77
3	Conductivity	mS/cm	51.67	51.82	52.05	51.59	51.97	51.94	52.18	50.46	52.14
4	Salinity	ppt	33.99	34.10	34.26	33.92	34.21	34.19	34.35	33.18	34.33
5	DO	mg/L	6.85	7.05	6.96	6.74	6.94	6.96	6.85	7.01	6.59
6	Phosphate	mg/L	0.039	0.000	0.016	0.021	0.028	0.013	0.031	0.020	0.013
7	Nitrite	mg/L	0.003	0.003	0.003	0.003	0.003	0.003	0.004	0.030	0.040
8	Nitrate	mg/L	0.085	0.071	0.058	0.081	0.068	0.077	0.069	0.067	0.051
9	Ammonia	mg/L	0.044	0.042	0.043	0.039	0.041	0.05	0.04	0.037	0.041
10	Total Organic Matter (TOM)	mg/l	3.1	3.0	2.7	2.7	3.0	3.4	2.5	3.0	2.5
11	Total Nitrogent	mg/l	1.18	0.96	1.15	1.07	1.16	0.97	1.06	1.16	1.04
III	**Parameter Biologi**										
1	Chlorophyll-a	µg/L	0.012	0.002	0.001	0.004	0.010	0.013	0.011	0.011	0.003
2	Plankton	Cell/l	136	59	80	28	58	125	70	38	84
3	Fecal Coliform	ind/100 ml	0	0	0	0	0	0	0	0	0
IV	**Hydrocolor**										
1	Turbidity	NTU	80	20	80	1	16	80	7	10	80
2	SPM	mg/l	80	19	80	1	15	80	7	10	80
3	Chlorophyll-a	(µg/l	1.334	1.887	1.357	1.114	1.524	1.580	1.330	3.054	0.0197
	Ref. Red		0.0009	0.0205	0.0741	0.0013	0.0181	0.0396	0.0099	0.0131	0.0544
	Ref. Green		0.0024	0.0418	0.1501	0.0033	0.0327	0.0793	0.0136	0.0176	0.1294
	Ref. Blue		0.003	0.038	0.1783	0.0047	0.0353	0.084	0.0151	0.0197	0.1434
	(Blue-Red)/(Green-Red)		1.4	0.821596	1.371053	1.7	1.178082	1.118388	1.405405	0.0197	0.0197

OBSERVATION RESULT-FISH GIS





OBSERVATION RESULT- Ocean Color

DATA OCEAN COLOR MODIS

- CHLO
- SST

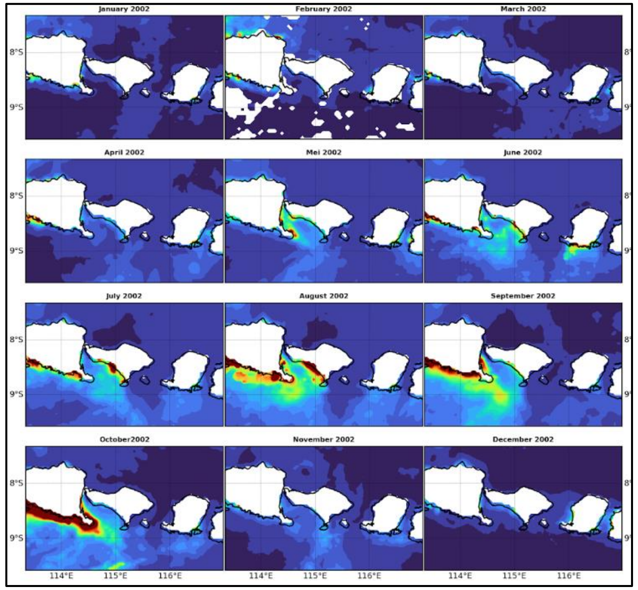
- Monthly
- monthly_join
- Seasonal
- seasonal_join
- Yearly
- yearly_join

- Monthly
- monthly_join
- Seasonal
- seasonal_join
- Yearly
- yearly_join

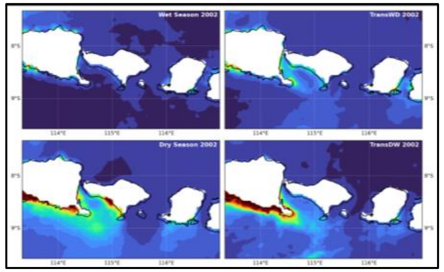
DIGITAL DATA

	lon	chlor_a
-7.316909	112.96928	5.690891
-7.316909	113.01102	3.3768444
-7.316909	113.05276	2.0677378
-7.316909	113.0945	1.1210618
-7.316909	113.136246	0.58848315
-7.316909	113.177986	0.46312344
-7.316909	113.21973	0.44798732
-7.316909	113.26147	0.43097696
-7.316909	113.303215	0.44983834
-7.316909	113.344955	0.44833818
-7.316909	113.386696	0.31964448
-7.316909	113.428444	0.37704805
-7.316909	113.470184	0.29969484

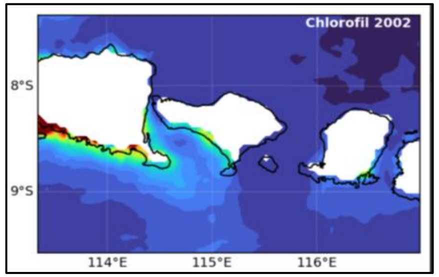
MONTHLY IMAGERY DATA



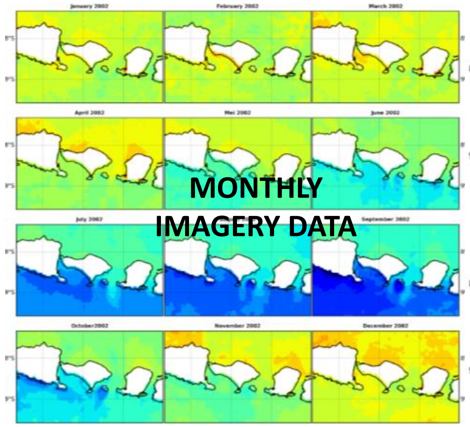
SEASONAL IMAGERY DATA



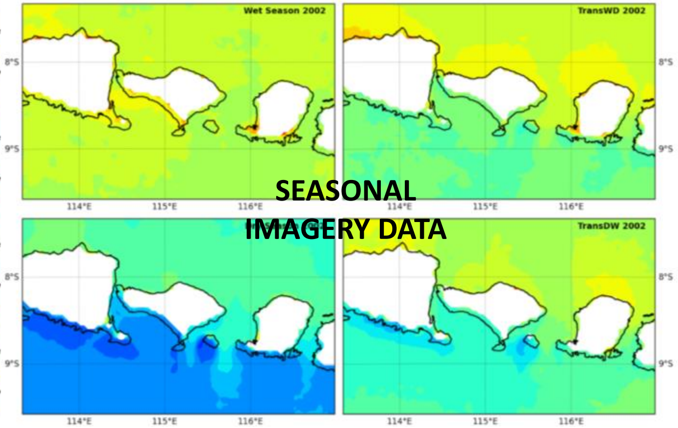
ANNUAL IMAGERY DATA



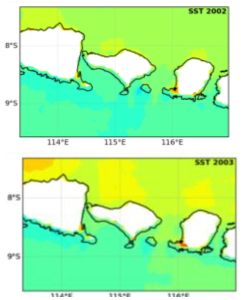
lat	lon	sst
-7.316909	112.96928	29.890625
-7.316909	113.01102	29.618124
-7.316909	113.05276	29.610998
-7.316909	113.0945	29.6445
-7.316909	113.136246	29.598335
-7.316909	113.177986	29.985556
-7.316909	113.21973	29.993334
-7.316909	113.26147	29.876665
-7.316909	113.303215	29.816427
-7.316909	113.344955	29.71
-7.316909	113.386696	29.695713
-7.316909	113.428444	29.809286
-7.316909	113.470184	30.012857



MONTHLY IMAGERY DATA



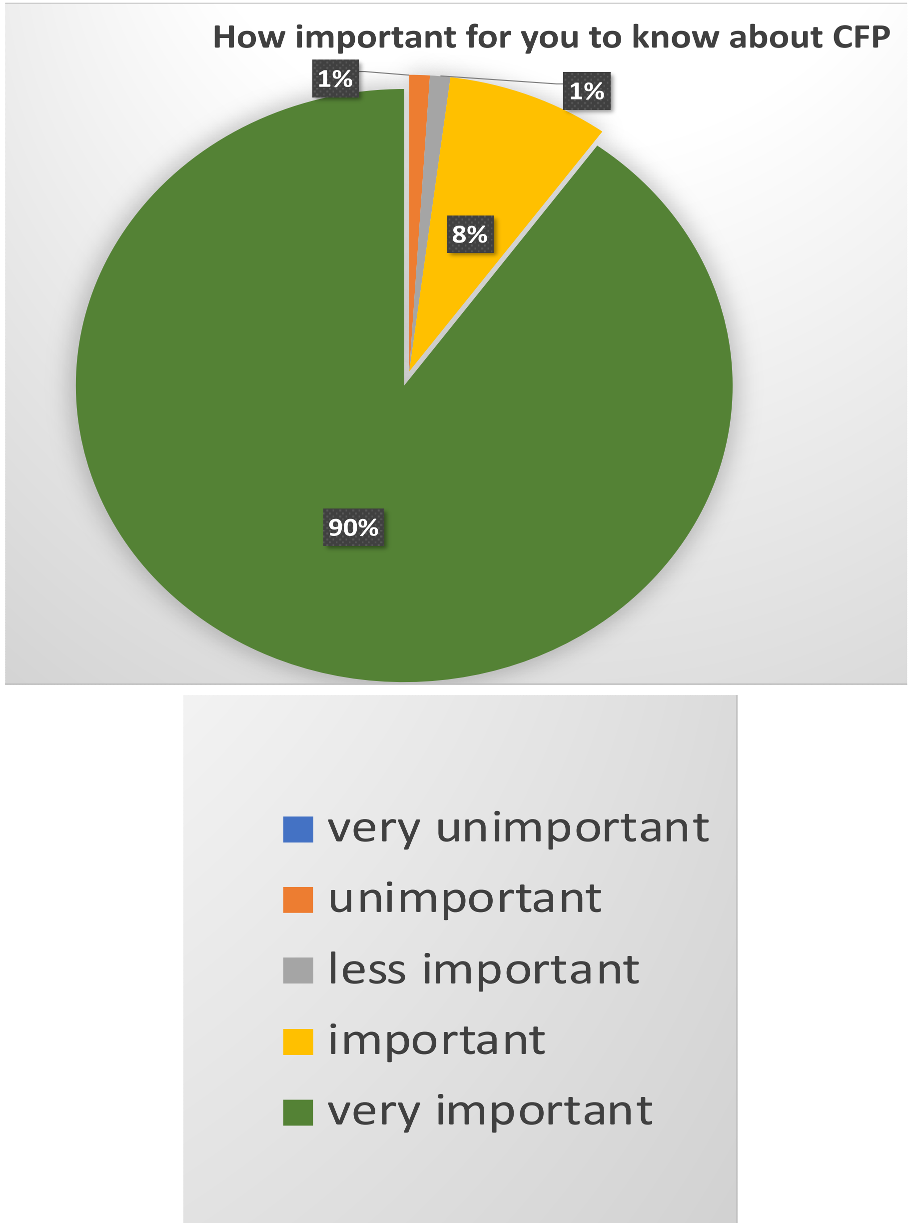
SEASONAL IMAGERY DATA

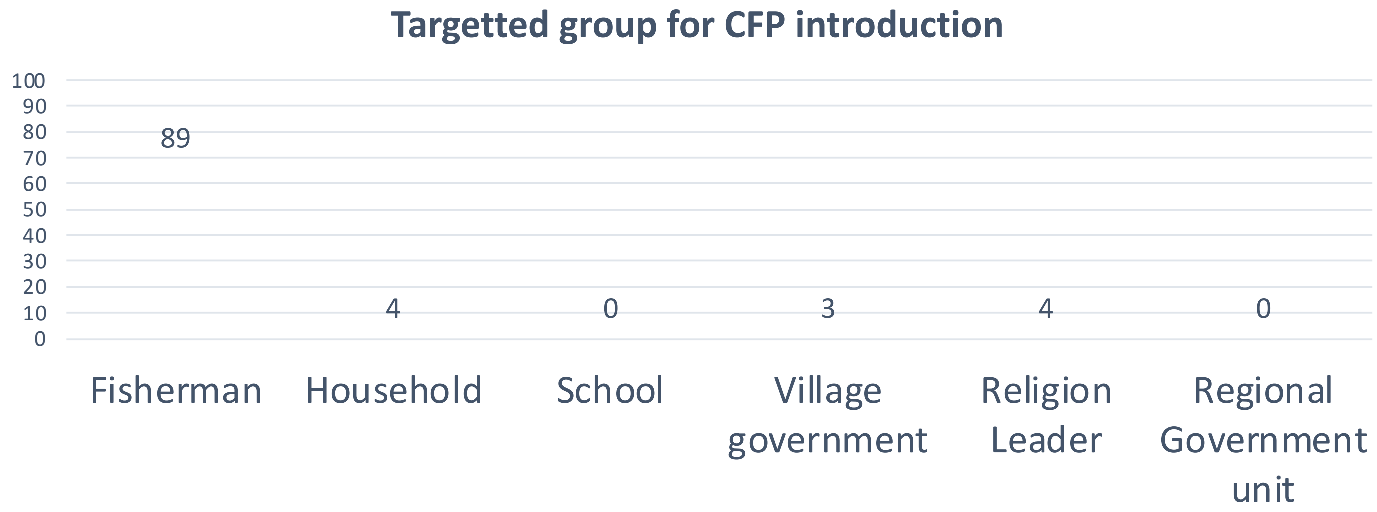


ANNUAL IMAGERY DATA

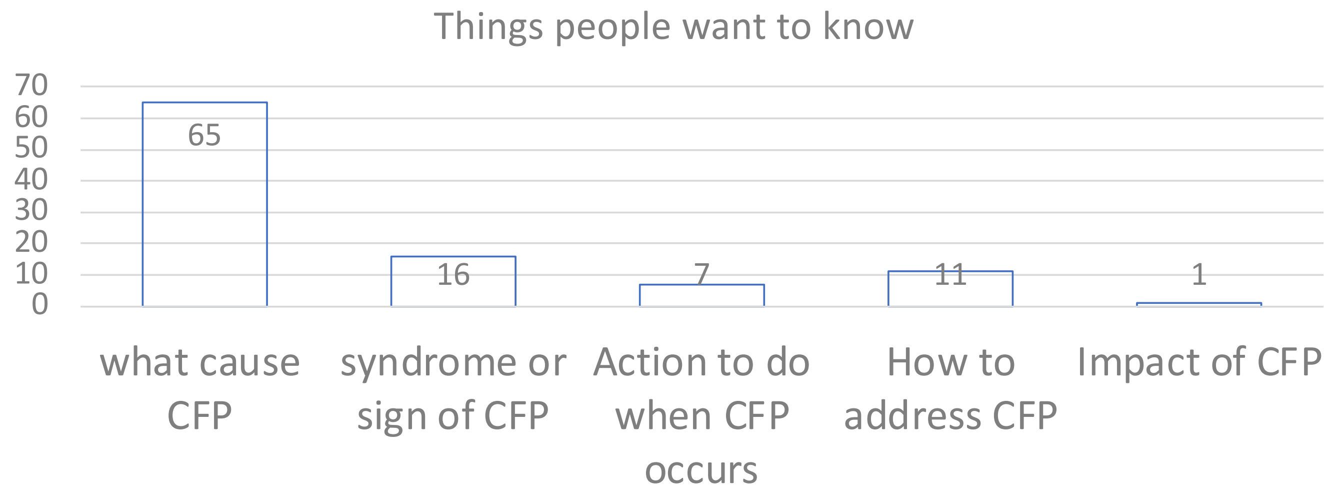
OBSERVATION RESULT-Social Aspect

How important of the CFP





Things that people want to know related to CFP



Planned activities – 2026 HAB mitigation in Lombok Island-Proposed to IOC WESTPAC

Program	Plan				Funding Required		Remark
	Activities	Objectives	Expected outputs/outcomes	Date and place	IOC	Other sources (i.e. from national or international)	
Harmful Algae Bloom (HAB) and Ciguatera Fish Poisoning (CFP) Disaster Mitigation Research (R&D)	1. HAB and CFP Disaster Mitigation Research	To develop HAB and CFP Disaster Mitigation Model	Prototype model/ model of HAB and CFP Disaster Mitigation as a guidance to reduce HAB/CFP disaster risk	Jan- Dec 2024-2025 Lombok, Indonesia	-	20,000	RIIM Project BRIN and in-kind others
	2. HAB and CFP Mitigation Workshop	To disseminate HAB and CFP Disaster Mitigation Model	Dissemination of HAB and CFP disaster mitigation models to various stakeholders	August 2026/ Lombok, Indonesia	16,425		
	3. Reporting	Report of Workshop	Documentation of workshop results as a reference for policy determination	December 2026	3,000		

FUTURE ACTIVITY PLANS

Field Survey 2025

1. 4-8 May 2025 (Transition from Wet to Dry Season)
2. 6-9 October 2025 (Transition from Dry to Wet Season)
3. Encouraging students of Mataram University and others to use Fish GIS/Hydrocolor for their research.

