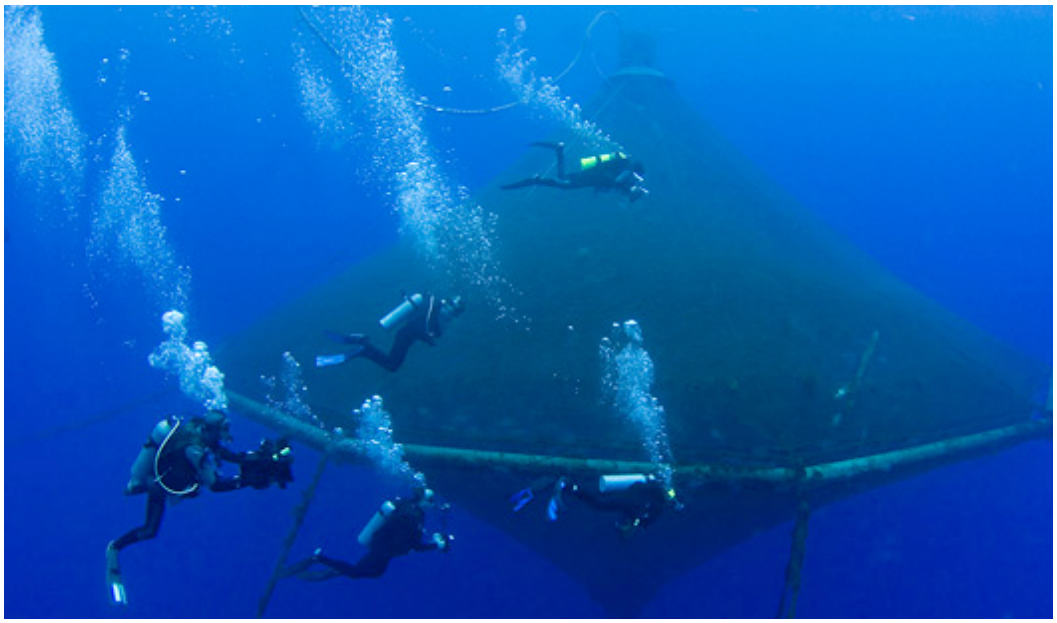
Blue Ocean MARICULTURE

BLUE OCEAN MARICULTURE



6/12/2025

Water Quality Monitoring – June 2025

Prepared by

MEGA Lab
UHH – CNHS
200 W. Kawili St.
Hilo, HI 96720

BLUE OCEAN MARICULTURE

WATER QUALITY MONITORING – JUNE 2025

SAMPLING REPORT

Survey Date: 6/12/2025

Client: Blue Ocean Mariculture

Current: North

Log Number: BOM-WQ-JUNE-2025

Environmental Conditions

Effluent samples were collected adjacent to the net pen containing the highest biomass of fish. Sample collection occurred approximately 2-hours after a feeding event at a distance of 3-meters from the pen. The pen was partially raised prior to sampling. The water was clear with no evidence of high turbidity, discoloration, visible sheen, foam, solids, or floating debris near the pen during the sampling event.

Samples were collected during a rising tide (0.9ft to 2.2ft) influenced by a full moon. Conditions consisted of 6-10kt Southwest winds that increased to 8-12kts at the Effluent and Control sites. A 1-2ft South swell was present during sampling and stayed consistent throughout the entire sampling event. Overall, sea conditions were choppy with white cap. Skies over the ocean were clear with rainclouds hovering above the coastline. The air had light levels of vog from the Kilauea geological activity. There were visible slicks at all sampling stations with visible particulates in the water**.** There were schools of baitfish observed at the Effluent site.

A strong North current was evident during the time of sampling.

Description of sampling methods

Water samples are collected at the monitoring sites monthly throughout the year. Monitoring sites are at the effluent discharge location near the pen containing the highest biomass of fish, four zone of mixing sites, and two control sites. Effluent samples are collected down current from the net pen containing the highest biomass at the surface, mid-pen, and bottom of the receiving water two hours after feeding. Surface samples are collected no less than 1 meter or more than 5 meters below the surface, and no farther than 10 meters down current from the net pen. Mid-pen samples are collected at the mid-pen depth no farther than one 1 meter down current from the net pen. Bottom samples are collected no less than 1 meter or more than five 5 meters above the sea floor, and no farther than 10 meters down current from the net pen. Zone of Mixing (ZOM) samples are collected down-current from the facility at the boundaries of the ZOM. Samples are collected at the north or south locations depending on the dominant current during the day of sampling. Samples are collected at the surface, mid-pen depth, and bottom of the receiving waters. Surface samples are collected not less than 1 meter or more than 5 meters below the surface. Bottom samples are collected not less than 1 meter nor more than 5 meters above the sea floor.

