



Whitsunday Water Quality Monitoring Blueprint for Tourism Operators: Progress Report August 2022

Jordan Iles, Paula Cartwright, and Nathan Waltham

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A Report for Reef Catchments (Mackay Whitsunday Isaac) Limited

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Great Barrier
Reef Foundation

TABLE OF CONTENTS

TABLE OF FIGURES	4
1 INTRODUCTION.....	5
2 RESULTS.....	5
2.1 Logger data.....	6
2.2 Water samples.....	8
2.2.1 Field observations.....	8
2.2.2 Physico-chemical parameters.....	9
2.2.3 Nutrients.....	10
2.2.4 Chlorophyll <i>a</i>	12

TABLE OF FIGURES

Figure 2-1 Map of the Whitsunday Islands showing the location of the two water quality monitoring sites included in this program.	6
Figure 2-2 Raw 10-minute MGL logger data collected from Cairn Beach. Periods of missing data are indicated by the orange bar. Note MGL loggers were taken out of service on 19/08/2022 and the ‘missing data’ from the end of this period was captured by the new IMO loggers and will be provided in future reports.	7
Figure 2-3 Raw 10-minute MGL logger data collected from Tongue Bay. Periods of missing data are indicated by the orange bar. Note MGL loggers were taken out of service on 19/08/2022 and the ‘missing data’ from the end of this period was captured by the new IMO loggers and will be provided in future reports.	8
Figure 2-4 Secchi depth measured by tourism operators at Cairn Beach (green) and Tongue Bay (blue).	9
Figure 2-5 Electrical conductivity (Cond), total suspended solids (TSS), and pH from samples collected by tourism operators at Cairn Beach (green) and Tongue Bay (blue).	10
Figure 2-6 Total nitrogen (TN), total dissolved nitrogen (TDN), particulate nitrogen (PN), and nitrate-nitrite (NO _x) concentrations measured in water samples collected from Cairn Beach (green) and Tongue Bay (blue). Note different y-axis.	11
Figure 2-7 Total phosphorus (TP), total dissolved phosphorus (TDP), and particulate phosphorus (PP) concentrations measured in water samples collected from Cairn Beach (green) and Tongue Bay (blue).	12
Figure 2-8 Chlorophyll-a from samples collected by tourism operators at Cairn Beach (green) and Tongue Bay (blue).	13

1 INTRODUCTION

This report gives a quarterly update on data collected by the Whitsunday Water Quality Monitoring Blueprint for Tourism Operators covering the period of March to August 2022. The water sampling and logger maintenance schedule for this period is outlined in Table 1.1.

For project background and methodology please refer to the annual report: Iles, JA & Waltham, NJ 2020, 'Whitsunday Water Quality Monitoring Blueprint for Tourism Operators: Annual report 2019-2020', Centre for Tropical Water & Aquatic Ecosystem Research (TropWATER) Publication, James Cook University, Townsville, 29 pp.

Table 1.1. Water sampling and logger maintenance schedule undertaken by Whitsunday tourism operators between March and August 2022.

Date	Cairn Beach (WH1)	Tongue Bay (WH2)
16/03/2022		True Blue Sailing (logger maintenance)
22/03/2022	Red Cat (water sampling)	
27/03/2022		Ocean Rafting (water sampling)
6/05/2022		Ocean Rafting (water sampling)
8/05/2022	Southern Cross (logger maintenance)	
9/05/2022	Red Cat (water sampling)	
2/06/2022		True Blue Sailing (logger maintenance)
21/06/2022	Whitsunday Bullet (logger maintenance)	
26/06/2022		Ocean Rafting (water sampling)
7/07/2022	Red Cat (water sampling)	
19/08/2022	TropWATER (water sampling & logger maintenance)	TropWATER (water sampling & logger maintenance)

2 RESULTS

The results within this progress report cover the period 01/03/2022 to 31/08/2022. MGL logger instruments were deployed at Cairn Beach and Tongue Bay during this period (Figure 2.1). The MGL loggers were taken out of service and replaced by more modern IMO loggers towards the end of August 2022. As this occurred only approximately one week before end of this reporting period the data from the IMO loggers have not been included here but will be provided in the annual report to follow.



Figure 2-1 Map of the Whitsunday Islands showing the location of the two water quality monitoring sites, Cairn Beach and Tongue Bay, included in this program.