Workshop/General Lecture/Training

1. Workshop/General Lecture online (2024 and 2025 and 2026)
2. Workshop/Training at Lombok offline in August 2026 (If proposal approved by IoC WESTPAC)

Others

1. Developing disaster mitigation model of HAB and CFP
2. Publishing scientific paper

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2. Dept. of Agricultural Industrial Technology, Institute Technology of Indonesia (ITI),

3. Expert Council of PPI (Indonesian Research Association)

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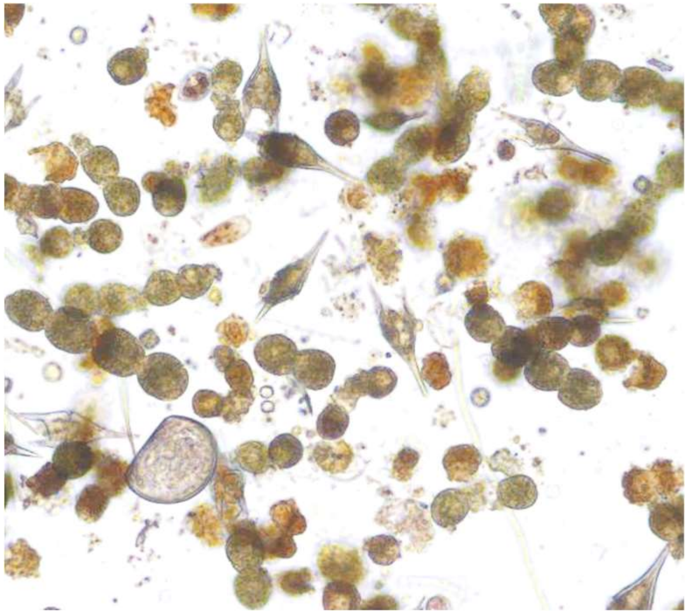
Mobile :+62-82122014795

THANK YOU



Ciguatera Indonesia II

PREPARED BY RIIM-4 CIGUATERA II INDONESIAN TEAM

PICES

BRIN
BADAN RISET DAN INOVASI NASIONAL

INSTITUT TEKNOLOGI INDONESIA
The Technology-based Entrepreneur University

UNIVERSITAS MATARAM

RIIM-4

DEVELOPING THE DISASTER MITIGATION MODELS FOR CIGUATERA FISH POISONING (CFP) AND HARMFUL ALGAL BLOOMS (HABS) IN THE MARINE TOURISM PARK OF GILI MATRA, LOMBOK

Harmful Algal Blooms (HABs)

Harmful Algal Blooms (HABs) → one among 10 Plagues of the Seas → the occurrence could threaten the ecosystem balance and the life of coastal communities (Duarte et al., 2014)

Harmful effects (GEOHAB, 2000) →

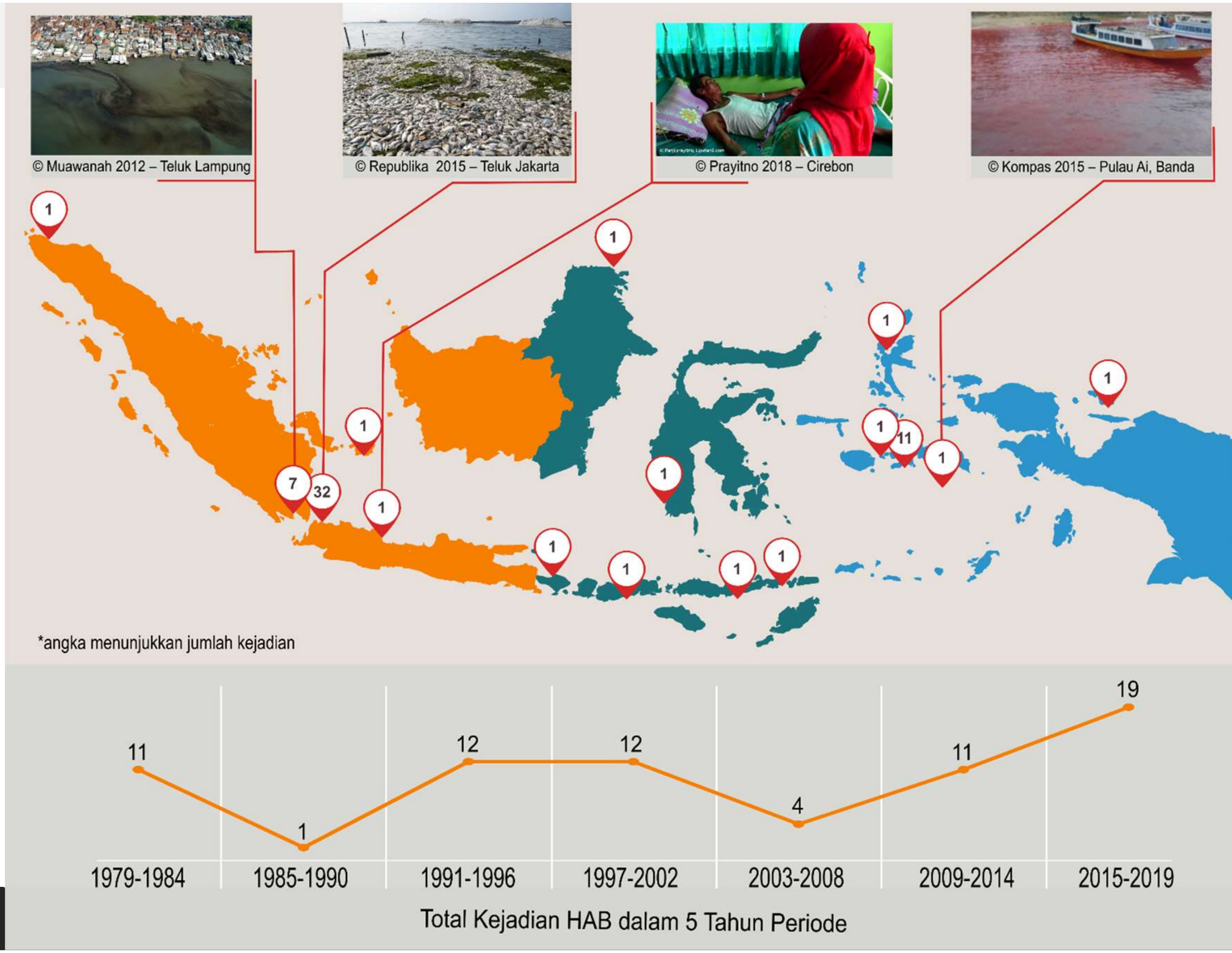
- *Ocean discoloration*
- *Mass fish mortality/fish kill*
- Toxin contamination of seafood products
- Altering/disrupting the balance of the ecosystem
- Danger to the health of humans (poisoning cases could lead to death)
- Negatively impacting the economy of coastal communities

HAB Dashboard
Plankton and Primary Productivity Laboratory

(Mariana D. B. Intan, 2019)

Distribution of reported HABs cases in Indonesia during the periods of 1979 - 2019

Lack of awareness and research on HABs in Indonesia → low report or publications → HABs cases in Indonesia is ***underreported***



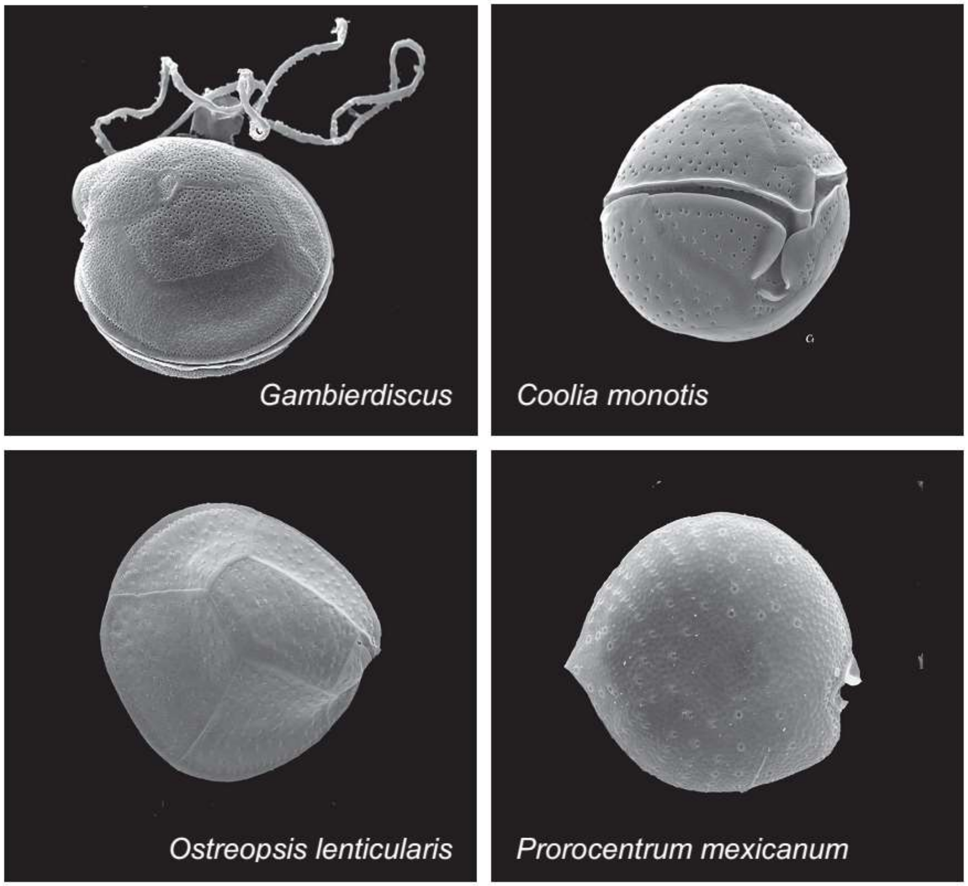


Figure 4. Morphology of *Gambierdiscus*, *Coolia*, *Ostreopsis* and *Prorocentrum* is illustrated in scanning electron micrographs. Cell dimension are estimated by the length and width of the species: *Gambierdiscus* 53-85 µm x 44-58 µm; *Coolia monotis* 23-49 µm x 23-38 µm; *Ostreopsis lenticularis 65-75* µm x 57-63 µm; and *Prorocentrum mexicanum* 32-40 um x 26-30 µm.

(Faust et al. 2009)

Ciguatera Fish Poisoning

Ciguatera Fish Poisoning → poisoning disease in human or marine mammals due to consumption of reef fishes that are contaminated by ciguateoxin (CTX) produced by several species of benthic dinoflagellates → *Gambierdiscus toxicus* and other associated species → *Ostreopsis ovata*, *Prorocentrum lima*, *P. concavum*, *P. mexicanum* (*rhathymum*), and *Amphidinium carterae* (Burkholder 1998; Lehane and Lewis 2000)

Known symptoms of CFP (deSylva 1994; Lehane dan Lewis 2000) :

- diarrhea
- nausea
- vomitting
- stomachache
- reversal of cold-hot sensation
- muscles and joints pain
- tingling (often painful)
- numbness on lips and tongue
- itch
- hypotension (low blood pressure)

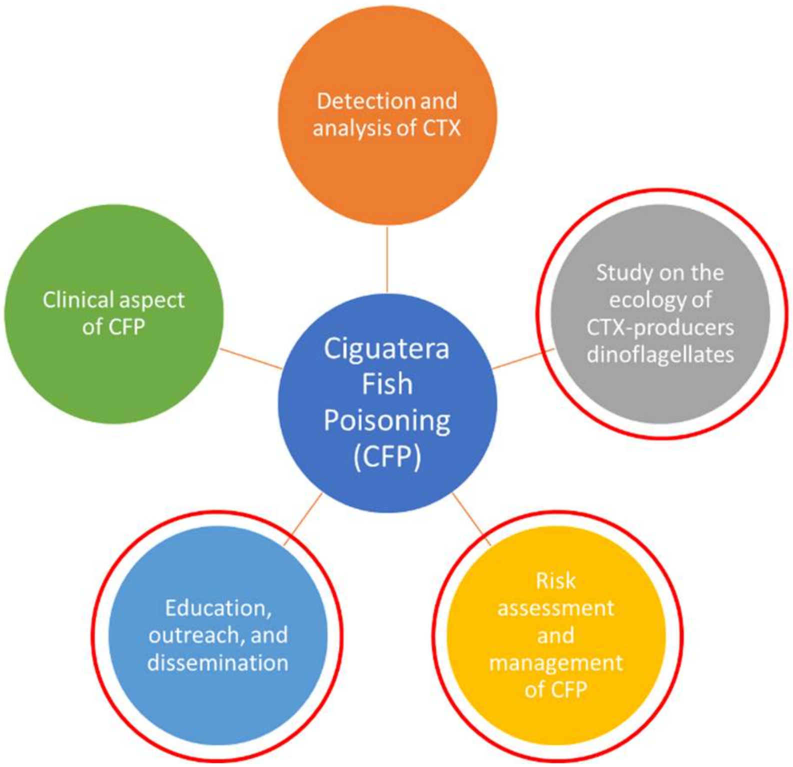
Records of benthic dinoflagellate species associated with CFP

Benthic dinoflagellates which could potentially caused CFP → *Amphidinium* sp., *G. toxicus*, *O. ovata*, *O. siamensis*, *P. lima*, *P. concavum*, dan *P. rhathymum*, *Gambierdiscus sp.*, *Ostreopsis sp* → have been reported and studied from several places in Indonesia:

- Seribu Island
- Belitung Island
- Bali coastal waters
- West coast of South Sumatera
- Bintan Island
- Padang coastal waters
- Lampung Bay
- Weh Island coastal waters
- Gili Matra

Widiarti 2002, Widiarti 2010, Skinner et al. 2011, Widiarti 2011, Thamrin 2014, Dwivayana 2015, Eboni et al. 2015, Oktavian et al. 2015, Seygita et al. 2015, Widiarti & Pudjiarto 2015, Widiarti et al. 2016a, Widiarti et al. 2016b, Widiarti & Adi 2016, Widiarti et al. 2019

bHABs and CFP → not yet considered as a major threat to Indonesian coastal communities or ecosystems (no formal report or huge cases) → lack of awareness and studies

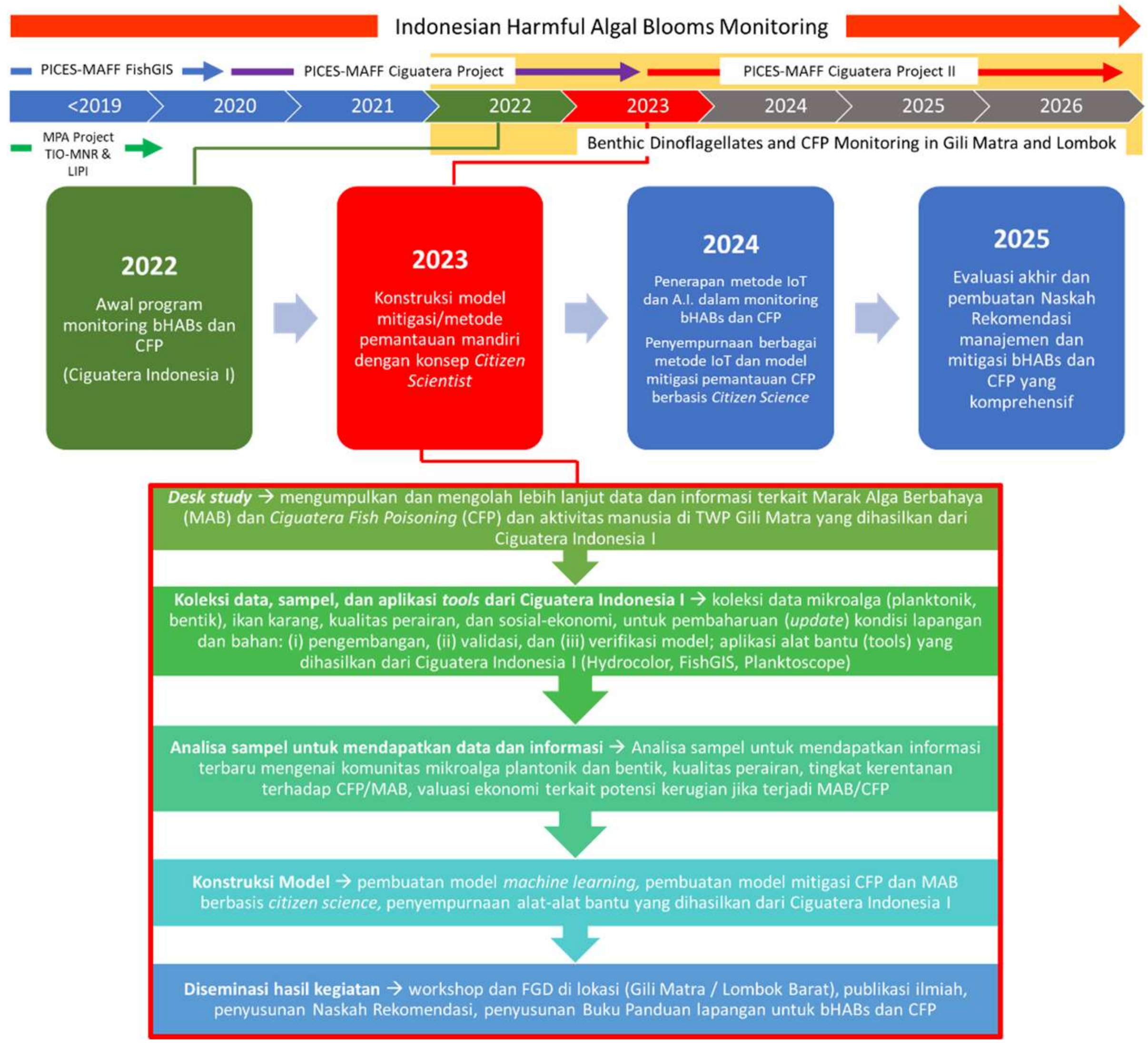


Integrated Multidisciplinary Research

- **Ciguatera Indonesia** → integrated multidisciplinary research
- Including several topics (but not limited to):
  - **Biological Oceanography**→ planktonology dan benthic micoralgal ecology and taxonomy
  - **Chemical Oceanography** → nutrient level and water column chemical properties
  - **Physical Oceanography** → water column's physical properties
  - **Coastal Ecology**→ ecology of important coastal ecosystems, such as seagrass, coral reefs, and macroalgal beds
  - **Information Technology** → the use of smartphone application, real-time monitoring via satellite imageries, and machine learning and Artificial Intelligence
  - **Social-Economic** → anthropogenic activities, ecosystem economic valuation

Ciguatera Project II

Continuation of the Ciguatera Project I (2022-2023) → focused on the monitoring and mitigation strategies for bHABs and CFP



Research Aims

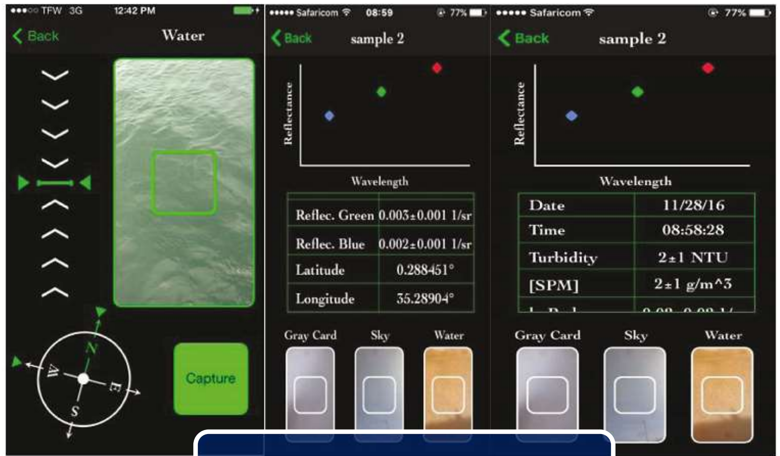
Ciguatera Indonesia II

To continue the study the benthic dinoflagellate communities which could potentially cause CFP and their relationship with anthropogenic pressure and the habitat condition

To continue to disseminate information and increase the local public awareness on the potential health and economic impacts of HABs and CFP

To develop independent Citizen Science monitoring and mitigation strategies using available tools from the previous project (Ciguatera Project I)

Integration of monitoring tools to monitor and mitigate the Harmful Algal Blooms (HABs)

