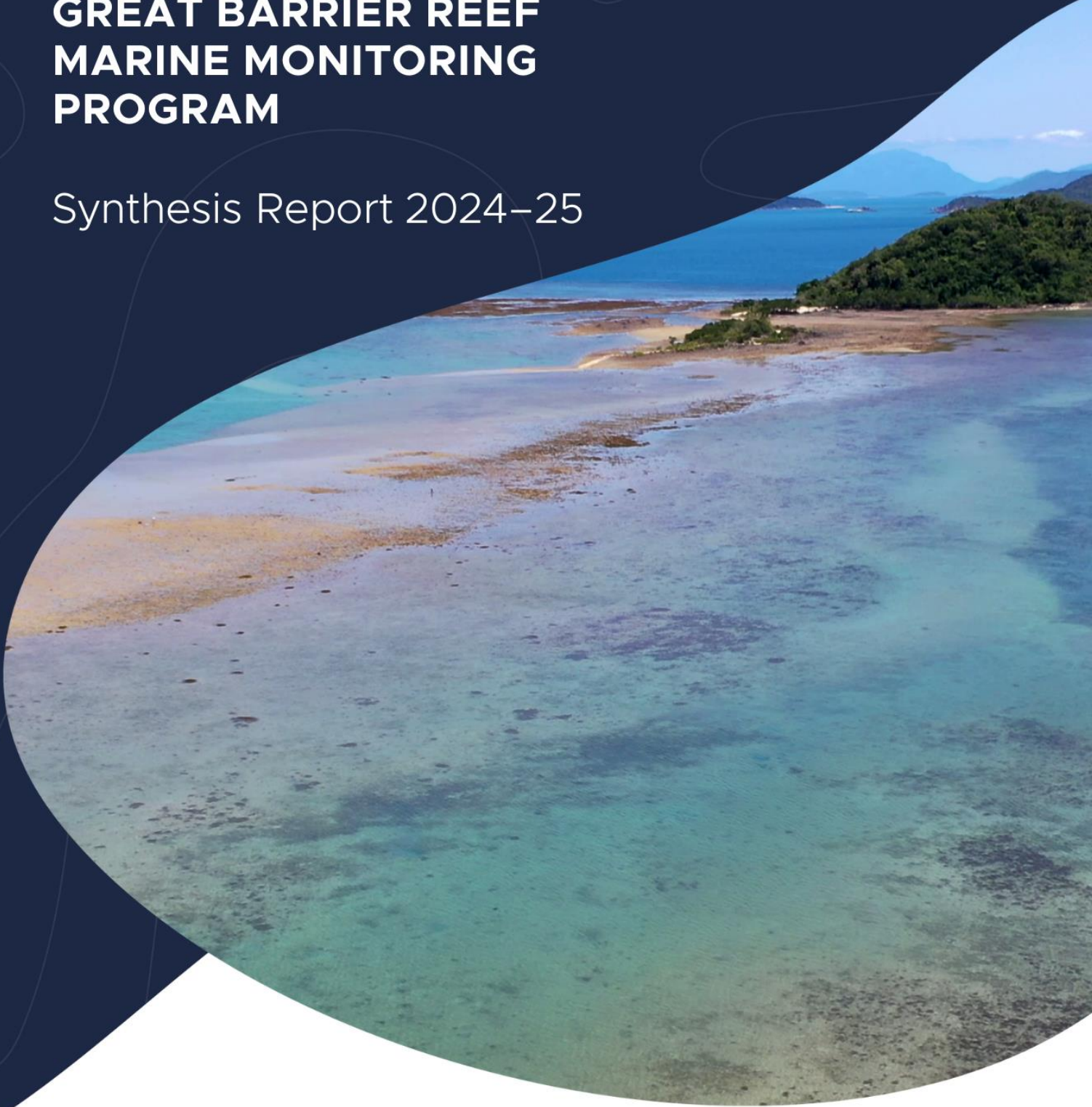


GREAT BARRIER REEF MARINE MONITORING PROGRAM

Synthesis Report 2024–25



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Front cover photography: Aerial image of the seagrass meadows between Dunk Island and Kumboola Island. © TropWATER, James Cook University. Photo credit: Rudi Yoshida.

The Great Barrier Reef Marine Park Authority acknowledges the continuing Sea Country management and custodianship of the Great Barrier Reef by Aboriginal and Torres Strait Island Traditional Owners whose rich cultures, heritage values, enduring connections and shared efforts protect the Reef for future generations.

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Contents

Glossary.....	5
Acknowledgements.....	7
Executive summary.....	8
Water quality	9
Pesticides.....	11
Seagrass condition.....	12
Coral condition	13
Introduction.....	14
Methods.....	15
Water quality monitoring.....	16
Remote sensing.....	17
Pesticides	17
Seagrass monitoring.....	19
Coral reef monitoring.....	20
Community involvement.....	21
Water quality.....	21
Seagrass	21
Coral	22
Reef-wide environmental conditions.....	23
Rainfall and riverine discharge	23
Temperature.....	25
Regional summaries	26
Cape York.....	26
Environmental conditions.....	26
Water quality.....	27
Seagrass	28
Wet Tropics.....	29
Environmental conditions.....	29
Water quality.....	31
Seagrass	34
Coral	35
Burdekin.....	38
Environmental conditions.....	38
Water quality.....	40
Seagrass	42
Coral	43
Mackay-Whitsunday.....	44

Environmental conditions	44
Water quality	45
Seagrass	47
Coral	48
Fitzroy	49
Environmental conditions	49
Water quality	50
Seagrass	51
Coral	52
Burnett-Mary.....	53
Environmental conditions	53
Water quality	54
Seagrass	55
Discussion	56
References	58

Glossary

AIMS	The Australian Institute of Marine Science
Chl-a	Chlorophyll-a, a measure of surface water “greenness” as detected by satellites. It is used as an indicator of primary productivity (i.e. concentration of microalgae) in surface waters.
Composition indicator	One of five indicators included in the calculation of the Coral Index, which compares the composition of hard coral communities at each reef to a baseline composition at that reef. It is an indicator of selective pressures imposed by the environmental conditions at a reef.
Coral Index	Average of the five coral indicators: Coral cover, Cover change, Composition, Macroalgae, and Juvenile coral.
Coral cover indicator	One of five indicators included in the calculation of the Coral Index, based on the level of coral cover derived from point intercept transects.
Cover change indicator	One of five indicators included in the calculation of the Coral Index, derived from a comparison of the change in hard coral cover observed <i>in situ</i> between two visits without disturbance, and the change in hard coral cover predicted by modelling, averaged over a four-year period. It is an indicator of the recovery potential of coral communities due to growth.
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CYWP	Cape York Water Partnership
Ecosystem health	Ecological processes, biodiversity and function of biological communities is maintained.
Guideline value	<p>A measurable quantity (e.g. concentration) or condition of an indicator for a specific community value below which (or above which, in the case of stressors) there is considered to be a low risk of unacceptable effects occurring to that community value.</p> <p>The water quality guideline values describe the concentrations of sediment, nutrients and pesticides that are needed for the protection and maintenance of marine species and the Reef’s ecosystem health.</p>
i-Sea	i-sea.fr remote sensing specialists
Inshore monitoring	For the purposes of this Synthesis Report, monitoring of “inshore” areas includes enclosed coastal, open coastal and sections of other water bodies where water quality is typically influenced by terrestrially derived runoff
JCU	James Cook University
Juvenile coral indicator	One of five indicators included in the calculation of the Coral Index, which is based on the number of juvenile (up to 5 cm diameter) hard coral colonies that have successfully survived early life cycle stages converted to a density per m ² of available space for settlement, which indicates the coral population’s ability to recover from disturbance events.

LTMP	Long-Term Monitoring Program
Macroalgae indicator	One of five indicators included in the calculation of the Coral Index, which considers the proportional representation of macroalgae in the algal community, based on cover estimates derived from point intercept transects. It is an indicator of competition with corals.
MMP	Great Barrier Reef Marine Monitoring Program
Marine Park	Great Barrier Reef Marine Park
NO _x	Nitrogen oxides (the sum of nitrate and nitrite)
PN	Particulate nitrogen
PO ₄	Phosphate (dissolved inorganic phosphorus)
Pollutants	This synthesis report refers to excess suspended (fine) sediments, nutrients (nitrogen, phosphorus), as well as the presence of pesticides as 'pollutants'.
PP	Particulate phosphorus
PSII-inhibiting herbicides	A class of herbicides that inhibit the function of Photosystem II (PSII), a critical process responsible for converting light energy into chemical energy during photosynthesis.
The Reef	Great Barrier Reef
Reef Authority	Great Barrier Reef Marine Park Authority
Reef 2050 WQIP	Reef 2050 Water Quality Improvement Plan
RJFMP	The Reef Authority's Reef Joint Field Management Program
Seagrass abundance indicator	One of two indicators included in the calculation of the Seagrass Index, measured using the median seagrass percentage cover relative to the site or reference guideline.
Seagrass Index	Average of the two seagrass condition indicators: abundance and resilience
Seagrass resilience indicator	Seagrass resilience is calculated based on proportion of colonising species and the number of reproductive structures observed (inflorescence, fruit, spathe, seed)
Secchi depth	A measure of water clarity.
TSS	Total suspended solids
UQ	University of Queensland
Water quality Long-term Index	Metric based on five indicators measured <i>in situ</i> : water clarity, Chl- <i>a</i> , NO _x , PN, and PP.
Water quality Annual Index	Metric based on three sub-indicators, which are averages of <i>in situ</i> measurements: water clarity, productivity (average of NO _x and Chl- <i>a</i>) and particulate nutrients (average of PN and PP).
Water types (WT)	Reef WT1, WT2 and WT3 refer to the classification of waterbodies with different colour characteristics and concentrations of optically active components, water quality indicators and light attenuation typically found in the Reef during the wet season.