2.1 Logger data

2.1.1 Cairn Beach

A logger was deployed at Cairn Beach for the duration of the reporting period (Figure 2-2). Water depth at this site ranged from 7 to 20 m. The logger appears to have been moved from its usual location (approx. 11 m depth) to a deeper site (17 m) over the period from 11/03/2022 to 08/05/2022. Cairn Beach had a maximum RMS depth of 0.05 m (minimal wave activity) as it is fairly well protected. Turbidity ranged from 0 to 15 NTUe with a mean value of 1.06 NTUe over the reporting period. Instantaneous PAR readings ranged from 0 to 186 $\mu\text{mol m}^{-2} \text{s}^{-1}$. Water temperature ranged from 20.5 to 30.0 °C over the reporting period and showed a decreasing trajectory over that time due to seasonal changes. There is 1.5 weeks of missing data from 08/05/2022 to 18/05/2022 due to possible instrument malfunction. The instrument was deployed 08/05/2022 according to field notes, but instrument data [including raw data] only starts from 18/05/2022.

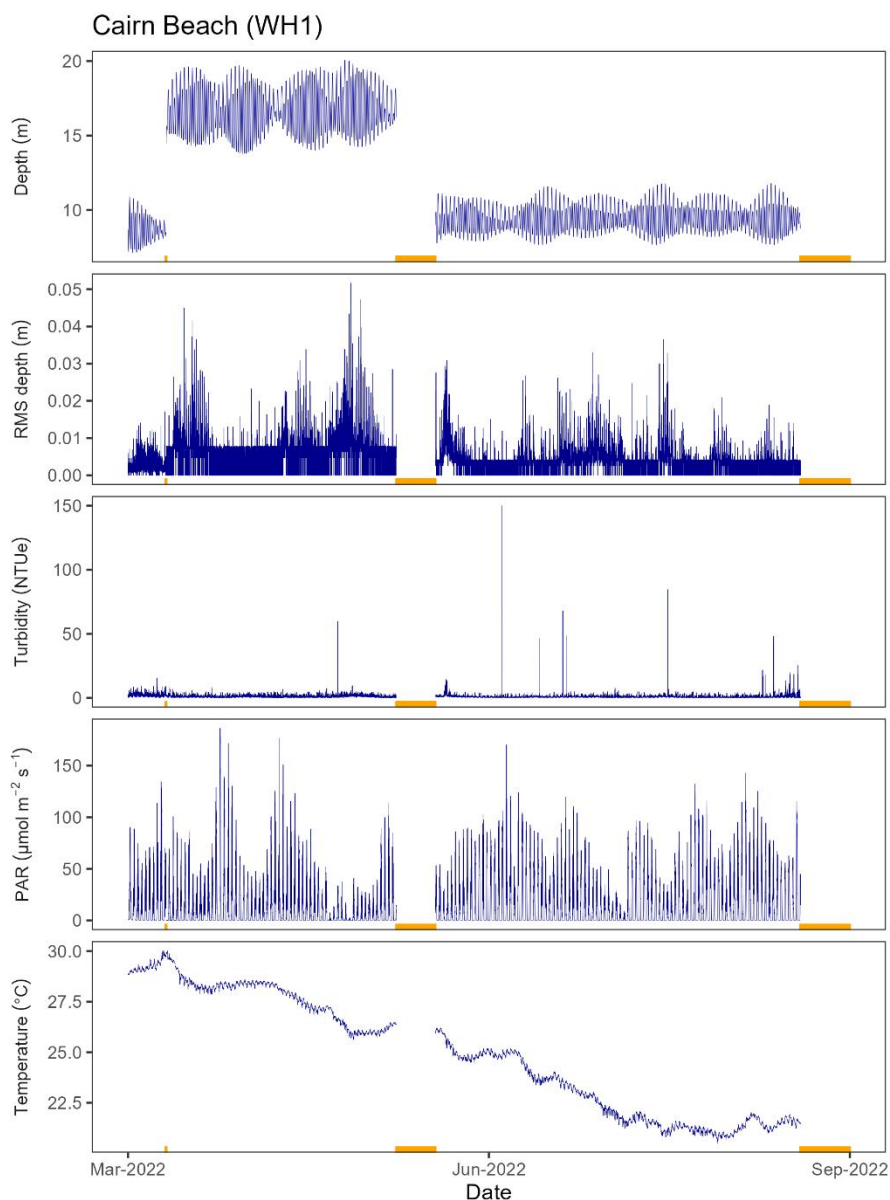


Figure 2-2 Raw 10-minute MGL logger data collected from Cairn Beach. Periods of missing data are indicated by the orange bar. Note MGL loggers were taken out of service on 19/08/2022 and the short period of ‘missing data’ from the end of this period was captured by the new IMO loggers and will be provided in future reports.