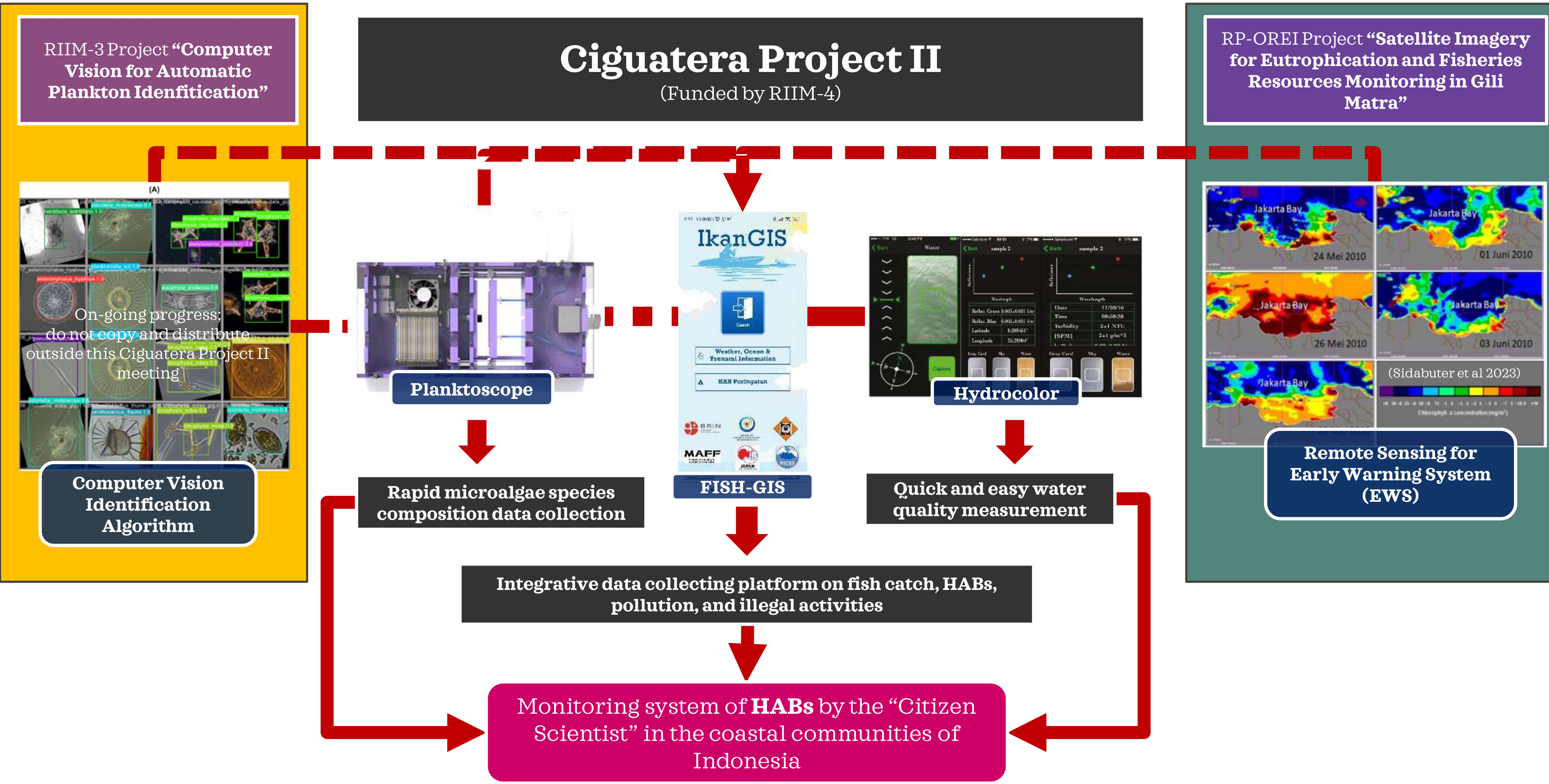


Hydrocolor

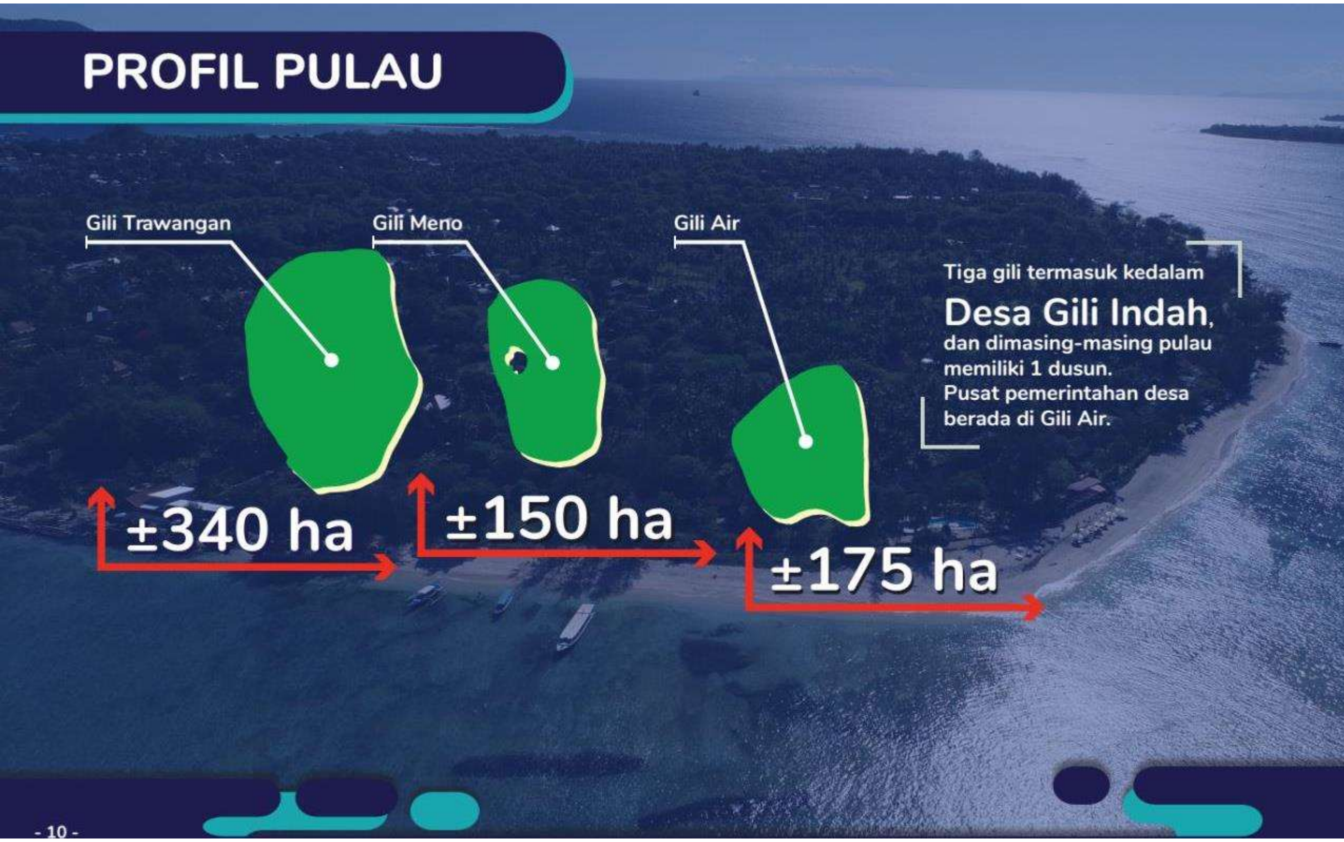
FISH-GIS

Monitoring system of **HABs** by the "Citizen Scientist" in the coastal communities in Indonesia

Planktoscope


RIIM-3 Project "Computer Vision for Automatic Plankton Idenfitication"
Ciguatera Project II
(Funded by RIIM-4)
RP-OREI Project "Satellite Imagery for Eutrophication and Fisheries Resources Monitoring in Gili Matra"
On-going progress; do not copy and distribute outside this Ciguatera Project II meeting
Computer Vision Identification Algorithm
IkanGIS
Weather, Ocean & Tsunami Information
HAB Peringatan
MAFF
Planktoscope
FISH-GIS
Hydrocolor
Jakarta Bay
24 Mei 2010
01 Juni 2010
26 Mei 2010
03 Juni 2010
(Sidabuter et al 2023)
Remote Sensing for Early Warning System (EWS)
Rapid microalgae species composition data collection
Quick and easy water quality measurement
Integrative data collecting platform on fish catch, HABs, pollution, and illegal activities
Monitoring system of HABs by the "Citizen Scientist" in the coastal communities of Indonesia

Sampling Site



Sumber: Balai Kawasan Konservasi Perairan Nasional Kupang Wilker TWP Gili Matra, 2019

Gili Matra Marine Tourism Park (Taman Wisata Perairan/TWP) → Gili Trawangan, Gili Meno, Gili Air

An important conservation and tourism area to the local people and marine biota in the coastal area of West Lombok

Conservation area → **2.273,56 ha**

Consist of important coastal ecosystems:

- Mangrove
- Coral Reef
- Seagrass

Have ecologically vital function to some protected and charismatic rare species, such as :

- Hiu Sirip Hitam (Blacktip reef shark)
- Hiu Sirip Putih (Whitetip reef shark)
- Penyu (Sea turtle)
- Kima (Giant clam)
- Pari Manta (Manta rays)

Sampling Area

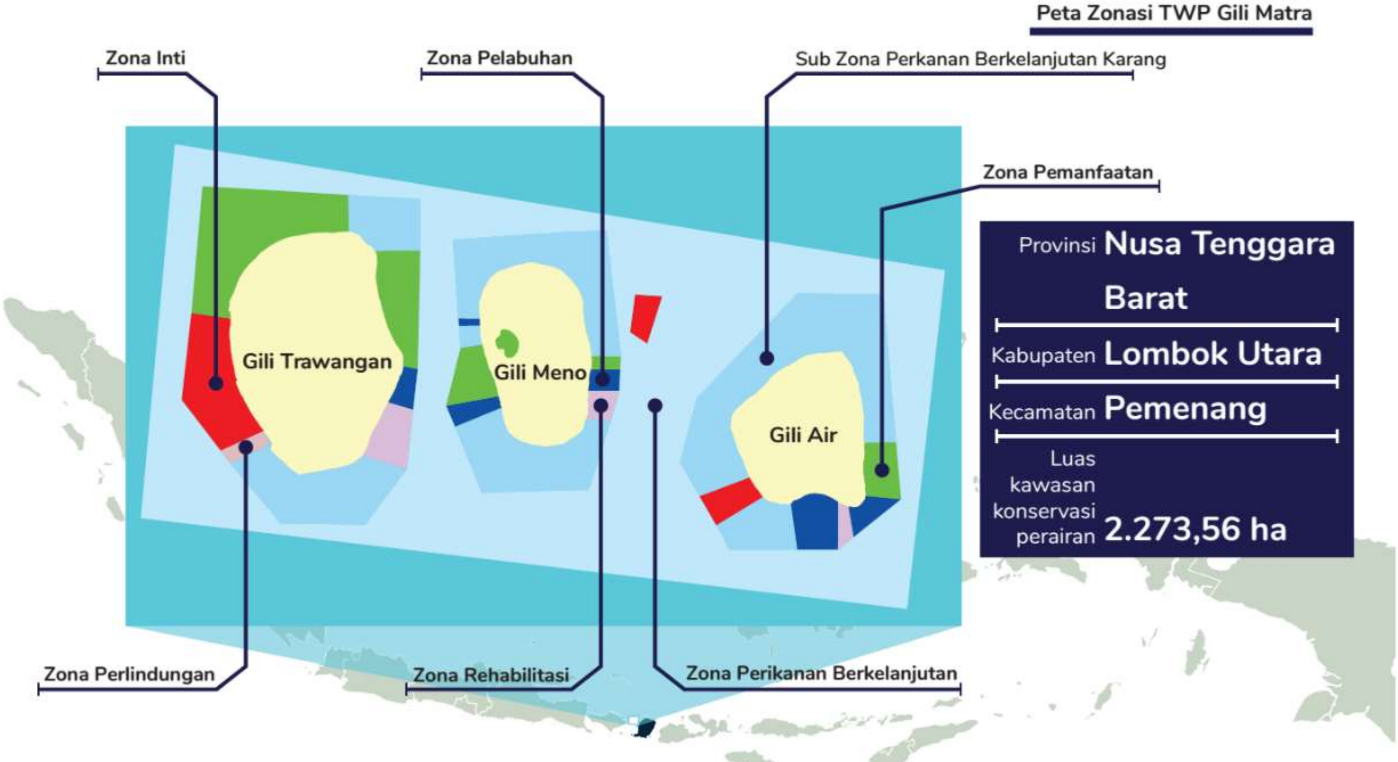
Sampling and data collection → will be conducted within selected zones around the Gili Trawangan, Gili Meno, dan Gili Air

Fieldworks within the timeframe of 2024 → March (Transition Season I) & August (Dry Season)

Fieldwork → 4 days → 2 days effective working days on field

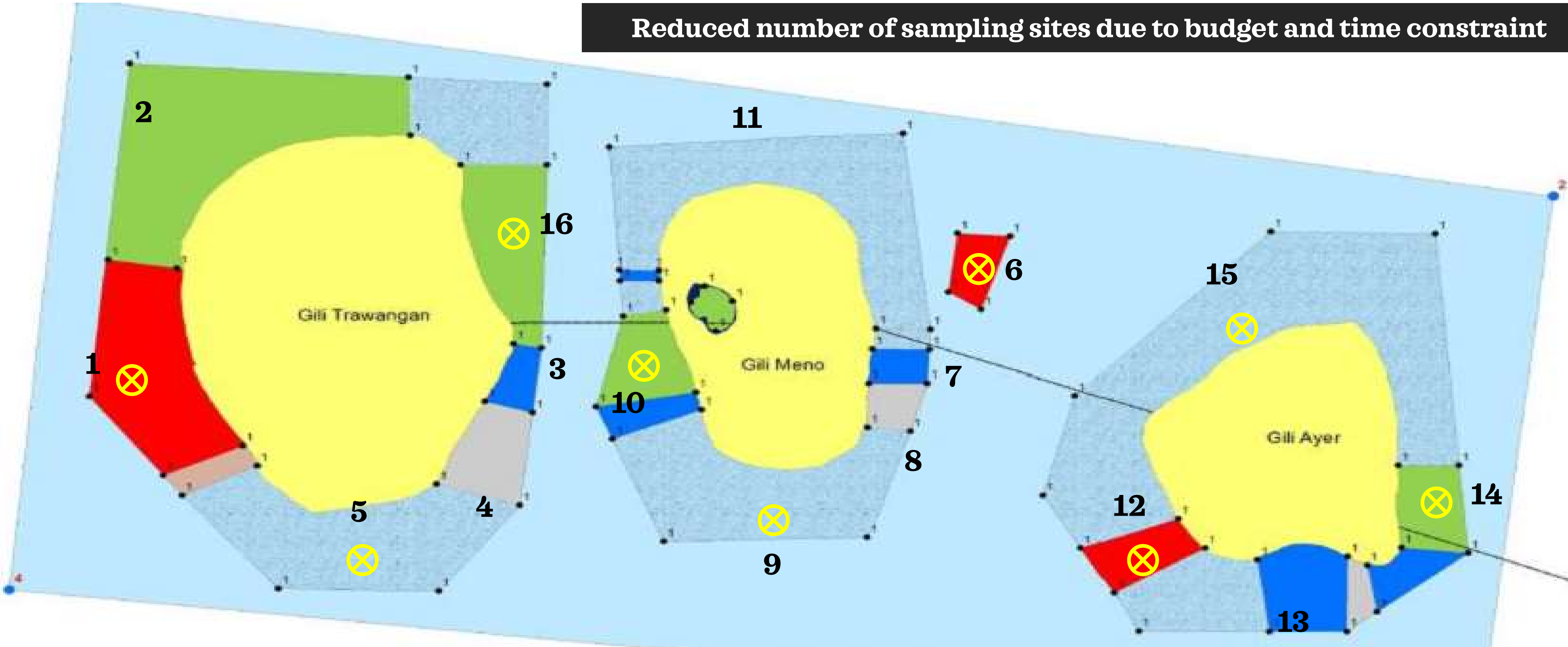
Microalgal sampling →

- Water column
- Seagrass,
- Macroalgae



Sumber: Balai Kawasan Konservasi Perairan Nasional Kupang Wilker TWP Gili Matra, 2019

Reduced number of sampling sites due to budget and time constraint



⊗ Water column sampling sites → **16 Sites (Ciguatera I)** → **9 sites (Cigatera II)**

- Plankton (phytoplankton + zooplankton) → **18 samples**
- Water quality (Temperature, pH, Salinity, DO, TDS) → **9 dataset**
- Nutrient concentration → **9 sampel**
- Chlorophyll-a (?
- e-DNA (?)

Focused on: the Core Zones (red), Utilization Zones (green), and Sustainable Fisheries Zones (light blue)

Station	Long (E)	Lat (S)	Colour Code	Zone	Island
1	116.0236	-8.35352	Red	Core	Gili Trawangan
5	116.0358	-8.36574	Light-blue	Sustainable Fisheries	Gili Trawangan
6	116.0681	-8.34595	Red	Core	Gili Meno
9	116.0572	-8.36373	Light-blue	Sustainable Fisheries	Gili Meno
10	116.0502	-8.35152	Green	Utilization	Gili Meno
12	116.0722	-8.36524	Red	Core	Gili Ayer
14	116.0909	-8.36069	Green	Utilization	Gili Ayer
15	116.0845	-8.34567	Light-blue	Sustainable Fisheries	Gili Ayer
16	116.0448	-8.34519	Green	Utilization	Gili Trawangan

Water column sampling sites

Numbering of the sites will be changed later

Water column sampling

Plankton

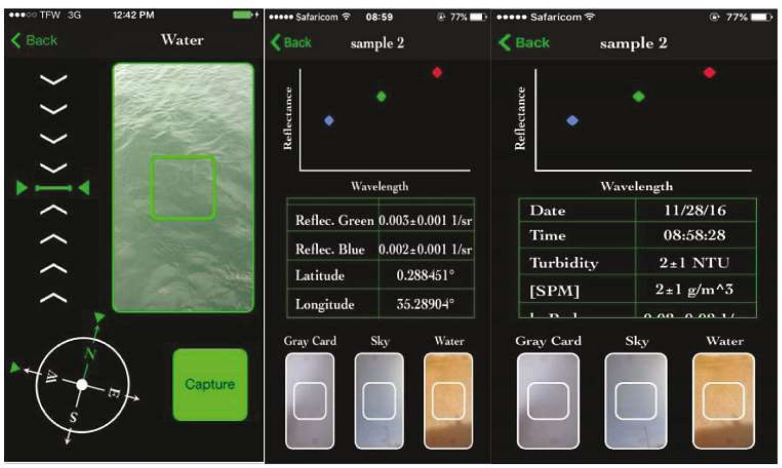
- Vertical towing with plankton net (zooplankton net, mesh 125 um; phytoplankton net, mesh 20 um)

Water (nutrient, chlorophyll-a, eDNA?)