Acknowledgements

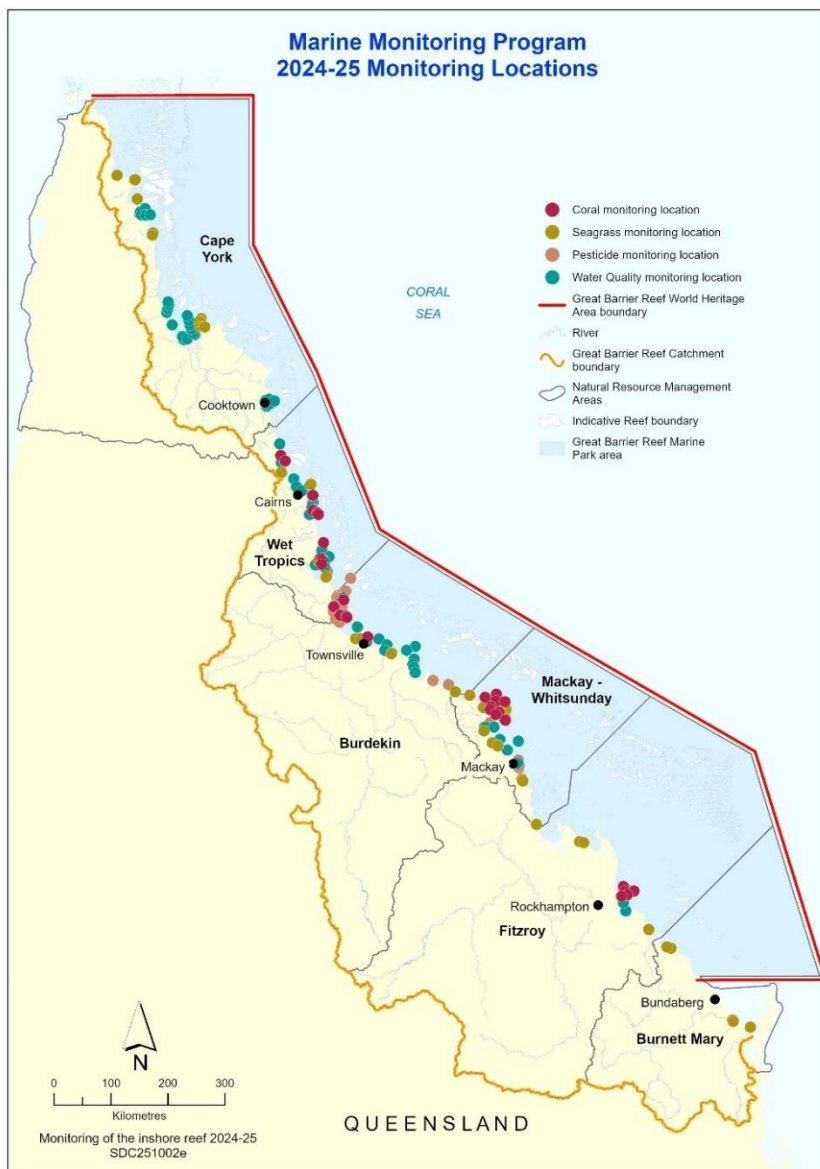
The Great Barrier Reef Marine Monitoring Program (MMP) is a collaboration between the Great Barrier Reef Marine Park Authority, the Australian Institute of Marine Science (AIMS), James Cook University (JCU), the Cape York Water Partnership (CYWP), and the University of Queensland, with important contributions from the Commonwealth Scientific and Industrial Research Organisation's (CSIRO) eReefs program, i-Sea, Traditional Custodians, the Reef Joint Field Management Program, Seagrass-Watch, tourism operators, and community volunteers.

We thank our long-term research partners and collaborators for their dedication to monitoring, evaluation and synthesis of science about the Great Barrier Reef. We thank our partners in the Paddock to Reef Integrated Monitoring, Modelling and Reporting program, of which the MMP is a component, for ongoing collaboration. Finally, we acknowledge the contextual information, including rainfall data provided by the Australian Bureau of Meteorology and river discharge data provided by the Queensland Government (Department of Local Government, Water and Volunteers).

Executive summary

The Great Barrier Reef Marine Monitoring Program assesses water quality, coral, and seagrass condition on the inshore Great Barrier Reef (the Reef) as part of the Australian Government's commitment to the Reef 2050 Water Quality Improvement Plan (Reef 2050 WQIP). Key results for the 2024–25 monitoring season are summarised below.

During the 2024–25 marine monitoring season (1 October 2024 to 30 September 2025), while no cyclones crossed the Reef, above-average rainfall was predominantly concentrated in the southern Wet Tropics and Burdekin regions, resulting in significant flood events. River discharge was 1.9 times the long-term median for the Reef catchments as a whole, with the Burdekin region in particular experiencing its highest river discharge (6.8 times the long-term median) since the 2010–11 floods.



Sea surface temperatures in the 2024–25 period exceeded the long-term average in all regions except the Burdekin. Sea surface temperatures in the northern Great Barrier Reef were within the range expected to cause coral bleaching, but no significant bleaching events were reported.

Within-canopy temperature in seagrass meadows was the sixth warmest on record, and the fourth consecutive year of above-average temperature.

Figure 1. Monitoring locations for the Marine Monitoring Program in 2024–25 showing: routine and event-based water quality sites, routine (passive samplers and grab samples) and event-based pesticide sites, inshore coral sites and inshore seagrass sites.

Water quality

Most water quality indicators have shown trends of stability since 2015 (Fig. 2). Some water quality indicators have shown deterioration, especially in the last two years, which is primarily related to high river discharge in many regions. Coastal water quality is closely linked to annual and inter-annual patterns in river discharge.

The annual condition of inshore water quality in 2024–25 was:

- **'good'** in the Cape York region, representing improvement compared with the previous year's 'moderate' score following Tropical Cyclone Jasper. However, water quality in the Annan River inshore region continued to decline, reflecting on-going impacts from Tropical Cyclone Jasper on the landscape and water quality.
- **'moderate'** in the Wet Tropics region, related to high river discharge during 2024–25 and 2023–24.
- **'good'** in the Burdekin region, similar to 2023–24, and showing a trend of improving nitrate/nitrite concentration, despite the major flood events in this region.
- **'moderate'** in the Mackay-Whitsunday region, representing a deterioration related to high river discharge during 2024–25. This interrupts the gradual improvement in the region observed since Tropical Cyclone Debbie in March 2017.
- **'good'** in the Fitzroy region, similar to the previous four years.

Positive results from this year included the recovery of most of the Cape York region to 'good' condition following the devastating impacts of Tropical Cyclone Jasper in 2023–24. Additionally, nitrate/nitrite continued to show a trend of improvement in the Tully and Burdekin regions despite above-median river discharge in these regions.

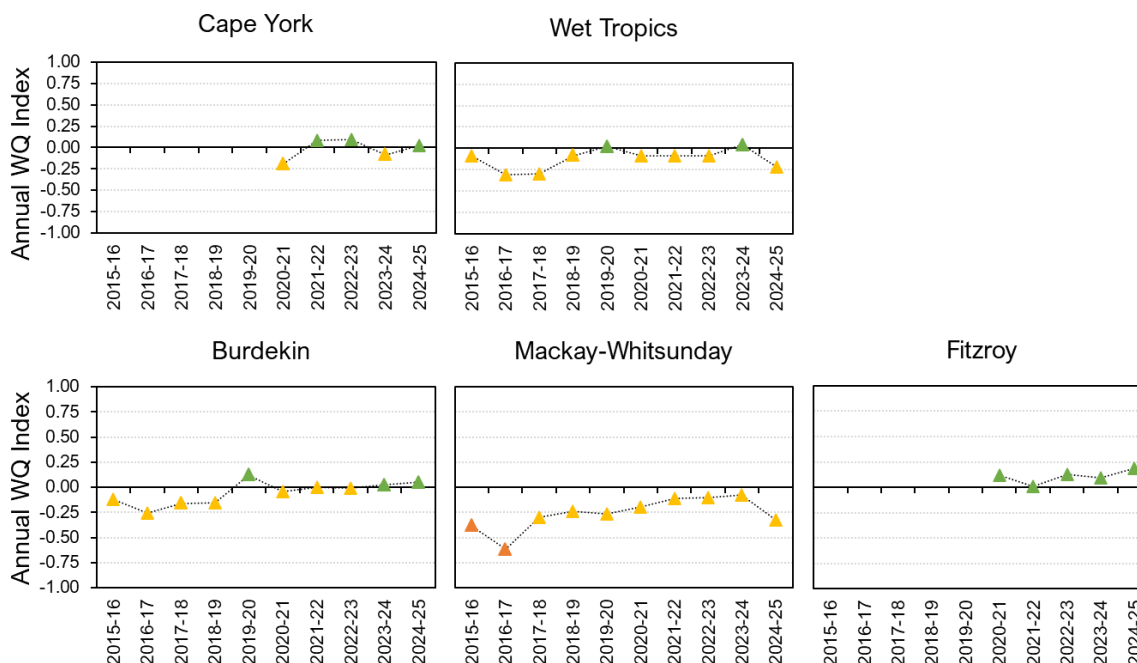


Figure 2. Trends in the regional Annual Water Quality (WQ) Index for each region. The current Annual Water Quality Index has only been in place since 2015 (Kuhnert *et al.* 2015). Values are scaled from -1.0 to 1.0 and graded: **very good** (1 to 0.5), **good** (0.5 to 0), **moderate** (< 0 to -1/3), **poor** (< -1/3 to -2/3), **very poor** (< -2/3 to -1). Note scores are unitless. Data source: Gruber *et al.* (2026).

Individual water quality indicators were monitored for trends and compared against water quality Guideline Values. This water year, Guideline Values were:

- **met in most regions** for total suspended solids, particulate nitrogen, particulate phosphorus and chlorophyll *a*; and
- **not met in any region** for turbidity, Secchi depth, and nitrate/nitrite.

Satellite imagery showed about 11,220 km² of the Reef was potentially exposed to pollutants, which was around 4% of coral reefs, 77% of seagrasses, and 50% of inshore waters. Almost 90% of the Reef, primarily the mid-shelf and offshore waters, was at no or very low risk of exposure to pollutants during the 2024–25 wet season.