2.1.2 Tongue Bay

A logger was deployed at Tongue Bay for the duration of the reporting period (Figure 2-3). Water depth at this site ranged from 6.8 to 10.8 m. Tongue Bay had a maximum RMS depth of 0.25 m (moderate wave activity). Turbidity ranged from 0 to 489 NTUe with a mean value of 3.41 NTUe over the reporting period. Instantaneous PAR readings ranged from 0 to 475 $\mu\text{mol m}^{-2} \text{s}^{-1}$. There was an extended period of increased reduced PAR from 20/04/2022 to when the logger was changed over on 02/06/2022, indicating the PAR sensor may have fouled. Water temperature ranged from 19.8 to 30.3 °C over the reporting period and showed a decreasing trajectory over that time due to seasonal changes.

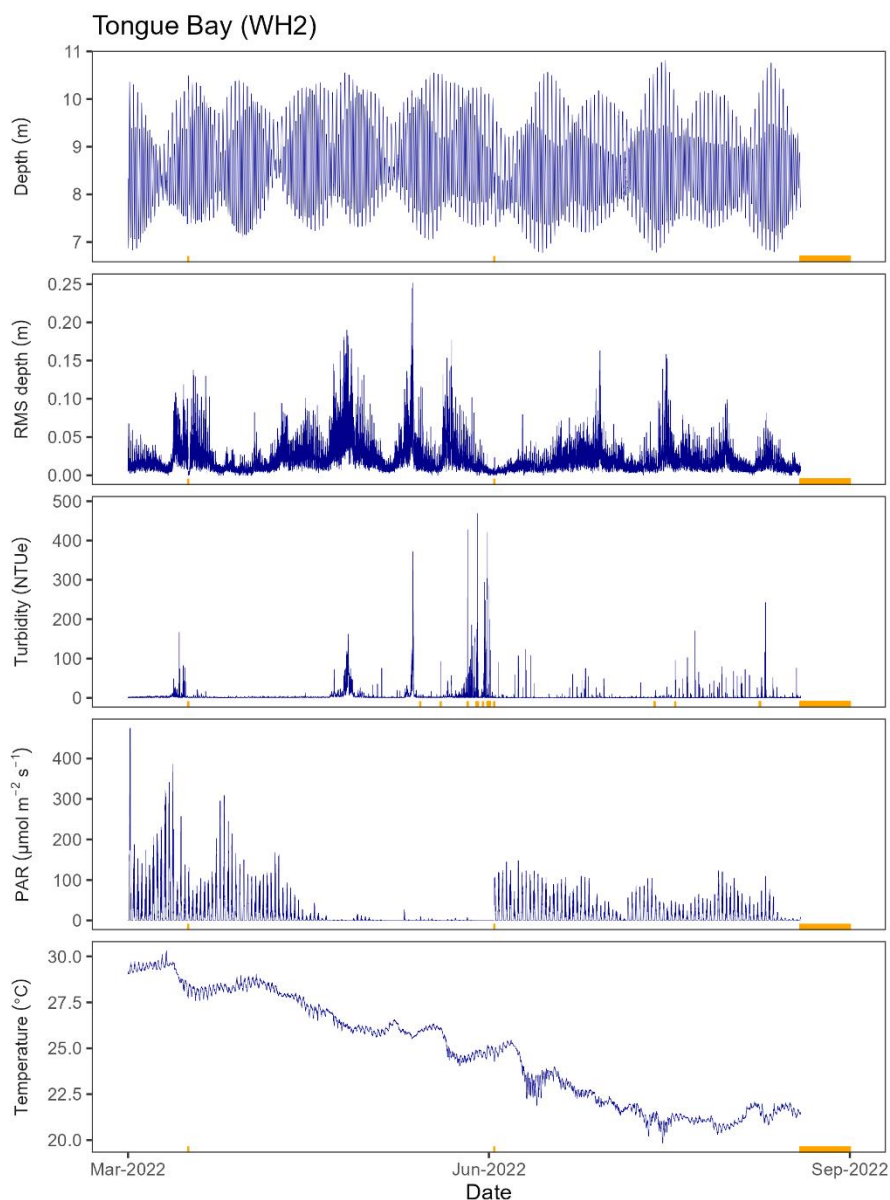


Figure 2-3 Raw 10-minute MGL logger data collected from Tongue Bay. Periods of missing data are indicated by the orange bar. Note MGL loggers were taken out of service on 19/08/2022 and short period of ‘missing data’ from the end of this period was captured by the new IMO loggers and will be provided in future reports.

2.2 Water samples

2.2.1 Field observations

The tourism operators recorded observations of conditions on the water at the time of each sampling and maintenance event (Table 2.1). Secchi disk depth ranged from 4 to 9 m (Figure 2-4). The mean Secchi depth was 5.25 m for Cairn Beach and 6.75 m at Tongue Bay. Secchi disk depth was not recorded in May and July at Cairn Beach. Weather and sea conditions varied between sampling trips and sites, although water quality sampling was generally done on calm days with light breezes. Tourist involvement was recorded on the field