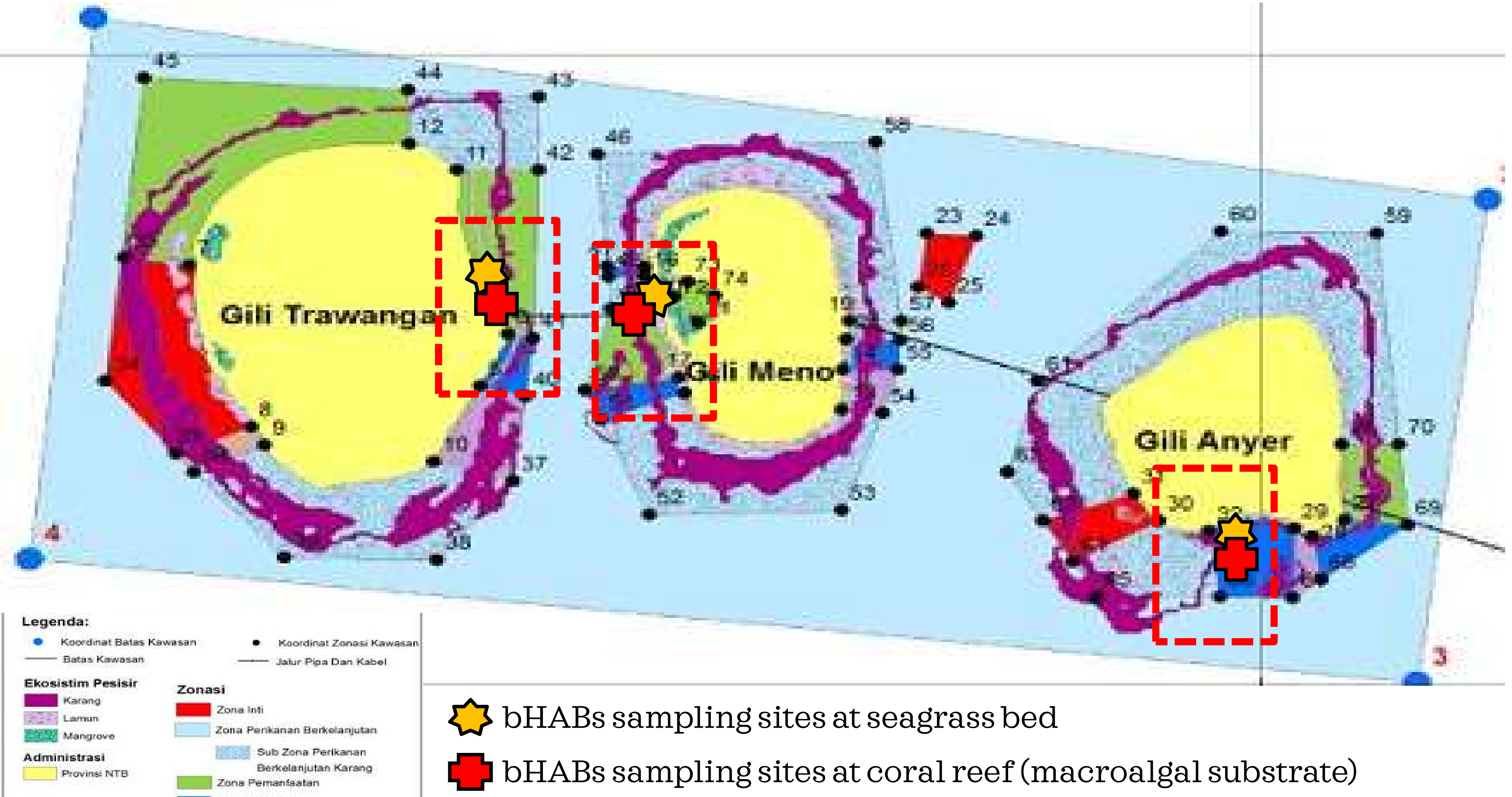
- Van Dorn / Nansen bottle → at minimum, 1 sample at surface layer (0.5 – 1 m depth); if possible, 2 sample (surface + near bottom)

Water quality

- Water multiparameter tester or separate measurement devices :
  - pH meter (pH),
  - hand refractometer (salinity),
  - DO meter (DO and oxygen saturation),
  - TDS meter (turbidity),
  - Digital thermometer (temperature),
  - secchi disk (light penetration depth),
  - Hydrocolor



Water column sampling



Sampling sites on 3 permanent benthic habitat sites from the Ciguatera Project I

Benthic microalgal sampling

Benthic microalgae

- *Natural substrat (free dive)*

Air (analisis nutrient, klorofil dan eDNA)

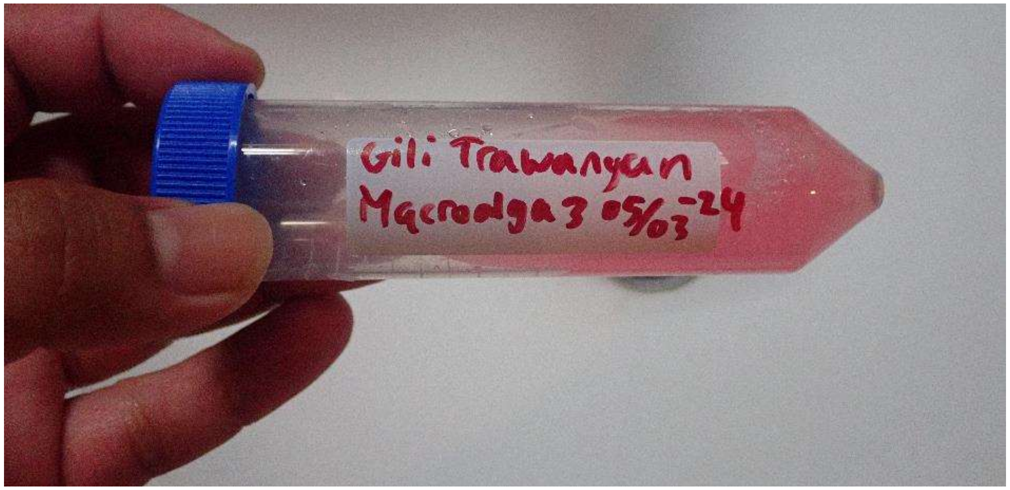
- *Van Dorn / Nansen bottle → at minimum, 1 sample at middle column (0.5 – 1m from the bottom/habitat/substrate)*

Water quality

- *Water multiparameter tester or separate measurement devices :*
  - pH meter (pH),
  - hand refractometer (salinity),
  - DO meter (DO and oxygen saturation),
  - TDS meter (turbidity),
  - Digital thermometer (temperature),
  - secchi disk (light penetration depth),
  - Hydrocolor

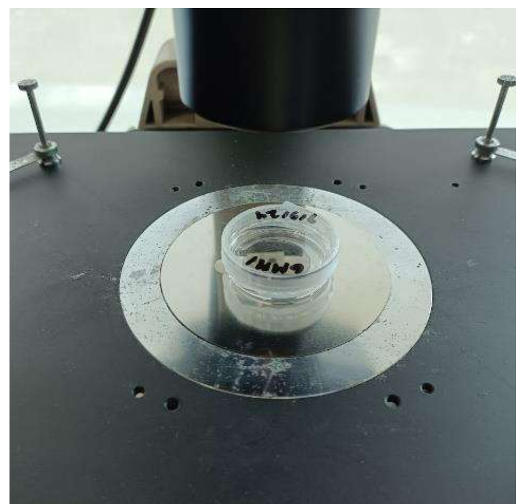
Benthic dinoflagellate sampling

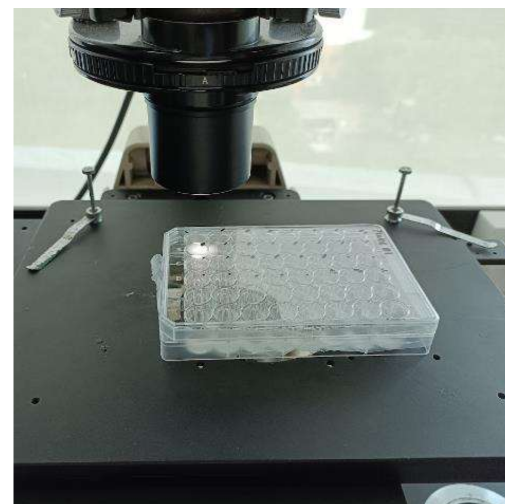
Benthic dinoflagellate sample extraction



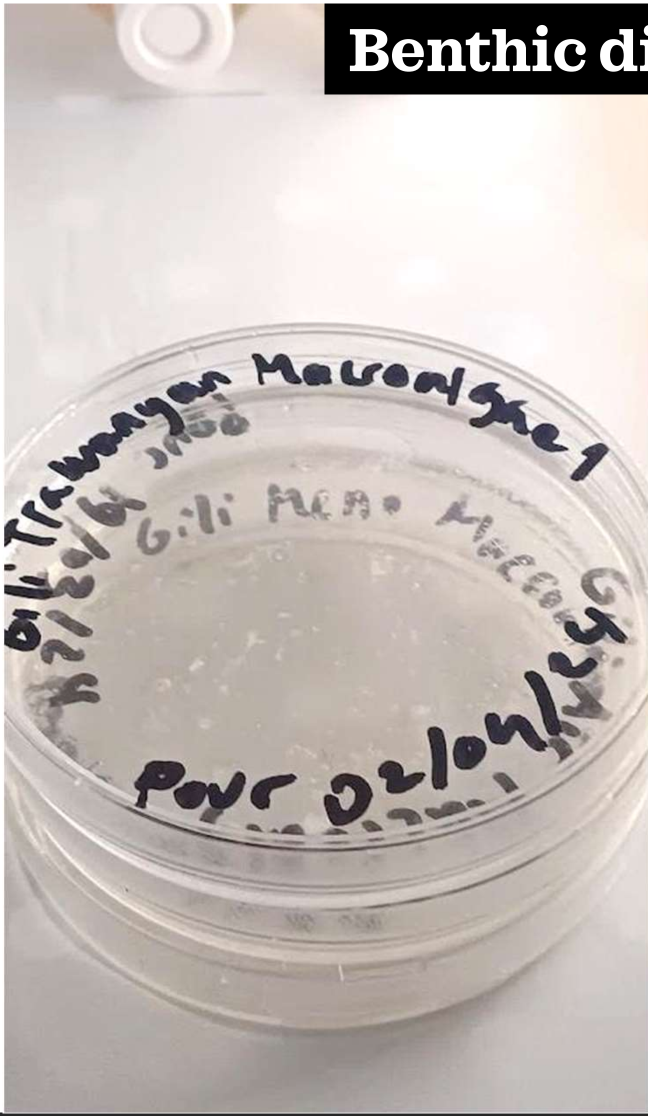
Benthic dinoflagellates culture experiments

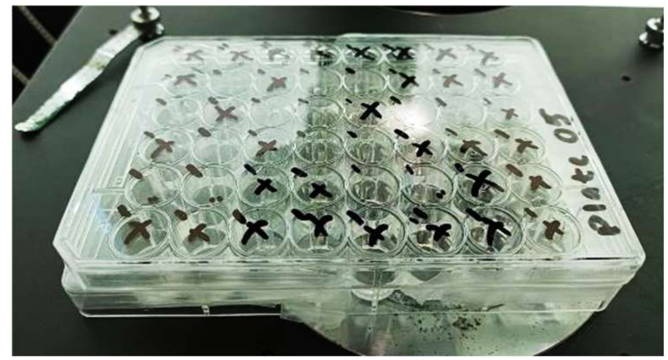
- Live benthic dinoflagellate samples from macroalgae were cultured → adding 0.5 – 1 mL live sample and filtered and syringe-sterilized ambient seawater in a 25 cm^2 culture flask
- Raw cultures were incubated in a culture chamber with side mounted dual-tone LED light at 26°C, 12:12h Light:Dark period, at around 1000 – 2000 LUX (17 – 34 $umol/s/m^2$) for 15- 30 days → 1mL ENSW medium (ambient sterile seawater + F/2 or F/4 medium) was added every 7 – 10 days
- Raw cultures with targeted species were transferred to TC-treated petri dish → cells were isolated with capillary Pasteur pipette → washed 2-3 times in sterile seawater droplet → inoculated in 35mm petri dish with ENSW → between 5 – 20 cells per petri dish → left to grow for 5 – 7 days
- Living and healthy cells in 35mm pre-culture petri → isolated → washed 2 times → inoculated in 48-well TC-treated culture plate → 100 uL ENSW medium added every 5-7 days

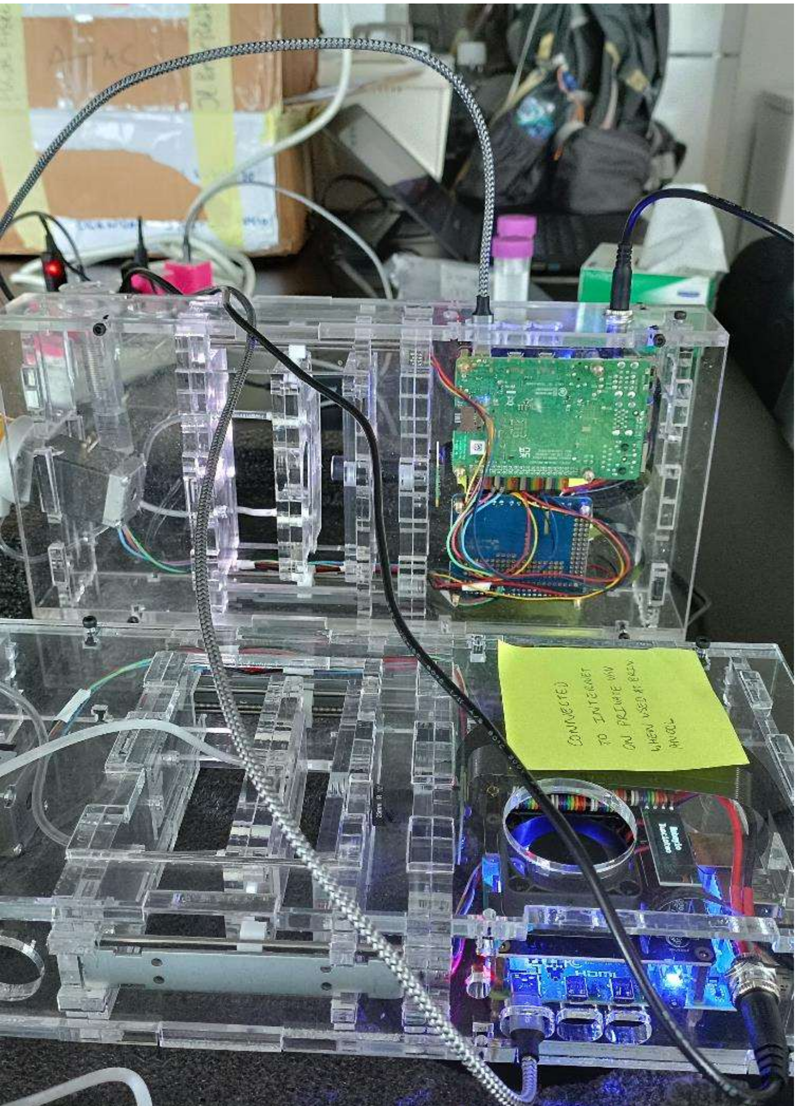




Benthic dinoflagellate culture experiment







Planktoscope analysis

Plankton samples for analysis will be collected from

- Plankton Net samples
- Water samples
- Macrophyte natural samples

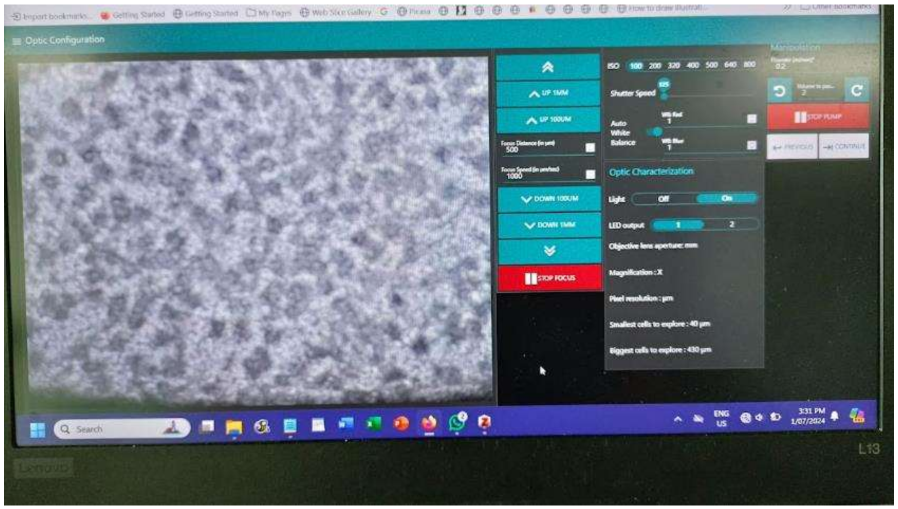
Samples will not be preserved → to avoid staining in the microfluidic column

Fresh sample will be analyzed with Planktoscope at hotel

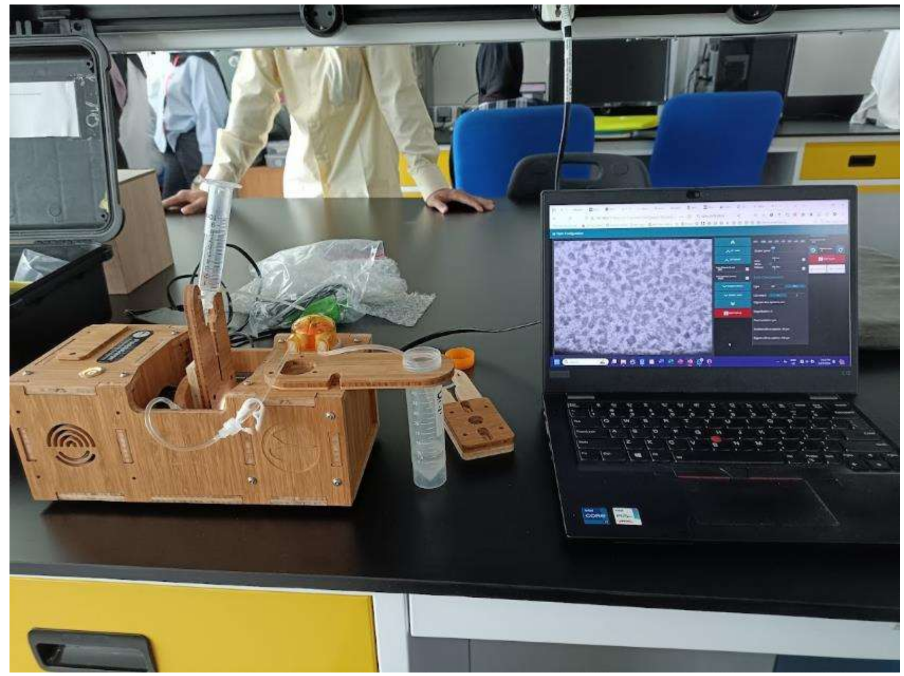
If the analysis can't be carried out directly at the same day → sample can be stored in low temperature (4°C) to reduce the rate of decomposition

Samples that have been analyzed → will be preserved with Alcohol 70%

Planktoscope analysis



- Currently have issue with **<u>fungi on lens</u>** due to high humidity → wooden casing prone to trap humidity? → acrylic case might be the best in tropical countries
- **Planktoscopes** → currently in the care of ITI to disassemble and to learn to fix and improve the design/function

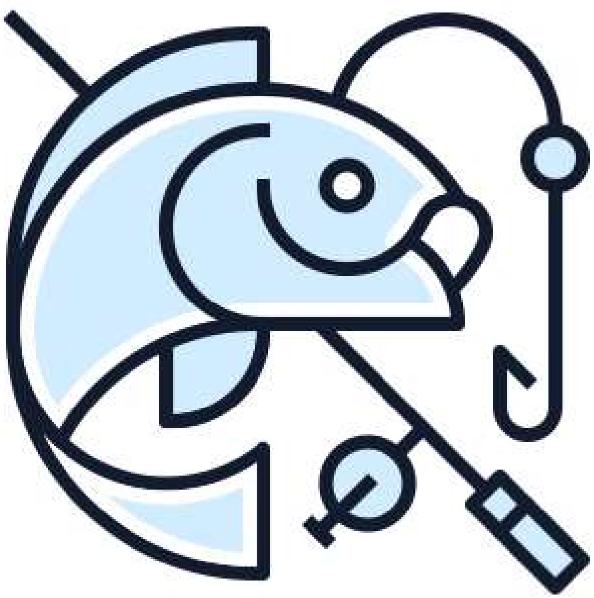


Social-economy sampling/data collection

On-site survey	Random sampling by finding respondents at the study area (Gili Matra and coastal area of West Lombok)
	On-site interview with the help of questionnaire
Questionaire	Spreading paper questionnaire to the respondents or selected groups of respondents (purpose sampling)
	Spreading digital questionnaire via Google Form to gather information at wider scale to random respondents
Focus Group Discussion	Discussion with local community or other important/relevant stakeholders (local government, academics, NGO, fisheries department, conservation department, etc)
Secondary data	Collecting secondary data from related institutions or local government

