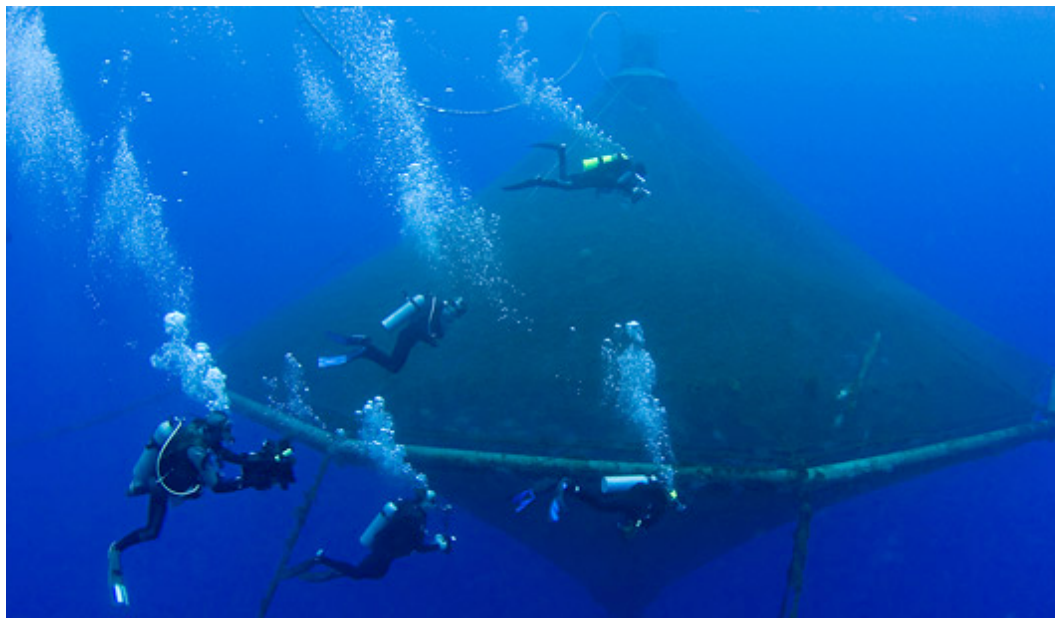




BLUE OCEAN MARICULTURE



9/23/2025

Water Quality Monitoring – Sep. 2025

Prepared by



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

BLUE OCEAN MARICULTURE

WATER QUALITY MONITORING – SEP. 2025

SAMPLING REPORT

Survey Date: 9/23/2025

Client: Blue Ocean Mariculture

Current: North

Log Number: BOM-WQ-SEP-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 (0.4ft to 1.7ft) influenced by a 3% waxing moon. Conditions consisted of 6-8kt Southwest winds that stayed consistent throughout the sampling duration. A 1-2ft Southwest swell was present during sampling and stayed consistent throughout the entire sampling event. Overall, sea conditions were moderately chopping with consistent winds. Skies over the ocean were clear with rainclouds moving over the coastline and at higher elevation. The air had light levels of vog from the Kilauea geological activity. There were visible slicks at all sampling stations with heavy amounts visible particulates in the water. There were schools of baitfish observed at the Effluent site.

A moderate 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 (NO₃- + NO₂-), ammonium (NH₄+), phosphate (PO₄3-), 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 NH₃, Si, PO₄, NO₃, and NO₂ 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

