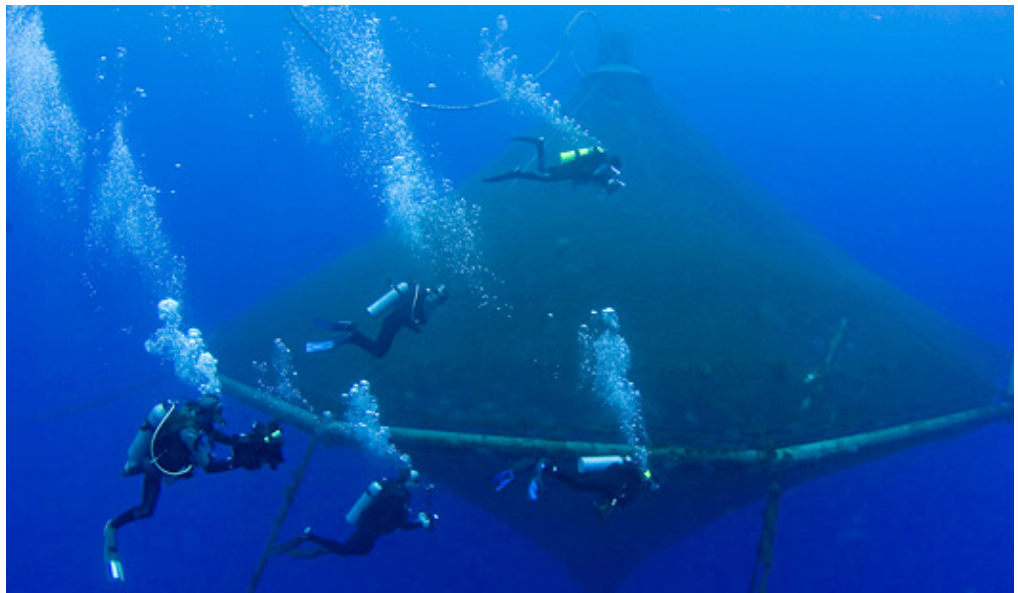




BLUE OCEAN MARICULTURE



8/13/2025

Water Quality Monitoring – August 2025

Prepared by



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

BLUE OCEAN MARICULTURE

WATER QUALITY MONITORING – AUGUST 2025

SAMPLING REPORT

Survey Date: 8/13/2025

Client: Blue Ocean Mariculture

Current: North

Log Number: BOM-WQ-AUG-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 dropping tide (1.6ft to 0.5ft) influenced by a 76% waning moon. Conditions consisted of 4-6kt Southwest winds that stayed consistent throughout the sampling duration. A 1-2ft South swell was present during sampling and stayed consistent throughout the entire sampling event. Overall, sea conditions were calm with light winds and chop. 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 moderate amounts visible particulates in the water. There were schools of baitfish and a monk seal 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- μ m), 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 (PO₄-), 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				<u>TDN</u>
			<u>NO₂+ NO₃</u>	<u>NH₃+ NH₄</u>	<u>PO₄</u>	<u>TDP</u>	
		<i>MDL</i>	<i>0.5</i>	<i>0.7</i>	<i>0.5</i>	<i>0.5</i>	<i>0.5</i>
Z1B	8/13/25	31	1.60	1.30	<MDL	5.50	78.80
Z1M	8/13/25	34	2.60	0.90	<MDL	5.30	79.30
Z1S	8/13/25	35	0.50	<MDL	<MDL	5.20	83.30
Z2B	8/13/25	36	1.50	0.80	<MDL	5.50	89.70
Z2M	8/13/25	37	1.10	<MDL	<MDL	6.20	91.70
Z2S	8/13/25	38	1.80	0.70	<MDL	6.40	88.20
Z3B	8/13/25	43	1.70	1.70	<MDL	6.00	84.20
Z3M	8/13/25	44	1.20	1.60	<MDL	5.50	80.20
Z3S	8/13/25	45	1.90	2.00	<MDL	5.30	88.20
Z4B	8/13/25	46	1.40	1.30	<MDL	5.40	76.60
Z4M	8/13/25	47	1.20	1.10	<MDL	5.40	78.20
Z4S	8/13/25	50	1.90	1.10	<MDL	6.30	88.80
EB	8/13/25	59	2.30	1.10	<MDL	6.80	90.60
EM	8/13/25	60	1.60	1.80	<MDL	6.80	85.50
ES	8/13/25	61	2.90	1.30	<MDL	6.50	86.90
C1B	8/13/25	51	1.70	1.70	<MDL	5.00	77.50
C1M	8/13/25	52	1.40	1.40	<MDL	6.00	82.10
C1S	8/13/25	53	1.50	1.90	<MDL	6.90	120.00
C2B	8/13/25	54	0.80	<MDL	<MDL	6.20	90.00
C2M	8/13/25	57	1.20	<MDL	<MDL	6.90	95.90
C2S	8/13/25	58	2.50	1.50	<MDL	7.00	104.00