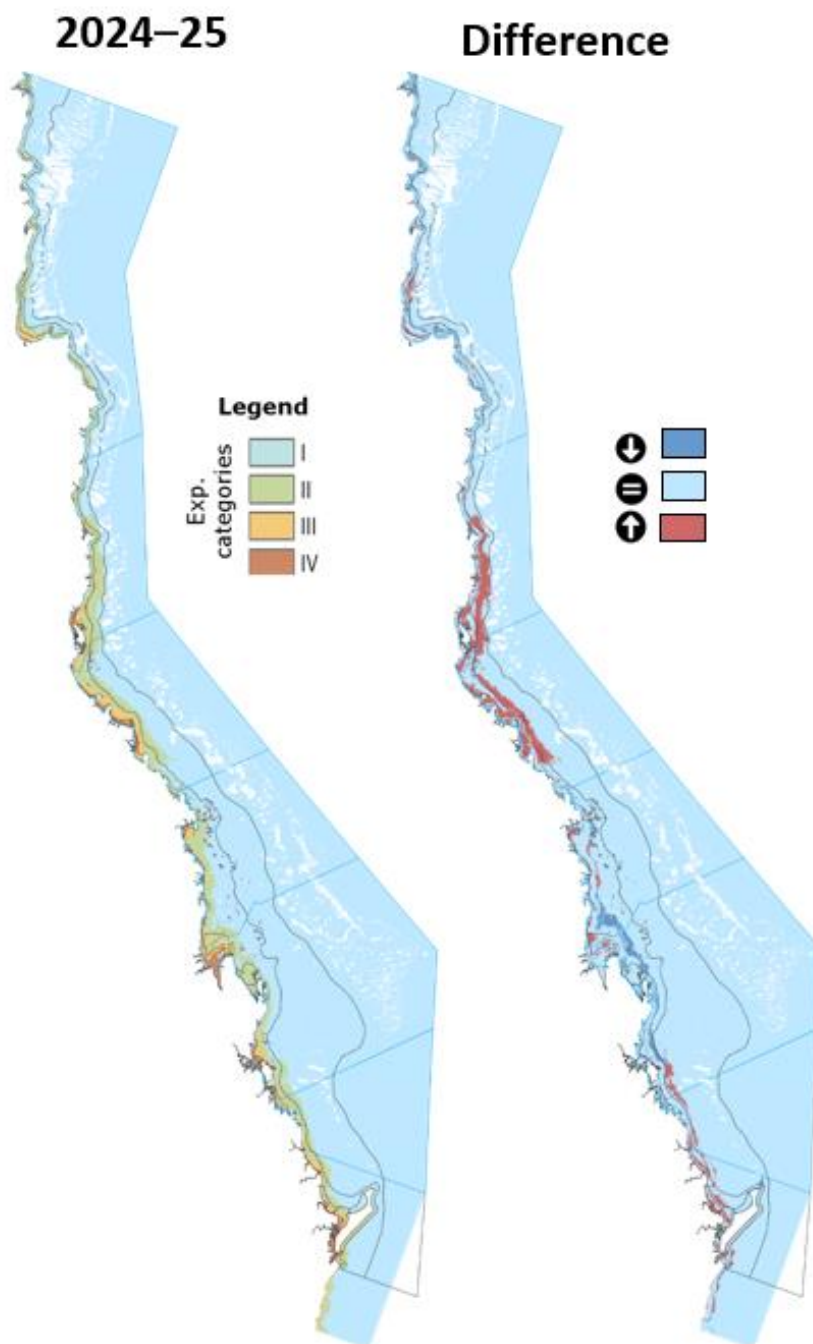


Figure 3. Left: map showing the categories of potential exposure to pollutants in the 2024–25 wet season. Relative potential risk categories range from I: no/low risk to IV: highest relative risk. Right: difference map showing areas with an **increase** and **decrease** in risk category in 2024–25 against long-term trends (20 wet seasons since 2002–03). Image extracted from Gruber *et al.* (2026).

Pesticides

Pesticides were monitored during the wet season using passive samplers at 8 locations (Wet Tropics region: Low Isles, High Island, and Dunk Island; Burdekin region: Haughton River mouth; Mackay-Whitsunday region: Whitsunday Channel, Repulse Bay, Flat Top Island and Sandringham Bay) with additional monitoring during flood conditions in some regions. Routine pesticide monitoring showed relatively consistent patterns with previous years, with the peak concentrations detected during high river discharge periods in the Wet Tropics and Burdekin regions in January and February 2025 (Fig. 4).

The Reef 2050 WQIP specifies a pesticide target to protect at least 99% of aquatic species at the river mouth across the Reef. The Pesticide Risk Metric (PRM) was designed for Reef catchments and was developed to reflect that while multiple pesticides can individually be detected below guideline values, in combination they can create an increased risk to species.

Routine monitoring identified that the Pesticide Risk Metric exceeded species protection targets at 6 of the 8 monitored sites (Wet Tropics region: High Island and Dunk Island; Burdekin region: Haughton River mouth; Mackay-Whitsunday: Repulse Bay, Flat Top Island and Sandringham Bay; Fig. 4). Diuron was found in all passive samplers, and the composition of pesticide mixtures continued to reflect adjacent land uses. Consistent with previous years, Sandringham Bay recorded the highest pesticide concentrations in the 2024–25 wet season, driven by high levels of the insecticide imidacloprid.

The herbicides metolachlor and tebuthiuron each exceeded freshwater protection guidelines in event-based sampling during the Herbert and Burdekin River flood events in February 2025.



Figure 4. Percentage of species affected by pesticides calculated using the Pesticide Risk Metric (PRM) at each routine monitoring site using (a) passive samplers and (b) grab samples over the 2024–25 wet season. Figures extracted from Gruber *et al.* (2026). Passive samplers represent a time-integrated average water concentration over the deployment period (i.e. chronic exposure). Grab samples represent a point-in-time concentration estimate (i.e. acute exposure)

Seagrass condition

Overall condition of inshore seagrass meadows across the Reef declined in 2024–25 (Fig. 5) from ‘moderate’ to ‘poor’. At a regional level, conditions were:

- ‘**poor**’ in the **Cape York** region, a decline from the previous year and the lowest score recorded to date for this region.
- ‘**poor**’ in the **Wet Tropics** and **Burdekin** regions, remaining in the same range as the previous year but continuing to decline.
- ‘**moderate**’ in the **Mackay–Whitsunday** region, remaining in the same range as the previous year but continuing to decline.
- ‘**moderate**’ in the **Fitzroy** region, an improvement from the previous year.
- ‘**good**’ in the **Burnett–Mary**, an improvement from the previous year.

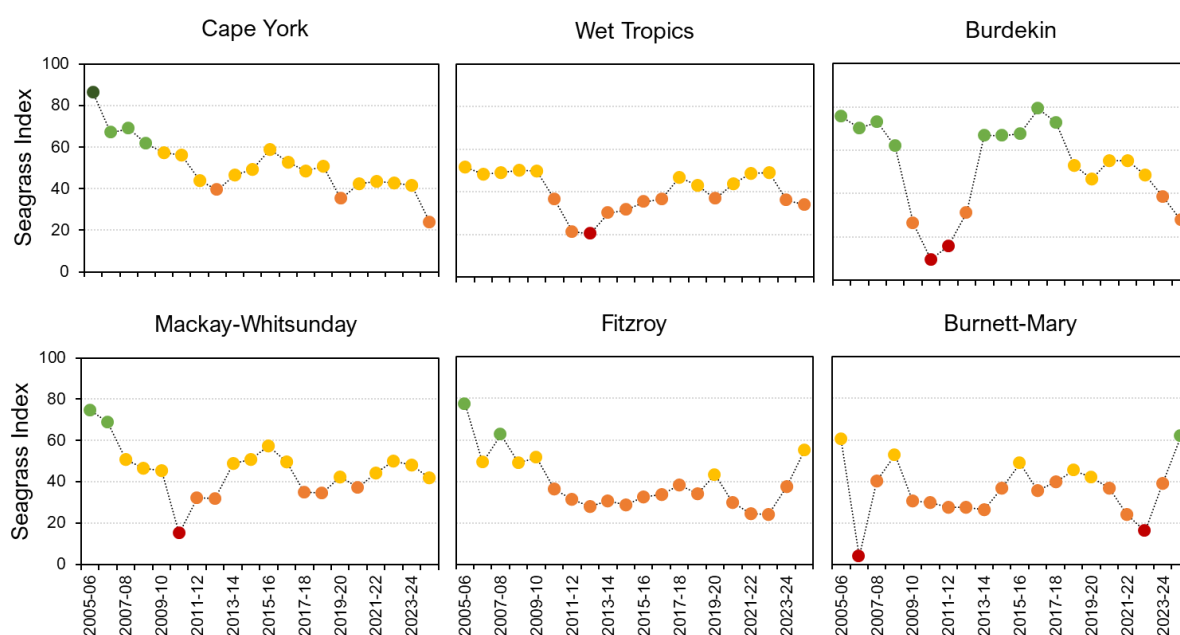


Figure 5. Temporal trend in regional Seagrass Index from 2005–06 to 2024–25. Values are scaled from 0–100 and graded: **very good** (81–100), **good** (61–80), **moderate** (41–60), **poor** (21–40), **very poor** (0–20). Note scores are unitless. Data source: McKenzie *et al.* (2026).

These regional patterns reflect a system under sustained pressure from multiple environmental drivers, including elevated river discharge, marine heatwaves, cyclones and local-scale disturbances. The observed spatial variability in condition and indicator scores is strongly influenced by the legacy of past extreme events, such as Tropical Cyclone Debbie in 2016–17 in the Mackay–Whitsunday region, widespread above-average riverine discharge across the southern and central Reef, and the 2018–19 marine heatwave that affected northern and central regions. In 2024–25, extreme and widespread elevated discharge affected most of the inshore Reef, especially in the central region, and contributed to below-average light availability, a key limiting factor for seagrass productivity. Daily within-canopy temperatures were comparable to the previous reporting year but reflected the fourth consecutive year of above-average temperatures, and the sixth-highest recorded since the MMP began (with 2016–17 the highest). Improving water quality through reductions in catchment run-off remains central to reducing stress on seagrass meadows.

Coral condition

Reef-wide, inshore reefs have remained in an overall ‘poor’ condition since 2018. However, there are important regional differences (Fig. 6).

At a regional level:

- In the **Wet Tropics**, the Coral Index has remained ‘**moderate**’ since 2005, although it was stable at the top of the ‘moderate’ range from 2016 to 2022. While still in the same ‘moderate’ range in 2025, conditions have declined in both the Barron-Daintree and Herbert-Tully sub-regions.
- The Coral Index for the **Burdekin** region was ‘**moderate**’, remaining in the same range since 2016 but continuing to decline since 2019.
- The Coral Index in **Mackay-Whitsunday** region improved to ‘**moderate**’, driven by continued improvement in the Juvenile coral, Coral cover and Macroalgae indicators since 2020.
- In the **Fitzroy** region, the Coral Index declined to ‘**very poor**’ in 2025, driven by reductions in the Coral cover indicator, following a period of gradual recovery from 2014 to 2020.