Water samples collected from the monitoring sites are filtered through pre-combusted (500° C, 6h) GF/F (Whatman) filters (pore size 0.7-µm), as well as directly collected for RAW samples. These water samples are transported to the laboratory on ice and stored at -20°C until analysis. Samples are analyzed for nitrate + nitrite (NO_3^- + NO_2^-), ammonium (NH_4^+), phosphate (PO_4^{3-}), total dissolved phosphorus (TDP), and total dissolved nitrogen (TDN). The nutrient values are measured using standard autoanalyzer methods. Inorganic nitrogen and phosphorus will be considered indirect measure of terrigenous effluents. Values recorded below the minimum detection limit (MDL) are presented as '<MDL.'. The MDL is calculated with analysis of seven of the same samples (Gravimetric Standard C4, 10, 100, 10, 10 ug/L for NH_3, Si, PO_4, NO_3, and NO_2 respectively). These samples are analyzed in order to determine the standard deviation, which is multiplied by the degree of freedom in order to calculate the precise MDL. The gravimetric standards are analyzed throughout the runs to determine calibration drift. Copper values are determined with inductively coupled plasma—mass spectrometry (ICP-MS). Analytical mass and instrumental parameters are selected to ensure accurate and precise determination of copper by using known standards. Turbidity is measured for all samples collected from these locations using a turbidimeter. The turbidimeter is calibrated with known standards prior to analyzing the collected samples to ensure accuracy.

To characterize the conditions at each monitoring station during sampling events, physiochemical parameters (temperature, salinity, conductivity, dissolved oxygen concentration, dissolved oxygen percent saturation, pH) are measured on site using multi-parameter YSI and pH meters. The multi-parameter sonde sensors are calibrated prior to taking measurements using known standards.

LABORATORY TEST RESULTS

			Reported in µg/L				
ID	**DATE**	**LAB ID**	**NO2+ NO3**	**NH3 +NH4**	**PO4**	**TDP**	**TDN**
		MDL	***0.9***	***1.7***	***0.5***	***0.5***	***0.9***
Z1B	6/12/25	31	<MDL	5.70	1.90	8.60	95.50
Z1M	6/12/25	34	1.20	15.50	0.50	5.60	72.40
Z1S	6/12/25	35	2.00	2.10	0.70	6.50	87.00
Z2B	6/12/25	36	1.30	2.20	0.60	5.90	88.80
Z2M	6/12/25	37	<MDL	3.40	0.50	5.70	75.60
Z2S	6/12/25	38	3.20	2.60	<MDL	6.20	88.10
Z3B	6/12/25	43	<MDL	2.50	0.80	6.00	76.20
Z3M	6/12/25	44	<MDL	3.10	0.70	5.80	73.50
Z3S	6/12/25	45	<MDL	2.80	0.90	6.90	85.60
Z4B	6/12/25	46	<MDL	3.00	0.60	5.50	75.30
Z4M	6/12/25	47	<MDL	2.40	0.70	5.80	70.90
Z4S	6/12/25	50	<MDL	2.50	1.70	7.20	84.90
EB	6/12/25	59	1.80	2.60	0.50	6.10	80.80
EM	6/12/25	60	1.90	4.10	<MDL	6.10	78.40
ES	6/12/25	61	3.60	2.50	0.80	6.20	84.90
C1B	6/12/25	51	<MDL	2.50	0.80	5.60	70.70
C1M	6/12/25	52	<MDL	4.70	0.90	6.10	74.50
C1S	6/12/25	53	<MDL	2.40	0.90	6.20	78.40
C2B	6/12/25	54	<MDL	3.50	0.70	5.70	82.30
C2M	6/12/25	57	<MDL	3.40	0.90	7.10	93.30
C2S	6/12/25	58	<MDL	1.90	0.80	7.00	83.80

LAB QUALITY CONTROL AND QUALITY ASSURANCE

FASPac II

Run date: 6/17/25
Configuration: BOM Offshore
Run Name: BOM Offshore June 2025

				Si	PO4	NO_3 & NO_2	Total NH_3 & NH_4
	Position	**Identifier**	**Type**	**µg/l**	**µg/l**	**µg/l**	**µg/l**
22	2:54	GravStd C4	Unknown	97.2	10.1	10.9	11.3
23	2:55	GravStd C4	Unknown	96.9	10.3	10.6	11.2
24	2:56	GravStd C4	Unknown	96.8	10.4	10.9	11.4
27	2:57	GravStd C4	Unknown	96.7	10.2	11.1	10.8
28	2:58	GravStd C4	Unknown	98.8	10.2	10.5	10.5
29	2:59	GravStd C4	Unknown	97.0	10.0	10.5	11.9
30	0.125	GravStd C4	Unknown	97.3	10.4	11.2	12.0
Mean				97.2	10.2	10.8	11.3
std dev				0.718	0.150	0.285	0.542
MDL				2.3	0.5	0.9	1.7
18	SR:19	GravStd C3	Check Cal	243.9	22.7	26.7	23.4
39	SR:19	GravStd C3	Check Cal	244.5	23.3	25.9	23.8
62	SR:19	GravStd C3	Check Cal	248.5	23.9	27.2	24.7
85	SR:19	GravStd C3	Check Cal	243.2	23.4	27.7	24.2
99	SR:19	GravStd C3	Check Cal	252.4	24.1	27.6	22.5
Mean				246.5	23.5	27.0	23.7
std dev				3.888	0.550	0.740	0.835