LAB QUALITY CONTROL AND QUALITY ASSURANCE

FAS Pac II

Run date: 8/14/25

Configuration: BOM Offshore

Run Name: BOM Offshore August 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	90.1	10.2	11.2	11.8
	23	2:55	GravStd C4	Unknown	92.9	10.0	11.0	12.0
	24	2:56	GravStd C4	Unknown	90.6	10.2	11.2	11.9
	27	2:57	GravStd C4	Unknown	90.8	9.9	11.0	11.9
	28	2:58	GravStd C4	Unknown	91.0	10.3	11.2	12.4
	29	2:59	GravStd C4	Unknown	90.4	10.4	10.8	12.2
	30	0.125	GravStd C4	Unknown	90.5	10.1	11.2	12.3
Mean				90.9	10.2	11.1	12.1	
std dev				0.927	0.172	0.157	0.229	
MDL				2.9	0.5	0.5	0.7	
	18	SR:19	GravStd C3	Check Cal	247.9	24.5	26.5	23.8
	39	SR:19	GravStd C3	Check Cal	244.4	24.5	27.4	24.2
	62	SR:19	GravStd C3	Check Cal	259.7	23.8	27.8	24.3
	85	SR:19	GravStd C3	Check Cal	261.9	24.4	27.9	24.1
	108	SR:19	GravStd C3	Check Cal	284.0	24.4	28.3	22.7
	131	SR:19	GravStd C3	Check Cal	283.8	24.2	29.3	24.0
	136	SR:19	GravStd C3	Check Cal	283.9	23.9	29.8	89.3
Mean				266.5	24.2	28.1	33.2	
std dev				17.369	0.288	1.121	24.744	

MDL Calculations: Analysis of seven of the same samples (Gravimetric Standard C4 10, 100, 10, 10 µg/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

