Ministry of Marine Resources
TU'ANGA O TE PAE MOANA
COOK ISLANDS

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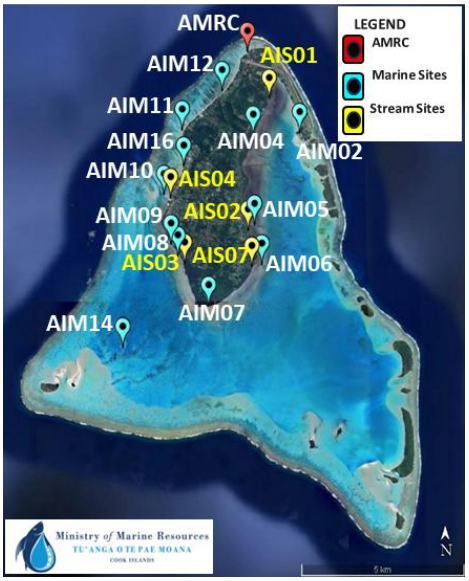
AITUTAKI WATER QUALITY REPORT
DECEMBER 2025

SUMMARY

Water samples were collected on Tuesday 9th December. Weather observed prior to and on the day of sampling was sunny, windy and calm. Tides were low during sample collection. All twelve lagoon sites were accessible and sampled. Algae such as Boodlea, Padina, Turbinaria, Caulerpa, Sargassum and Dictyota were observed at nine out of twelve sites, except at Vaipae and Arutanga Wharves and Maina Nursery. Stagnancy and lack of water were observed at all five streams and therefore were not sampled. Delays in receiving our reagents order from suppliers resulted in no bacteria data for this month. Summary table for total suspended solids and dissolved oxygen results and levels below.

Lagoon Site	Site ID	Total Suspended Solids (mg/L)	Dissolved Oxygen (%)
Ootu	AIM02	4.4	99
Vaipeka	AIM04	0.3	114
Vaipae Wharf	AIM05	5.2	112
Tautu Wharf	AIM06	5.4	110
Taravao	AIM07	2.4	113
Vainamu	AIM08	13.6	100
Vainamu Wharf	AIM09	2.2	82
Arutanga Wharf	AIM10	3.1	81
Rapae	AIM11	0.3	95
Maunga Pu	AIM12	1.4	80
Maina Nursery	AIM14	0.3	78
Amuri Wharf	AIM16	2.3	73



GRADING SCALE	Excellent	Very Good	Good	Poor	Very Poor	Extremely Poor

Lagoon:

