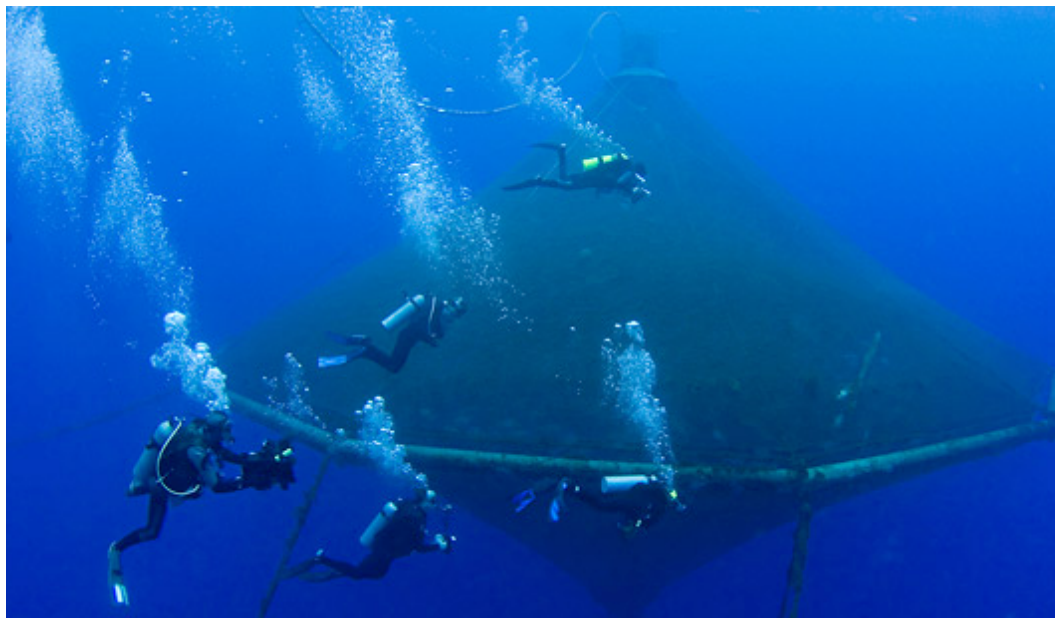




BLUE OCEAN MARICULTURE



1/23/2024

Water Quality Monitoring – Jan. 2024

Prepared by



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BLUE OCEAN MARICULTURE

WATER QUALITY MONITORING – JAN. 2024

SAMPLING REPORT

Survey Date: 1/23/2024

Client: Blue Ocean Mariculture

Current: South

Log Number: BOM-WQ-JAN-2024

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 0.9ft) influenced by a full moon. Conditions consisted of 2-3kt Northwest winds that stayed consistent throughout the sampling event. A 7-9ft West swell was present during sampling and stayed consistent throughout the entire sampling event. There had been a high frequency of large west swells occurring this month. Overall, sea conditions were calm with large pulses of west swell which caused mixing along the shoreline. Skies had dark cloud cover and the area had experienced recent rainfall. Rain was occurring in the early morning and then the clouds moved upland. The air had low levels of vog from the Kilauea geological activity. There were observable slicks near all sites with minimal visible particulates. There were schools of baitfish and dolphins, as well as a monk seal, observed at the Effluent site.

A moderate South 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 (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

ID	DATE	LAB ID	Reported in µg/L				TDN
			NO ₂ +NO ₃	NH ₃ +NH ₄	PO ₄	TDP	
		MDL	1.9	3.3	2.1	2.1	1.9
Z1B	1/23/24	31	<MDL	<MDL	<MDL	4.00	89.80
Z1M	1/23/24	34	<MDL	<MDL	<MDL	4.80	138.80
Z1S	1/23/24	35	<MDL	<MDL	<MDL	4.60	134.80
Z2B	1/23/24	36	<MDL	<MDL	<MDL	5.10	115.60
Z2M	1/23/24	37	1.90	<MDL	<MDL	3.70	114.00
Z2S	1/23/24	38	2.30	<MDL	<MDL	2.70	89.10
Z3B	1/23/24	43	<MDL	<MDL	<MDL	4.30	85.00
Z3M	1/23/24	44	<MDL	<MDL	<MDL	3.30	88.80
Z3S	1/23/24	45	<MDL	<MDL	<MDL	2.60	86.20
Z4B	1/23/24	46	<MDL	<MDL	<MDL	<MDL	79.60
Z4M	1/23/24	47	<MDL	<MDL	<MDL	2.90	88.20
Z4S	1/23/24	50	<MDL	<MDL	<MDL	<MDL	74.90
EB	1/23/24	59	<MDL	<MDL	3.00	3.20	90.40
EM	1/23/24	60	<MDL	<MDL	3.60	4.00	89.80
ES	1/23/24	61	<MDL	<MDL	<MDL	2.70	80.20
C1B	1/23/24	51	<MDL	<MDL	<MDL	4.50	81.60
C1M	1/23/24	52	<MDL	<MDL	<MDL	<MDL	84.60
C1S	1/23/24	53	2.00	<MDL	<MDL	3.00	86.80
C2B	1/23/24	54	<MDL	<MDL	<MDL	3.10	83.90
C2M	1/23/24	57	<MDL	<MDL	<MDL	3.00	94.10
C2S	1/23/24	58	<MDL	<MDL	3.80	3.40	83.80