<u>Sample ID</u>	<u>Time</u>	<u>Date</u>	<u>Dissolved Oxygen</u>	<u>Dissolved Oxygen</u>	<u>Temperature</u>
Z1B	9:41	8/13/25	6.76	94.39	80.78
Z1M	9:46	8/13/25	6.21	95.29	80.78
Z1S	9:48	8/13/25	6.44	95.47	80.96
Z2B	9:58	8/13/25	6.74	95.34	80.78
Z2M	10:04	8/13/25	6.77	96.62	80.78
Z2S	10:05	8/13/25	6.54	95.46	80.96
Z3B	10:14	8/13/25	6.27	94.59	80.78
Z3M	10:18	8/13/25	6.34	94.64	80.78
Z3S	10:21	8/13/25	6.36	94.02	80.96
Z4B	10:30	8/13/25	6.63	95.99	80.78
Z4M	10:36	8/13/25	6.43	95.24	80.78
Z4S	10:39	8/13/25	6.63	95.02	80.96
EB	10:55	8/13/25	6.49	95.67	80.78
EM	11:04	8/13/25	6.56	93.79	80.78
ES	11:12	8/13/25	6.38	97.12	80.96
C1B	11:20	8/13/25	6.77	96.99	80.78
C1M	11:25	8/13/25	6.46	96.79	80.78
C1S	11:27	8/13/25	6.23	96.97	80.96
C2B	11:34	8/13/25	6.65	97.12	80.78
C2M	11:39	8/13/25	6.23	93.39	80.78
C2S	11:43	8/13/25	6.61	96.50	80.96
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	9:41	8/13/25	8.10	35.40	0.10
Z1M	9:46	8/13/25	8.10	35.50	0.11
Z1S	9:48	8/13/25	8.10	35.36	0.08
Z2B	9:58	8/13/25	8.10	35.45	0.07
Z2M	10:04	8/13/25	8.10	35.34	0.09
Z2S	10:05	8/13/25	8.10	35.33	0.08
Z3B	10:14	8/13/25	8.10	35.24	0.08
Z3M	10:18	8/13/25	8.10	35.57	0.08
Z3S	10:21	8/13/25	8.10	35.27	0.16
Z4B	10:30	8/13/25	8.10	35.32	0.08
Z4M	10:36	8/13/25	8.10	35.38	0.07
Z4S	10:39	8/13/25	8.10	35.20	0.10
EB	10:55	8/13/25	8.10	35.19	0.08
EM	11:04	8/13/25	8.10	35.38	0.09
ES	11:12	8/13/25	8.10	35.18	0.13
C1B	11:20	8/13/25	8.10	35.39	0.08
C1M	11:25	8/13/25	8.10	35.27	0.12
C1S	11:27	8/13/25	8.10	35.45	0.26
C2B	11:34	8/13/25	8.10	35.47	0.09
C2M	11:39	8/13/25	8.10	35.26	0.12
C2S	11:43	8/13/25	8.10	35.35	0.18
Units				PPT	NTU
DL			0.01	0.01	0.01



ICP RESULTS

Hawco lab results
September 26 2025
Analyst: Dr. Logan Tegler
Instrument: Thermo Scientific ICAP-TQ, O2 collision mode

Sample name	Sample Month	Copper, ppb	Zinc, ppb	Selenium, ppb
EB	August	0.37	9.7	BD
C	August	0.86	15.5	BD
EM	August	0.60	8.3	BD
ES	August	0.58	11.8	BD
Detection limit (3x standard deviation of offshore seawater)		0.20	0.28	0.32
ICPMS mode		65Cu 65Cu (66Zn 66Zn († 80Se 80Se.16O (CH2-TQ-O2)		

Samples diluted by a factor of 20 and analyzed. Calibrated relative to a 9.5 ppb multielement standard with a 1:20 diluted offshore seawater matrix