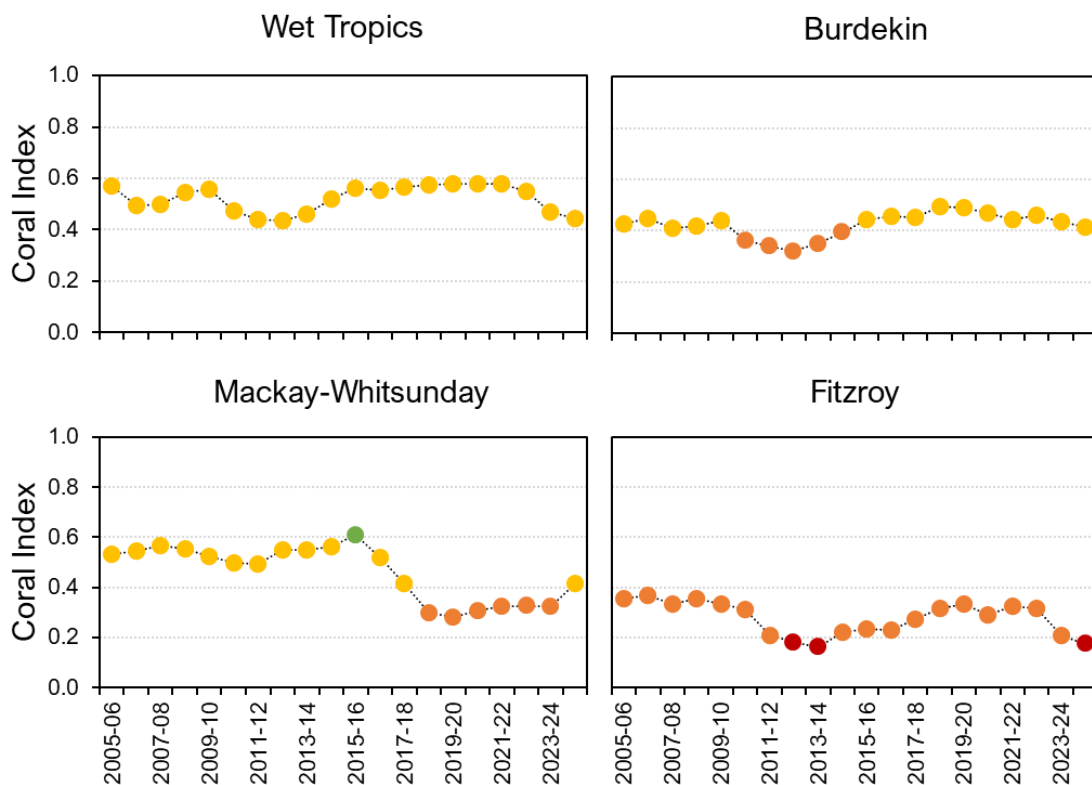


Figure 6. Temporal trend in regional Coral Indices from 2005–06 to 2024–25. Values are scaled from 0.00–1.00 and graded: **very good** (0.81–1.00), **good** (0.61–0.80), **moderate** (0.41–0.60), **poor** (0.21–0.40), **very poor** (0.0–0.20). Note scores are unitless. Data source: Thompson *et al.* (2026).

Introduction

Water quality is a key issue for the health of the Great Barrier Reef (the Reef), its catchments and for the communities, industries and ecosystems that rely on good water quality (Great Barrier Reef Marine Park Authority 2020). Substantial investment is being undertaken by Australian and Queensland governments to halt and reverse the decline of water quality entering the Reef lagoon under the Reef 2050 Water Quality Improvement Plan (Australian and Queensland Governments 2018).

The Great Barrier Reef Marine Monitoring Program (MMP) was established in 2005 to assess the long-term status and health of inshore ecosystems. It is an integral component of the Paddock to Reef Integrated Monitoring, Modelling and Reporting Program, assessing long-term improvement in regional marine water quality arising from improved land management practices in Reef catchments.

This 2024–25 Synthesis Report summarises the latest results on the condition and trends in water quality, seagrass and coral habitats in the inshore Great Barrier Reef, and explores linkages to catchment runoff and other environmental pressures.

The information underpinning this Synthesis Report is provided by the 2024–25 Marine Monitoring Program Annual Reports. These will be available on the Reef Authority's elibrary:

- Gruber, R., Waterhouse, J., Petus, C., Lewis, S., Howley, C., Thompson, K., James, C., Logan, M., Bove, U., Brady, B., Bray, L., Choukroun, S., Connellan, K., Davidson, J., Dick, E., Massuger, J., Mellors, J., Molinari, B., Moran, D., O'Callaghan, M., O'Dea, C., Polglase, L., Bushotts, M., Shellberg, J., White-Kiely, D., Shiels, R., Elisei, G., Paxman, C., Lei Li, S., Li, Y., Carswell, C., Xia, S., Prasad, P., Gallen, M., Reeks, T., Clokey, J.E., Jekimovs, L.J., Marano, K., and Kaserzon, S. 2026. *Great Barrier Reef Marine Monitoring Program Inshore Water Quality Monitoring: Annual Report 2024–25*. Great Barrier Reef Marine Park Authority, Townsville.
- McKenzie, L.J., Collier, C.J, Langlois, L.A., Brien, H., Wilson, N. and Yoshida, R.L. 2026, *Marine Monitoring Program: Annual Report for Inshore Seagrass Monitoring 2024–25. Report for the Great Barrier Reef Marine Park Authority*, Great Barrier Reef Marine Park Authority, Townsville.
- Thompson, A., Davidson, J., Logan, M., Thompson, C., 2026, *Marine Monitoring Program Annual Report for Inshore Coral Reef Monitoring: 2024–25. Report for the Great Barrier Reef Marine Park Authority*, Great Barrier Reef Marine Park Authority, Townsville.

A brief overview of the design and methods of the MMP is provided in the next section of this report. For comprehensive information on each of the monitoring sub-programs, including objectives and detailed methods, refer to the individual sub-program reports cited above as well as the latest Marine Monitoring Program Quality Assurance and Quality Control Manual (Gruber *et al.* 2025).

Methods

This section briefly describes the field methods used in the MMP to collect data on inshore marine water quality and condition of coral and seagrass (Fig. 7). A subset of these indicators is used to calculate the inshore marine water quality, seagrass, and coral indices. Specific and detailed information on data analyses and calculation of the indices, synthesis and integration of data can be found in each of the annual reports, which are referenced above. Coral and seagrass indices mentioned here are incorporated into the Reef Water Quality Report Card. Water Quality Indices reported here are a specific tool developed by AIMS for the MMP to visualise trends in the suite of water quality variables.

Note: The MMP's monitoring season is the water year: 1 October 2024 to 30 September 2025.

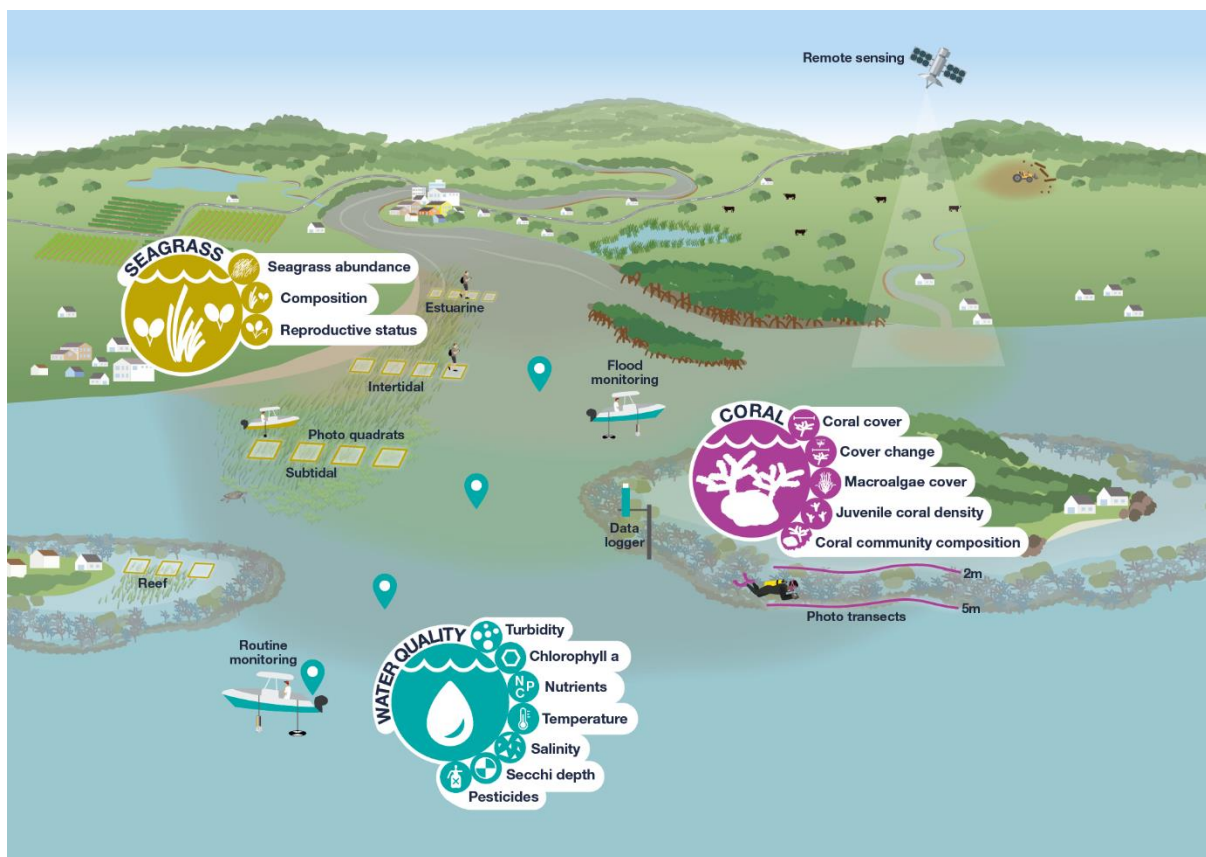


Figure 7. Conceptual diagram representing the main sub-programs of the Marine Monitoring Program and the ecosystem health indicators monitored within each sub-program.

Water quality monitoring

Monitoring of sediment, nutrient and environmental parameters is delivered as part of the MMP through collaborative efforts between AIMS, JCU, CYWP and i-Sea. Each of these partner organisations has responsibilities across different geographical areas for monitoring ambient water quality conditions throughout the year, and/or for monitoring wet season conditions and specific flood events.

In-situ water quality monitoring is carried out in the inshore waters of the Reef to assess changes over time in concentrations of relevant water quality indicators during wet and dry seasons (Fig. 8). In addition, monitoring of flood plumes (resulting from river flood events) occurs opportunistically in the monitoring regions. Detailed information on inshore marine water quality monitoring and data analyses can be found in Gruber *et al.* (2026).

Monitoring at inshore sites includes the following parameters:

- concentrations of dissolved and particulate nitrogen and phosphorus species
- turbidity, Secchi depth, and concentration of total suspended solids as a proxy for water clarity
- concentration of chlorophyll-*a* as proxy for productivity
- temperature, salinity, and coloured dissolved organic matter
- remote sensing analysis to determine spatial and temporal variation in wet season water quality and potential exposure of inshore coral and seagrass ecosystems to pollutants.

A subset of these parameters is used to calculate each region's Water Quality Index, measured against established local water quality guideline values (Great Barrier Reef Marine Park Authority 2010). Different water quality parameters are used to calculate the Water Quality Indices, which communicate the long-term trend (insensitive to year-to-year variability) and annual condition (sensitive to year-to-year variability) of water quality relative to those guideline values (Gruber *et al.* 2026).