datasheets from May 2020 onwards. A total of 210 tourists were recorded on the field datasheets to have been involved in the project over this reporting period.

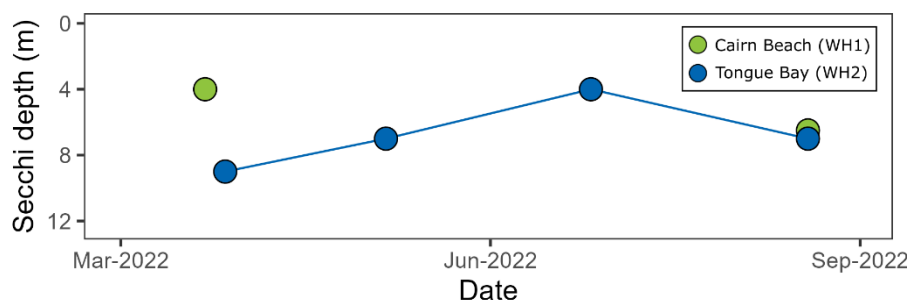


Figure 2-4 Secchi depth measured by tourism operators at Cairn Beach (green) and Tongue Bay (blue).

Table 2.1 Water quality measurements and observations recorded by tourism operators at Cairn Beach and Tongue Bay.

Site Name	Site Code	Date	Time	Secchi depth	Cloud cover	Wind	Sea surface	Surface scum/slick
				m	%	knots		
Cairn Beach	WH1	22/03/2022	15:50	4	0	15	glass	No
		9/05/2022	15:25	NR	98	5-10	calm but strong current	no
		7/07/2022	16:00	NR	0	7	calm	no
		19/08/2022	8:58	6.5	20	<5	calm	no
Tongue Bay	WH2	27/03/2022	11:30	9	30	5-15	small waves	Yes-light scum
		6/05/2022	14:00	7	10	10-15	NR	No
		26/06/2022	11:00	4	100	25	small waves	no
		19/08/2022	11:00	7	20	<5	calm	no

NR = not recorded.

2.2.2 Physico-chemical parameters

Water samples collected from the monitoring sites over the reporting period were measured in the laboratory for electrical conductivity, total suspended solids (TSS), and pH (Figure 2-5). Conductivity ranged from 51.16 to 52.83 mS cm⁻¹ at Cairn Beach and 52.17 to 53.33 mS cm⁻¹ at Tongue Bay. These values are within expected range of seawater with limited freshwater inputs. TSS ranged from 0.9 to 1.2 mg L⁻¹ at Cairn Beach and 0.9 to 1.8 mg L⁻¹ at Tongue Bay. pH ranged from 8.14 to 8.23 at Cairn Beach and 8.24 to 8.23 at Tongue Bay.

