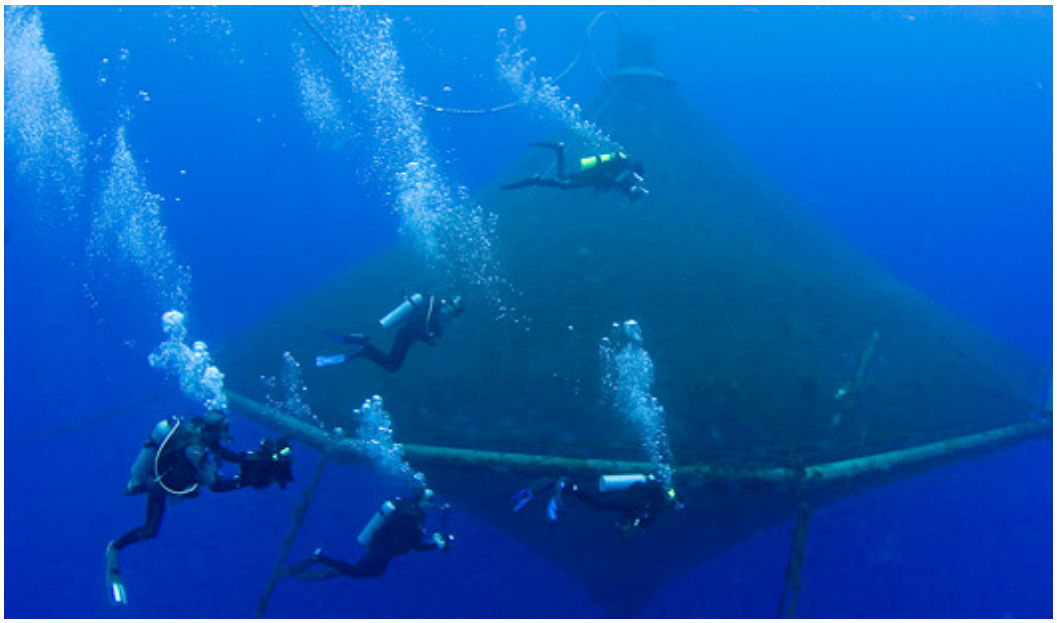
# BLUE OCEAN MARICULTURE



4/9/2025

## Water Quality Monitoring – April 2025


Prepared by

**MEGA Lab**
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Hilo, HI 96720

# BLUE OCEAN MARICULTURE

## WATER QUALITY MONITORING – APRIL 2025

## SAMPLING REPORT

**Survey Date:** 4/9/2025

**Client:** Blue Ocean Mariculture

**Current:** North

**Log Number:** BOM-WQ-APRIL-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 (0.0ft to 1.4ft) influenced by a 91% waxing moon. Conditions consisted of 4-6kt Southwest winds that increased to 10-12kts while sampling the Effluent and Control sites. A 5-7ft North swell was present during sampling and stayed consistent throughout the entire sampling event. Overall, sea conditions were choppy and rough with white caps and the North swell evident along the coastline. Clouds were abundant above the coastline with clear skies over the ocean. The air had moderate levels of vog from the Kilauea geological activity. There were several visible slicks at all sampling stations with some visible amounts of particulates observed 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*** | ***0.7*** | ***1.1*** | ***0.9*** | ***0.9*** | ***0.7*** |
| Z1B | 4/9/25 | 31 | 1.20 | 1.20 | 1.70 | 4.80 | 85.70 |
| Z1M | 4/9/25 | 34 | 0.80 | 1.70 | 3.10 | 4.80 | 79.00 |
| Z1S | 4/9/25 | 35 | 2.10 | 1.20 | 2.80 | 8.80 | 116.60 |
| Z2B | 4/9/25 | 36 | 1.60 | <MDL | 1.90 | 5.10 | 88.70 |
| Z2M | 4/9/25 | 37 | 0.80 | 1.20 | 2.70 | 5.00 | 84.50 |
| Z2S | 4/9/25 | 38 | 2.80 | 1.10 | 1.40 | 5.70 | 99.40 |
| Z3B | 4/9/25 | 43 | 0.90 | <MDL | 1.00 | 5.70 | 94.40 |
| Z3M | 4/9/25 | 44 | 1.30 | 1.70 | <MDL | 5.50 | 88.40 |
| Z3S | 4/9/25 | 45 | 2.60 | 1.80 | 1.20 | 5.10 | 78.80 |
| Z4B | 4/9/25 | 46 | 1.00 | 1.90 | 1.00 | 4.40 | 75.90 |
| Z4M | 4/9/25 | 47 | 1.10 | 1.80 | 1.30 | 5.00 | 72.60 |