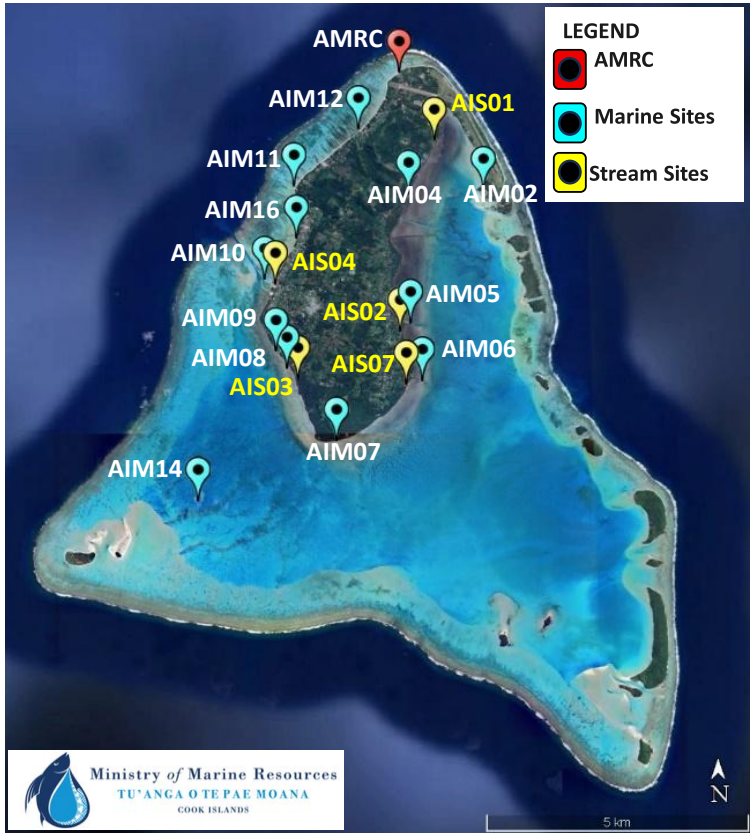
- Nine out of twelve sites were below the total suspended solids recommended limit of 5.0 mg/L for healthy coral reefs that indicated clear waters and minimal threat to coral reefs. Vaipae and Tautu Wharves and Vainamu observed poor and very poor levels, respectively, exceeding the limit of 5.0 mg/L.
- Dissolved oxygen levels were above the recommended threshold of 80% showing good, very good and excellent levels at ten sites. Poor levels below 80% were observed at Maina Nursery and Amuri Wharf.
- Temperature ranged from 24.8 degrees at Taravao to 27.5 degrees at Maunga Pu. Average temperature was 26.3 degrees.
- Salinity readings were stable and ranged from 32.3 ppt at Taravao to 36.5 ppt at Vaipeka. Mean salinity was 35.4 ppt.
- pH ranged from 7.59 at Amuri Wharf to 7.92 at Vaipae Wharf and Maina Nursery. Average pH was 7.79.

The monthly summary reports, rainfall data and lab study report can be found at the end of this report.

1. ENTEROCOCCI BACTERIAL COUNTS - AITUTAKI - Most Probable Number of Enterococci per 100 mL (MPN/100mL)

Lagoon Site	Site ID	Jul	Aug	Sep	Oct	Nov	Dec
Ootu	AIM02	10	<1	<1	<1	<1	ND
Vaipeka	AIM04	<1	10	10	<1	20	ND
Vaipae Wharf	AIM05	10	<1	20	<1	187	ND
Tautu Wharf	AIM06	110	<1	10	<1	<1	ND
Taravao	AIM07	<1	<1	20	<1	10	ND
Vainamu	AIM08	30	31	31	107	<1	ND
Vainamu Wharf	AIM09	<1	63	<1	10	30	ND
Arutanga Wharf	AIM10	<1	<1	10	<1	<1	ND
Rapae	AIM11	<1	41	<1	41	10	ND
Maunga Pu	AIM12	20	20	<1	<1	<1	ND
Maina Nursery	AIM14	10	NW	NW	NW	NW	ND
Amuri Wharf	AIM16	<1	<1	10	41	41	ND

Stream Site	Site ID	Jul	Aug	Sep	Oct	Nov	Dec
Vaitiare	AIS01	NW	NW	NW	NW	NW	NW
Vaipae	AIS02	NW	NW	NW	NW	NW	NW
Pata	AIS03	NW	NW	NW	NW	NW	NW
Arutanga	AIS04	NW	NW	NW	NW	NW	NW
Tautu	AIS07	39	NW	NW	56	NW	NW