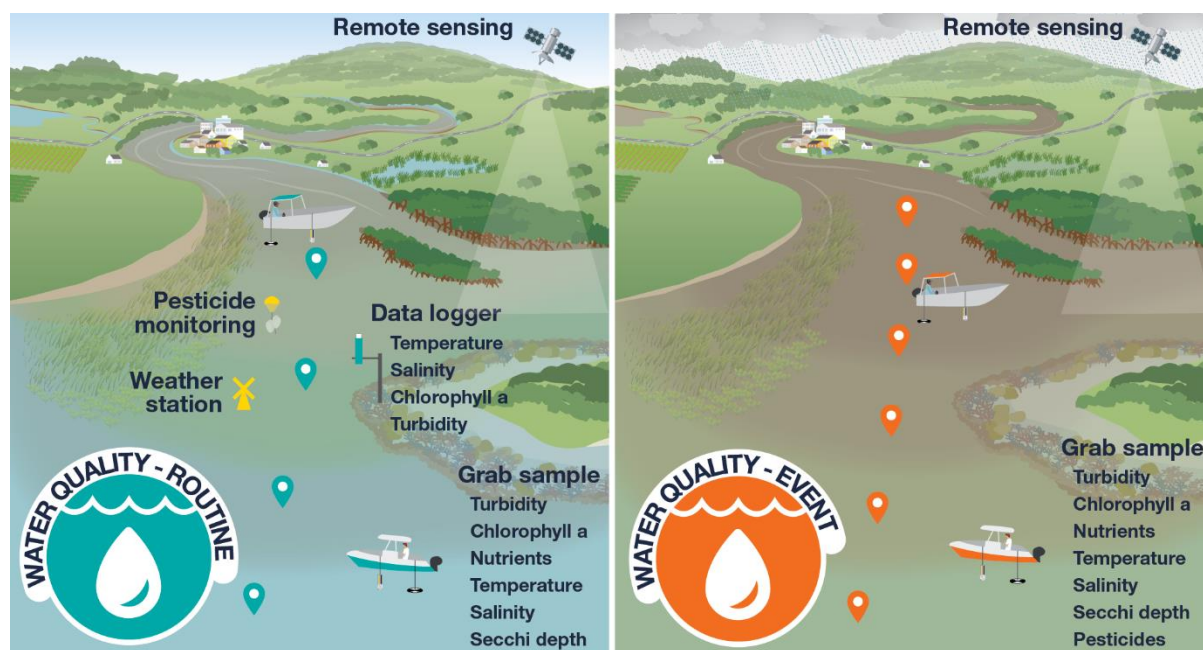


Figure 8. Water quality monitoring is routinely undertaken during wet and dry seasons (left), along permanent transects located from river mouths to open coastal areas. Additional monitoring of flood plumes is conducted opportunistically during flood events (right).

Remote sensing

Satellite imagery is used to interpret where and when three specific water types, which reflect different water quality conditions, are present in the Reef during the wet season (the 22 weeks from November to May):

- Reef Water Type 1 (WT1): brownish, turbid waters, which are rich in sediment and dissolved organic matter from river flood plumes, typically found inshore in enclosed and open coastal waters.
- Reef Water Type 2 (WT2): the less turbid part of flood plumes, greenish waters rich in algae and dissolved organic matter, typically found in open coastal and mid-shelf waters.
- Reef Water Type 3 (WT3): greenish-blue waters with suspended sediment slightly above ambient conditions and enriched with nutrients, typically found offshore towards the open sea.

Satellite imagery and modelling outputs are then linked with *in situ* monitoring to estimate the exposure of coastal waters and ecosystems to different water quality conditions. This approach estimates the magnitude and likelihood of exposure to pollutants mapped in each of the three water types (Reef WT1, WT2 and WT3). By overlaying the exposure maps with information on the spatial distribution of coral reefs and seagrass meadows, the areas and percentages of these ecosystems that may be exposed to pollutants during the wet season is calculated (Gruber *et al.* 2026). The exposure categories are not validated against ecological health data and represent relative potential risk categories for seagrass and coral reef ecosystems. Exposure is grouped into potential risk categories (I to IV [highest]) based on a relative Natural Breaks classification. Category I (no or very low risk) represents waters with ambient or detectable-but-low pollutant concentrations, and therefore low risk of any detrimental ecological effect. The areas and percentages of ecological communities affected by the different categories of exposure are calculated as a relative measure between regions and the long-term average.

Pesticides

In the 2024–25 wet season, passive samplers were deployed at 8 fixed monitoring sites along the inshore Reef across the Wet Tropics, Burdekin and Mackay Whitsunday regions. A total of 40 Empore™ Disk (ED) based passive water samplers (including 4 duplicates) were deployed between November 2024 and May 2025. ED samplers are designed to detect hydrophilic organic chemicals with relatively low octanol-water partition coefficients including photosystem II (PSII) inhibiting herbicides such as diuron. Duration of deployments varied between 14 and 44 days. Monitoring sites were located at three locations in the Wet Tropics (Low Isles, High Island and Dunk Island), one site in the Burdekin region (Haughton River Mouth), and four sites in the Mackay-Whitsunday region (Whitsunday Channel, Repulse Bay, Flat Top Island, and Sandringham Bay). In addition, 45 grab samples were collected at the 8 fixed sampling sites upon deployment and retrieval of passive samplers.

A further 71 grab samples were collected opportunistically during flood events at additional sites in the Wet Tropics, Burdekin and Mackay-Whitsunday regions between 5 and 25 February 2025.

In the 2024–25 monitoring season, a suite of 25 pesticides were analysed including PSII-inhibiting herbicides such as diuron, atrazine and its metabolites, ametryn, hexazinone, and tebuthiuron. These PSII-inhibiting herbicides negatively affect photosynthesis and are

commonly detected due to their high usage in adjacent catchments and their high water solubility. Other pesticides monitored include those that have non-photosynthetic effects such as the insecticides imidacloprid and metolachlor, and “knockdown herbicides” such as 2,4-D. Detailed information on inshore marine pesticide monitoring and data analyses can be found in Gruber *et al.* (2026).

Using results from passive samplers from each monitoring site, the Pesticide Risk Metric (PRM) (Warne *et al.* 2020a, Warne *et al.* 2020b, Bezzina *et al.* 2022) was calculated utilising the available quantified pesticides. The PRM was specifically designed as a reporting tool for the Reef 2050 WQIP to take into account the additive ecological effect of multiple pesticides, and provides a consistent method for assessing the risk of pesticides and pesticide mixtures on the Reef. The risk is expressed as the percentage of species potentially affected (or conversely, protected) by the combined toxicity of a selection of 22 pesticides (Warne *et al.* 2020a), including many quantified within the MMP monitoring.

Seagrass monitoring

Monitoring is conducted in all regions and covers each major seagrass habitat types where possible: estuarine, coastal intertidal, coastal subtidal, reef intertidal and reef subtidal (Fig. 9). Detailed information on inshore seagrass monitoring and data analyses can be found in McKenzie *et al.* (2026).

During the 2024–25 monitoring season, monitoring was carried out at 75 sites across 34 locations. This sampling strategy covered 17 coastal, 4 estuarine and 13 reef locations (2 or 3 sites at each location).

At least 2 sites were selected for sampling at each location, nested within 500 metres (m) of each other. Subtidal sites were not always replicated within locations. Intertidal sites were defined as a 5.5 ha area within a relatively homogenous section of a representative seagrass community/meadow. Monitoring occurred at sites in the late dry season (September–November 2024) and late wet season (March–May 2025). In each site, two indicators were assessed:

- Seagrass abundance: an assessment of the average percentage cover of seagrass per monitoring site in relation to the Seagrass Abundance Guidelines (McKenzie 2009).
- Seagrass resilience: an assessment of reproductive effort, species traits, relative meadow extent and density of seeds in the seed bank, which are used to infer capacity of a meadow to resist or recover following a disturbance event (Collier *et al.* 2021).

These indicators are weighed equally and used to calculate the Seagrass Index.

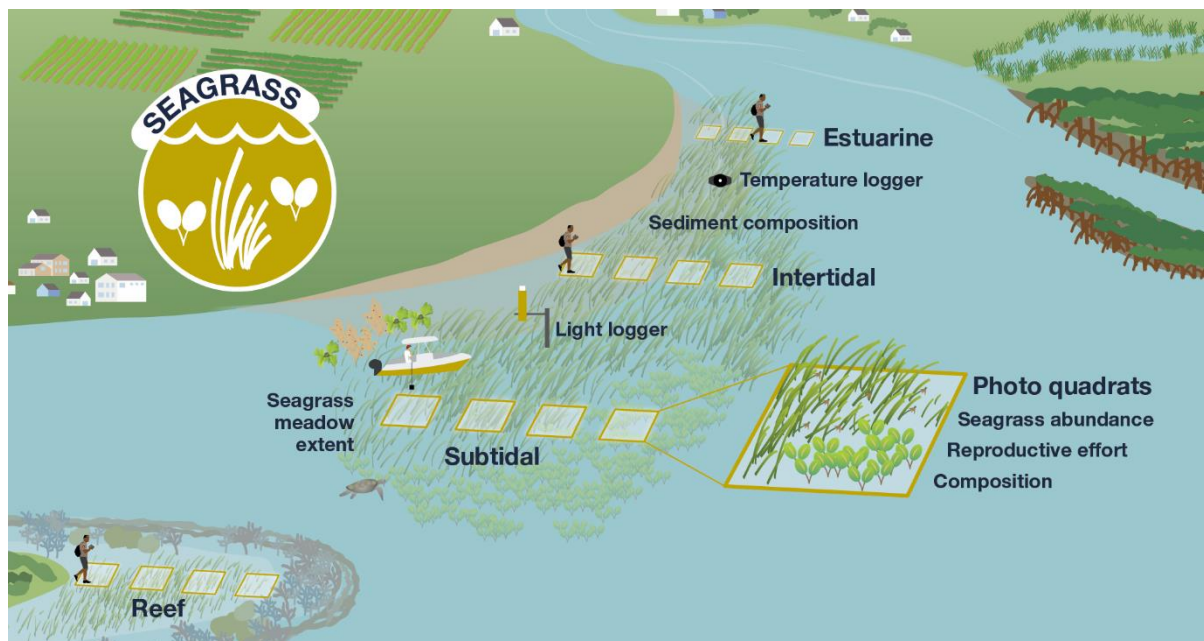


Figure 9. Seagrass meadows are monitored in coastal and reefal habitats of the inshore region using metrics to assess abundance and resilience.

Coral reef monitoring

Monitoring of inshore coral reef communities occurs yearly at reefs in the Wet Tropics, Burdekin, Mackay-Whitsunday and Fitzroy regions. No reefs in the Cape York region are included due to logistic and occupational health and safety issues relating to diving in coastal waters in this region. In addition, there are few coral reefs in inshore waters of the Burnett-Mary region, and therefore there are no established monitoring sites in this area. Detailed information on inshore coral reef monitoring and data analyses can be found in Thompson *et al.* (2026).

Thirty reefs are monitored at 2 m and 5 m depth, with an additional 6 inshore reefs monitored at a single depth under the AIMS Long-Term Monitoring Program. All are included in the annual assessment of coral condition. Coral monitoring for the 2024–25 report predominantly occurred between May and July 2025, which allowed for detection of any impacts from disturbances common in the wet season, such as bleaching and cyclones.