Social-economy field survey by Mataram University students

Fish Sampling for Ciguatoxin Analysis



Fish Sampling

Fish sampling → conducted by buying fish from local market in Lombok or in Gili (possibly, in Gili Trawangan) OR by the aid of fisherman who catch coral reef fishes

Targeted fish → Coral reef fishes that was sold and (most likely) catch locally around Gili Matra or Lombok

Sample Handling

Fish tissue → viscera, gill, body flesh (min. 500gr) will be collected from each species → will be frozen until analysis

Toxin analysis → LC50 via mouse bioassay in the laboratory of the Fish Quarantine and Inspection Agency, Ministry of Marine Affairs and Fisheries, Indonesia

Fish tissue (ciguatoxin analysis)

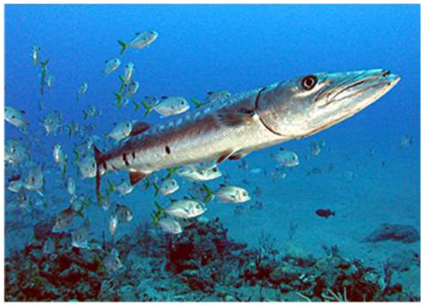
- Fish from local market in Lombok or in Gili Matra (Gili Trawangan & Air)
- Viscera, gill, body flesh (min. 500gr) → collected from each targeted species
- Ciguatoxin analysis → mouse bioassay (the laboratory of the Fish Quarantine and Inspection Agency, Ministry of Marine Affairs and Fisheries, Indonesia)

Targeted Ciguatera Fishes

(common fishes that have been reported to cause CFP in humans)

Sources: Todd 1990, Legrand 1998, Lehane & Lewis 2000

- Moray eel (*Lycodontis* or *Gymnothorax* sp.) – Ikan Kerondong
- Barracuda (*Sphyraena* spp.) – Ikan Barakuda
- Grouper (*Epinephelus* spp.)– Ikan Kerapu (Predator)
- Snapper (*Lutjanus* spp.) – Ikan Kakap
- Mackerel (*Scomberomorus* spp.) – Ikan Kembung
- Parrotfish (*Scarus* spp.) – Ikan Kakatua (Herbivore/Grazer)
- Maori wrasse (*Chelinus* sp.) – Ikan Napoleon
- Trevally (*Caranx* spp.) – Ikan Kuwe
- Kingfish/ Amberjack (*Seriola* spp.) – Ikan Aji-aji
- Frigate tuna (*Auxis thazard*) – Ikan Tongkol
- Surgeonfish (Acanthuridae) – Ikan Botana



IkanGIS (FishGIS) data collection

- Fish data collection will be conducted in the local fish markets in Mataram and in Gili Trawangan
- All fish photo must be accompanied by a scale → ruler, pen, pencil, card, etc
- Any anomalies on field → floating debris/garbage, algal blooms, and unusual ship activities → will also be reported using IkanGIS apps

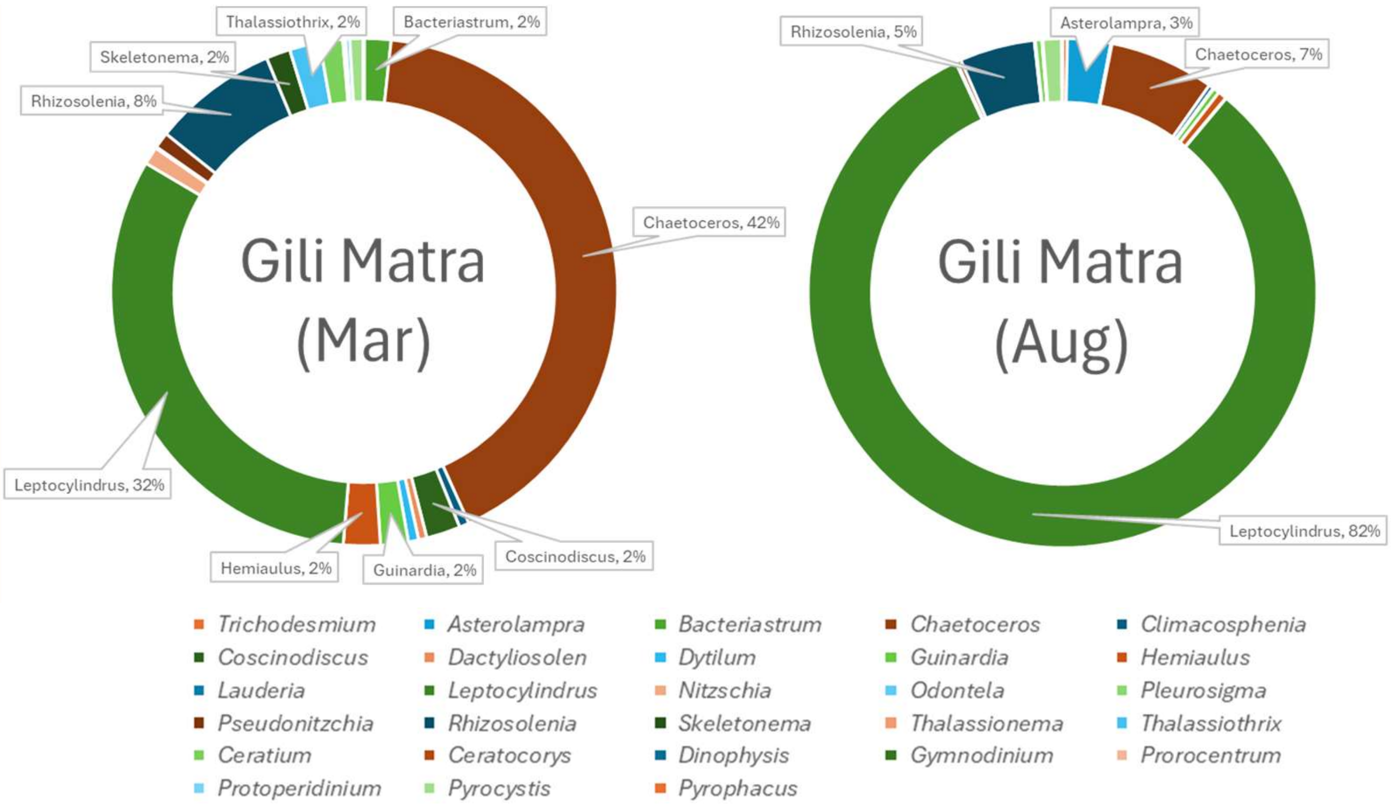
FISH-GIS data collection

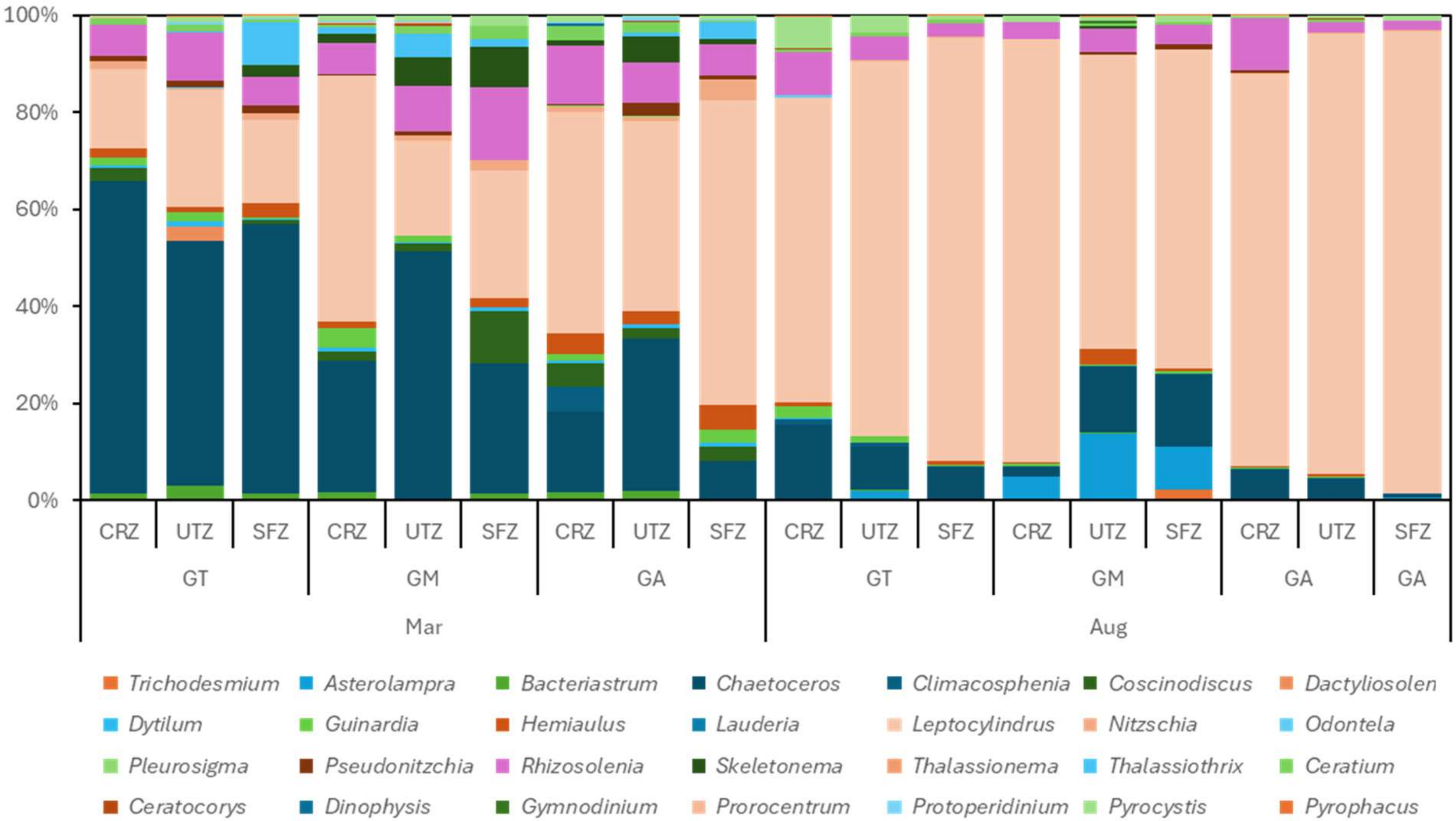
Results

CIGUATERA II FIELDWORKS AND LABORATORY EXPERIMENTS

General phytoplankton assemblages

- Mainly dominated by Diatoms→ *Chaetoceros* and *Leptocylindrus*
- Other commonly abundant genus → *Rhizosolenia*, *Skeletonema*, *Thalassiothrix*, *Bacteriastrum*, and *Asterolampra*
- Significant differences in the phytoplankton assemblages between March and August

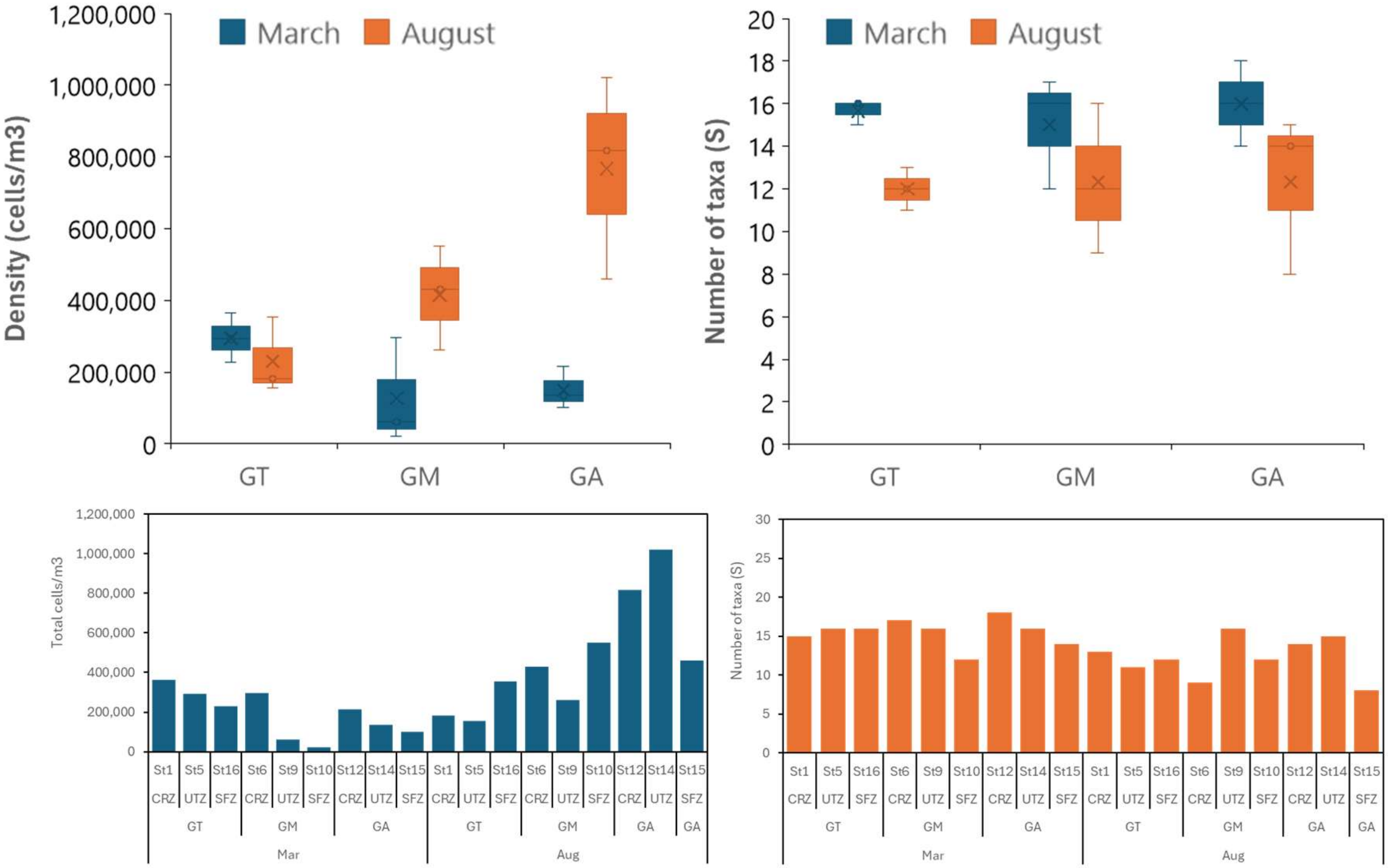




Note:

CRZ = Core Zone; UTZ = Utilization Zone; SFZ = Sustainable Fisheries Zone; GT = Gili Trawangan; GM = Gili Meno; GA = Gili AIr

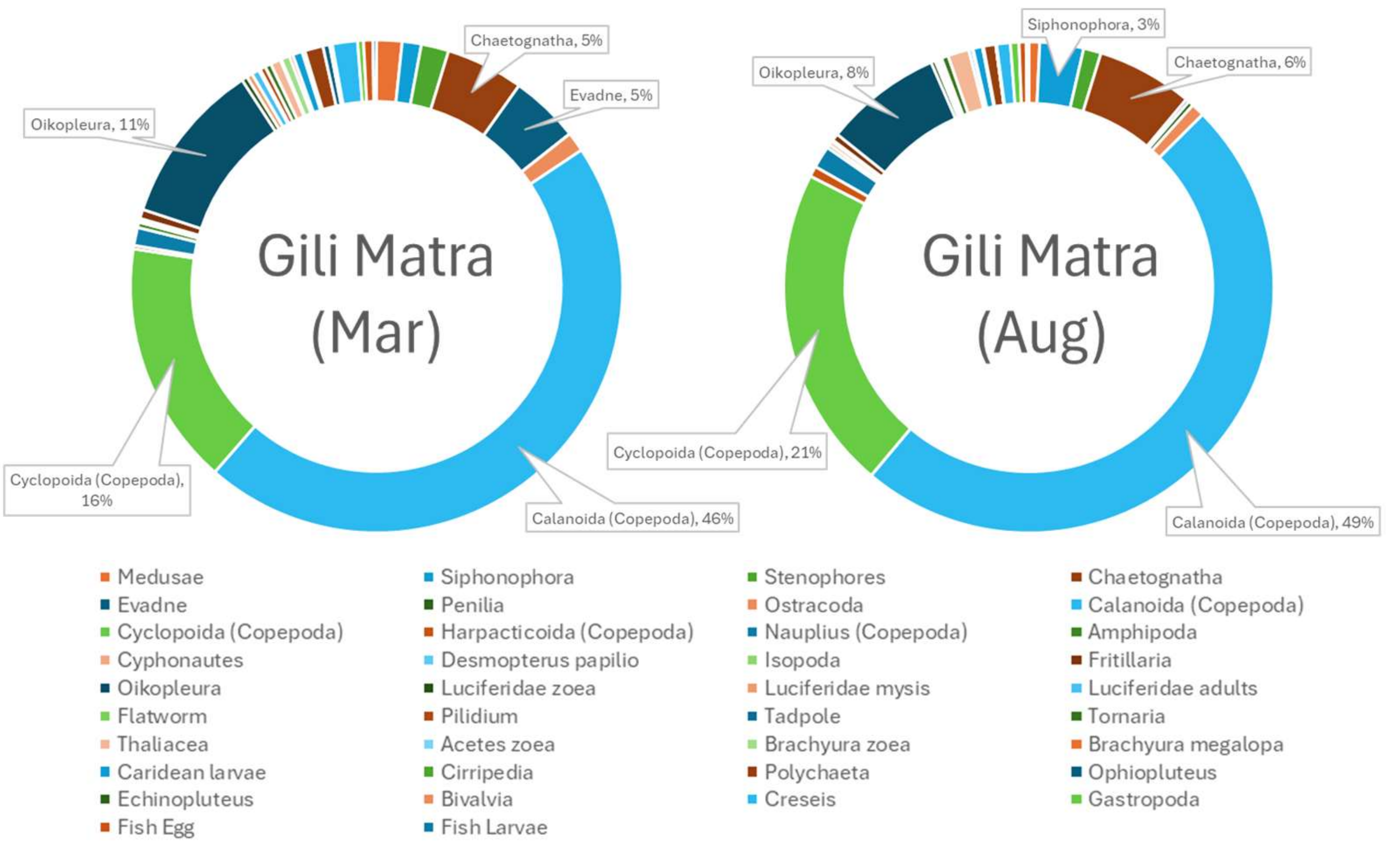
- The phytoplankton assemblages (at genus level) were significantly different in March than in August
- Co-domination of *Chaetoceros* and *Leptocylindrus* in March was completely replaced by domination of *Leptocylindrus* in August

