

---

## Workshop on Coral Health in Gladstone Harbour - 2022

### Background

Corals have been identified as an important ecosystem in Gladstone Harbour, and assessments of coral condition have been included in the Gladstone Healthy Harbour Partnership Report Card each year since 2015.

The monitoring assesses the condition of six representative reefs, located in the Mid Harbour and the Outer Harbour. Four sub-indicators are used to assess coral health: coral cover, macroalgal cover, juvenile density and change in hard coral cover. Coral cover and macroalgal cover measure the percent cover of living, adult corals and macroalgae respectively; juvenile density is the number of coral recruits (<5 cm); and change in hard coral cover was averaged over a three-year period to give the rate at which hard coral cover increases or decreases. Coral cover is used to assess the state of a reef while the other sub-indicators measure a reef's potential to recover.

Consistent with a report card monitoring system, the assessment process is replicated each year to give annual snapshots. However there is no formal comparison with other regions or trends over time. A workshop process is a useful way of updating knowledge and gaining extra insights into coral health beyond the results of the annual monitoring program.

### Workshop

The GHHP Independent Science Panel hosted a two-hour workshop on coral health in the Gladstone Harbour on the 6<sup>th</sup> of September 2022, with a mix of online and face-to-face participation.

The key issues that were of focus for the workshop were why coral health continues to be so poor in the Gladstone harbour, how it compares to coral health in other inshore areas along the coast, and what can be learnt from other monitoring and rehabilitation activities. The workshop was chaired by Professor John Rolfe, and the speakers were:

- Mac Hansler (GHHP) – ISP report card & GHHP coral health indicator
- Angus Thompson (AIMS) - Coral Health in Gladstone: research issues and trends
- Ross Jones (AIMS) - Sensitivity of coral to altered environmental conditions
- Katie Chartrand (JCU) - Coral health assessment in the northern ports
- Adam Smith & Nathan Cook (Reef Ecologic) - Reef restoration and citizen science

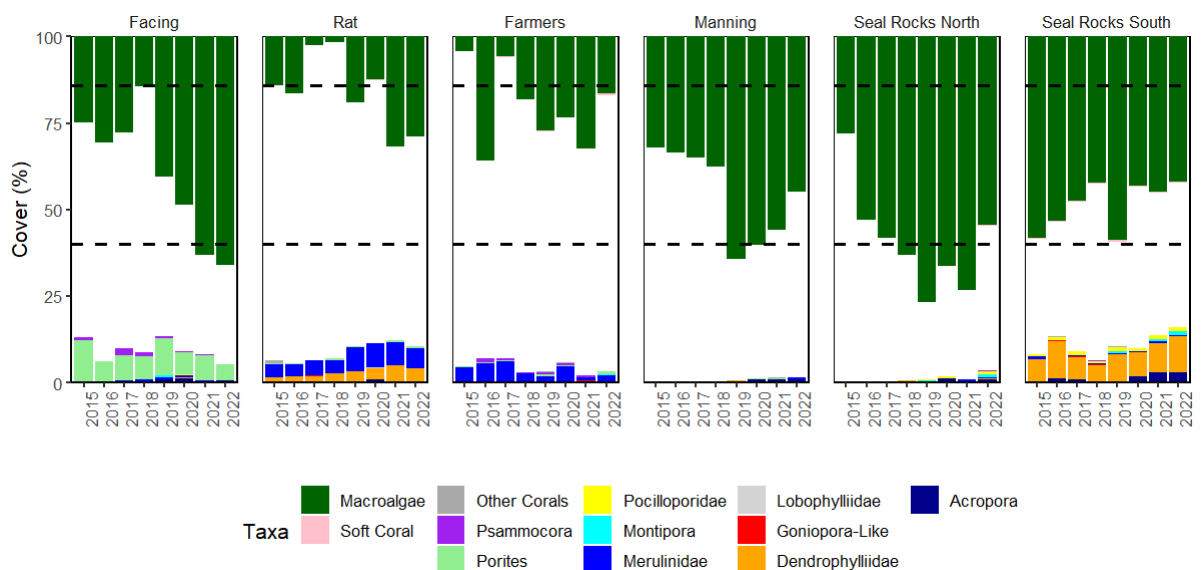
## Key Observations from the Workshop

### ISP report card & GHHP coral health indicator (Mac Hansler, GHHP)

- Mac Hansler provided a brief overview of the GHHP coral indicator methods, scoring system and general trends in grades

