WHAT IS THE DATA TELLING US SO FAR?

FOR THE WHITSUNDAYS WATER QUALITY BLUEPRINT FOR TOURISM PROJECT

Update for the period of February 2020 to July 2020

DATA LOGGERS ARE ANCHORED UNDER WATER AND CONTINUOUSLY COLLECT DATA ON A RANGE OF INDICATORS.

1. DATA FROM IN-SITU LOGGERS

Data loggers anchored on the seafloor continuously collect data on:

- Water temperature
- Water depth and wave height (by measuring pressure)
- Water clarity (by measuring turbidity)
- Light (by measuring PAR)

Warmer water temperatures have been consistently measured at Cairn Beach compared to Tongue Bay (approx. 0.5 °C difference between sites). The temperatures from both sites are comparable to temperatures recorded by AIMS at nearby Hayman, Hook and Border Islands over previous years. In February 2020, the average water temperature at both sites was 29.6°C; remember this is based on data collected near the seafloor.

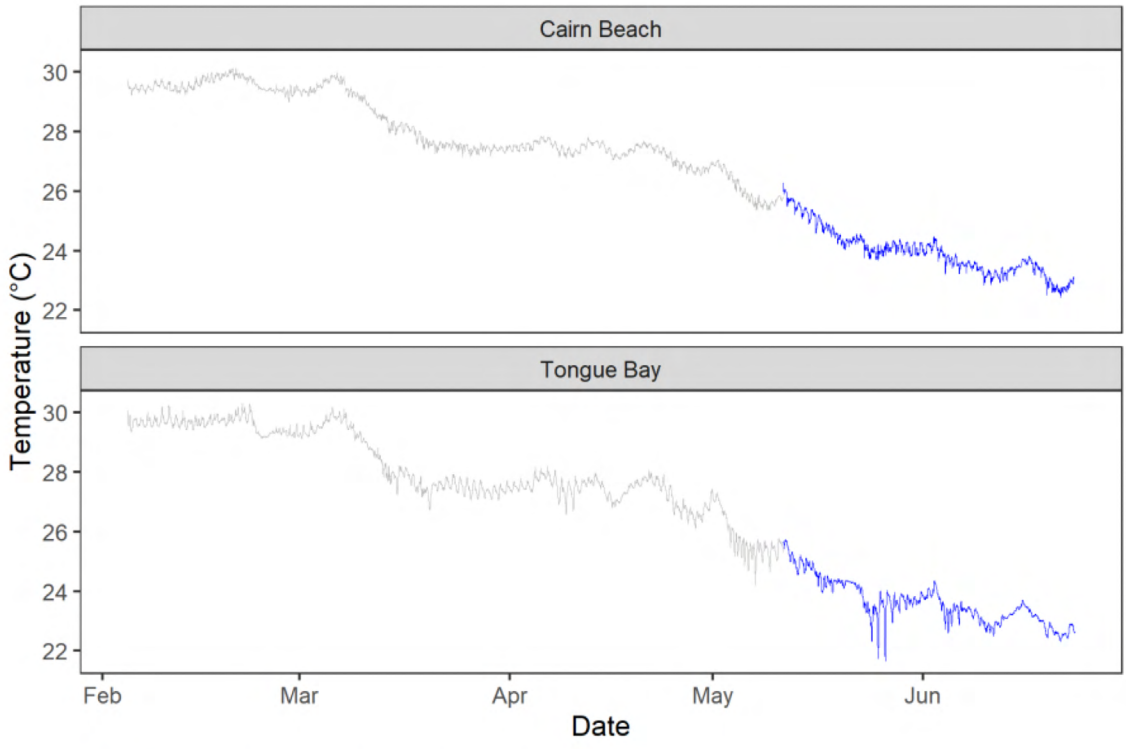

Figure 1. Temperature measured at Cairn Beach and Tongue Bay.

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DATA FROM IN-SITU LOGGERS

During the most recent logger deployment (May to June 2020), the average water depth of the deployed loggers was 11.2m at Cairn Beach compared to 8.9m at Tongue Bay. While there have been slight changes in the location and depth that the loggers were sitting between the deployments, the Cairn beach logger has generally been sitting approximately 2m deeper than the logger at Tongue bay since the start of the program in February 2020.