| Z4S | 4/9/25 | 50 | 2.40 | 1.80 | 1.10 | 5.20 | 86.80 |
| EB | 4/9/25 | 59 | 1.70 | 1.10 | <MDL | 4.20 | 87.00 |
| EM | 4/9/25 | 60 | 3.60 | 7.40 | <MDL | 4.50 | 88.80 |
| ES | 4/9/25 | 61 | 5.10 | 5.50 | 1.60 | 5.10 | 95.70 |
| C1B | 4/9/25 | 51 | 0.90 | <MDL | 1.00 | 4.10 | 72.70 |
| C1M | 4/9/25 | 52 | 1.30 | 1.50 | 1.30 | 5.20 | 79.50 |
| C1S | 4/9/25 | 53 | 1.80 | 2.00 | 1.20 | 5.10 | 91.40 |
| C2B | 4/9/25 | 54 | 1.00 | 2.80 | 1.10 | 4.60 | 84.10 |
| C2M | 4/9/25 | 57 | 1.00 | 1.80 | <MDL | 5.40 | 84.30 |
| C2S | 4/9/25 | 58 | 1.60 | 1.60 | 1.10 | 5.60 | 90.60 |

# LAB QUALITY CONTROL AND QUALITY ASSURANCE

## FASPac II

Run date: 4/10/25
Configuration: BOM Offshore
Run Name: BOM Offshore Fish Cages April 2025

| | Position | Identifier | Type | Si µg/l | PO4 µg/l | $NO_3$ & $NO_2$ µg/l | Total $NH_3$ & $NH_4$ µg/l |
|---|---|---|---|---|---|---|---|
| 22 | 2:54 | GravStd C4 | Unknown | 96.9 | 9.8 | 10.9 | 10.1 |
| 23 | 2:55 | GravStd C4 | Unknown | 96.6 | 10.5 | 10.8 | 11.2 |
| 24 | 2:56 | GravStd C4 | Unknown | 96.2 | 10.2 | 10.9 | 10.9 |
| 27 | 2:57 | GravStd C4 | Unknown | 96.3 | 9.9 | 10.7 | 11.2 |
| 28 | 2:58 | GravStd C4 | Unknown | 97.2 | 9.8 | 10.9 | 10.9 |
| 29 | 2:59 | GravStd C4 | Unknown | 97.0 | 10.2 | 11.2 | 10.8 |
| 30 | 0.125 | GravStd C4 | Unknown | 96.1 | 10.4 | 11.3 | 10.9 |
| Mean | | | | 96.6 | 10.1 | 11.0 | 10.9 |
| std dev | | | | 0.430 | 0.285 | 0.215 | 0.369 |
| MDL | | | | 1.3 | 0.9 | 0.7 | 1.2 |
| 18 | SR:19 | GravStd C3 | Check Cal | 243.4 | 21.9 | 27.2 | 23.9 |
| 39 | SR:19 | GravStd C3 | Check Cal | 243.5 | 22.4 | 27.6 | 25.4 |
| 62 | SR:19 | GravStd C3 | Check Cal | 249.0 | 22.2 | 28.0 | 25.1 |
| 85 | SR:19 | GravStd C3 | Check Cal | 3.3 | 22.4 | 28.7 | 26.1 |
| 99 | SR:19 | GravStd C3 | Check Cal | 240.9 | 22.2 | 29.0 | 26.8 |
| Mean | | | | 196.0 | 22.2 | 28.1 | 25.5 |
| std dev | | | | 107.774 | 0.205 | 0.748 | 1.092 |