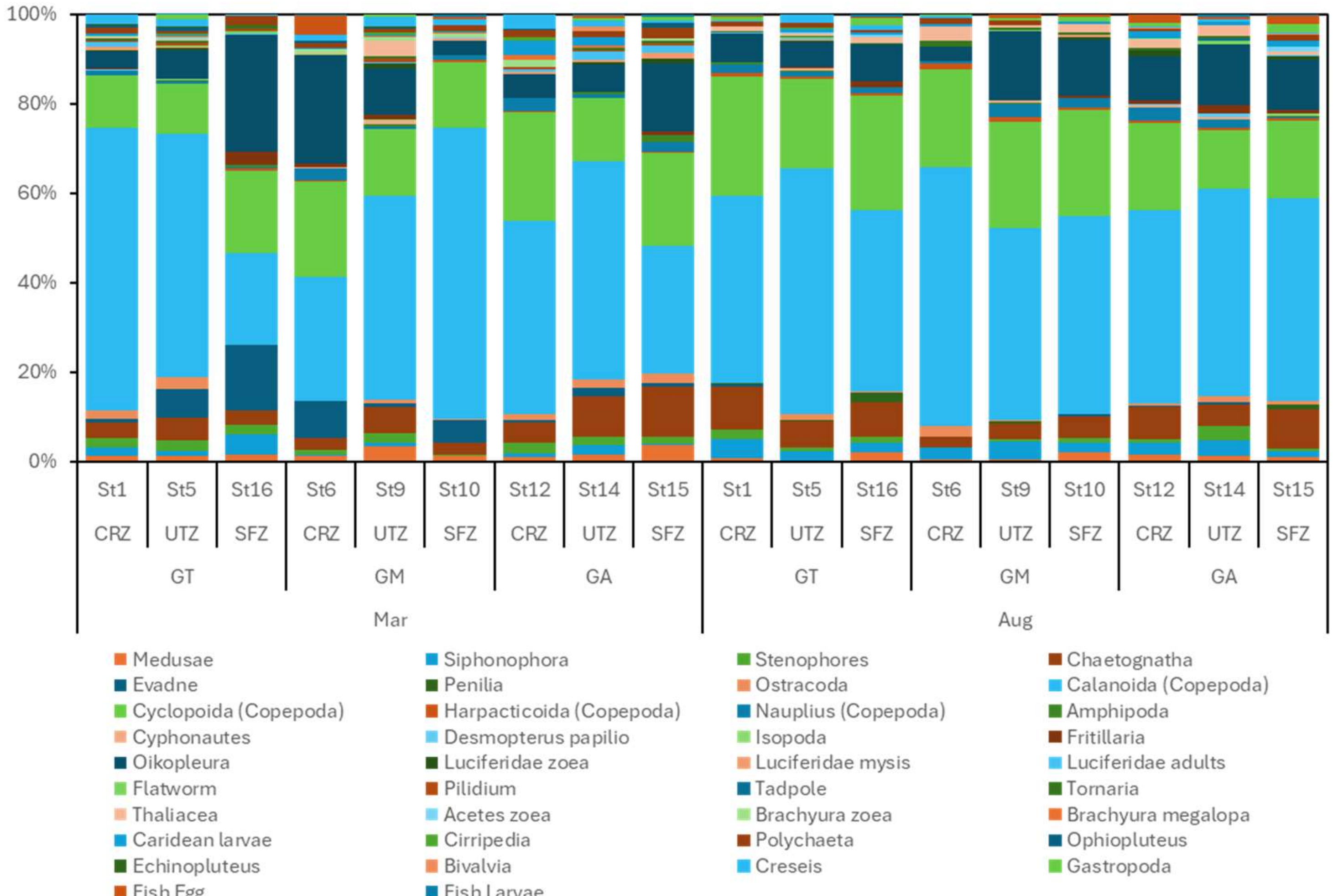


- The average density of phytoplankton was higher in August compared to in March
- Average number of taxa (genus) generally decrease due to dominance of *Leptocylindrus* in August

General zooplankton assemblages

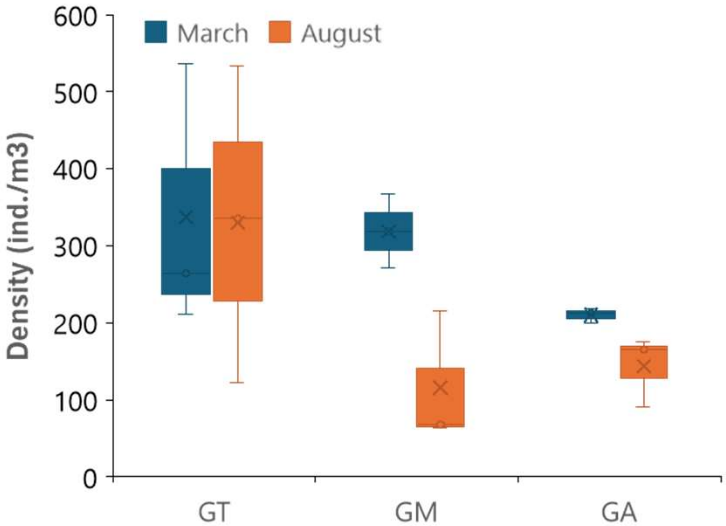
- Mainly dominated by Copepods → Calanoida and Cyclopoida
- Other commonly abundant taxa → Oikopleura, Chaetognatha, Evadne (only in March) and Siphonophore (only in August)
- No significant differences in the zooplankton assemblages between March and August 2024

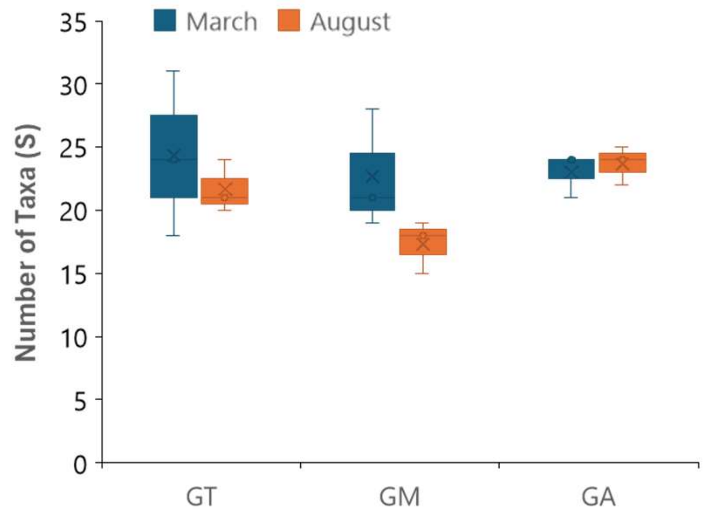


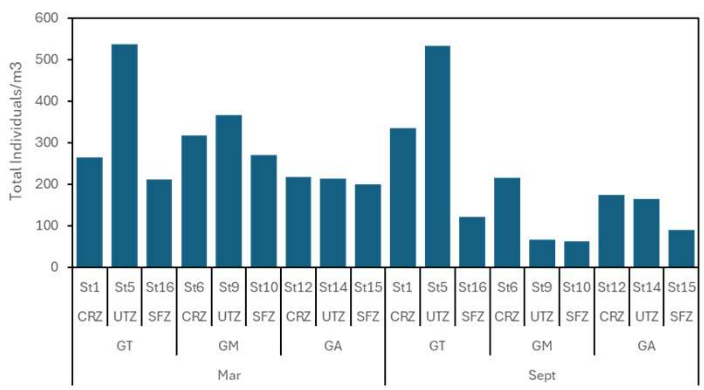


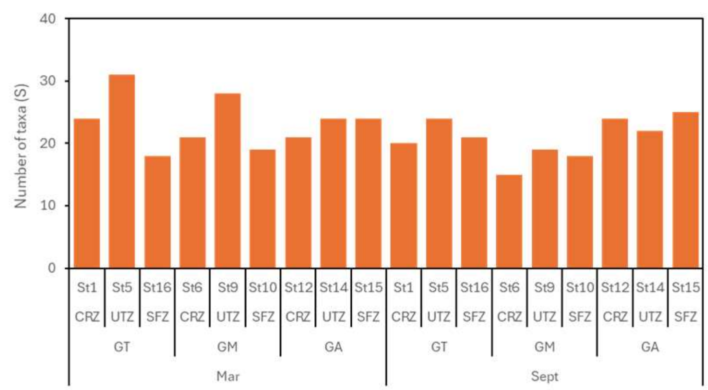
Note:
CRZ = Core Zone; UTZ = Utilization Zone; SFZ = Sustainable Fisheries Zone; GT = Gili Trawangan; GM = Gili Meno; GA = Gili AIr

- No abnormal/anomalies found between the zonation, sites, or months → GT SFZ and GM CRZ do have unique zooplankton assemblages
- Noticed that Evadne only found during March and disappear in August → mostly found in SFZ in Gili Trawangan
- The density of Siphonophora increased in August
- Oikopleura were more abundant in March → particularly in SFZ Gili Trawangan and CRZ Gili Meno



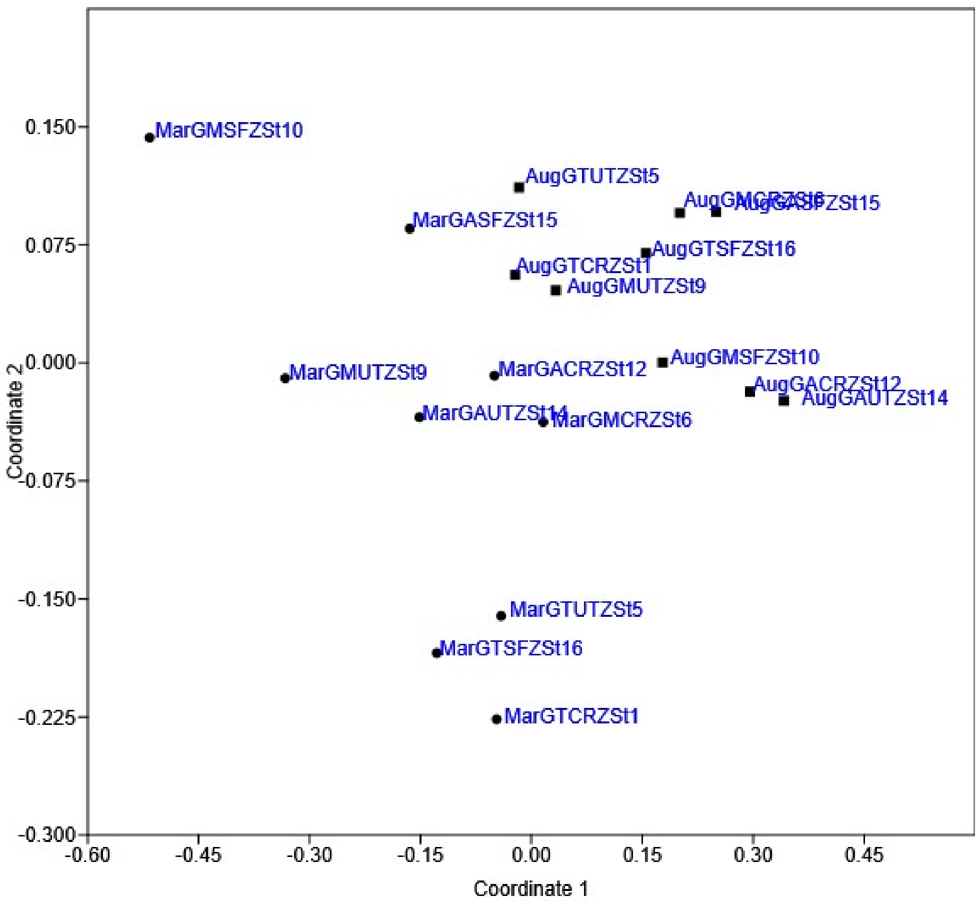




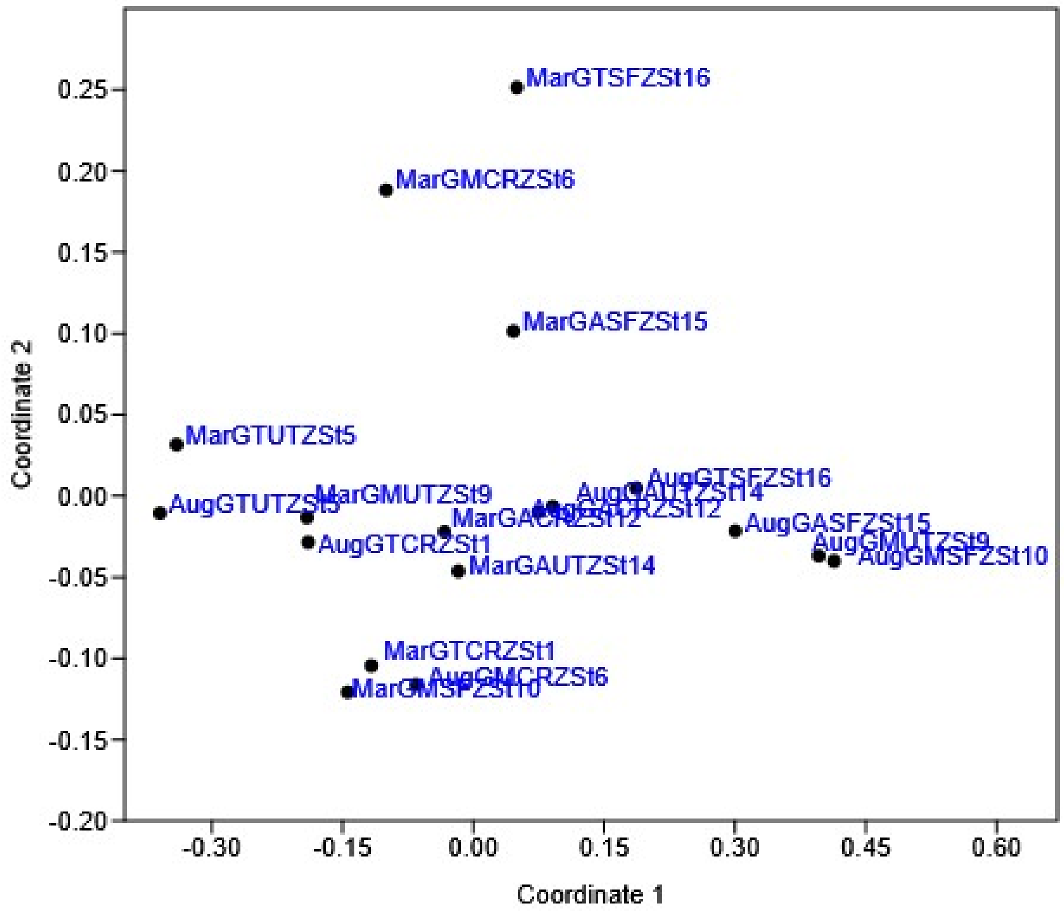


- The average density of zooplankton changes drastically especially in Gili Meno and Gili Air → Gili Trawangan showed less changed in zooplankton density
- The Core Zone in Gili Trawangan (GT CRZ) remains the hotspot for zooplankton density in both March and August sampling

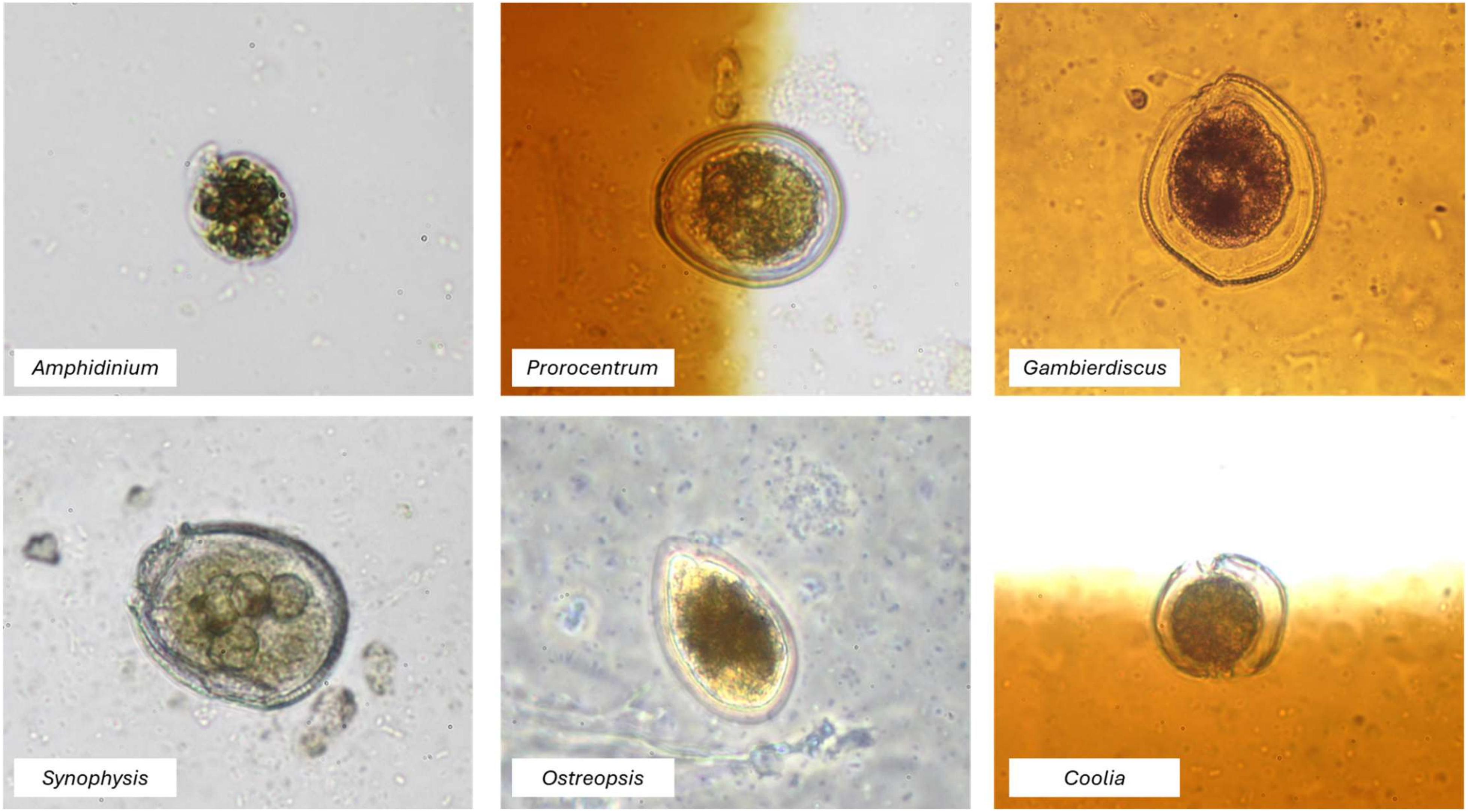
Phytoplankton



Zooplankton



Note: CRZ = Core Zone; UTZ = Utilization Zone; SFZ = Sustainable Fisheries Zone; GT = Gili Trawangan; GM = Gili Meno; GA = Gili AIr