LAB QUALITY CONTROL AND QUALITY ASSURANCE

FASPac II

Run date: 1/25/24
 Configuration: BOM Offshore
 Run Name: BOM January 2024 Fish Cages

				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	100.4	11.3	11.7	10.5
	23	2:55	GravStd C4	Unknown	100.1	10.9	12.6	12.8
	24	2:56	GravStd C4	Unknown	99.6	10.0	11.1	9.5
	27	2:57	GravStd C4	Unknown	97.7	10.5	12.0	10.4
	28	2:58	GravStd C4	Unknown	95.8	10.1	11.9	10.1
	29	2:59	GravStd C4	Unknown	95.3	9.2	12.0	10.0
	30	0.125	GravStd C4	Unknown	94.4	10.2	10.8	10.7
Mean				97.6	10.3	11.7	10.6	
std dev				2.479	0.677	0.605	1.058	
MDL				7.8	2.1	1.9	3.3	
	18	SR:19	GravStd C3	Check Cal	247.8	21.6	26.2	23.5
	39	SR:19	GravStd C3	Check Cal	244.0	22.1	26.6	24.9
	62	SR:19	GravStd C3	Check Cal	254.1	25.6	28.2	24.6
	85	SR:19	GravStd C3	Check Cal	254.1	23.4	31.5	24.2
	105	SR:19	GravStd C3	Check Cal	254.9	20.0	29.7	24.3
Mean				251.0	22.5	28.4	24.3	
std dev				4.839	2.100	2.203	0.524	

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

<u>Sample ID</u>	<u>Time</u>	<u>Date</u>	<u>Dissolved Oxygen</u>	<u>Dissolved Oxygen</u>	<u>Temperature</u>
Z1B	9:50	1/23/24	6.72	96.87	78.26
Z1M	9:58	1/23/24	6.29	96.58	78.26
Z1S	10:01	1/23/24	6.56	96.18	78.44
Z2B	10:11	1/23/24	6.30	92.18	78.26
Z2M	10:14	1/23/24	6.44	91.18	78.26
Z2S	10:18	1/23/24	6.23	94.38	78.44
Z3B	10:23	1/23/24	6.48	94.95	78.26
Z3M	10:30	1/23/24	6.40	91.01	78.26
Z3S	10:31	1/23/24	6.22	91.83	78.44
Z4B	10:42	1/23/24	6.41	96.81	78.26
Z4M	10:49	1/23/24	6.26	93.08	78.26
Z4S	10:53	1/23/24	6.23	95.32	78.44
EB	11:06	1/23/24	6.46	93.18	78.26
EM	11:16	1/23/24	6.14	94.56	78.26
ES	11:21	1/23/24	6.71	92.80	78.44
C1B	11:38	1/23/24	6.39	93.75	78.26
C1M	11:43	1/23/24	6.29	94.74	78.26
C1S	11:49	1/23/24	6.36	96.44	78.44
C2B	12:02	1/23/24	6.35	94.55	78.26
C2M	12:09	1/23/24	6.64	96.61	78.26
C2S	12:12	1/23/24	6.27	96.25	78.44
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	9:50	1/23/24	8.10	35.24	0.17
Z1M	9:58	1/23/24	8.10	35.37	0.12
Z1S	10:01	1/23/24	8.10	35.40	0.12
Z2B	10:11	1/23/24	8.10	35.35	0.14
Z2M	10:14	1/23/24	8.10	35.42	0.12
Z2S	10:18	1/23/24	8.10	35.22	0.17
Z3B	10:23	1/23/24	8.10	35.25	0.10
Z3M	10:30	1/23/24	8.10	35.38	0.11
Z3S	10:31	1/23/24	8.10	35.18	0.13
Z4B	10:42	1/23/24	8.10	35.19	0.11
Z4M	10:49	1/23/24	8.10	35.25	0.11
Z4S	10:53	1/23/24	8.10	35.30	0.11
EB	11:06	1/23/24	8.10	35.35	0.13
EM	11:16	1/23/24	8.10	35.38	0.10
ES	11:21	1/23/24	8.10	35.24	0.17
C1B	11:38	1/23/24	8.10	35.30	0.13
C1M	11:43	1/23/24	8.10	35.23	0.13
C1S	11:49	1/23/24	8.10	35.33	0.15
C2B	12:02	1/23/24	8.10	35.21	0.14
C2M	12:09	1/23/24	8.10	35.25	0.17
C2S	12:12	1/23/24	8.10	35.31	0.12
Units				PPT	NTU
DL			0.01	0.01	0.01