ICP QA/QC

SampleList	SampleList	Raw.Average	Raw.Average	Raw.Average	Raw.Average	Raw.Average	Raw.Average	Raw.Average	Raw.Average	Raw.Average	Raw.Average	Raw.Average	Raw.Average	Raw.Average	Raw.Average
SampleID	SampleLine	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		55Mn 55Mn	57Fe (CH2-SQ	59Co 59Co	60Ni (CH2-SQ	63Cu 63Cu	64Zn 64Zn	65Cu 65Cu	66Zn 66Zn	68Zn (CH2-SQ	75As 75As	78Se 78Se	80Se 80Se	80Se 80Se	80Se 80Se
		Y (cps)	Y (cps)	Y (cps)	Y (cps)	Y (cps)	Y (cps)	Y (cps)	Y (cps)	Y (cps)	Y (cps)	Y (cps)	Y (cps)	Y (cps)	Y (cps)
1	0.1 N blank (10ppb In)	3062	609	72	4660	1573	5633	778	3336	3531		3	0		1
2	HOT Blank (250 uL HOT 140m sw 4.75 mL 0.1 N wit	126	3585	32	1648	92	298	41	165	208		87	1		7
3	ESI Blank (250 uL sw 4.75 mL 0.1 N HNO3)	72	93	11	976	2345	228	78	151	118		2	0		2
4	10 ppb and HOT sw (4.75 multi-element standard,	86760	4131	72404	34265	40672	18864	19804	11065	12468		9494	971		2118
5	10 ppb (0.1 N Nitric) A	119468	2051	100915	40316	61530	30965	29793	18287	16354		14401	1602		3514
6	EB	148	2498	25	509	284	1132	87	691	729		99	1		5
7	C	169	217	15	502	368	1745	138	1020	822		3	1		1
8	EM	164	2675	30	402	305	1034	111	607	666		110	2		5
9	ES	178	2040	31	349	316	1300	108	807	829		86	1		2
11	HOT Blank (250 uL sw 4.75 mL 0.1 N) 140 m	110	1942	23	382	197	229	48	135	176		99	1		5
12	HOT Blank (250 uL sw 4.75 mL 0.1 N) 140 m	106	1848	28	284	224	233	55	136	153		87	1		3
13	HOT Blank (250 uL sw 4.75 mL 0.1 N) 140 m	105	1847	24	236	242	255	41	126	168		95	1		4
14	10 ppb (0.1 N Nitric) B	129643	2306	111270	46248	67955	34109	32598	20220	19142		15819	1749		3876
16	0.1 N blank (10ppb In)	6949	506	126	1966	3078	12162	1457	7389	6186		4	0		1
		9119	57			4272	1954	2080	1147	1291			102		222
		107				221	239	48	133	166			1		4
	Sample name	3				23	14	7	5	12			0		1
	EB	0.090				0.294	9.138	0.371	9.740	8.738			0.109		0.100
	C	0.135				0.691	15.416	0.864	15.469	10.174			-0.022		-0.260
	EM	0.125				0.394	8.135	0.601	8.264	7.761			0.239		0.100
	ES	0.156				0.444	10.858	0.579	11.762	10.282			0.044		-0.230
	Detection lim DL, ppb	0.018				0.318	0.437	0.202	0.282	0.541			0.113		0.316



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



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

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

[illegible]

Relinquished By:	Date/Time	Received By:	Date/Time	Temp °C:	Matrix Key:
J. Burns	8/13/25 13:50	<i>[Signature]</i>	8/13/25 1350	6.1	E = effluent GW = groundwater
					O = ocean water
					Y = other/unknown

CHAIN OF CUSTODY RECORD										Page 1 of 1
Sampling Organization: UH Hilo		Sampler: John Burns		On-site		Lab Analysis			Preservation Codes: A - HCl B - Ascorbic acid N - None	
Address: 200 W. Kawili Street, Hilo HI 96720		Phone/Email: johnhr@hawaii.edu								
Field Sample No.		Date	Time	Preservation:					Remarks	
EB		8/13/2025			N					250 mL shipped on ice overnight
EM		8/13/2025			1					250 mL shipped on ice overnight
ES		8/13/2025			1					250 mL shipped on ice overnight
C		8/13/2025			1					250 mL shipped on ice overnight
Relinquished by: (Name/Affiliation) John Burns - UHH	Date/Time	Received by: (Name/Affiliation) Catherine Rong - WRRC		Date/Time Aug 19, 2025 2:57pm			Remarks			
Signature:		Signature:								
Relinquished by: (Name/Affiliation)	Date/Time	Received by: (Name/Affiliation)		Date/Time			Remarks			
Signature:		Signature:								
Relinquished by: (Name/Affiliation)	Date/Time	Received by: (Name/Affiliation)		Date/Time			Remarks			
Signature:		Signature:								
Relinquished by: (Name/Affiliation)	Date/Time	Received by: (Name/Affiliation)		Date/Time			Remarks			
Signature:		Signature:								