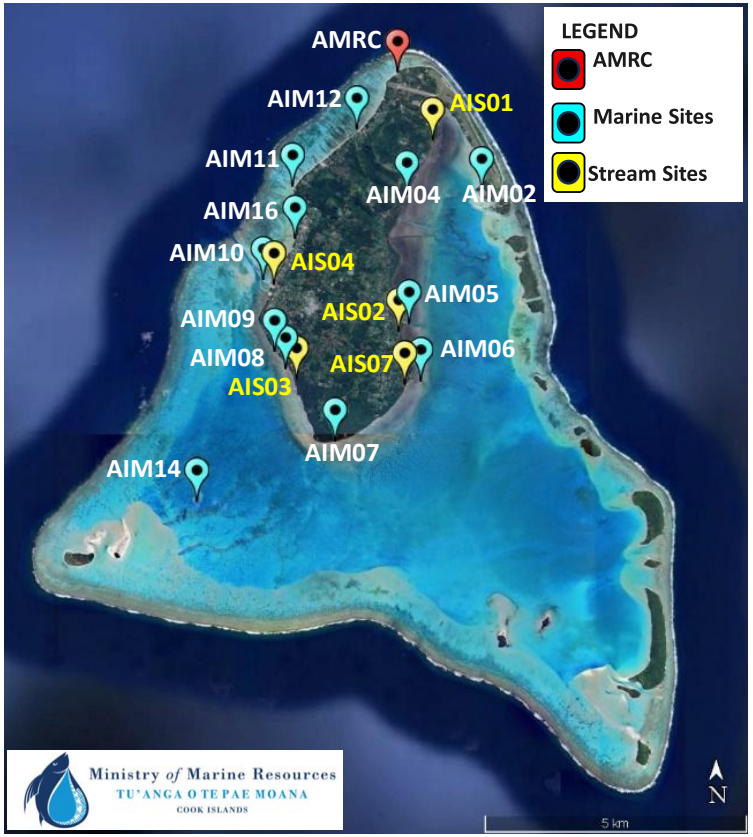


ENTEROCOCCI BACTERIA STANDARDS	< 41	41 ≥ 100	101 ≥ 200	201 ≥ 350	351 ≥ 500	> 500
	A	B	C	D	E	F
	Excellent	Very Good	Good	Poor	Very Poor	Extremely Poor
REFERENCE: WHO 2021 Guidelines on Recreational Water Quality for Coastal and Fresh Waters.						

2. TOTAL SUSPENDED SOLIDS - AITUTAKI - Milligrams per Litre (mg/L)

Lagoon Site	Site ID	Jul	Aug	Sep	Oct	Nov	Dec
Ootu	AIM02	3.6	1.0	4.6	7.5	3.0	4.4
Vaipeka	AIM04	3.0	9.1	3.5	7.7	3.0	0.3
Vaipae Wharf	AIM05	2.6	6.0	2.0	13.6	4.0	5.2
Tautu Wharf	AIM06	3.3	3.8	13.0	4.0	2.0	5.4
Taravao	AIM07	3.3	11.9	2.9	5.4	5.0	2.4
Vainamu	AIM08	11.8	9.5	20.5	17.9	6.7	13.6
Vainamu Wharf	AIM09	6.3	6.8	4.6	9.5	13.2	2.2
Arutanga Wharf	AIM10	4.6	5.4	7.1	8.9	3.9	3.1
Rapae	AIM11	1.0	1.0	2.2	2.0	1.0	0.3
Maunga Pu	AIM12	1.0	1.0	1.3	0.3	4.8	1.4
Maina Nursery	AIM14	0.3	NW	NW	NW	NW	0.3
Amuri Wharf	AIM16	1.0	2.0	2.3	2.4	1.0	2.3

Stream Site	Site ID	Jul	Aug	Sep	Oct	Nov	Dec
Vaitiare	AIS01	NW	NW	NW	NW	NW	NW
Vaipae	AIS02	NW	NW	NW	NW	NW	NW
Pata	AIS03	NW	NW	NW	NW	NW	NW
Arutanga	AIS04	NW	NW	NW	NW	NW	NW
Tautu	AIS07	8.3	NW	NW	10.0	NW	NW