The Cairn Beach logger is deeper (11.2m), the Tongue Bay logger is shallower (8.9m)

Data so far shows that the Cairn Beach site is more sheltered compared to the Tongue Bay site. This is seen in lower wave height values at Cairn Beach on average, which indicates the force of the water at the seafloor is lower. This was expected, since Cairn Beach is generally more sheltered from the wind and open ocean due to its position between two islands. With less wave energy at Cairn Beach we expect that less sediments would be re-suspended from where they have settled on the ocean floor, although tidal currents likely also contribute to sediment resuspension throughout the Whitsundays. The biggest wave heights measured so far have been at Tongue Bay and they aligned with TC Gretel in mid-March. While the cyclone remained well offshore it did cause local increased wind and wave activity, which is reflected in the high values in wave height data over this period at more exposed Tongue Bay.

The most recent data (May to June 2020) continued to show the pattern that the Tongue Bay site was more exposed with greater wave heights.

Cairn Beach is more sheltered, Tongue Bay is more exposed

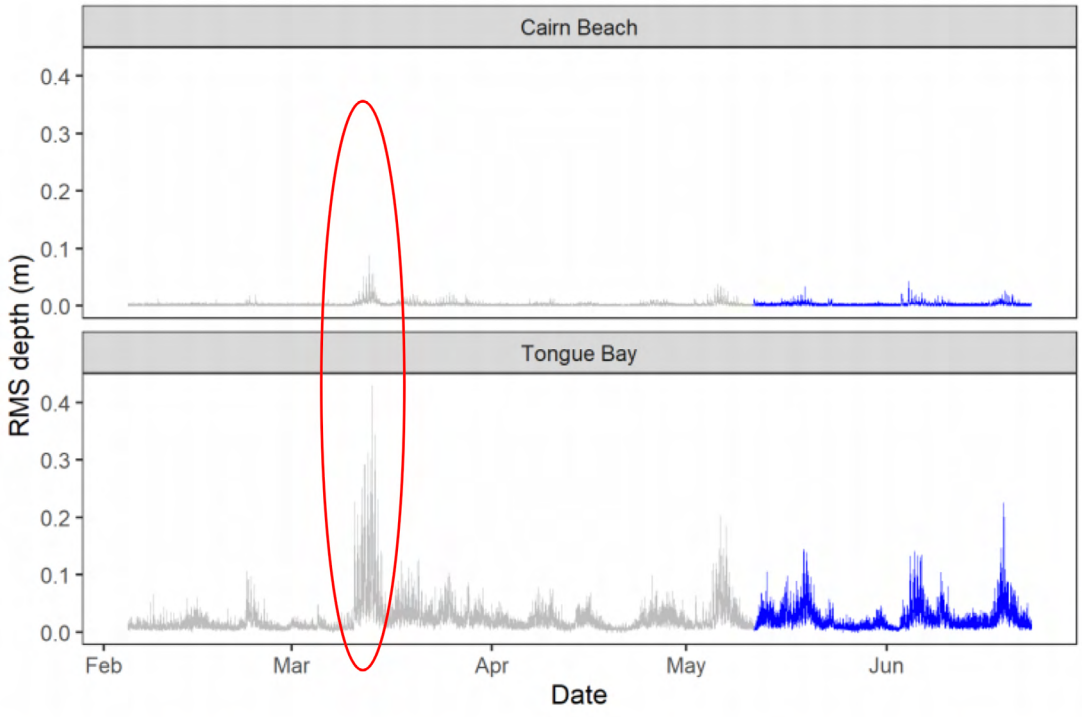

Figure 2 Wave height (RMS) measured at Cairn Beach and Tongue Bay. Peaks circled in red show impact of TC Gretel.

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DATA FROM IN-SITU LOGGERS

Light measurements (PAR) at the seafloor were on average higher at the Cairn Beach site than at Tongue Bay over the most recent deployment period (May to June 2020). This result differed to the previous period, which showed light levels generally lower at the deeper Cairn Beach than at the shallower Tongue bay site.