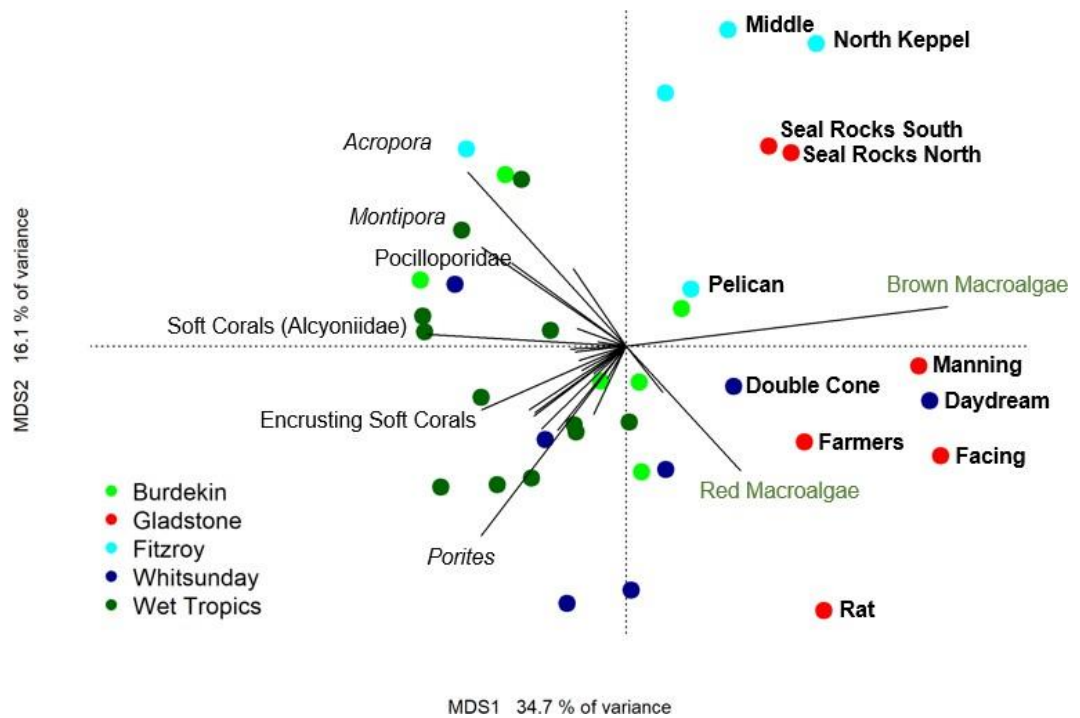
### Coral Health in Gladstone: research issues and trends (Angus Thompson, AIMS)

- Preceding the 2013 floods, coral cover was observed at much higher levels within the harbour
  - 39% at Mid Harbour in 2009 (BMT), observed at 6% in 2015
  - 50% in Outer Harbour in 2012 (pers. obs.), observed at 4% in 2015
- 2013 floods caused high coral mortality, with river discharge 17 times greater than the LTM
- Benthic cover & juvenile density among the 6 reefs from 2015 to 2021:
  - Macroalgae cover has been variable but generally increasing to 2021
  - Coral cover has shown slow to no recovery, hindered by bio-eroding sponges and thermal stress in 2020
  - Juvenile density was higher in earlier years, however, has declined at all 6 reefs and is extremely low at some reefs



**Composition of benthic cover at each location.** Rising bars break down coral cover into major taxonomic groups (Families and Genera). Hanging bars represent macroalgae cover and are read in reverse (observed cover is read as 100 – y axis value, i.e. 10% cover will appear as a bar between 100 and 90% on the plot). White space is the remaining cover not occupied by indicators and will include: sand and silt substrate, turfing and crustose coralline algae along with other organisms such as sponges. Dashed reference lines indicate the boundary between the condition categories ‘Poor’ and ‘Satisfactory’. Hanging macroalgae cover bars not extending to the upper reference line would be categorised as ‘Satisfactory’, or better. Rising bars for coral cover would have to extend to the lower reference line to receive a ‘Satisfactory’ categorisation.