<u>ID</u>	<u>DATE</u>	<u>LAB ID</u>	Reported in µg/L				TDN
			NO₂+ NO₃	NH₃+ NH₄	PO₄	TDP	
		MDL	0.1	0.3	0.3	2.5	1.6
Z1B	9/23/25	31	1.62	1.20	5.07	11.33	84.83
Z1M	9/23/25	34	2.06	1.66	4.05	11.49	105.11
Z1S	9/23/25	35	1.01	4.43	4.08	11.06	80.32
Z2B	9/23/25	36					
Z2M	9/23/25	37	0.96	1.54	3.97	10.70	82.74
Z2S	9/23/25	38	1.43	3.44	3.27	11.10	86.24
Z3B	9/23/25	43	1.68	2.87	3.69	10.80	83.40
Z3M	9/23/25	44	0.71	4.62	4.33	10.99	77.14
Z3S	9/23/25	45	1.11	1.98	4.05	10.58	78.05
Z4B	9/23/25	46	0.71	<MDL	4.44	11.15	77.44
Z4M	9/23/25	47	0.99	0.83	4.44	11.20	82.15
Z4S	9/23/25	50	1.38	1.78	4.03	11.22	84.33
EB	9/23/25	59	0.60	0.82	4.54	10.70	72.60
EM	9/23/25	60	0.68	<MDL	4.25	11.07	70.90
ES	9/23/25	61	0.64	0.83	3.99	10.31	76.67
C1B	9/23/25	51	1.11	1.10	3.60	10.48	73.29
C1M	9/23/25	52	1.23	0.63	3.72	10.32	71.51
C1S	9/23/25	53	1.42	1.88	4.31	11.24	78.62
C2B	9/23/25	54	1.10	<MDL	3.77	10.34	74.09
C2M	9/23/25	57	0.87	1.63	4.25	10.94	75.76
C2S	9/23/25	58	1.07	<MDL	3.40	10.60	73.82



LAB QUALITY CONTROL AND QUALITY ASSURANCE

ANALYSIS All Nutrients LOW
 RUN 251016AR1.RUN
 DATE 10/16/2025
 TIME 1:48:39 PM

	1	3	4
METH	Total P	Phosphate	Silicate
UNIT	µmol/L	µmol/L	µmol/L
Base	-7338	-7120	-5680
Gain	109	290	69
Lamp	291	276	245
Cal RSQ	1.000	1.000	0.998

Sample ID

Cal.	9	2	15
Cal.	6	1	10
Cal.	4	0.5	8
Cal.	2	0.25	4
Cal.	0	0	0
Blank DI	0.04	0.01	0.06
Cal 3	97.70	99.86	99.70
Cal 3	102.35	100.76	100.96
Z1B	0.36582943	0.163689633	2.107239682
Z1M	0.370924001	0.130668961	2.272789365
Z1S	0.357011902	0.131658681	2.116623065
Z2M	0.345451143	0.12819466	2.068030547
Z2S	0.358383517	0.105431091	2.027480929
Z3B	0.348586264	0.119287176	2.037869674
Z3M	0.354660561	0.139891356	1.97453184
Z3S	0.341728187	0.130668961	1.991958122
Z4B	0.359951078	0.143265403	2.027145808
Z4M	0.361714584	0.14331039	2.05295011
Z4S	0.362106474	0.130219088	2.047923298
EB	0.345451143	0.146504487	2.06099301
EM	0.357403792	0.137102144	1.704089342
ES	0.332714714	0.128959444	1.661528999
Blank DI	0.03	0.01	0.05
Cal 3	98.52	101.27	101.16
Cal 3	101.51	101.85	99.04
C1B	0.338397121	0.116183053	2.031502378
C1M	0.33330255	0.120006973	2.162534617
C1S	0.362890254	0.139261534	2.103553353
C2B	0.33369444	0.121806465	2.113271857
C2M	0.353093001	0.137282093	1.958781162
C2S	0.342120077	0.109794858	1.981569377
Blank DI	0.04	0.01	0.05
Cal 3	97.80	100.13	98.71
Cal 3	102.25	100.28	97.41

*highlighted samples have been analyzed with a dilution. Dilutions have been applied to reported results.

Certified Reference Material			
	Phosphate	Silicate	N+N
	umole/kg	umole/kg	umole/kg
NMIJ Mid	1.08+/- .05	30.49 +/- .6	15.96+/- .5
S-LAB Value	1.11	31.09	
NMIJ Low	.07+/- .01	1.31+/- .15	.06+/- .02
S-LAB Value	0.08	1.36	

