



RAROTONGA WATER QUALITY REPORT JANUARY 2021

SUMMARY

Water samples were collected on Tuesday 19th January. Results were as follows:

Lagoon:

- Overall water quality status was good with the average score at B.
- Average temperature was 29.6 degrees. Temperature was highest at Paringaru with 30.8 degrees and lowest at Pouara Raui and Betela Beach with 29.1 degrees.
- Salinity and pH were normal.
- Although tides were low during sampling at all sites, overcast skies with rain showers contributed to steady water movement causing very good and excellent levels of dissolved oxygen with high results. However levels were poor with low results at Paringaru, Tikioki Packing Shed and Muri Koka from extremely slow water movement.
- Enterococci bacteria levels were very good and excellent with low results. However Avatiu had extremely poor levels with high results. Resampling for Avatiu was done the next day and the outcome was excellent levels with low results. This indicated a well flushed lagoon.
- Suspended solids ranged from very good to very poor levels with low and high results.

Stream:

- Of the eight streams, only Avana, Paringaru and Areiti were flowing. There was no water at Akapuao and water was stagnant/not flowing at Totokoitu, Betela, Avatiu and Vaiterenga.
- Average temperature was 25.5 degrees. Temperature was highest at Avana with 25.7 degrees and lowest at Paringaru with 25.2 degrees.
- Salinity and pH were normal.
- Dissolved oxygen results for Avana stream was excluded due to mechanical error with the instrument. However Paringaru and Areiti levels were excellent and good with high results.
- Enterococci bacteria levels were extremely poor with high results.
- Suspended solids levels were very good and excellent with low results at Avana and Paringaru. However levels were very poor with high results at Areiti.

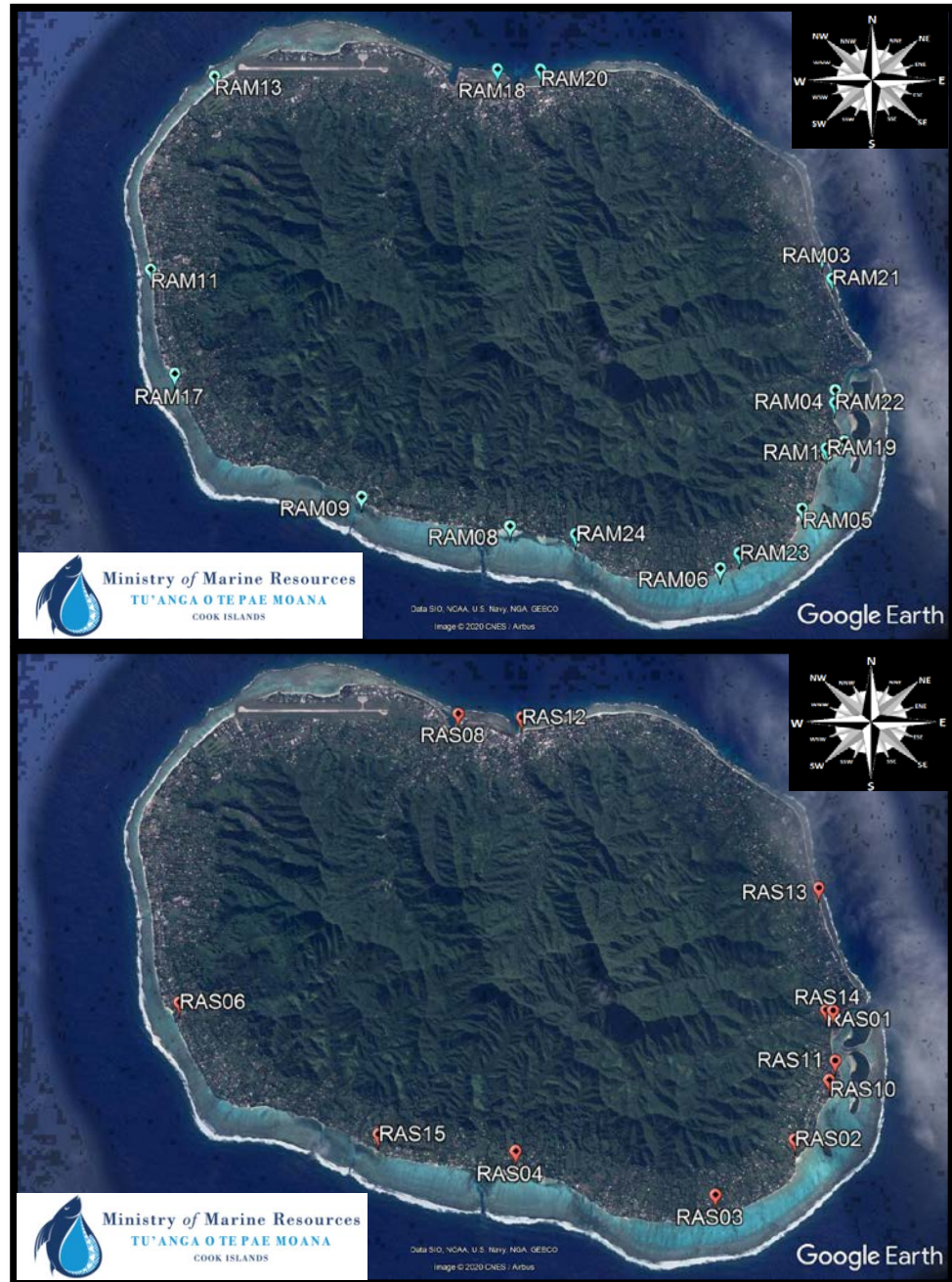
Rainfall:

The average rainfall for the month of December was 2.5mm at Nikao and 5.7mm at Tikioki. Both stations recorded 11 days (Nikao) and 12 days (Tikioki) of no rainfall in December. The highest 1-day rainfall in December was 48mm on Thursday 3rd at Tikioki and 20.3mm on Wednesday 23rd at Nikao.

Below are the monthly report, report card and lab study report for the month of January.

RAROTONGA MONTHLY WATER QUALITY REPORT – JANUARY 2021

Site Name	Site ID	Dissolved Oxygen (%)	Enterococci (MPN per 100ml)	Suspended Solids (mg/L)			
LAGOON SITES							
Pouara Rai	RAM03	163	<1	2.5			
Avana Mudflats	RAM04	122	<1	3.8			
Paringaru	RAM05	76	<1	16.0			
Tikioki Packing Shed	RAM06	79	<1	6.5			
Totokoitu Station	RAM08	102	<1	3.4			
Papua	RAM09	131	<1	1.7			
Arorangi School	RAM11	142	<1	8.5			
Social Centre	RAM13	99	41	16.3			
Muri Buoy	RAM16	93	10	2.3			
Betela Beach	RAM17	83	41	1.8			
Avatiu	RAM18	104	<1	5.0			
Muri Koka	RAM19	73	41	3.0			
Ngatipa	RAM20	NO DATA					
Matavera Outfall	RAM21						
Muri Aroko	RAM22						
Tikioki	RAM23						
Papaaroa	RAM24						
STREAM SITES							
Avana	RAS01				ND	980	1.4
Paringaru	RAS02	100	1986	0.3			
Akapuao	RAS03	NW	NW	NW			
Totokoitu	RAS04	NW	NW	NW			
Betela	RAS06	NW	NW	NW			
Avatiu	RAS08	NW	NW	NW			
Vaiterenga	RAS10	NW	NW	NW			
Areiti	RAS11	84	816	13.6			
Takuvaine	RAS12	NO DATA					
Pouara	RAS13						
Avana Mouth	RAS14						
Papua	RAS15						



01/21 Rarotonga Lagoon Water Quality Report

B

How to interpret this report card:

Sampling in Rarotonga is divided into Lagoon and Stream sites. The numbers following each site name can be used to identify the site location on the map of Rarotonga below. Indicators are grouped into four major categories: **physical parameters**, **bacteria**, **water clarity** and **nutrients**. Results are reported for each indicator at each site where data is available. For measurements that are compared against the grading scales, a score from A-E is given to indicate the current status for that water quality measurement. An average score for each category is further calculated and displayed at the top of the table, and plotted in the graph below to show the trend in water quality over the last six months.

What do the scores mean?