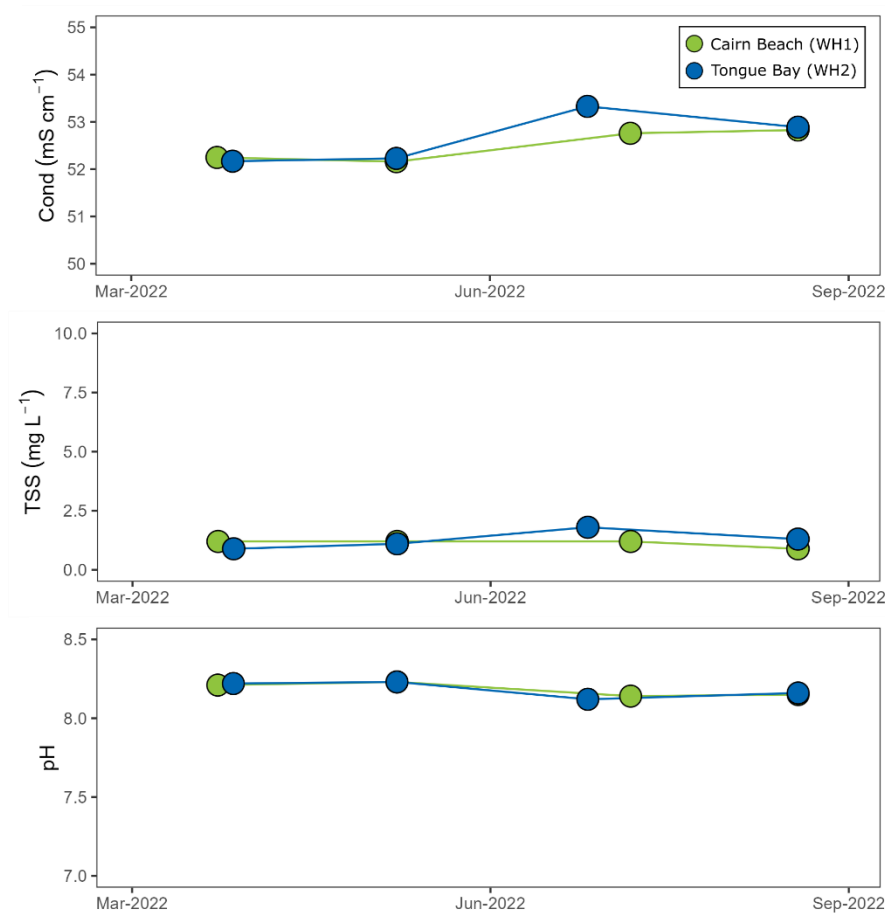


Figure 2-5 Electrical conductivity (Cond), total suspended solids (TSS), and pH from samples collected by tourism operators at Cairn Beach (green) and Tongue Bay (blue).

2.2.3 Nutrients

Nitrogen and Phosphorus concentrations for water samples collected during the reporting period are presented in Figure 2-6 and Figure 2-7. Total nitrogen concentrations ranged from 107 to 178 $\mu\text{g N L}^{-1}$ at Cairn Beach and 113 to 151 $\mu\text{g L}^{-1}$ at Tongue Bay. Total phosphorus concentrations ranged from 6 to 11 $\mu\text{g P L}^{-1}$ at Cairn Beach and 5 to 8 $\mu\text{g P L}^{-1}$ at Tongue Bay. Nitrate-nitrite concentrations ranged 2 to 3 $\mu\text{g N L}^{-1}$ at Cairn Beach and 1 to 2 $\mu\text{g N L}^{-1}$ at Tongue Bay.