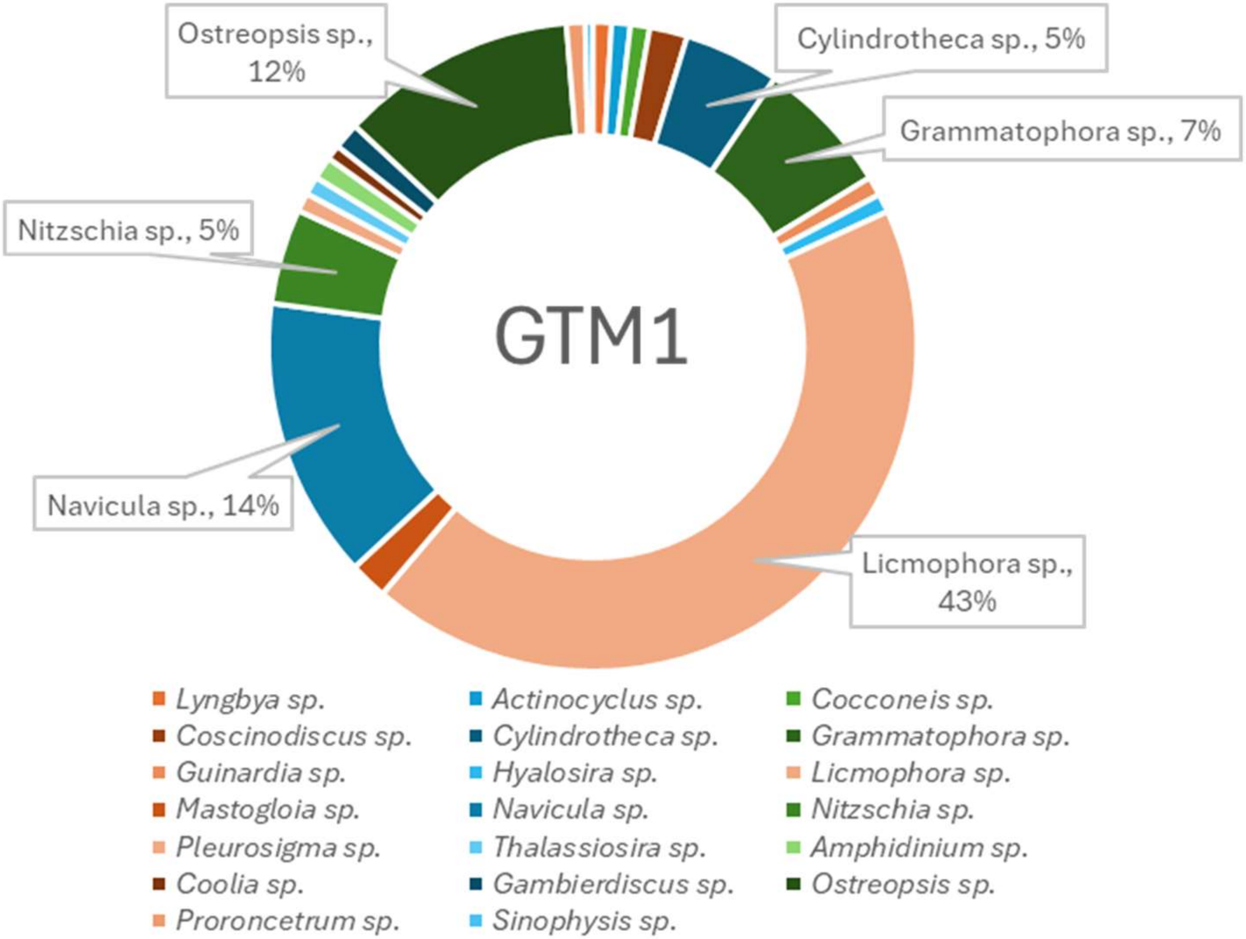
BHABs cells in preserved samples

Benthic microalgae assemblages

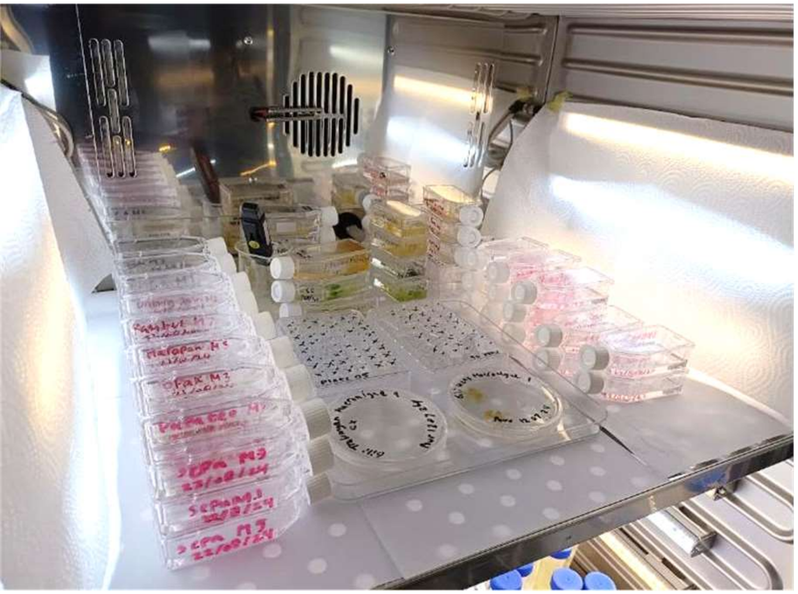
<u>Analysis is still ongoing</u>

Mostly dominated by benthic diatoms → *Licmophora* sp.

In Gili Trawangan Macroalgae 1 sample (GTM1; Gracilaria sp.) in March 2024 → *Ostreopsis* sp. density was high and contributes to 12% of total microalgae cell density in the sample

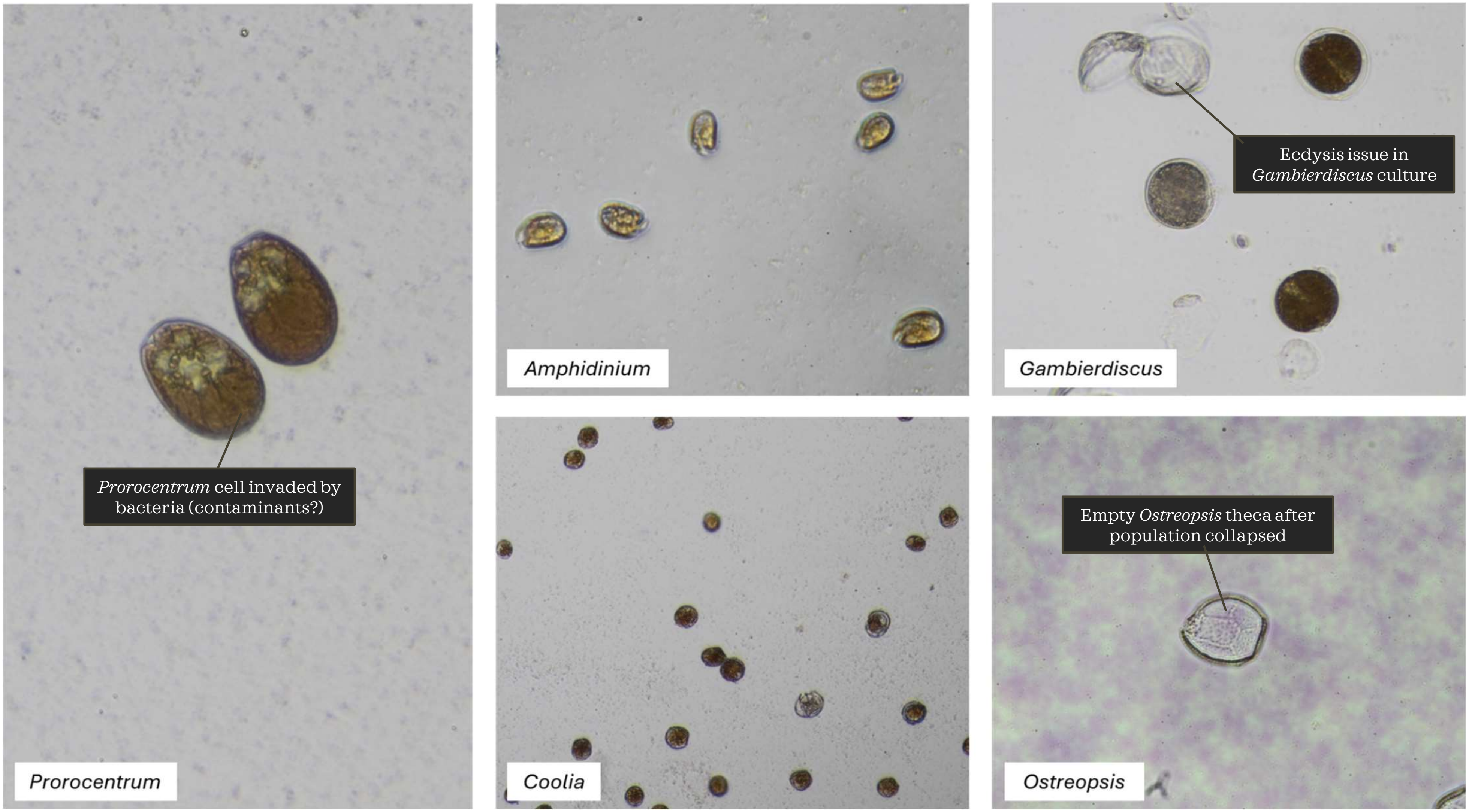


BHABs culture experiments



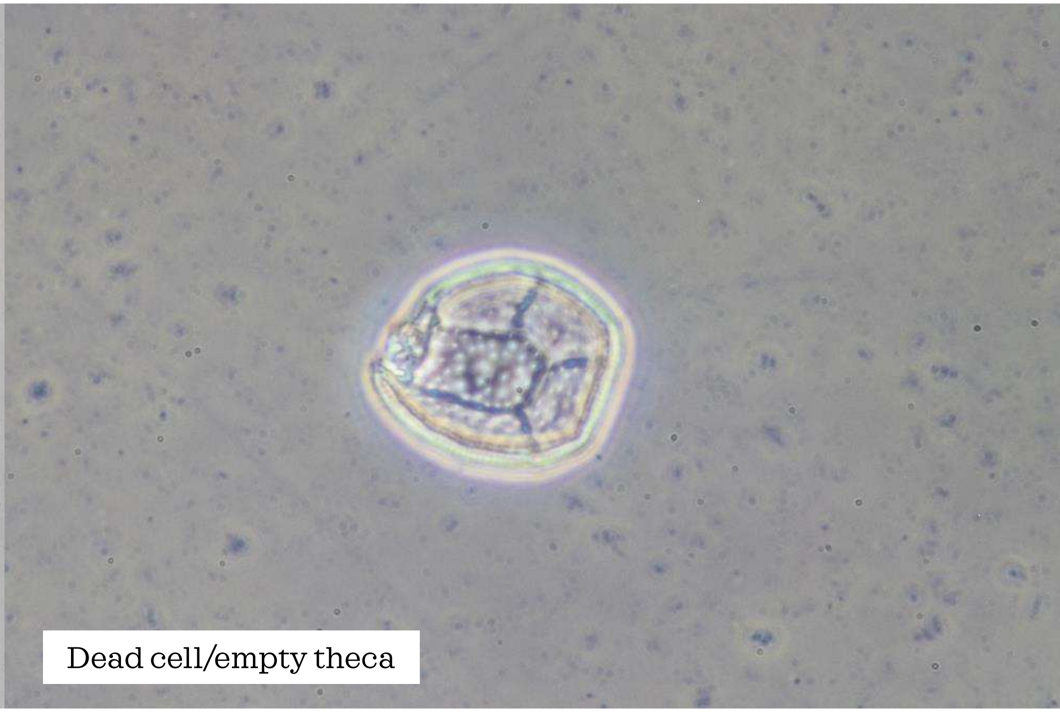
BHABs clonal culture

- From March and August samples → 96 isolates from 5 targeted genus were created → unfortunately **<u>none survived</u>**
  - *Gambierdiscus* → 6 isolates → at least 2 clonal culture grows up to 20 cells/well → cells undergo repeated ecdysis → died after 4-5 ecdysis
  - *Ostreopsis* → 10 isolates → one of the clonal culture grow up to >50 cells → population collapse → re-culture did not work
  - *Coolia* → 30 isolates → at least 2 clonal culture grow up to >100 cells → population collapse → re-culture did not work
  - *Amphidinium* → 25 isolates → 2 clonal cultures grow very dense and established as clonal culture → problem of rapid population collapse and abnormal cell shape → occurred after inoculation to 25cm^2 culture flask with ENSW + F/2 medium
  - *Prorocentrum* → 25 isolates → 2 clonal cultures grow up to > 50 cells → growth stagnation and invasion by contaminant bacteria occurred and collapsing the population