*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 | 9:36 | 4/9/25 | 6.84 | 92.46 | 78.98 |
| Z1M | 9:40 | 4/9/25 | 6.85 | 93.48 | 78.98 |
| Z1S | 9:42 | 4/9/25 | 6.40 | 96.09 | 79.16 |
| Z2B | 9:49 | 4/9/25 | 6.14 | 93.06 | 78.98 |
| Z2M | 9:55 | 4/9/25 | 6.41 | 96.13 | 78.98 |
| Z2S | 9:57 | 4/9/25 | 6.78 | 94.11 | 79.16 |
| Z3B | 10:08 | 4/9/25 | 6.09 | 98.90 | 78.98 |
| Z3M | 10:12 | 4/9/25 | 6.67 | 94.72 | 78.98 |
| Z3S | 10:13 | 4/9/25 | 6.12 | 93.88 | 79.16 |
| Z4B | 10:21 | 4/9/25 | 6.53 | 92.03 | 78.98 |
| Z4M | 10:25 | 4/9/25 | 6.33 | 96.74 | 78.98 |
| Z4S | 10:27 | 4/9/25 | 6.24 | 93.27 | 79.16 |
| EB | 10:39 | 4/9/25 | 6.22 | 96.63 | 78.98 |
| EM | 10:44 | 4/9/25 | 6.67 | 94.72 | 78.98 |
| ES | 10:50 | 4/9/25 | 6.74 | 92.76 | 79.16 |
| C1B | 11:02 | 4/9/25 | 6.40 | 97.34 | 78.98 |
| C1M | 11:08 | 4/9/25 | 6.28 | 93.18 | 78.98 |
| C1S | 11:09 | 4/9/25 | 6.75 | 93.17 | 79.16 |
| C2B | 11:18 | 4/9/25 | 6.44 | 92.01 | 78.98 |
| C2M | 11:23 | 4/9/25 | 6.15 | 96.56 | 78.98 |
| C2S | 11:25 | 4/9/25 | 6.61 | 95.17 | 79.16 |
| Units | | | mg/mL | % Saturation | Fahrenheit |
| DL | | | 0.01 | 0.01 | 0.01 |

# GRAB SAMPLE RESULTS

| Sample ID | Time | Date | pH | Salinity | Turbidity |
|---|---|---|---|---|---|
| Z1B | 9:36 | 4/9/25 | 8.10 | 35.19 | 0.11 |
| Z1M | 9:40 | 4/9/25 | 8.10 | 35.47 | 0.05 |
| Z1S | 9:42 | 4/9/25 | 8.10 | 35.32 | 0.09 |
| Z2B | 9:49 | 4/9/25 | 8.10 | 35.23 | 0.05 |
| Z2M | 9:55 | 4/9/25 | 8.10 | 35.43 | 0.10 |
| Z2S | 9:57 | 4/9/25 | 8.10 | 35.58 | 0.09 |
| Z3B | 10:08 | 4/9/25 | 8.10 | 35.21 | 0.06 |
| Z3M | 10:12 | 4/9/25 | 8.10 | 35.21 | 0.07 |
| Z3S | 10:13 | 4/9/25 | 8.10 | 35.63 | 0.07 |
| Z4B | 10:21 | 4/9/25 | 8.10 | 35.58 | 0.05 |
| Z4M | 10:25 | 4/9/25 | 8.10 | 35.29 | 0.05 |
| Z4S | 10:27 | 4/9/25 | 8.10 | 35.60 | 0.08 |
| EB | 10:39 | 4/9/25 | 8.10 | 35.46 | 0.12 |
| EM | 10:44 | 4/9/25 | 8.10 | 35.13 | 0.09 |
| ES | 10:50 | 4/9/25 | 8.10 | 35.42 | 0.06 |
| C1B | 11:02 | 4/9/25 | 8.10 | 35.31 | 0.07 |
| C1M | 11:08 | 4/9/25 | 8.10 | 35.37 | 0.07 |
| C1S | 11:09 | 4/9/25 | 8.10 | 35.45 | 0.08 |
| C2B | 11:18 | 4/9/25 | 8.10 | 35.16 | 0.09 |
| C2M | 11:23 | 4/9/25 | 8.10 | 35.30 | 0.12 |
| C2S | 11:25 | 4/9/25 | 8.10 | 35.20 | 0.08 |
| Units | | | | PPT | NTU |
| DL | | | 0.01 | 0.01 | 0.01 |

# ICP RESULTS

**Laboratory Test Results**

Description: April 2025, 4 water samples for copper, zinc, selenium, silver, chromium, and arsenic.