At each monitoring site and depth, permanently marked transects were deployed and data to evaluate 5 **indicators** were collected using methods detailed in Thompson *et al.* (2026) (Fig. 10):

- **Coral cover:** hard and soft coral cover
- **Juvenile coral:** number of juvenile hard coral colonies (up to 5 cm diameter)
- **Macroalgae:** proportion (percentage) of macroalgae cover
- **Cover change:** rate of change in coral cover (as an indication of the recovery potential of the reef following a disturbance)
- **Composition:** coral community composition

These indicators were weighed equally and used to calculate the Coral Index.

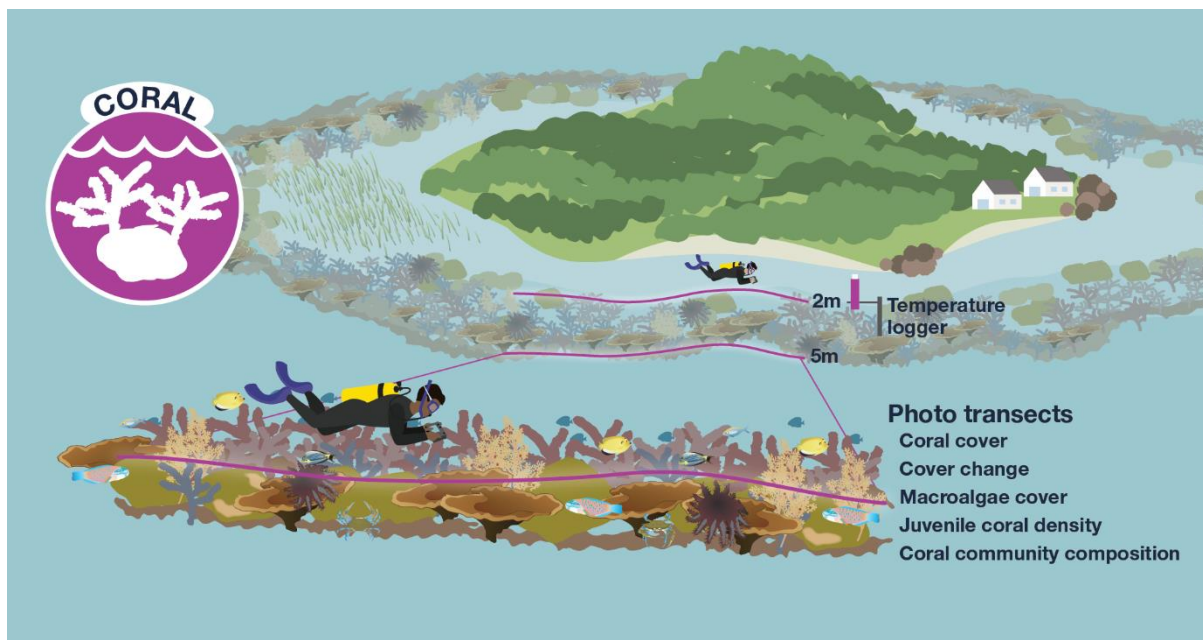


Figure 10. The condition of inshore coral reefs is assessed along fixed transects to monitor abundance and composition of key benthic organisms (soft coral, hard coral, and macroalgae) and hard coral recruitment.

Community involvement

Water quality

Water quality monitoring occurs in Traditional Owners' Sea Country represented by at least 15 Aboriginal Corporations, Traditional Use of Marine Resources Agreement (TUMRA) committees or Claimant Groups. The level of engagement and the relationships between these groups and the MMP water quality teams are at various stages of maturity.

In Cape York, the Cape York Water Partnership (CYWP) has strong relationships with Yuki Baja Muliku and Lama Lama (Yintingga) Land and Sea Rangers, who have jointly undertaken and provided critical logistical support for field work from the start of monitoring in this region. CYWP continues to build on these partnerships, and more recently has strengthened collaborations with Gamaay and Kuku Ya'u Traditional Owners, who are now also supporting joint monitoring efforts in the Endeavour and Pascoe River regions. When possible, CYWP presents the annual monitoring results back to each group at their Joint Management or TUMRA meetings.

AIMS and JCU have also been initiating discussions and building relationships with groups from the Daintree to the Fitzroy River. Strong relationships have been formed between AIMS and the Woppaburra TUMRA Aboriginal Corporation and Darumbal People Aboriginal Corporation, whose Sea Country spans the coastal areas adjacent to the Fitzroy River (including the Keppel Islands). Over the past 5 years, when available, Woppaburra and Darumbal rangers and community representatives accompany MMP water quality scientists during field work in their Sea Country, and use these findings to complement their own understanding of Sea Country conditions.

In 2024–25 AIMS and JCU met with several more groups both to seek consent to continue monitoring and explore ways to better integrate with the needs and interests of Traditional Owners. We are now building new relationships with four groups throughout the Wet Tropics and Townsville regions including Gunggandji PBC Aboriginal Corporation, Gunggandji-Mandingalbay Yidinji Peoples Prescribed Body Corporate, Giringun Aboriginal Corporation, and the Manbarra and Bwgcolman historical peoples, who have voiced their ongoing support for regular and ongoing water quality monitoring activities in their sea country areas. MMP scientists yarned with elders, company directors, TUMRA coordinators, rangers and community members and are now arriving at opportunities to conduct water quality field work with local rangers and community representatives. These relationships are in their early stages, but open lines of communication will lead to better integration and collaboration around the MMP water quality monitoring and lead to new opportunities for all parties in future.

The MMP team will continue to share monitoring data and build new relationships with Traditional Owners to support their ongoing management and protection of Sea Country.

Seagrass

The inshore seagrass component of the MMP partners with the Reef Joint Field Management Program (RJFMP), along with various Citizen Science and First Nations groups, to gather valuable contributory data and to assist with supervised field assessments. In particular, the Whitsunday Seagrass Volunteers, and the Wuthathi, Kuku Yau, Yithuwarra, Giringun, Gidarjil and Darumbal groups, Traditional Owners and Custodians of the Sea Countries on which monitoring is conducted, assisted in field data collection.

To ensure the quality of the contributory data, citizen scientists participate in capacity-building initiatives through the Seagrass-Watch global seagrass observing network. Participants must demonstrate competency in globally standardised methods before their data can be integrated into the MMP.

QPWS rangers (through the RJFMP) as well as Indigenous Rangers receive capacity-building support from Seagrass-Watch. Rangers are trained to collect standardised imagery using a drop-camera in subtidal habitats. The collected imagery is submitted to Seagrass-Watch, where quantitative data is extracted from photoquadrats and incorporated into the MMP database.

All data used within the MMP undergoes a quality check and validation prior to use. The data gathered in collaboration with citizen science and ranger partners encompasses approximately 40% of the long-term monitoring sites used to report on the condition of inshore seagrass in the Reef.

Coral

Coral monitoring occurs within the Sea Country of 10 distinct Aboriginal Corporations, committees, and Claimant Groups. During the 2024–25 season, AIMS engaged with each group to secure monitoring consent and align MMP efforts with their specific interests.

Currently, the MMP coral monitoring team has secured verbal or written consent from six groups and is actively building relationships with the remaining four. Moving forward, the MMP aims to integrate Traditional Owners into field trips and refine information-sharing strategies to better support the local management of their Sea Country.

Reef-wide environmental conditions

Rainfall and riverine discharge

The volume of freshwater discharge entering the Reef lagoon is closely related to wet season rainfall and can have a significant influence on coastal and inshore water quality. In the 2024–25 season, above-average rainfall was predominantly concentrated in the southern Wet Tropics and the Burdekin regions (Fig. 11).

No significant cyclones affected the Reef during the 2024–25 cyclone season. However, there was some storm damage to coral reefs in the Burdekin region attributed to high winds associated with an active monsoon trough in early February 2025.

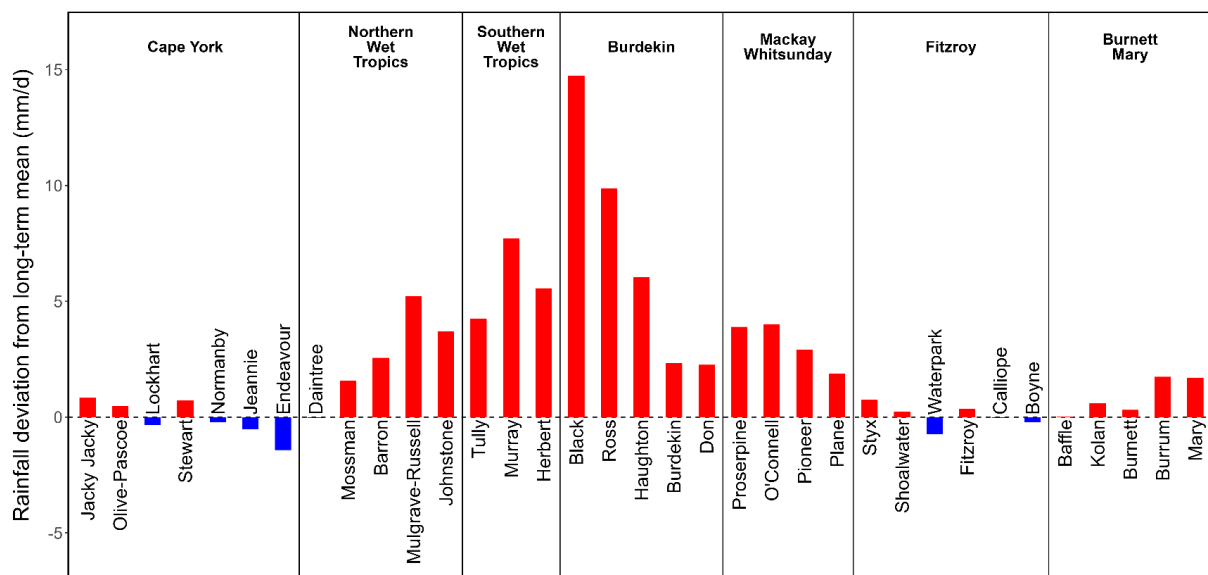


Figure 11. Difference between daily average wet season rainfall (December 2024–April 2025) and the long-term wet season rainfall average (from 1961–1990). Red and blue bars denote basins with rainfall above and below the long-term average, respectively. Note that the basins are ordered from north to south (left to right). Compiled by Gruber *et al.* (2026).

In the 2024–25 season, the overall Reef catchment area had river discharge nearly double (1.9 times) the long-term median, which is the largest discharge since the extreme 2010–11 water year. On a regional basis, the Burdekin, Mackay-Whitsunday and Burnett Mary regions had river discharge well above their long-term medians (6.8, 2.8, and 3.4 times the median, respectively) with above-average discharge from the Cape York and Wet Tropics regions (1.4 and 1.6 times the median, respectively, Fig. 12). The river discharge from the Burdekin region for the 2024–25 water year was the highest since the extreme 2010–11 water year. Discharge from the Fitzroy region was near the long-term median (1.2 times the median).