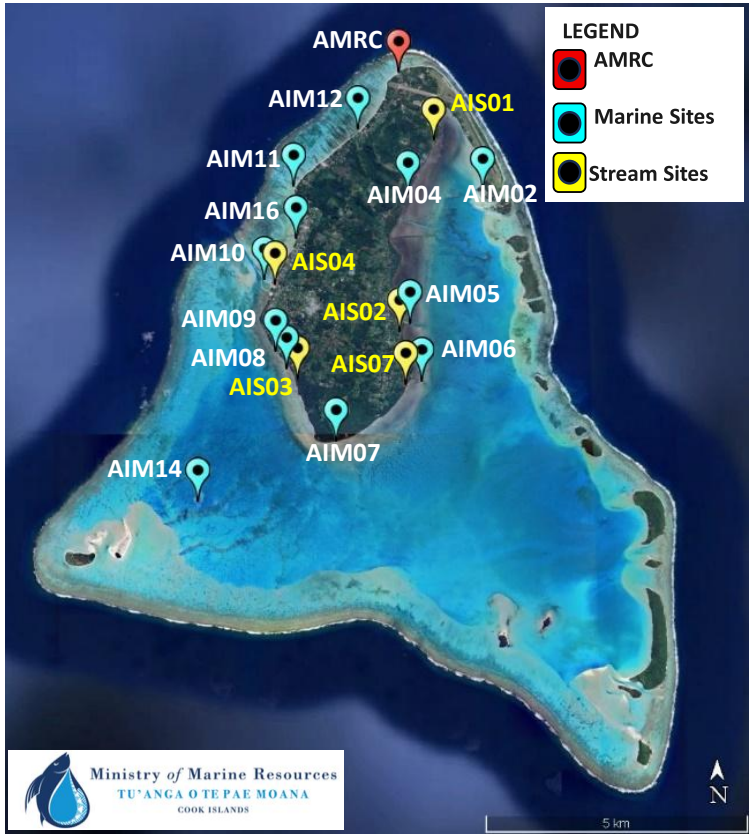
TOTAL SUSPENDED SOLIDS STANDARDS	< 1.0	1.0 ≥ 2.5	2.5 ≥ 5.0	5.0 ≥ 10	10 ≥ 20	> 20
	A	B	C	D	E	F
	Excellent	Very Good	Good	Poor	Very Poor	Extremely Poor

REFERENCE: Bell 1992, total suspended solids recommended limit is ≤5 mg/L for healthy coral reef.

3. DISSOLVED OXYGEN - AITUTAKI - Percent (%)

Lagoon Site	Site ID	Jul	Aug	Sep	Oct	Nov	Dec
Ootu	AIM02	93	102	77	110	87	99
Vaipeka	AIM04	89	119	111	117	112	114
Vaipae Wharf	AIM05	102	123	116	122	119	112
Tautu Wharf	AIM06	104	114	111	117	107	110
Taravao	AIM07	94	115	99	117	97	113
Vainamu	AIM08	89	91	86	87	79	100
Vainamu Wharf	AIM09	103	90	100	94	78	82
Arutanga Wharf	AIM10	95	104	109	106	104	81
Rapae	AIM11	105	89	80	84	88	95
Maunga Pu	AIM12	83	88	86	83	77	80
Maina Nursery	AIM14	92	NW	NW	NW	NW	78
Amuri Wharf	AIM16	93	86	92	87	73	73

Stream Site	Site ID	Jul	Aug	Sep	Oct	Nov	Dec
Vaitiare	AIS01	NW	NW	NW	NW	NW	NW
Vaipae	AIS02	NW	NW	NW	NW	NW	NW
Pata	AIS03	NW	NW	NW	NW	NW	NW
Arutanga	AIS04	NW	NW	NW	NW	NW	NW
Tautu	AIS07	62	NW	NW	15	NW	NW