MDL Calculations: Analysis of seven of the same samples (Gravimetric Standard C4 10, 100, 10, 10 ug/L for NH3, Si, PO4, NO3 & NO2 respectively), determine Std Dev, multiply Std Dev by degree of freedom (3.14)

Gravimetric standards (different from the calibration standards) are analyzed throughout the run to determine calibration drift.

GRAB SAMPLE RESULTS

Sample ID	Time	Date	Dissolved Oxygen	Dissolved Oxygen	Temperature
Z1B	9:45	6/12/25	6.37	98.43	80.06
Z1M	9:51	6/12/25	6.18	95.26	80.06
Z1S	9:53	6/12/25	6.61	93.97	80.24
Z2B	9:59	6/12/25	6.54	96.05	80.06
Z2M	10:03	6/12/25	6.31	93.66	80.06
Z2S	10:05	6/12/25	6.42	95.09	80.24
Z3B	10:12	6/12/25	6.36	98.84	80.06
Z3M	10:14	6/12/25	6.83	97.48	80.06
Z3S	10:17	6/12/25	6.69	96.40	80.24
Z4B	10:26	6/12/25	6.16	98.46	80.06
Z4M	10:29	6/12/25	6.30	96.08	80.06
Z4S	10:32	6/12/25	6.93	95.81	80.24
EB	10:48	6/12/25	6.37	94.42	80.06
EM	10:56	6/12/25	6.94	94.81	80.06
ES	11:01	6/12/25	6.85	95.72	80.24
C1B	11:12	6/12/25	6.33	96.45	80.06
C1M	11:18	6/12/25	6.61	96.62	80.06
C1S	11:20	6/12/25	6.74	94.61	80.24
C2B	11:28	6/12/25	6.94	95.48	80.06
C2M	11:34	6/12/25	6.35	96.88	80.06
C2S	11:36	6/12/25	6.95	96.37	80.24
Units			mg/mL	% Saturation	Fahrenheit
DL			0.01	0.01	0.01

GRAB SAMPLE RESULTS

Sample ID	Time	Date	pH	Salinity	Turbidity
Z1B	9:45	6/12/25	8.10	35.39	0.05
Z1M	9:51	6/12/25	8.10	35.54	0.09
Z1S	9:53	6/12/25	8.10	35.30	0.13
Z2B	9:59	6/12/25	8.10	35.17	0.08
Z2M	10:03	6/12/25	8.10	35.26	0.12
Z2S	10:05	6/12/25	8.10	35.10	0.13
Z3B	10:12	6/12/25	8.10	35.59	0.11
Z3M	10:14	6/12/25	8.10	35.15	0.05
Z3S	10:17	6/12/25	8.10	34.99	0.10
Z4B	10:26	6/12/25	8.10	35.41	0.14
Z4M	10:29	6/12/25	8.10	35.56	0.11
Z4S	10:32	6/12/25	8.10	35.29	0.10
EB	10:48	6/12/25	8.10	35.50	0.11
EM	10:56	6/12/25	8.10	35.64	0.09
ES	11:01	6/12/25	8.10	35.57	0.11
C1B	11:12	6/12/25	8.10	35.42	0.08
C1M	11:18	6/12/25	8.10	35.02	0.09
C1S	11:20	6/12/25	8.10	35.65	0.08
C2B	11:28	6/12/25	8.10	35.53	0.08
C2M	11:34	6/12/25	8.10	35.22	0.11
C2S	11:36	6/12/25	8.10	35.51	0.07
Units				PPT	NTU
DL			0.01	0.01	0.01

ICP RESULTS

Laboratory Test Results

Description: June 2025, 4 water samples for copper, zinc, selenium.