ICP RESULTS

Laboratory Test Results

Description: January 2024, 4 water samples for copper, zinc, selenium, silver, chromium, arsenic
 Job 2235

Site	Month	UHH Lab ID	mg/L					
			Cu	Zn	Se	Ag	Cr	As
ES	July	2235-1	ND	ND	ND	ND	ND	ND
ES duplicate	July	2235-1 dup	ND	ND	ND	ND	ND	ND
EM	July	2235-2	ND	ND	ND	ND	ND	ND
EM duplicate	July	2235-2 dup	ND	ND	ND	ND	ND	ND
EB	July	2235-3	ND	ND	ND	ND	ND	ND
EB duplicate	July	2235-3 dup	ND	ND	ND	ND	ND	ND
EC	July	2235-4	ND	ND	ND	ND	ND	ND
EC duplicate	July	2235-4 dup	ND	ND	ND	ND	ND	ND
Method Blank			ND	ND	ND	ND	ND	ND
Detection Limit			0.01	0.01	0.01	0.10	0.01	0.01

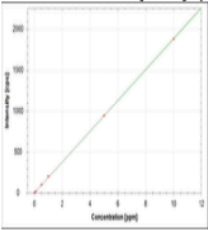
Method used: EPA 200.8



ICP QA/QC

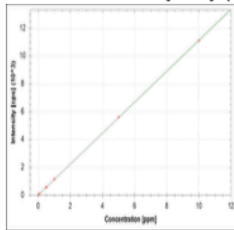
Curves for Job 2235

Cu 324.754 {104} (Radial)



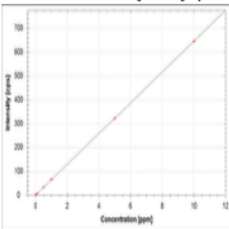
R² = 0.9999

Zn 213.856 {457} (Axial)



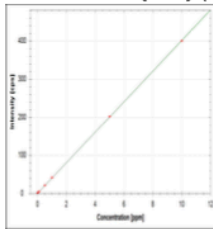
R² = 0.9999

As 193.759 {474} (Axial)



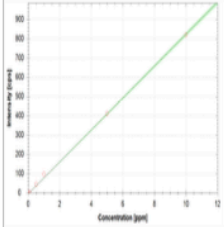
R² = 1.0000

Se 203.985 {465} (Axial)



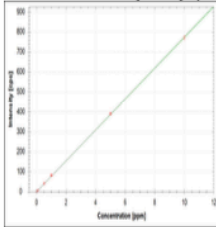
R² = 1.0000

Ag 328.068 {103} (Radial)



R² = 0.9992

Cr 267.716 {126} (Radial)



R² = 0.9999

QC utilized MTL62

Quality control samples

	mg/L					
	Cu	Zn	As	Ag	Cr	Se
Quality Control (QC) Sample	0.109	0.107	0.009	0.039	0.08	0.044
Accepted Range of QC	0.087 - 0.113	0.107 - 0.143	0.007 - 0.013	0.026 - 0.044	0.059 - 0.091	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
Affiliate Researcher - NOAA Papahānaumokuākea Marine National Monument
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Natural Energy Laboratory
of Hawaii Authority
Water Quality Laboratory

Sample Chain of Custody

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

Client Name: Blue Ocean Mariculture/MEGA Lab
Address: 200 W. Kawili St., Hilo HI 96720 Phone: 808-854-4057
Fax: _____ Email: johnhr@hawaii.edu
Contact Name: John Burns

Project Information: Offshore monitoring
Project Location: Keahole Point
Turn-Around Time: _____
Notes: _____

Sample ID	Collection		Sample Matrix	Sampler's Initials	Test(s) Requested:	Bottle Quantity	Comments / Field Data:
	Date	Time					
Fishcage, ZOM, Control	11/23/04	9:50	0	JB	Inorganics, totals, turbidity	21	

Relinquished By:	Date/Time	Received By:	Date/Time	Temp °C:	Matrix Key:
<u>J. Burns</u>	11/23/04 13:05				E = effluent GW = groundwater O = ocean water X= other/unknown