- Gladstone harbour corals are most similar to other reefs impacted by extreme weather events (e.g., Whitsundays reefs from Ex-TC Debbie, inshore Fitzroy reefs from 2010 floods)



**Ordination comparing Gladstone Harbour reef communities with other near-shore reefs.** The biplot is based on Bray Curtis dissimilarity of square root transformed genus-level cover of hard coral (black) and soft corals (orange) and higher order-level cover of macroalgae (green) observed on the Gladstone Harbour reefs in 2022 and at 2 m reefs sampled by the Marine Monitoring Program (MMP) in 2021. Labels on the axis indicate how much of the variance in community composition is captured by the first (x-axis, MDS1) and second (y-axis, MDS2) dimensions of the ordination

- Suggestions for useful research questions for better understanding Gladstone corals
  - What factors are facilitating a persistently high cover of macroalgae?
  - What is the availability of coral larvae?
  - Is water quality supporting bio-eroding sponges?
  - Are our expectations for recovery of these communities reasonable?

### Sensitivity of coral to altered environmental conditions (Ross Jones, AIMS)

- Largescale dredging projects leave a legacy of an altered environment. A study into three large Western Australia dredging projects indicated that silt/clay levels were 3 times higher than prior to dredging activities (3 years post-activity)
- Harbour channels are more prone to sediment resuspension from large vessels
- Storms/strong winds have a much stronger impact on sediment resuspension than maintenance dredging activities
- Seawater becomes green with increasing depth in dredge plume
  - Causes a loss of the blue light, leaving predominantly green and yellow light

- Resuspended sediments distort the spectral profile of light as well as the amount of available light
- Thus, at depth, there are very low light levels and a distorted spectral profile, which may impact corals
- Light has been very underrepresented in monitoring on the GBR, with consideration of its impact on sensitive species such as corals

### **Coral health assessment in the northern ports (Katie Chartrand, JCU)**

- The coral monitoring program at Abbot Point and Mackay / Hay Point was more aligned with the GBR Marine Monitoring Program (MMP) in 2020
- Abbot Point
  - Significant declines from Cyclone Debbie (2017) with slow recovery, which was further impacted by 2020 bleaching events at Camp Island
  - Camp Island (more inshore) predominated by macroalgae, whereas Holburne (more offshore) has shown low macroalgae cover
  - Recruitment at both sites has shown an increase during the most recent survey
- Mackay / Hay Point
  - Similar declines from Cyclone Debbie (2017) and further impacts from the 2020 bleaching event (e.g., 45% pre-cyclone to 21% cover at one site)
  - Coral recruitment was particularly high during the most recent sampling event (dominated by *Turbinaria* at all sites, though less *Acropora* than expected)
  - Overall report card scores are relatively better compared to Abbot Point
- In summary,
  - Coral cover has declined, and algal cover has risen during the monitoring program (similar to Gladstone)
  - Cyclones and the most recent bleaching event have been the biggest drivers in change in scores

### **Reef restoration and citizen science (Adam Smith & Nathan Cook, Reef Ecologic)**

- Reef Ecologic (RE) aims to provide strategic advice and capacity building to managers that want to preserve and improve the reef
- Most RE projects have a strong focus on social objectives (e.g., community engagement)
- Museum of Underwater Art was designed to start conversations with the broader audience, with the launch reaching 400 million people
- RE have actively implemented strategies to limit carbon footprint of RE, as climate action is the most vital solution that gets the least attention—most works involve more reactive activities like coral restoration, COTS removal, etc.

## Group discussion

- Due to technical difficulties at the start of the workshop, group discussion was brief
- Question for Angus Thompson – Is Gladstone Harbour no longer suited to corals and what does normal recovery look like?
  - Pelican Island (Fitzroy reef) was just showing signs of recovery after 1991 flood in 2004, recovery was rapid within a few years
  - There are density-dependent feedbacks with macroalgae
  - Reef Ecologic have been doing restoration works in the Whitsundays. Recruitment has been moderate, but growth rates of coral have been slow after 5 years.
- Gladstone Ports Corporation (GPC) noted they are trialling active restoration in the harbour
  - Project to include three coral restoration techniques at Manning Reef and Seal Rocks North sites:
    1. Macroalgae removed from some transects (completed)
    2. Macroalgae will be removed from some transects with active transplantation of corals (to commence soon)
    3. Control group
  - In 6 months, GPC will investigate if/where coral recruitment has increased