**Job 2313**

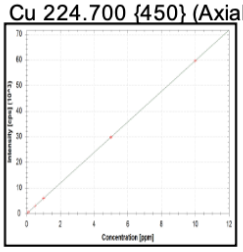
| | | | mg/L | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Site** | **Month** | **UHH Lab ID** | **Cu** | **Zn** | **Se** | **Ag** | **Cr** | **As** |
| ES | April | 2313-1 | ND | ND | ND | ND | ND | ND |
| ES duplicate | April | 2313-1d | ND | ND | ND | ND | ND | ND |
| EM | April | 2313-2 | ND | ND | ND | ND | ND | ND |
| EM duplicate | April | 2313-2d | ND | ND | ND | ND | ND | ND |
| EB | April | 2313-3 | ND | ND | ND | ND | ND | ND |
| EB duplicate | April | 2313-3d | ND | ND | ND | ND | ND | ND |
| Control | April | 2313-4 | ND | ND | ND | ND | ND | ND |
| Control duplicate | April | 2313-4d | ND | ND | ND | ND | ND | ND |
| | | Method Blank | ND | ND | ND | ND | ND | ND |
| | | **Detection Limit** | **0.01** | **0.01** | **0.01** | **0.01** | **0.10** | **0.01** |

Method used: EPA 200.8

# ICP QA/QC

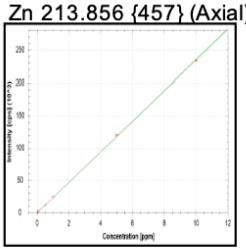
**QC Curves**

Cu 224.700 {450} (Axial)



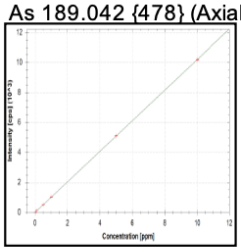
$R^2$ = 1.0000

Zn 213.856 {457} (Axial)



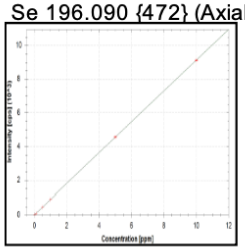
$R^2$ = 0.9998

As 189.042 {478} (Axial)



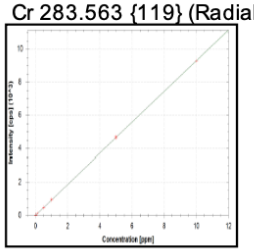
$R^2$ = 1.0000

Se 196.090 {472} (Axial)



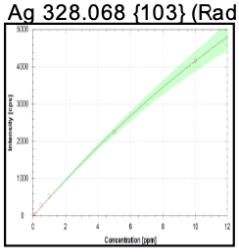
$R^2$ = 1.0000

Cr 283.563 {119} (Radial)



$R^2$ = 1.0000

Ag 328.068 {103} (Radial)



$R^2$ = 0.9997

QC utilized MTL 62 + S27*

Quality control samples

| | mg/L | | | | | |
|---|---|---|---|---|---|---|
| | **Cu** | **Zn** | **As** | **Cr** | **Se** | **Ag*** |
| Quality Control (QC) Sample | 0.097 | 0.132 | 0.010 | 0.073 | 0.037 | 0.972 |
| *Accepted Range of QC* | *0.087-0.113* | *0.107-.143* | *0.007-0.013* | *0.059-.091* | *0.026-0.044* | *0.896-1.110* |

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

Sincerely,

John Burns, Ph.D.
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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 | 4/9/25 | 9:36 | O | JB | Nutrients and turbidity | 21 | |
| | | | | | | | |
| | | | | | | | |
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| Relinquished By: | Date/Time | Received By: | Date/Time | Temp °C: | Matrix Key: |
|---|---|---|---|---|---|
| J. Burns JB | 4/9/25 13:20 | | 4/9/25 1320 | 6.7 | E = effluent |
| | | | | | GW = groundwater |
| | | | | | O = ocean water |
| | | | | | X= other/unknown |