Light at the seafloor can be linked to water depth (less light at deeper sites), weather (less light on cloudy days) and/or water clarity (less light with more turbid water). It may be that during May to June 2020 there was poorer water clarity at the Tongue Bay site, which may have reduced the amount of light reaching the seafloor. While the wave height measurements indicated higher force of the water at the Tongue Bay site in the May to June 2020 period, which typically drives re-suspension and therefore lower water clarity, this could not be confirmed with the turbidity measurements. Light measurements are assuming the logger frame is sitting upright and not on an angle. If the PAR sensor is tilted off horizontal it may give lower PAR readings than actual.

The light reaching the seafloor is not consistently higher at one site

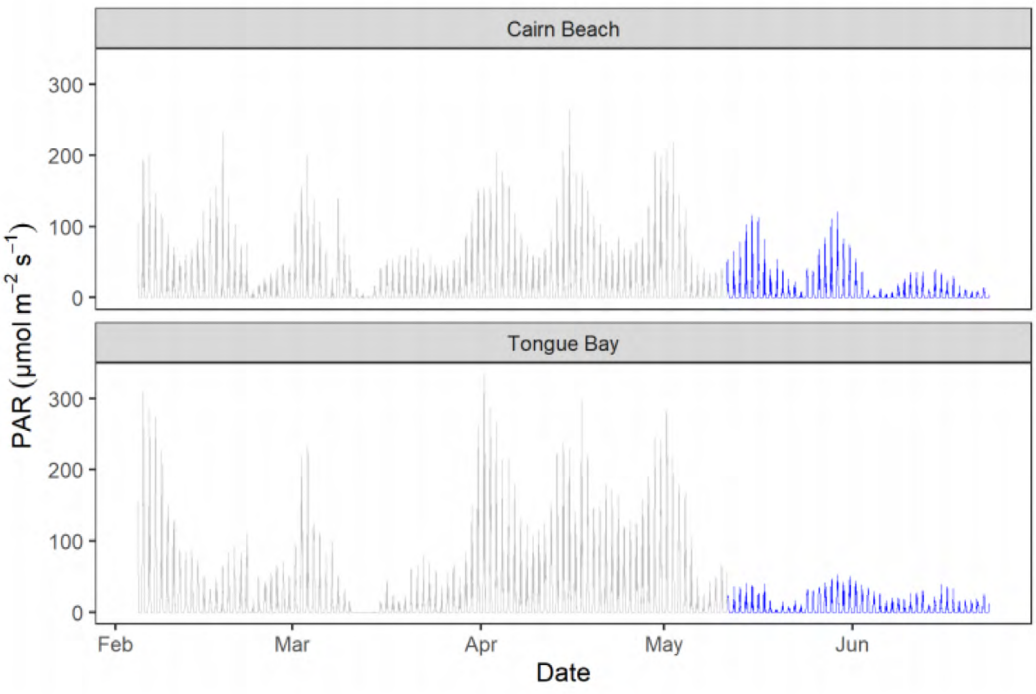

Figure 3 Light (PAR) reaching the seafloor at Cairn Beach and Tongue Bay

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Turbidity sensors at both sites had issues with bio-fouling during the May to June 2020 period, and much of the data at the Tongue Bay site was considered unreliable.

Turbidity was initially higher at more exposed Tongue Bay (Feb to May), but biofouling of sensors means an incomplete story

This situation is one example of why it is important to have a long-term data set to best understand water quality at a site and between different sites. When data has been collected over a short period of time, and during this time there is some data that is missing (this may end up occurring due to bio-fouling, equipment loss or even operator error), the story is incomplete. As data is collected over a longer period, the story becomes clearer and small amounts of missing data has less of an impact on our understanding.