Ministry of Marine Resources
 ʻŌKARANGA ʻŌ VĒPARI MĀHARA
 GOVERNMENT OF THE COOK ISLANDS
 This health card has been produced by:

With the support of:

Major categories	Physical Parameters				Bacteria	Water Clarity				Nutrients	
Average Scores	A				A	C				ND	
2020 Target	N/A	N/A	N/A	N/A	<200/100 mL	N/A	N/A	<5 mg/L	N/A	<14 µg/L (DIN)	<26 µg/L (DRP)
Indicator	Temperature	Salinity	Dissolved oxygen	pH	Enterococci	Turbidity	Chlorophyll a	TSS	VSS	Total nitrogen	Total phosphorus

Lagoon											
Site	Temp	Salinity	DO	pH	Enterococci	Turbidity	Chlorophyll a	TSS	VSS	TN	TP
RAM03	29.1	35.7	A	8.1	A	A	ND	B	A	ND	ND
RAM04	29.4	35.1	A	8.1	A	A	ND	C	A	ND	ND
RAM05	30.8	35.1	C	8.0	A	A	ND	E	B	ND	ND
RAM06	29.6	35.7	C	8.0	A	A	ND	D	A	ND	ND
RAM08	29.5	35.7	A	8.0	A	A	ND	C	A	ND	ND
RAM09	29.8	35.4	A	8.0	A	A	ND	B	A	ND	ND
RAM11	29.6	34.4	A	8.0	A	A	ND	D	B	ND	ND
RAM13	29.5	36.0	A	8.1	A	A	ND	E	A	ND	ND
RAM16	29.6	34.6	A	8.1	A	A	ND	B	A	ND	ND
RAM17	29.1	34.9	B	8.1	A	A	ND	B	A	ND	ND
RAM18	29.2	36.0	A	8.0	A	A	ND	D	A	ND	ND
RAM19	29.8	35.8	C	8.1	A	A	ND	C	A	ND	ND
Stream											
Site	Temp	Salinity	DO	pH	Enterococci	Turbidity	Chlorophyll a	TSS	VSS	TN	TP
RAS01	25.7	1.5	ND	7.1	E	A	ND	B	A	ND	ND
RAS02	25.2	0.1	A	7.1	E	ND	ND	A	A	ND	ND
RAS03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
RAS04	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
RAS06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
RAS08	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
RAS10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
RAS11	25.6	0.3	B	7.3	E	ND	ND	E	C	ND	ND

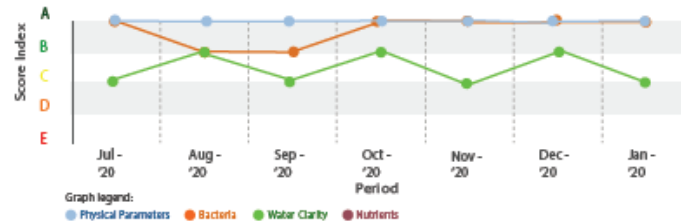
About this Health Report Card

Grading scores were calculated for bacterial counts, nutrient levels, water clarity, and physical parameters based upon NSDP targets and accepted international standards for human and marine ecosystem health. For each parameter, raw measurements were converted into an A-E scale where A means 'very good' and E means 'very poor'.

This is a new initiative and we appreciate feedback. Please email any comments to: S.Masters@mnr.gov.ck

Further details on the Water Quality results can be found online: <http://www.mnr.gov.ck/maps/wqms/wqms-rarotonga>

Temporal Evolution of the Rarotonga Water Quality Health Indices



LAB STUDY REPORT

Report Date: 16.02.2021

Lab Report No. 01H3156 – 01H3170

SAMPLE DESCRIPTION

Name of Sample:	Date Samples Collected:	Collected by:	Submitted by:	Time of Receipt:	Physical Description:	Quantity Per Site Received:
Marine	Tuesday 19 th January	NES		12:30pm	Clear	2.5L
Stream		MMR		10:43am		