GRAB SAMPLE RESULTS

<u>Sample ID</u>	<u>Time</u>	<u>Date</u>	<u>Dissolved Oxygen</u>	<u>Dissolved Oxygen</u>	<u>Temperature</u>
Z1B	11:05	9/23/25	6.57	96.31	81.14
Z1M	11:10	9/23/25	6.66	94.47	81.14
Z1S	11:12	9/23/25	6.53	95.14	81.32
Z2B	11:19	9/23/25	6.53	96.61	81.14
Z2M	11:23	9/23/25	6.31	96.22	81.14
Z2S	11:24	9/23/25	6.50	94.57	81.32
Z3B	11:37	9/23/25	6.56	95.65	81.14
Z3M	11:42	9/23/25	6.58	94.73	81.14
Z3S	11:45	9/23/25	6.43	94.67	81.32
Z4B	11:54	9/23/25	6.84	94.46	81.14
Z4M	11:57	9/23/25	6.27	94.77	81.14
Z4S	11:59	9/23/25	6.34	94.59	81.32
EB	12:17	9/23/25	6.26	95.55	81.14
EM	12:22	9/23/25	6.67	94.87	81.14
ES	12:29	9/23/25	6.61	96.30	81.32
C1B	12:36	9/23/25	6.58	94.66	81.14
C1M	12:40	9/23/25	6.83	95.81	81.14
C1S	12:41	9/23/25	6.28	95.36	81.32
C2B	12:55	9/23/25	6.50	95.98	81.14
C2M	12:58	9/23/25	6.67	96.35	81.14
C2S	13:01	9/23/25	6.57	96.03	81.32
Units			mg/mL	% Saturation	Fahrenheit
DL			0.01	0.01	0.01



GRAB SAMPLE RESULTS

<u>Sample ID</u>	<u>Time</u>	<u>Date</u>	<u>pH</u>	<u>Salinity</u>	<u>Turbidity</u>
Z1B	11:05	9/23/25	8.10	35.36	0.10
Z1M	11:10	9/23/25	8.10	35.40	0.14
Z1S	11:12	9/23/25	8.10	35.38	0.15
Z2B	11:19	9/23/25	8.10	35.34	0.11
Z2M	11:23	9/23/25	8.10	35.37	0.09
Z2S	11:24	9/23/25	8.10	35.41	0.13
Z3B	11:37	9/23/25	8.10	35.39	0.09
Z3M	11:42	9/23/25	8.10	35.36	0.10
Z3S	11:45	9/23/25	8.10	35.45	0.10
Z4B	11:54	9/23/25	8.10	35.28	0.08
Z4M	11:57	9/23/25	8.10	35.33	0.09
Z4S	11:59	9/23/25	8.10	35.39	0.10
EB	12:17	9/23/25	8.10	35.32	0.09
EM	12:22	9/23/25	8.10	35.30	0.12
ES	12:29	9/23/25	8.10	35.38	0.19
C1B	12:36	9/23/25	8.10	35.36	0.10
C1M	12:40	9/23/25	8.10	35.33	0.14
C1S	12:41	9/23/25	8.10	35.35	0.08
C2B	12:55	9/23/25	8.10	35.29	0.12
C2M	12:58	9/23/25	8.10	35.31	0.12
C2S	13:01	9/23/25	8.10	35.39	0.10
Units				PPT	NTU
DL			0.01	0.01	0.01



ICP RESULTS

Burns2025 (4)

251023

n.a.: below MDL (method detection limit)

e: eliminated (over calibration range, failed qc, interference, etc)

Primary: Primary/preferred wavelength for elements measured at multiple wavelengths

IS: internal standard, yttrium

Note:

	Primary ppb Cu3247	Primary ppb Se1960	Primary ppb Zn2062	Comments
MDL	2.9	2	4	
Sept-C	n.a.	n.a.	n.a.	
Sept-EB	3.912	n.a.	5.066	
Sept-EM	9.84	n.a.	n.a.	
Sept-ES	4.306	n.a.	n.a.	

ICP QA/QC

												Y_2243	Y_3710			
												Sept-ES	2476.7	2807.2		
												Sept-EM	2478.1	2824.9		
												Sept-ES	2484.9	2874.9		
												Oct-ES	2486.9	2883.7		
												Oct-EM	2489.2	2846.3		
												Oct-ES	2481.4	2880.5		
											MeanIS_SW	2482.9	2852.9			

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

Sincerely,

A handwritten signature in black ink, appearing to read 'John Burns', with a stylized flourish extending to the right.

John Burns, Ph.D.
Associate Professor - Marine Science and Data Science
University of Hawai'i at Hilo
200 W. Kawili St.
Hilo, HI 96720