The long-term data set is important to fully understand water quality at a site

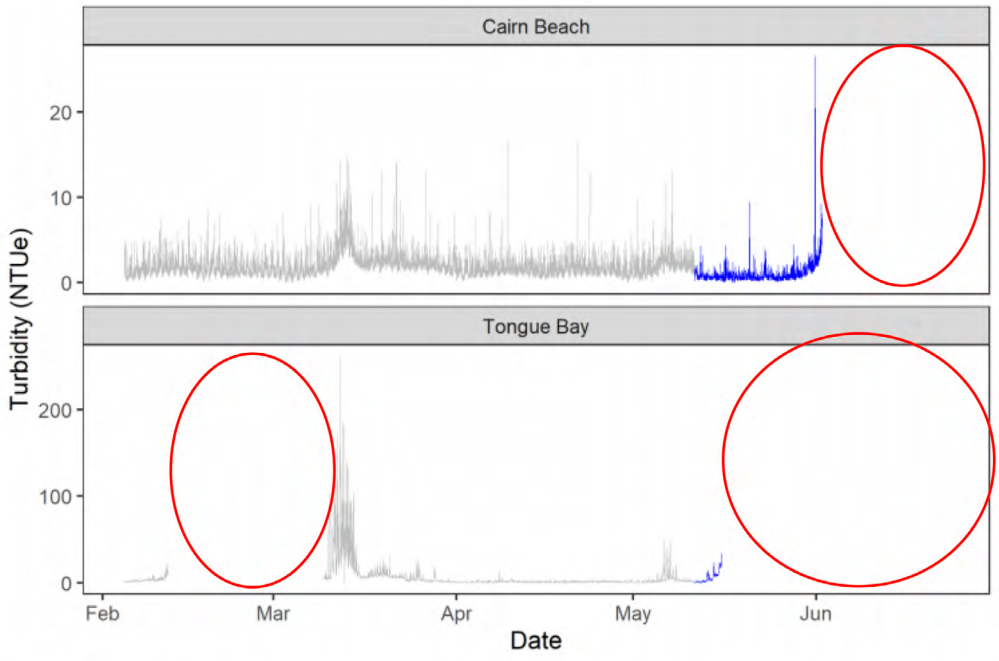

Figure 4 Water clarity (turbidity) at Cairn Beach and Tongue Bay. Red circles show missing data at both sites demonstrates importance of long-term monitoring for clear picture.

WHAT IS THE DATA TELLING US SO FAR?

WATER SAMPLES TAKEN AT A DISCREET POINT IN TIME

Water samples are taken by tourism operators and sent to JCU for laboratory analysis of range of indicators:

- Nutrients: Nitrogen and Phosphorus (attached to particles or dissolved in water)
- Water clarity (total suspended solids)
- Phytoplankton (by measuring chlorophyll-a)

The graphs below show the spread of the data from samples taken at Cairn Beach and Tongue Bay sites. Generally, concentrations of nutrients, total suspended solids and chlorophyll-a were similar between sites except in March when there was a peak in concentrations of total suspended solids and nutrients at Cairn Beach.

Peak concentration so far (suspended solids and nutrients) in March at Cairn Beach

The spread of data for each indicator can be seen in comparison to the guideline value in the graphs. It is important to understand that this data should not be interpreted as 'achieving' or 'exceeding' the guideline values until a full year of data can be explored.

A full year of data at each site needed before it can reliably be compared to guidelines

What is a guideline value?
A water quality guideline in the Great Barrier Reef is a recommended limit which, if achieved, will support and maintain environmental values. In the Great Barrier Reef waters, guideline values have been set for a range of common land-borne contaminants, such as Nitrogen and Phosphorus.

Exceedance of a guideline value indicates that there is a potential for an impact to occur, but does not provide certainty that an impact will occur. Exceedance should activate management action. Action may include evaluating whether the source has been contained, evaluating whether any impact on ecosystem health has occurred, changing a land management practice, or any number of alternatives – this information is taken from the *Water Quality Guidelines for the Great Barrier Reef Marine Park (2010)*.

When to decide if a water quality indicator is achieving or exceeding a guideline?
Many guideline values are derived from annual or seasonal average concentrations. It is important to compare data from a monitoring site in the same format. We need multiple samples over a full year or season to calculate an average in order to appropriately compare the indicator to its guideline value. So far, we only have samples from less than half of a year, so we are not ready to calculate whether water quality guidelines are achieved or exceeded at either site. We can only explore the spread of the data so far.