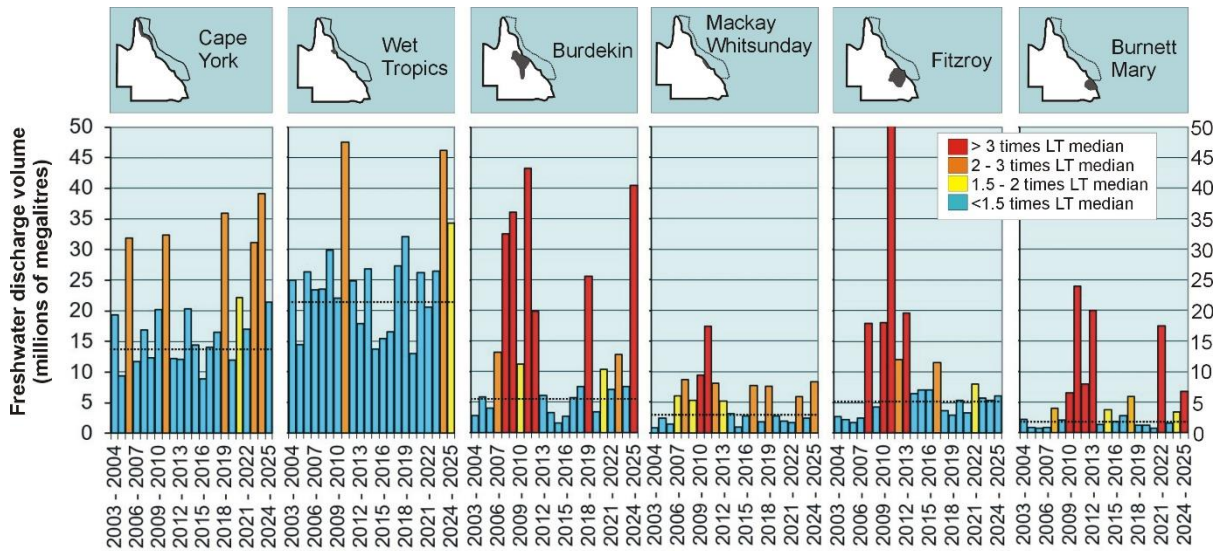


Figure 12. Annual water year (1 October to 30 September) discharge from each region for 2003–04 to 2024–25. Image extracted from Gruber *et al.* (2026).

Temperature

Sea surface temperatures over the 2025 summer were above long-term averages and within the 6-8 degree heating weeks (DHW, NOAA 2018) for which coral bleaching was probable in the northern Wet Tropics and close to the coast in the Burdekin region (Fig. 13). However, no major loss of coral was attributed to these 2025 sea surface temperatures.

Within-canopy temperature in seagrass meadows was the sixth warmest on record, and the fourth consecutive year of above-average temperatures.

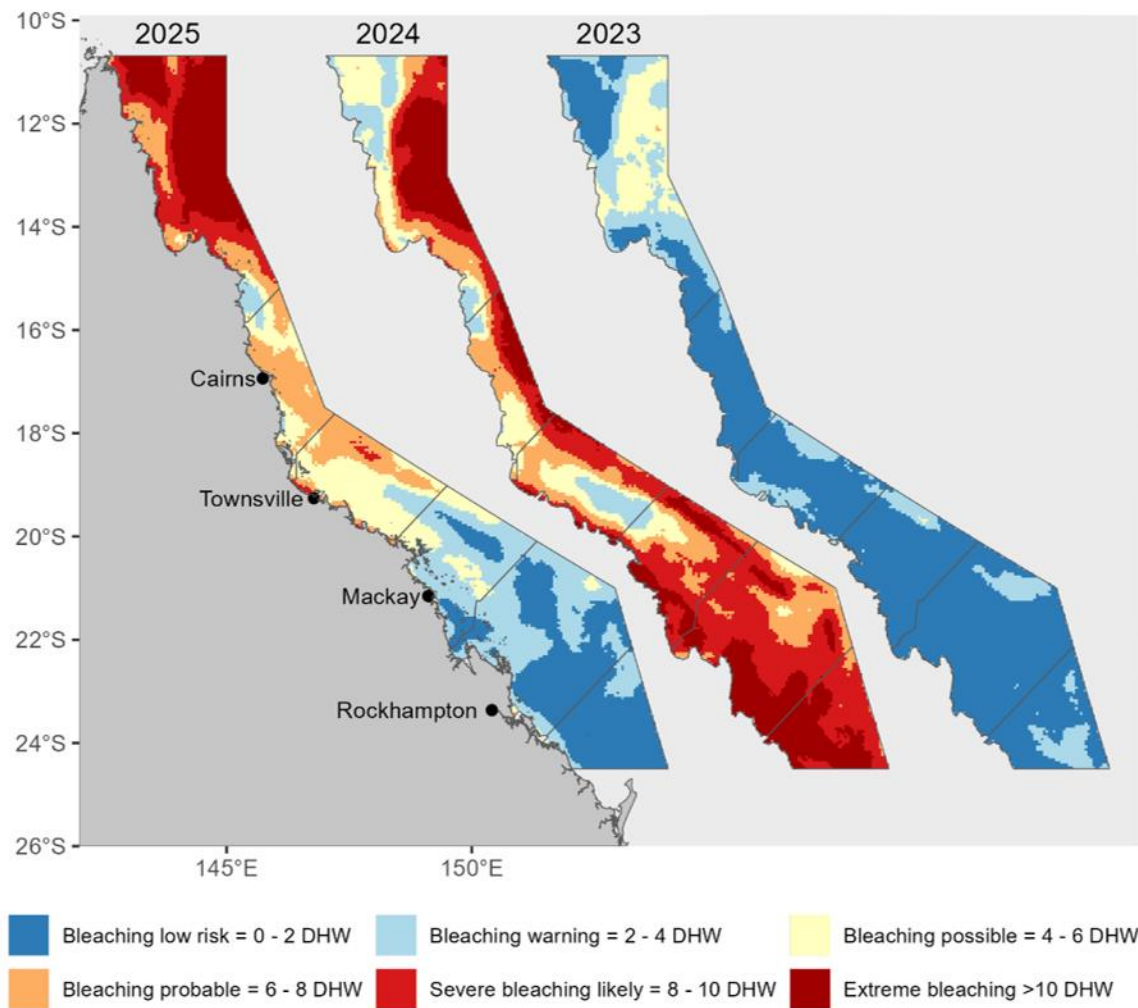


Figure 13. Annual degree heating week (DHW) estimates for the Reef for the past 3 years. Data are the annual maximum estimates for each ~25 km² pixel. Data were sourced from NOAA Coral Reef Watch. Image extracted from Thompson et al. (2026).

Regional summaries

Cape York

In the 2024–25 monitoring season, *in situ* water quality monitoring was conducted at 21 routine sites, sampled 4 to 5 times per year during ambient conditions. Flood event monitoring was also conducted from December to March along the Normanby and Annan-Endeavour River transects. Seagrass was monitored in 7 locations (Fig. 14) in the late dry season. For safety reasons, the MMP does not monitor inshore coral reefs in the Cape York region.

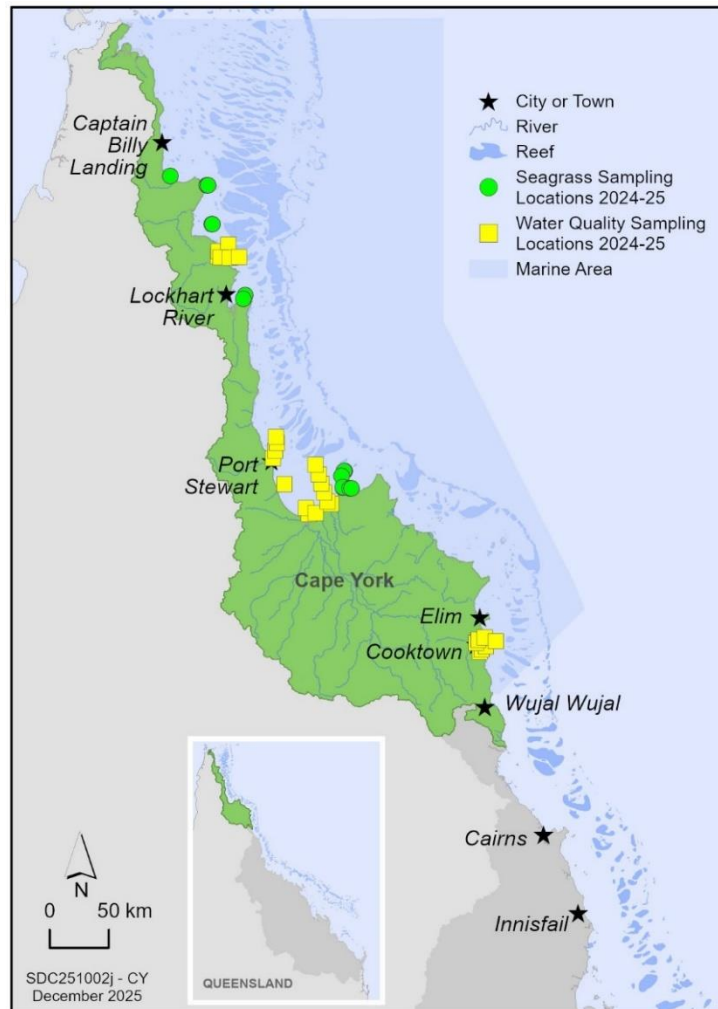


Figure 14. Water quality and seagrass sampling sites in the Cape York region shown with water body boundaries. Note coral monitoring is not conducted in Cape York as part of MMP.

Environmental conditions

The 2024–25 period was warmer than the previous year and the fifth warmest year since intertidal within-canopy temperature monitoring began in the region. Maximum within-canopy temperatures exceeded 35°C for a total of 37 days, which was higher than the two previous years.

Discharge from rivers in the Cape York region was between 1 to 1.5 times the long-term median discharge for all sub-regions. While there was typical high discharge throughout the wet season, there were no major above-average magnitude flood events.

Water quality

The Annual Condition Water Quality Index for the Cape York region overall was 'good' for the 2024–25 monitoring year (Fig. 15b). Water quality improved across most subregions following a deterioration in 2023–24, with the exception of the Annan-Endeavour subregion which declined as a result of on-going impacts associated with Tropical Cyclone Jasper, resulting in a 'moderate' annual WQ Index. The Normanby, Stewart, and Pascoe subregions were 'good'. This was the first 'good' score for the Normanby and Stewart subregions.