Job 2338

mg/L

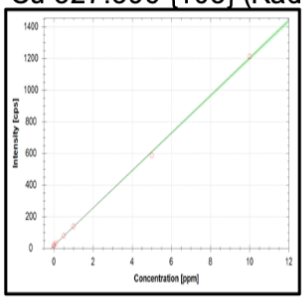
Site	Month	UHH Lab ID	Cu	Zn	Se
ES	June	2338-1	ND	0.002	ND
ES duplicate	June	2338-1d	ND	0.002	ND
EM	June	2338-2	ND	0.002	ND
EM duplicate	June	2338-2d	ND	0.002	ND
EB	June	2338-3	ND	0.002	ND
EB duplicate	June	2338-3d	ND	0.002	ND
Control	June	2338-4	ND	ND	ND
Control duplicate	June	2338-4d	ND	ND	ND
		Method Blank 2324	ND	0.001	0.004
		Method Blank 2338	ND	0.002	ND
		Detection Limit	**0.001**	**0.001**	**0.001**

Method used: EPA 200.8

ICP QA/QC

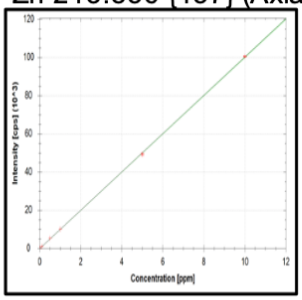
QC Curves

Cu 327.396 {103} (Radial)



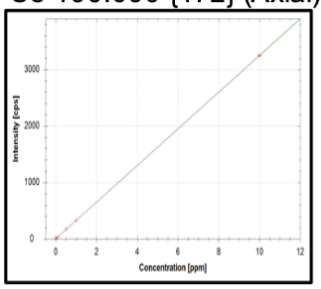
$R^2 = 0.9995$

Zn 213.856 {457} (Axial)



$R^2 = 0.9999$

Se 196.090 {472} (Axial)



$R^2 = 0.9999$

QC utilized MTL 62

Quality control samples

	mg/L		
	Cu	**Zn**	**Se**
Quality Control (QC) Sample	0.097	0.123	0.032
Accepted Range of QC	*0.087-0.113*	*0.107-0.143*	*0.026-0.044*

Please call if you have any questions regarding the water quality monitoring report.

Sincerely,

John Burns, Ph.D.
Associate Professor - Marine Science and Data Science
University of Hawai‘i at Hilo
200 W. Kawili St.
Hilo, HI 96720
Lab website: www.themegalab.org/

Natural Energy Laboratory
of Hawaii Authority
Water Quality Laboratory

NELHA

Sample Chain of Custody

73-4460 Queen Kaahumanu Hwy, #101, Kailua-Kona, HI 96740
808-327-9585 http://nelha.hawaii.gov

Client Name:	BOM		
Address:		Phone:	808-854-4057
		Fax:	
Contact Name:	J. Burns	Email:	

Project Information:	Monthly water quality monitoring
Project Location:	Keahole Point
Turn-Around Time:	5-10days
Notes:	

Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	Test(s) Requested:	Bottle Quantity	Comments / Field Data:
E, ZOM, C	6/12/25	9:45	O	JB	Nutrients and turbidity	21	

Relinquished By:	Date/Time	Received By:	Date/Time	Temp °C:	Matrix Key:
J. BURNS	6/12/25 12:59		6/12/25 1321	11.2	E = effluent
					GW = groundwater
					O = ocean water
					X= other/unknown

Clear Form

University of Hawai'i at Hilo Analytical Lab
Sample Submission/Analysis Request Form

Lab Information: 200 W. Kawili St. Hilo, HI 96720 – Marine Science Building – Room 139

Hours: 8am – 4pm, M-F, closed most state and federal holidays

Email: analytic@hawaii.edu **Website:** https://hilo.hawaii.edu/analytic/ **Phone:** (808) 932-7580

Client Information	
Client Name	John Burns
Project Title	BOM
Phone number	
Email address	

Billing Information	
Name/ Organization	MEGA Lab - BOM
Phone number	
Email address	
Funding type	☐ Private ☐ Non-profit ☐ Federal ☐ State ☐ County

Sample Information

Number of Samples	Sample Type	Sample Date	Analyses Requested
4	Seawater	6/12/25	HM (Cu, Zn, ~~Cr,~~ Se, ~~As, Ag~~) .
	Select		
	Select		
Example 4	Fresh Water	3/17/25	Total Phosphorus, NO3, NH4, pH

Email Sample Sheet with Sample IDs to analytic@hawaii.edu

Chain of Custody

Samples Relinquished by (Client): J Burns Date 6/18/25

By relinquishing the sample(s) to the UH Hilo Analytical Lab, I indicate that the information provided is accurate and complete and the samples are in the best quality for analysis. By submitting these samples, I agree to pay for all services rendered. I understand that the samples will be disposed of 30 days after the final report is completed, unless otherwise arranged.

Samples Received by (Technician): Date: 6/18/25

For Lab Use Only	
Sample Received Condition	1. (Drop off) Mail 2. Fresh Frozen Dried Other
Water Type	Fresh Brackish (Sea) FBaved? Y N
Sample location post arrival	fridge
Job Number	2338
	Comments:

V1 - 2/2025