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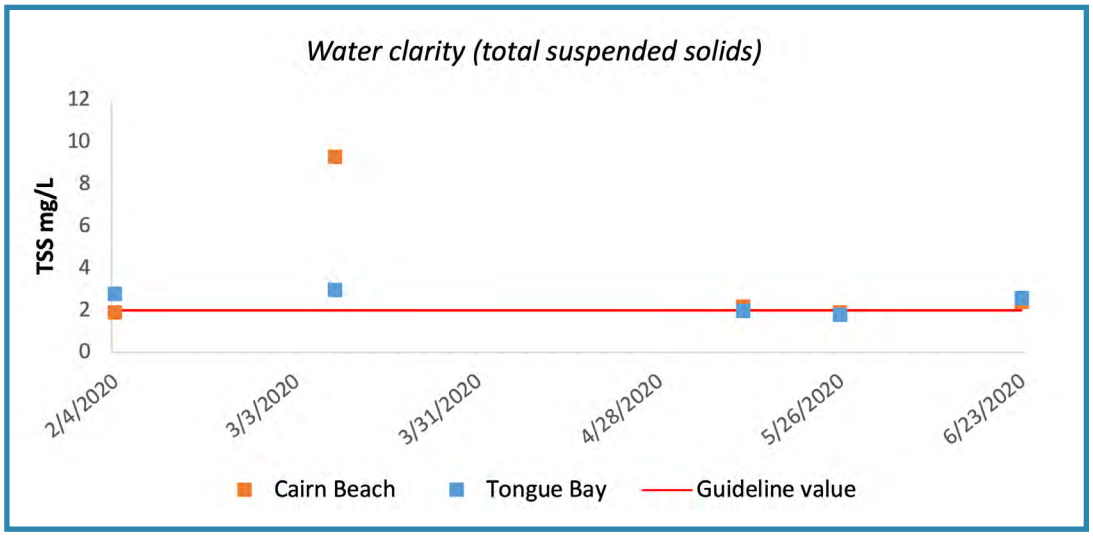