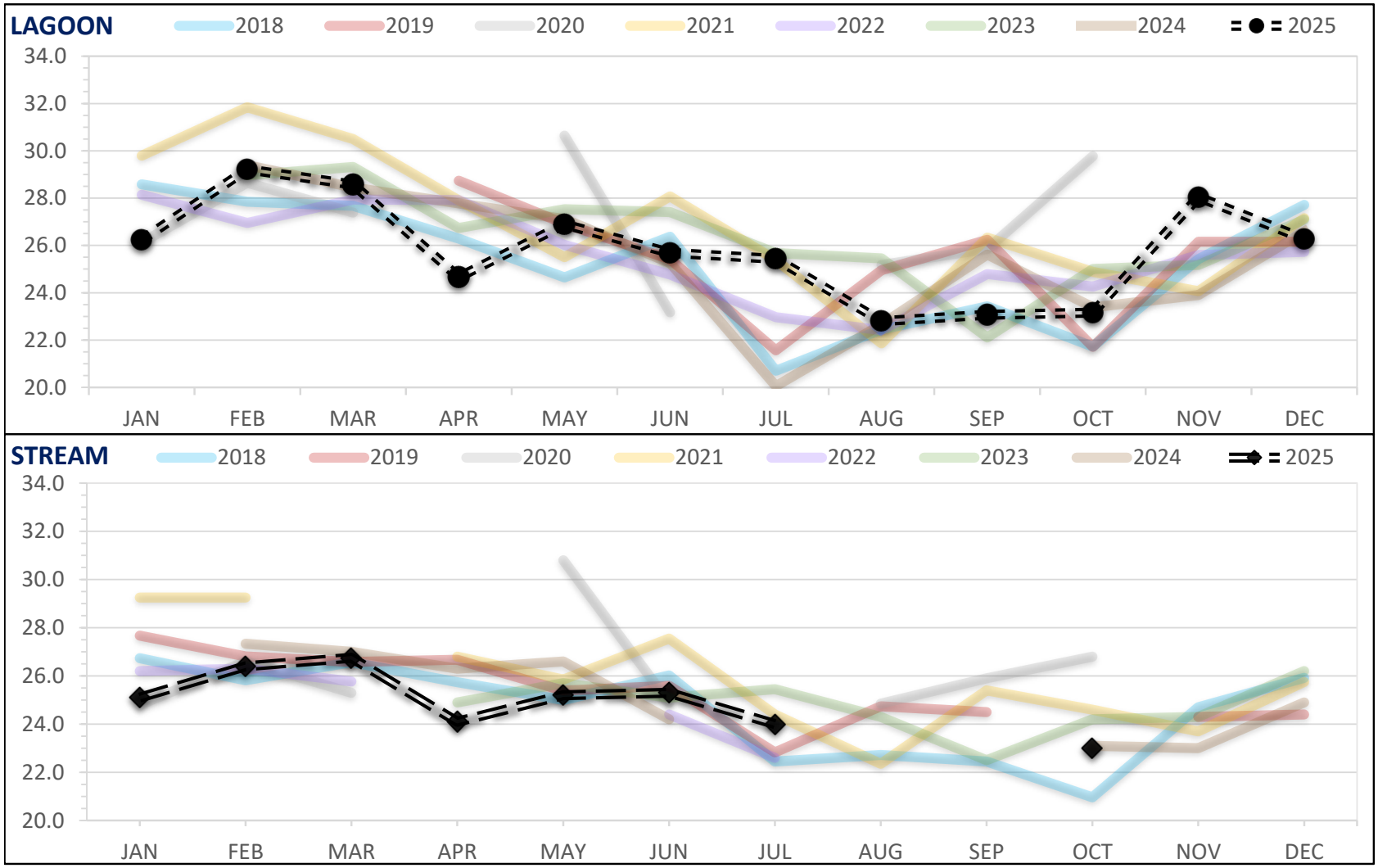


DISSOLVED OXYGEN STANDARDS	> 95	90 ≥ 95	80 ≥ 90	60 ≥ 80	40 ≥ 60	< 40
	A	B	C	D	E	F
	Excellent	Very Good	Good	Poor	Very Poor	Extremely Poor

REFERENCE: Department of Health, Clean Water Branch Hawaii 1994: Dissolved oxygen recommended limit is ≥75% saturation for oceanic waters, embayments, open coastal waers & estuaries; ≥80% saturation for streams.