S.No	Marine Study Parameter	Unit	RAM03	RAM04	RAM05	RAM06	RAM08	RAM09	RAM11	RAM13	RAM16	RAM17	RAM18	RAM19
			01H3156	01H3157	01H3158	01H3159	01H3160	01H3161	01H3162	01H3163	01H3164	01H3165	01H3166	01H3167
1	Turbidity	AU	0.000	0.002	0.004	0.001	0.002	0.001	0.003	0.014	0.001	0.002	0.003	0.002
2	Enterococci	MPN/100mL	<1	<1	<1	<1	<1	<1	<1	41	10	41	657	41
3	Temperature	°C	29.1	29.4	30.8	29.6	29.5	29.8	29.6	29.5	29.6	29.1	29.2	29.8
4	Salinity	ppt	35.7	35.1	35.1	35.7	35.7	35.4	34.4	36.0	34.6	34.9	36.0	35.8
5	Dissolved Oxygen	%	162.5	121.9	75.9	78.5	101.7	130.7	142.3	99.1	93.4	83.1	104.2	72.9
6	Dissolved Oxygen	mg/L	10.2	7.7	4.7	4.9	6.4	8.2	9.0	6.2	5.9	5.3	6.6	4.5
7	pH		8.1	8.1	8.0	8.0	8.0	8.0	8.0	8.1	8.1	8.1	8.0	8.1
8	Total Suspended Solids	mg/L	2.5	3.8	16.0	6.5	3.4	1.7	8.5	16.3	2.3	1.8	5.0	3.0
9	Volatile Suspended Solids	mg/L	1.0	1.0	1.4	1.2	0.3	0.7	2.1	0.3	0.9	0.7	0.9	1.2

S.No.	Stream Study Parameter	Unit	RAS01	RAS02	RAS11	Study Method	Recommended Limit
			01H3168	01H3169	01H3170		
1	Turbidity	AU	0.002	ND	ND	GENESYS 150 UV-Visible Spectrophotometer	Ref. Comments
2	Enterococci	MPN/100mL	980	1986	816	Enterolert*-E Test Kit	Ref. Comments
3	Temperature	°C	25.7	25.2	25.6	YSI Manual	Ref. Comments
4	Salinity	ppt	1.47	0.13	0.31	YSI Manual	Ref. Comments
5	Dissolved Oxygen	%	ND	99.7	84.1	YSI Manual	Ref. Comments
6	Dissolved Oxygen	mg/L	ND	8.2	6.9	YSI Manual	Ref. Comments
7	pH		7.1	7.1	7.3	YSI Manual	Ref. Comments
8	Total Suspended Solids	mg/L	1.4	0.3	13.6	MMR Lab Manual Water Quality Monitoring V5	Ref. Comments
9	Volatile Suspended Solids	mg/L	0.3	0.3	3.0	MMR Lab Manual Water Quality Monitoring V5	Ref. Comments

This report includes data based on adopting recommended Good Lab Practices and the information and contents reflects the findings of the Ministry's Laboratory only and within the limits of customer instruction. The document cannot be reproduced in full/part without prior written approval of the Ministry. The tested samples of external customers are retained for a period of 30 days only.

LAB STUDY REPORT – RESAMPLE #1

Report Date: 16.02.2021 Lab Report No. 01H3171

SAMPLE DESCRIPTION						
Name of Sample:	Date Samples Collected:	Collected by:	Submitted by:	Time of Receipt:	Physical Description:	Quantity Per Site Received:
Marine	Wednesday 20 th January	MMR		3:30pm	Clear	500mL

S.No.	Marine Study Parameter	Unit	RAM018	Study Method	Recommended Limit
			01H3171		
1	Enterococci	MPN/100mL	<1	Enterolert*-E Test Kit	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

Comments

- Temperature[#]
Subtropical regions (south of Cape Canaveral and Tampa Bay, Florida, and Hawaii)
Short-term Max. 32.2°C, Max. True daily mean 29.4°C (average of 24 hourly temperature reading)
- pH
Changes to pH can be caused by a range of potential water quality problems (eg 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.
- 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.
- Low DO[^]: 3.5 mg/L at 26C leads to 100% mortality of *Acipenser oxyrinchus*
2.7 mg/L at 19C leads to 22% mortality of *Acipenser oxyrinchus*
<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.
- 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.
- Turbidity
Water clarity (the degree of light penetration) is important as aquatic plants depend on light to photosynthesise 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.
- Marine water samples are tested for Enterococcus presence which is an indicator of faecal pollution.
- Nutrients (Nitrate, Nitrite, Ammonia, Phosphorous)
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.
- Chlorophyll-a
Chlorophyll-a is a pigment found in green plants, including aquatic plant. 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.

[#] 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

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