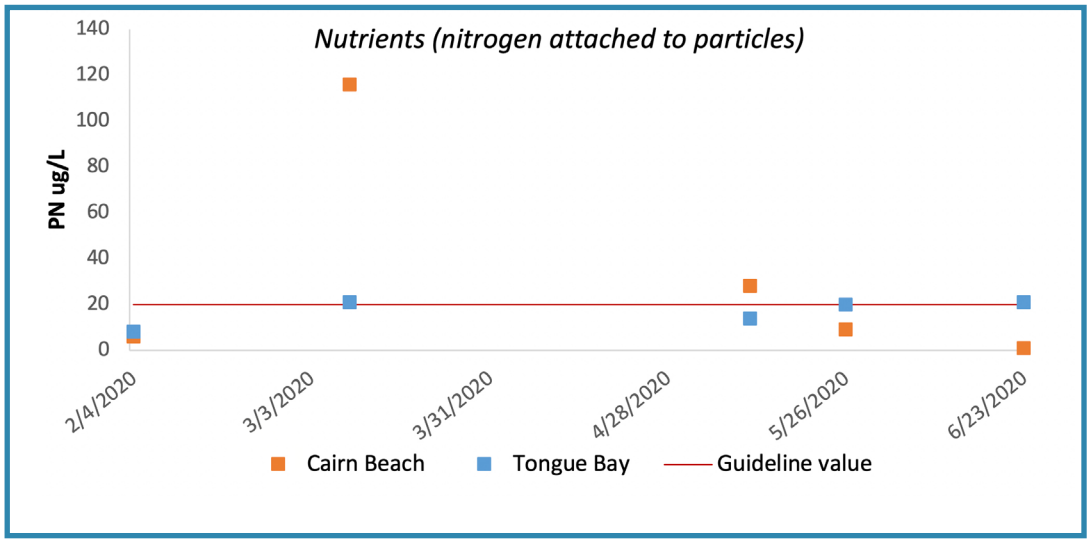

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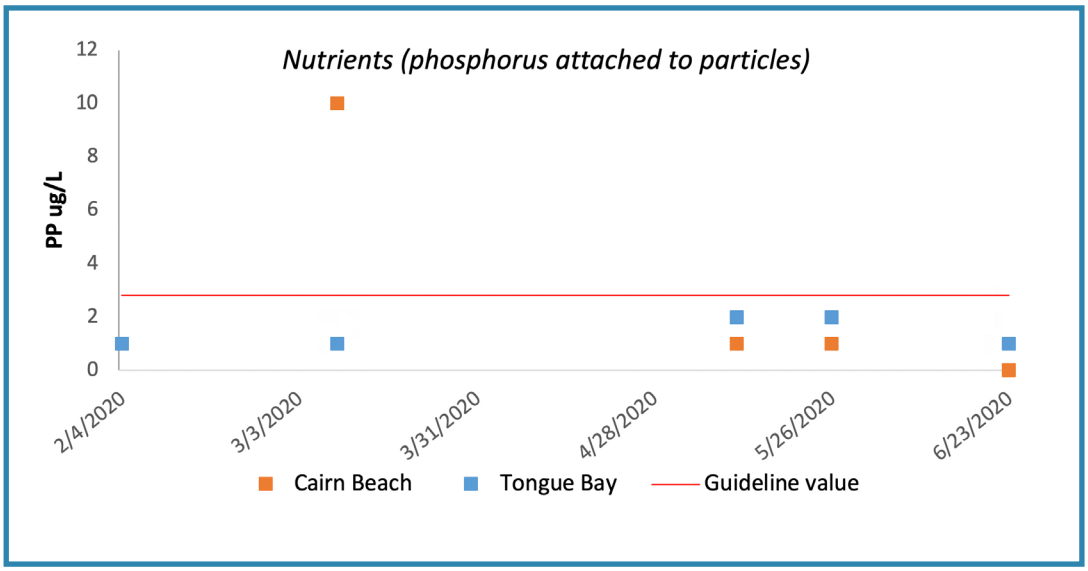

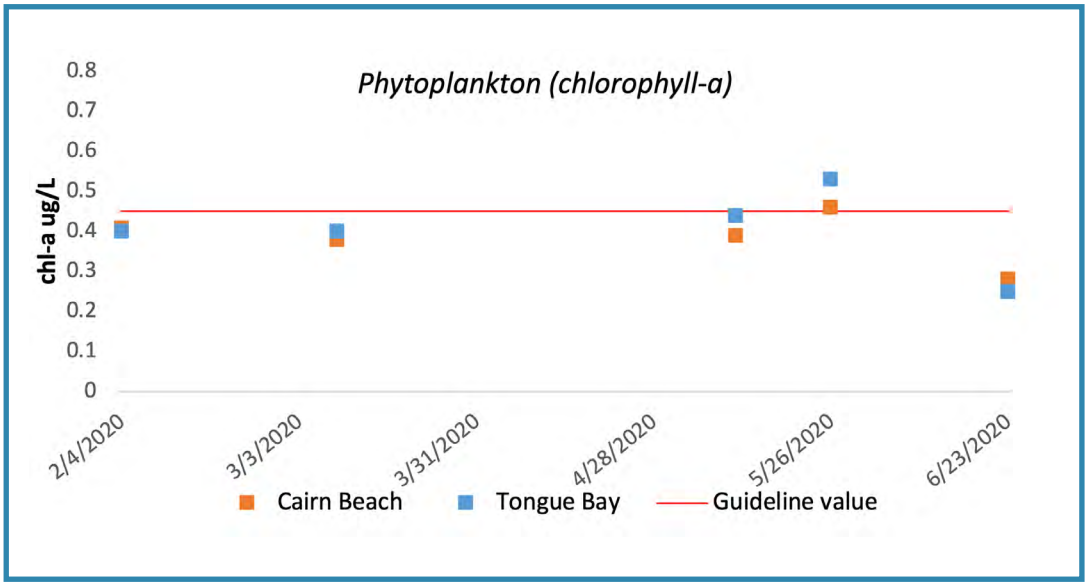

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