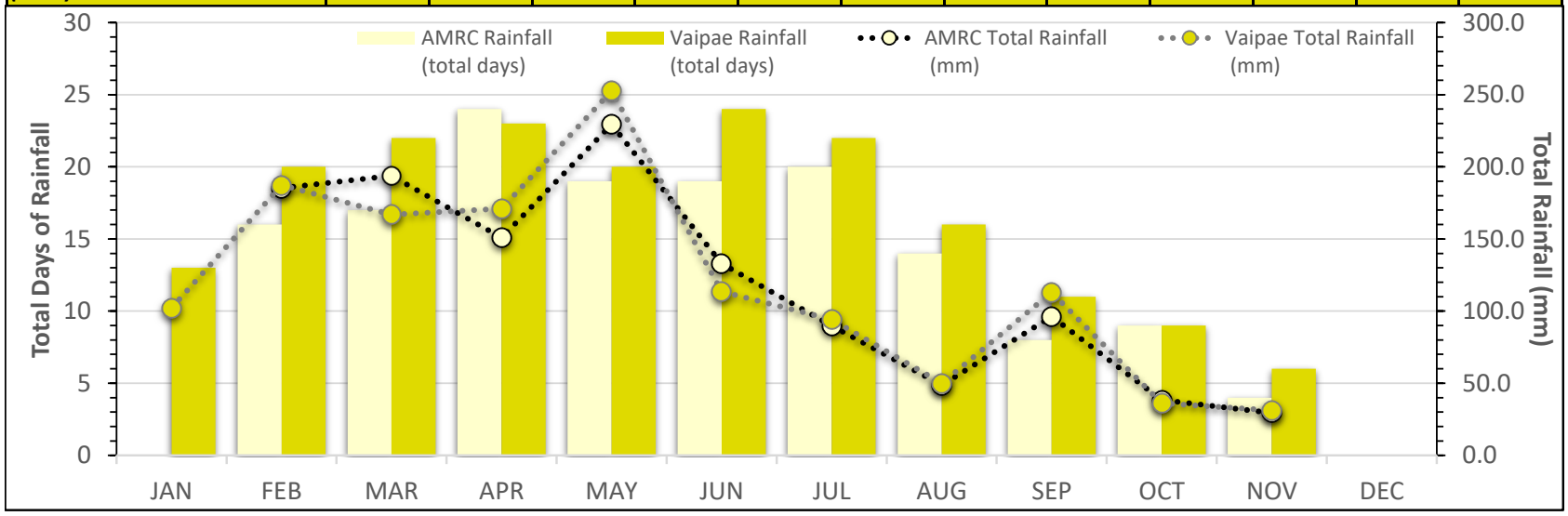
4. AVERAGE TEMPERATURE - AITUTAKI - Degrees Celcius (˚C)

2025	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Lagoon	26.2	29.2	28.6	24.7	26.9	25.7	25.4	22.8	23.1	23.2	28.0	26.3
Stream	25.1	26.4	26.8	24.1	25.2	25.3	24.0	ND	ND	23.0	ND	ND



5. AITUTAKI RAINFALL - AMRC & VAIPAE - Total Rainfall (mm) & Total Days of Rainfall

Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
AMRC Total Rainfall (mm)	ND	185.2	193.8	151.0	229.4	132.9	89.9	48.6	96.2	38.4	29.4	
AMRC Rainfall (total days)	*ND*	*16*	*17*	*24*	*19*	*19*	*20*	*14*	*8*	*9*	*4*	
AMRC Highest 1-Day (mm)	ND	43.8	39.6	75.8	95.0	72.4	20.4	19.2	74.8	14.0	14.0	
AMRC Highest 1-Day (date)	*ND*	*19th*	*3rd*	*6th*	*24th*	*26th*	*11th*	*7th*	*18th*	*5th*	*30th*	
Vaipae Total Rainfall (mm)	102.2	187.4	166.8	171.0	252.6	113.6	94.2	50.0	113.0	36.2	31.2	
Vaipae Rainfall (total days)	*13*	*20*	*22*	*23*	*20*	*24*	*22*	*16*	*11*	*9*	*6*	
Vaipae Highest 1-Day (mm)	26.2	44.4	33.0	68.4	100.2	52.0	20.0	19.0	89.0	14.4	14.4	
Vaipae Highest 1-Day (date)	*10th*	*19th*	*3rd*	*6th*	*24th*	*26th*	*11th*	*7th*	*18th*	*5th*	*30th*	