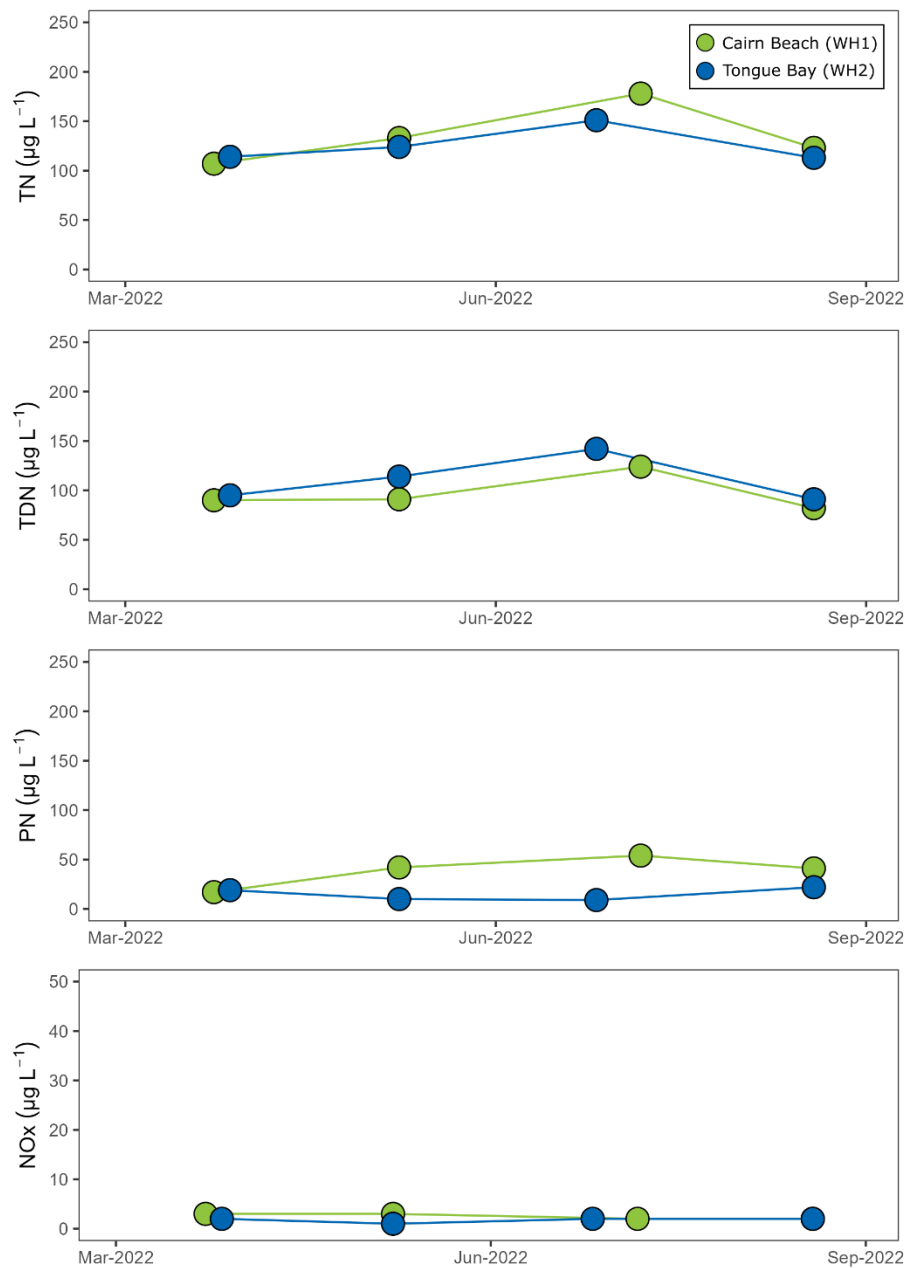


Figure 2-6 Total nitrogen (TN), total dissolved nitrogen (TDN), particulate nitrogen (PN), and nitrate-nitrite (NOx) concentrations measured in water samples collected from Cairn Beach (green) and Tongue Bay (blue). Note different y-axis.