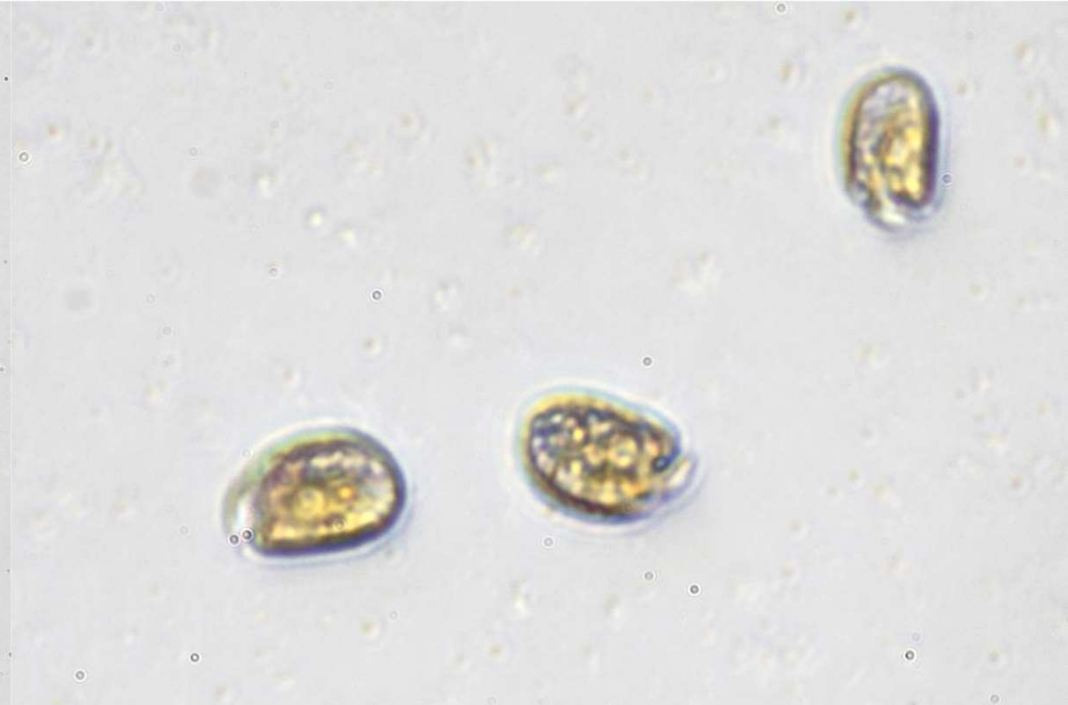


BHABs cells in cultures

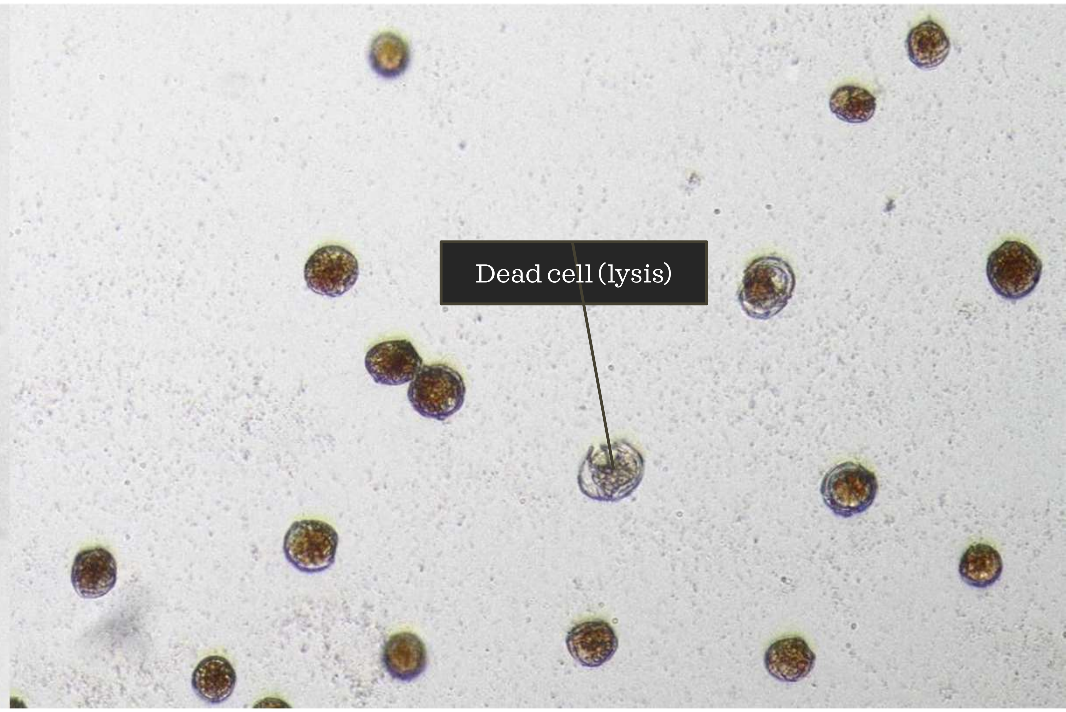
Gambierdiscus



Ostreopsis



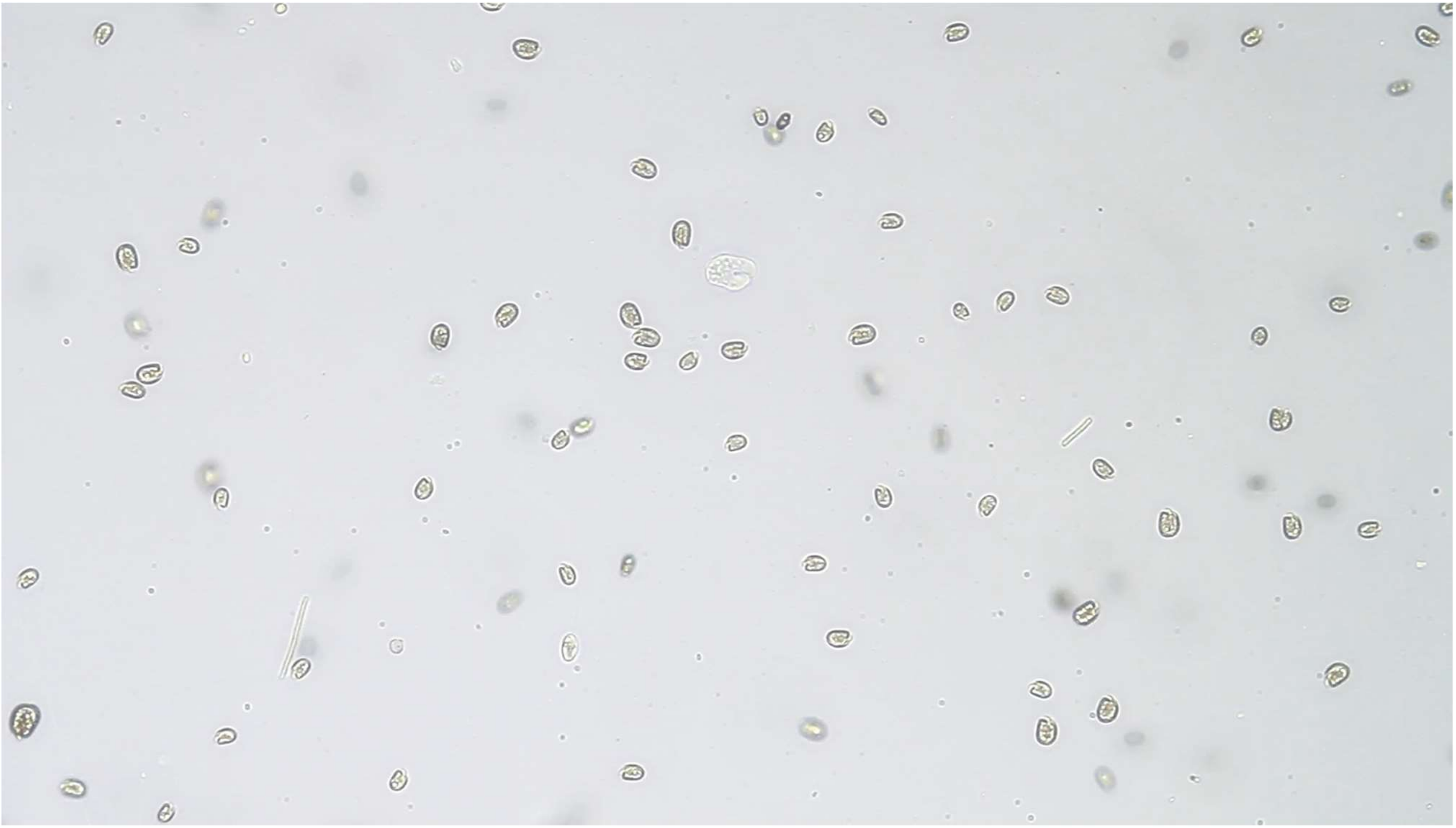
Amphidinium



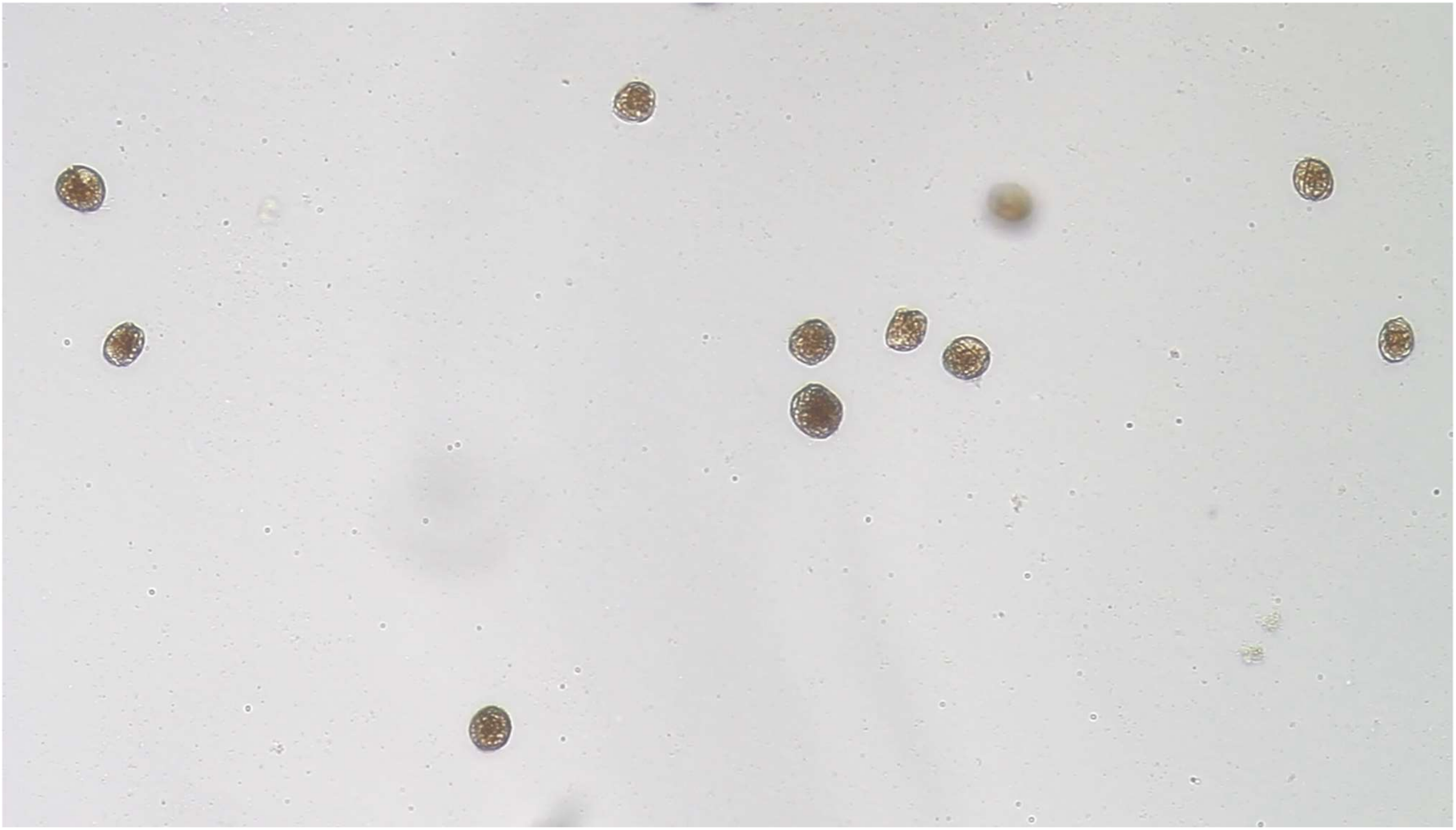
Coolia

Prorocentrum

Example of dense *Amphidinium* culture



Example of *Coolia* culture



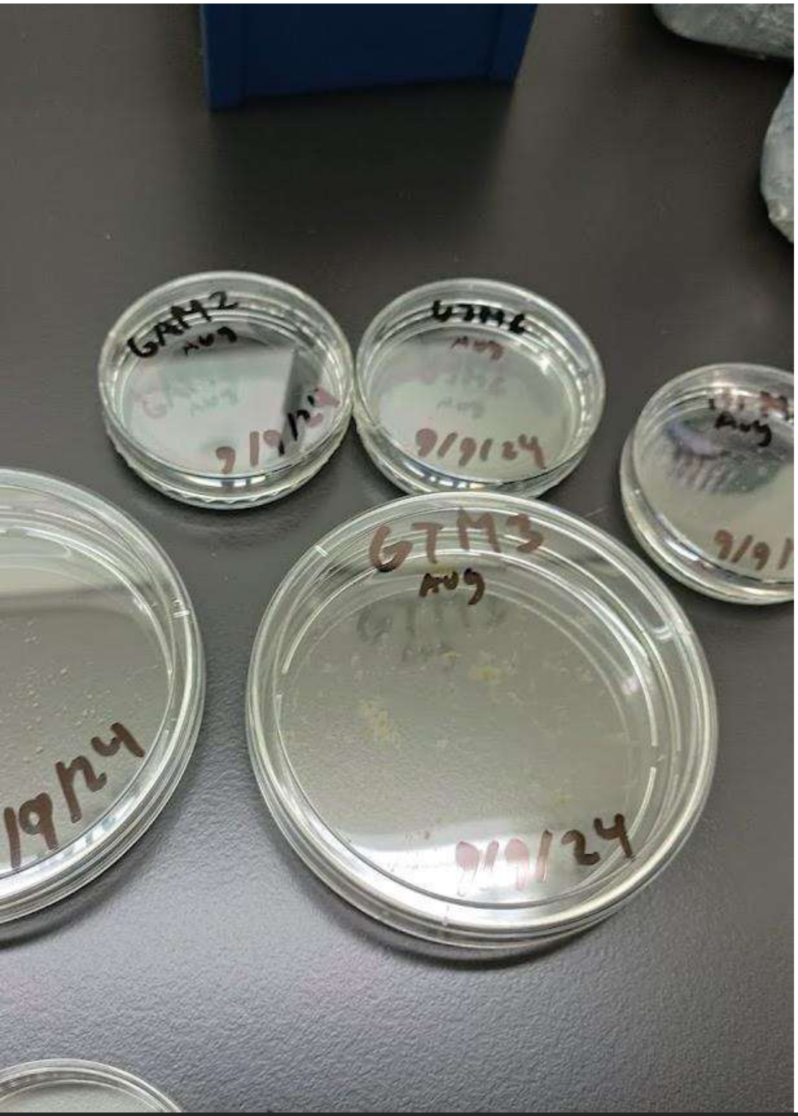
Example of *Prorocentrum* in raw/mixed culture

Problems encountered during BHABs culture experiment

- Each targeted BHABs genus have Specific growth conditions → attempt to establish clonal culture of 5 different groups of BHABs at the same time were too difficult and currently impossible due to:
  - **Limited equipment** → only 1 culture chamber in RCO-BRIN → so all isolates must be grown at the same temperature, irradiance level, and irradiance time; Laminar Air Flow cabinet often full or in use by other researchers, mainly microbiologist, which is not ideal due to high chance of cross contamination
  - **Limited personnel** → only 1 people actively doing culture experiment
  - **Limited budget for consumables** → BRIN administration system is too complicated for purchasing consumables and takes too long to buy something

Problems encountered during BHABs culture experiment (2)

- Total population collapse in all isolates might be related to:
  - **Bacterial contamination** → usually is not a problem since the culture that were tried to be established are not axenic culture and even with 'washing' technique, the isolated cells will always bring bacteria on the surface of cells or endogenic/endosymbiont/endoparasite
  - **Other species contamination** → in some isolates, other species, most commonly Amphidinium, often contaminate the well → might attribute to growth stagnation, ecdysis (in Gambierdiscus), or cell death due to competition/allelopathy
  - **Chemical contamination** → due to difficulties in purchasing administration → the current experiments used the culture flasks, multi-well plate, and F/2 medium that are well beyond their expiration date → the tissue-culture treated flasks and culture plates might now become toxic to some, if not, most BHABs species



Next plan for BHABs culture experiment

- Several raw/mixed culture still survive and contains cells of some targeted genus → mainly *Prorocentrum* and *Amphidinium*
- It is still possible to try to isolate and establish *Prorocentrum* and *Amphidinium* clonal culture
- Need new supply for consumables and F/2 medium
  - Currently new stock of K-medium was obtained from Arief's other research project
  - Still require culturing consumables, such as:
    - Tissue Culture multi-well plates (96, 48, 24 wells)
    - Culture flasks ($25cm^2$)
    - Tissue Culture sterile Petri dishes (90mm, 60mm, 35mm)
    - Pipette tips, preferably with barrier (0.1 – 10 uL, 1-100 uL, 100-1000 uL
    - Nitrile/latex non-powdered gloves

Additional Information

PhD Project

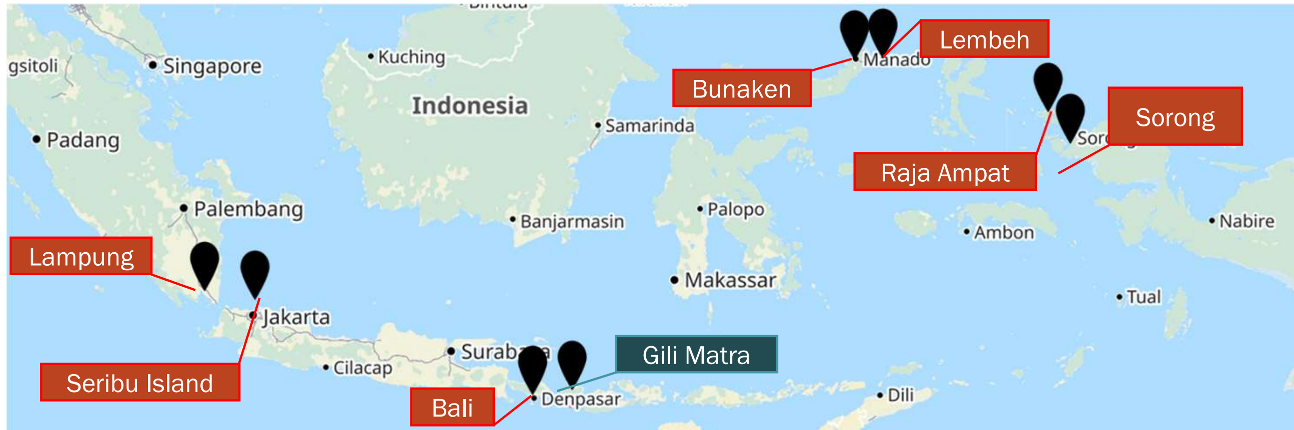
Study of the diversity, population dynamics and toxin production of Benthic Harmful Algae (BHAs) in the tropical coral reef ecosystems of Indonesia with a focus on Ciguateric species

Arief Rachman (Candidate)

Estelle Masseret (Supervisor)

Mohamed Laabir (Co-Supervisor)

Montpellier University, France



Aims

To understand the ecological characteristics of ciguateric BHA species colonizing the macrophytes within coral reef ecosystems in Indonesia and their physiological response towards variation in the water environmental parameters

Questions

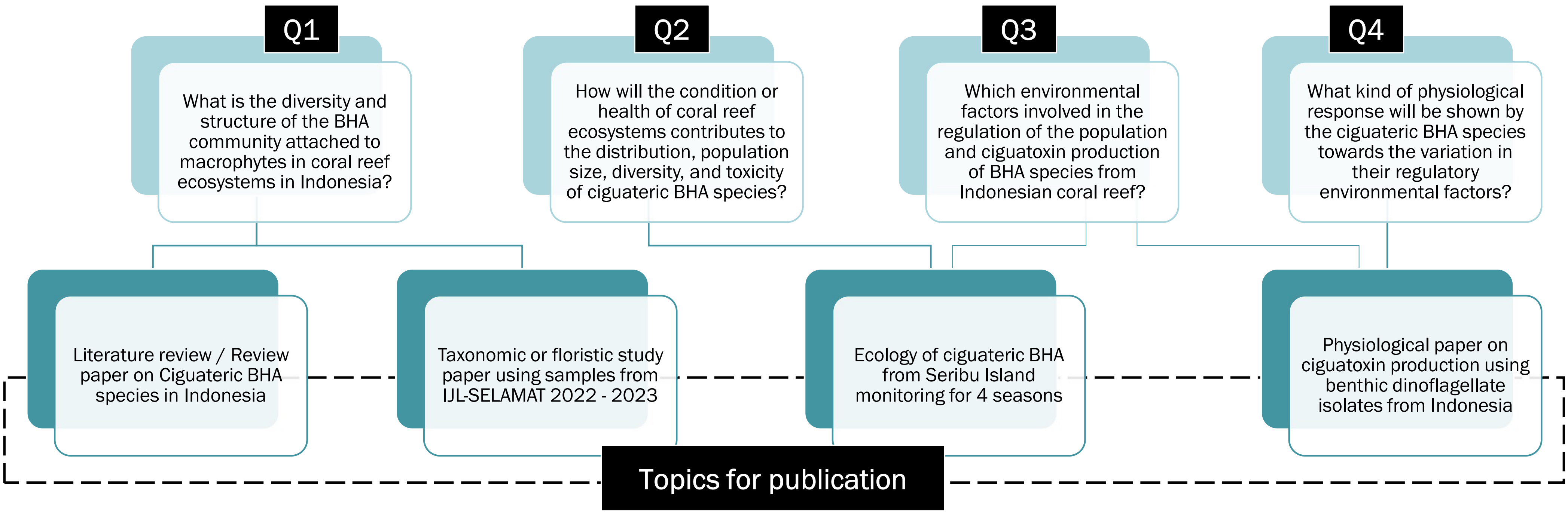
- What is the diversity and structure of the BHA community attached to macrophytes in coral reef ecosystems in Indonesia?
- How will the condition or health of coral reef ecosystems contributes to the distribution, population size, diversity, and toxicity of ciguateric BHA species?
- Which environmental factors involved in the regulation of the population and ciguatoxin production of BHA species from Indonesian coral reef?
- What kind of physiological response will be shown by the ciguateric BHA species towards the variation in their regulatory environmental factors?

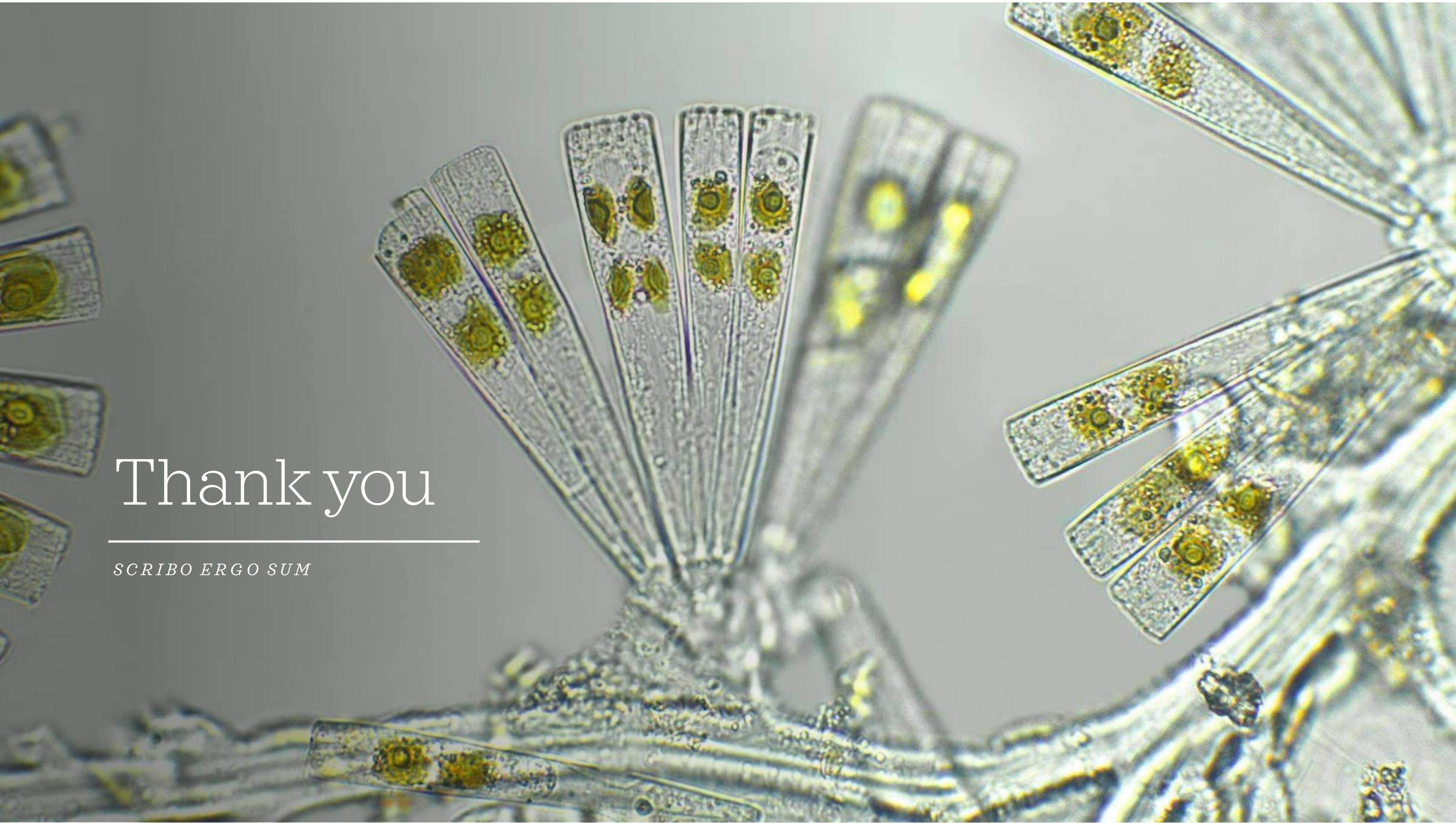
The result would fill the gap in the ecological and physiological characteristics of ciguateric BHA in Indonesia

Contributes towards the seafood security and safety management in Indonesia

Contributes towards the mitigation plan to control the BHA blooms and CFP cases in Indonesia

Structure of PhD thesis & potential publication topics

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