Report Date: 10.12.2025		AITUTAKI LAB STUDY REPORT – DECEMBER			Lab Report No.: 12L5405 – 12L5416		
SAMPLE DESCRIPTION							
Date Samples Collected:	Name of Sample:	Collected By:	Submitted By:	Time of Receipt:	Physical Description:		Quantity Per Site Received:
Tuesday 9th December	Marine	MMR		10:20am	Clear		2L
Study No.	1	2	3	4	5	6	7
SITE ID / LAB ID	Enterococci (MPN/100ml)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	pH	Total Suspended Solids (mg/L)
MARINE							
AIM02 / 12L5405	ND	26.8	35.3	99.0	6.49	7.77	4.4
AIM04 / 12L5406	ND	25.1	36.5	114.3	7.67	7.88	0.3
AIM05 / 12L5407	ND	26.4	36.3	111.9	7.34	7.92	5.2
AIM06 / 12L5408	ND	26.1	36.1	110.2	7.28	7.84	5.4
AIM07 / 12L5409	ND	24.8	32.3	112.8	7.79	7.72	2.4
AIM08 / 12L5410	ND	25.5	35.7	100.4	6.71	7.70	13.6
AIM09 / 12L5411	ND	26.7	36.4	81.7	6.34	7.66	2.2
AIM10 / 12L5412	ND	26.4	36.3	80.7	5.30	7.91	3.1
AIM11 / 12L5413	ND	26.5	35.0	94.9	6.27	7.77	0.3
AIM12 / 12L5414	ND	27.5	34.2	80.1	5.22	7.74	1.4
AIM14 / 12L5415	ND	26.2	35.7	78.1	5.16	7.92	0.3
AIM16 / 12L5416	ND	27.3	34.9	72.9	4.75	7.59	2.3
Study Method	IDEXX Enterolert*	YSI Manual	YSI Manual	YSI Manual	YSI Manual	YSI Manual	MMR Lab Manual Water Quality Monitoring V5
Recommended Limit	Ref. Comments	Ref. Comments	Ref. Comments	Ref. Comments	Ref. Comments	Ref. Comments	Ref. Comments

Abbreviation

NL: Not Listed, MPN: Most Probable Number, cfu: Colony Forming Unit, mL: milli Litre, FAU: Formazin Attenuation Unit, NTU: Nephelometric Turbidity Unit, ppt: Parts Per Thousand, DB: Designated Bathing Beach, MB: Moderate Use of Bathing, LB: Light Use of Bathing, IB: Infrequent Use of Bathing

NA: Not Available, however data will be available at a later date; ND: No Data due to equipment failure or logistics problems or time delay or methodology problem or combination of all; NW: No Water, stream dry or water stagnant or water level too low for sample collection or water dirty/murky.