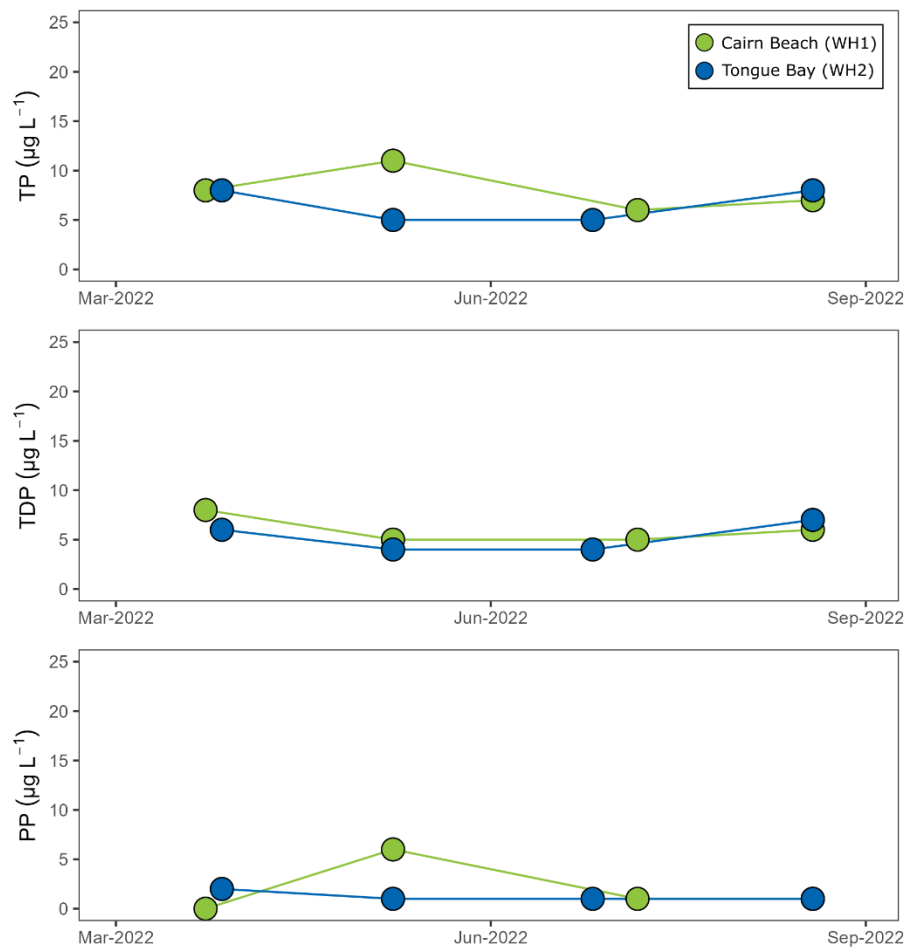


Figure 2-7 Total phosphorus (TP), total dissolved phosphorus (TDP), and particulate phosphorus (PP) concentrations measured in water samples collected from Cairn Beach (green) and Tongue Bay (blue).

2.2.4 Chlorophyll *a*

Chlorophyll-*a* concentrations ranged from <0.2 to $0.51 \mu\text{g L}^{-1}$ at Cairn Beach and ranged from 0.3 to $0.51 \mu\text{g L}^{-1}$ at Tongue Bay (Figure 2-8).

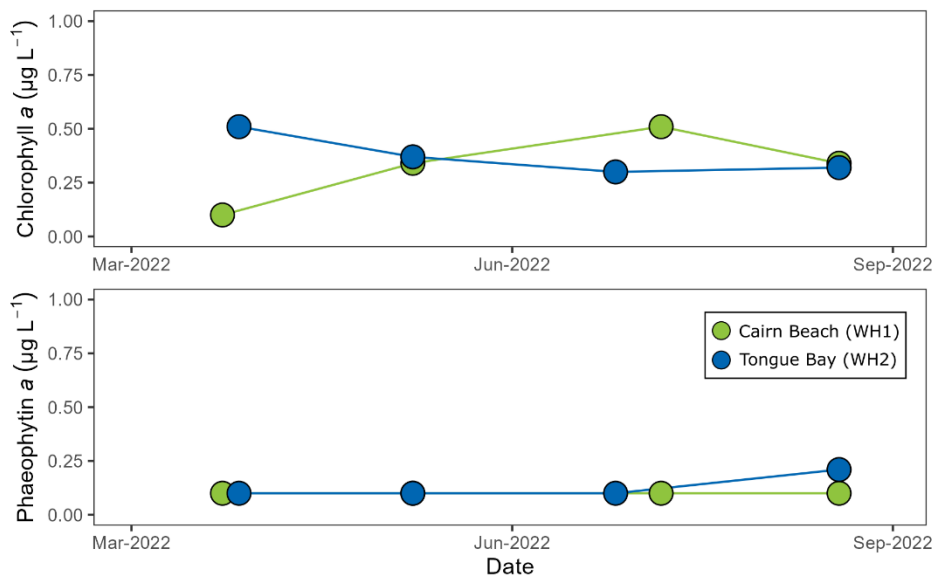


Figure 2-8 Chlorophyll-a from samples collected by tourism operators at Cairn Beach (green) and Tongue Bay (blue).

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