Comments

1. Temperature[#]
   Subtropical regions (south of Cape Canaveral and Tampa Bay, Florida, and Hawaii).
   Short-term Max. 32.2^{o}C, Max. True daily mean 29.4^{o}C (average of 24-hourly temperature reading).
   Temperature is the measure of warmth and coldness, reported as an average and measured in degrees celcius (°C).
2. pH
   Changes to pH can be caused by a range of potential water quality problems (e.g., low values due to acid sulphate runoff). pH values are also related to soil geology and may be naturally low or high (in limestone areas). High pH values can also be caused temporarily when high rates of photosynthesis by aquatic plants (including algae) lead to a decrease in carbon dioxide, and therefore a decrease in carbonic acid in the water.
3. Salinity
   A measure of the amount of dissolved salts in the water, and therefore an indicator of salinity. Excess salinity in freshwater streams occurs as a result of excess soil salinity, which may be caused by excess land clearing and changes to the groundwater table. Salinity is reported as parts per thousand (ppt).
4. Dissolved Oxygen^
   DO levels indicate how much oxygen is in the water. Low DO levels indicate an abnormal disturbance in the ecosystem such as an algal bloom. DO is measured in percentage (%).
   Low DO: 3.5 mg/L at 26C leads to 100% mortality of *Acipenser oxyrhincus*
   2.7 mg/L at 19C leads to 22% mortality of *Acipenser oxyrhincus*
   <3.7 mg/L Demersal finfish biomass diminishes
   <3.5 mg/L Species richness diminishes
   Below 2 mg/L infaunal species migrate to sediment surface and epifaunal species move to better aerated water.
   Oxygen is essential for life processes of most aquatic organisms. Many aquatic organisms will suffocate if there is insufficient oxygen in the water.
5. Suspended Solids[@]
   Settleable and suspended solids should not reduce the depth of the compensation point for photosynthetic activity by more than 10% from the seasonably established norm for aquatic life. Total suspended solids (TSS) are non-living (inorganic) such as silt and mud; and organic matter such as animal and plant material found in the water. The presence of large amounts of particles are responsible for creating the murky appearance of dirty water and can quickly kill coral reefs. TSS is measured in milligrams per litre (mg/L).
6. Turbidity
   Water clarity (the degree of light penetration) is important as aquatic plants depend on light to photosynthesize and produce oxygen. Large amounts of sediment in a water body can also smother benthic organisms. Suspended solid results are interactive and interdependent with turbidity. Expert interpretation needed. Turbidity is measured as FAU.
7. Enterococci[β]
   The presence of bacteria Enterococci *sp* is monitored as an indicator of human and animal waste pollution. The higher the numbers of Enterococci bacteria present in a sample, the greater the amount of faecal pollution in the water. Bacteria count is measured in Most Probable Number of Enterococci cells per 100mL of sample (MPN/100mL).
8. Nutrients (Nitrate, Nitrite, Ammonia, Phosphate)
   High nutrient concentrations in a water body (eutrophication) may lead to excessive weed and algal growth. Excess nutrients enter a water body through several means, including discharge of treated sewage, storm water, and in run-off from land, for example as fertiliser, animal waste, or decaying plant matter.
9. Chlorophyll-a
   Chlorophyll-a is a pigment found in green plants, including aquatic plants. Measuring the amount of chlorophyll-a in the water therefore indicates the amount of green algae present in the water. High concentrations of algae (algal blooms) may harm other aquatic organisms, either through the production of toxins, reduction of available light through covering the water surface, or by using all available oxygen during respiration at night. Chlorophyll-a is measured in micrograms per litre (µg/L).
10. Rainfall
    Rarotonga: daily rainfall data is provided by the Cook Islands Meteorological Service.
    Aitutaki: daily rainfall data is recorded by MMR Staff at Amuri (Aitutaki Marine Research Centre – AMRC) and at Vaipae (Rowan Strickland's residence).
    Rainfall is measured in millimetres (mm) and reported as total rainfall per month, total number of days that had rainfall and the highest amount of rainfall in 1-day and date(s).

[#]EPA Quality Criteria for Water Gold Book 1986
^EPA Ambient Aquatic Life Water Quality Criteria for DO (Saltwater): Cape Cod to Cape Hatteras Nov 2000
[@]EPA Quality Criteria for Water Red Book 1976
[β]WHO Guidelines on Recreational Water Quality for Coastal and Fresh Waters 2021