Progress towards Water Quality Guideline Values (GV):

- GVs were met for Particulate Phosphorus and Total Suspended Solids in all subregions
- GVs were met in some subregions for nitrates/nitrites (NO_x), phosphate (PO₄), particulate nitrogen (PN), and Chl-*a*.
- Secchi depth exceeded GVs in all subregions.
- Median wet season turbidity and Chl-*a* met the GVs for mid-shelf water bodies and for open coastal water bodies.

(a) Long-term Water Quality Index

Not available yet, as Water Quality monitoring only started in Cape York in 2017.

(b) Annual Condition Water Quality Index

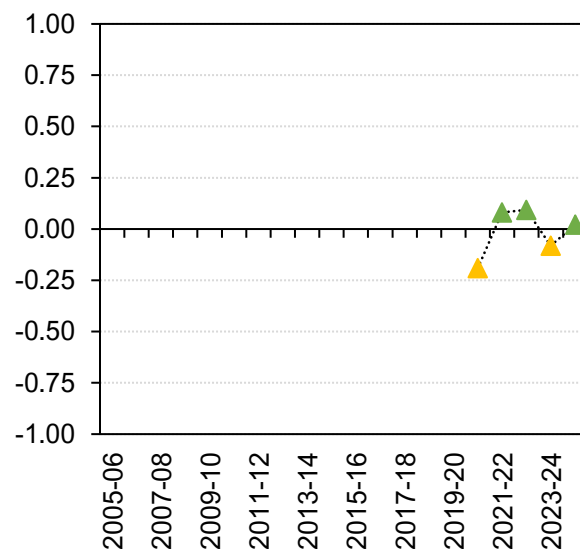


Figure 15. Temporal trends in (a) Long-term and (b) Annual Water Quality Indices for the Cape York region. The long-term Index is insensitive to year-to-year variability, while the annual Index is sensitive to year-to-year variability. Values are scaled from -1.0 to 1.0 and graded: **very good** (1 to 0.5), **good** (0.5 to 0), **moderate** (< 0 to -1/3), **poor** (< -1/3 to -2/3), **very poor** (< -2/3 to -1). Note scores are unitless. Data source: Gruber *et al.* (2026).

Potential exposure of coastal waters and ecosystems to pollutants (assessed using remote sensing techniques):

- Approximately 94% of Cape York waters were not exposed to a potential risk, which was similar to the long-term average (93%). The mid-shelf and offshore waterbodies were largely exposed to no/very low risk (98% and 100%, respectively). 66% of enclosed coastal waters and 7% of open coastal waters were exposed to the highest categories of potential risk (III and IV).
- Approximately 97% of coral reefs in Cape York were not exposed to a potential risk (long-term average: 97%). About 2% of corals were in the highest exposure categories (III and IV, combined 149 km²) and they were all inshore and enclosed coastal reefs.
- Approximately 15% (398 km²) of seagrasses in Cape York were exposed to the highest categories of potential risk (III and IV) and they were all inshore and enclosed coastal seagrasses.

Seagrass

Seagrass condition was only assessed in the late dry season in Cape York, which precedes the summer when the highest rainfall, river discharge and temperatures occurred. Seagrass meadow condition across the Cape York region in 2024–25 declined to ‘poor’ (Fig. 16) due to a deterioration of both the abundance and resilience scores (Fig. 17). For the indicators:

- abundance score was ‘poor’
- resilience score was ‘poor’.

Seagrass abundance declined to its second lowest score and lowest average percent cover since monitoring commenced (Fig. 17). This decline was driven by deterioration at all habitats, which was greatest in coastal intertidal and reef subtidal habitats, particularly in the south of the region. Due to the timing of surveys, this is the first seagrass monitoring data to capture the effects of Tropical Cyclone Jasper in December 2023.

Reproductive effort declined to zero across coastal and reef habitats in 2024–25, consistent with historically low reproductive activity and limited seed production in reef intertidal meadows. In 2024–25, the resilience score for intertidal seagrass meadows in Cape York reached the lowest on record, continuing a steady decline since 2016–17.

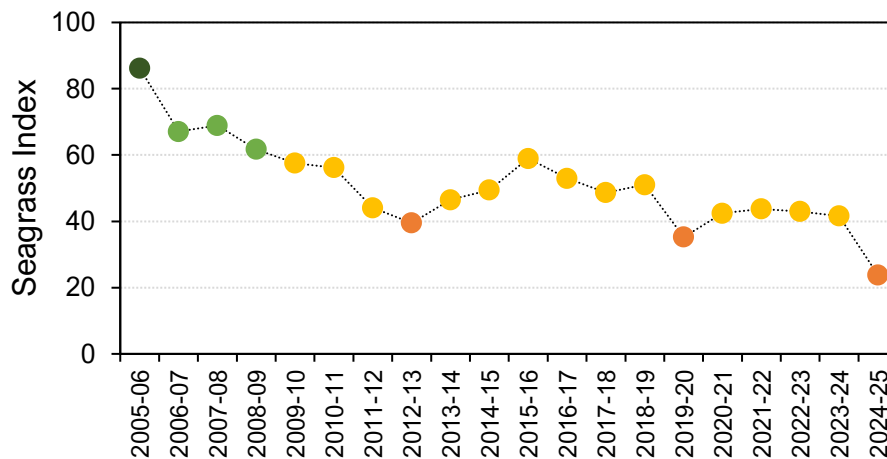


Figure 16. Seagrass Condition Index for the Cape York region from 2005–06 to 2024–25. Black line with circles represents the index and values are scaled from 0–100 and graded: **very good** (81–100), **good** (61–80), **moderate** (41–60), **poor** (21–40), **very poor** (0–20). Note, scores are unitless. Data source: McKenzie *et al.* (2026).

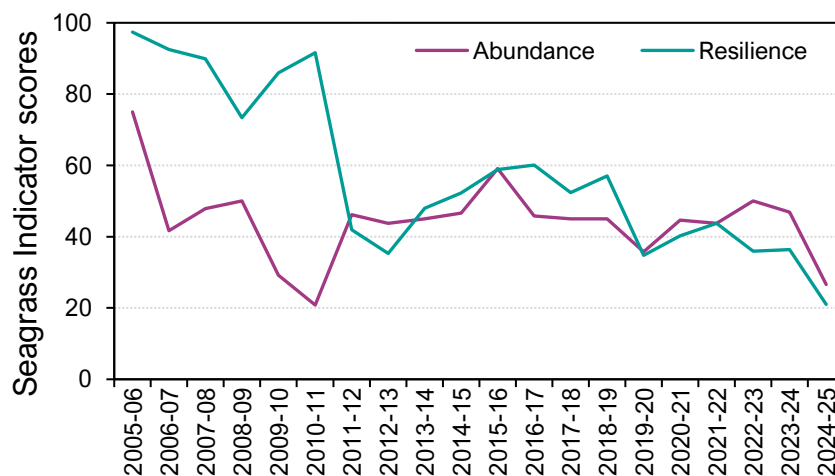


Figure 17. Seagrass Indicator scores of abundance and resilience for the Cape York region from 2005–06 to 2024–25. Values are scaled from 0–100 and graded: very good (81–100), good (61–80), moderate (41–60), poor (21–40), and very poor (0–20). Note, scores are unitless. Data source: McKenzie *et al.* (2026).

Wet Tropics

In the 2024–25 monitoring season, *in situ* water quality monitoring was conducted at 17 routine sites, sampled 3 to 10 times per year during ambient conditions and at 12 additional sites during major flood events. Pesticide sampling was undertaken at 3 routine sites over the wet season and at additional sites during flood events. Seagrass was monitored at 6 locations (Fig. 18) in the late wet and late dry seasons, while corals were monitored at 12 sites in the dry season by the MMP and 2 sites by AIMS' Long-Term Monitoring Program (often in the late wet season).

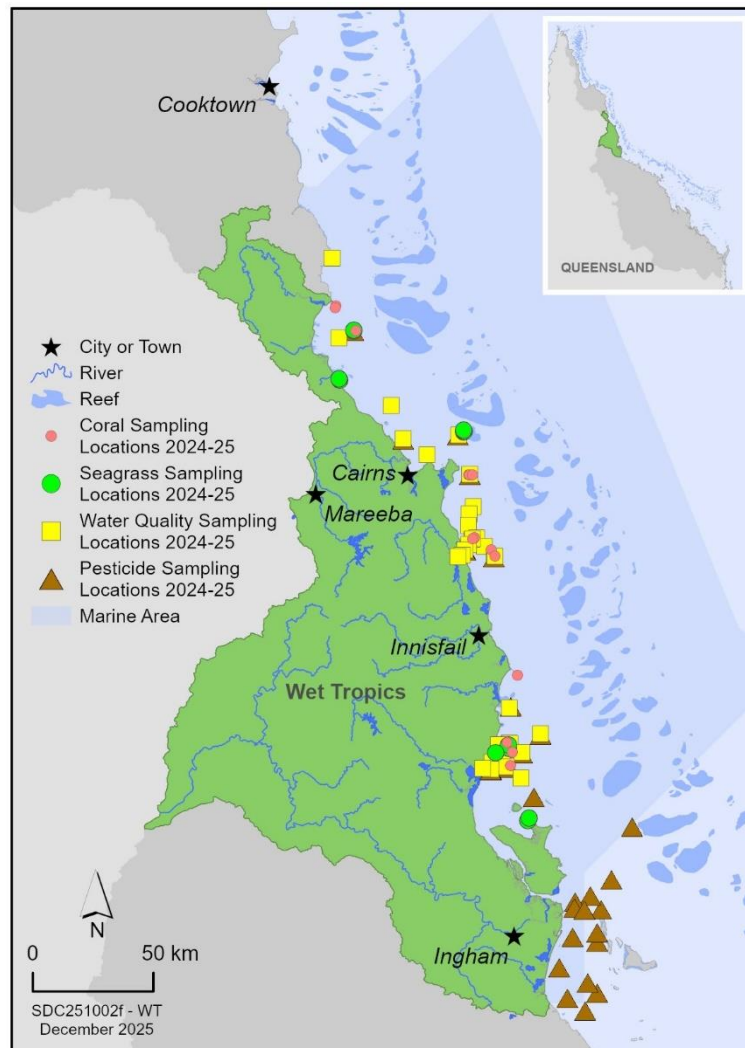


Figure 18. Map showing sampling sites in the Wet Tropics region. Note that water quality sites shown include flood event monitoring sites in addition to routine monitoring sites.

Environmental conditions

Temperature was not a major stressor in the Wet Tropics region in the 2024–25 monitoring season. Intertidal seagrass within-canopy temperature varied strongly across the region, with some sites lower than, at, or above the long-term average.

In the 2024–25 monitoring year, the southern Wet Tropics region experienced significant rainfall resulting in high flow events that impacted the inshore Reef. The combined discharge

from the Daintree, Mossman, and Barron basins was around 1.6 times the long-term median. Discharge from the Johnstone Russell-Mulgrave basins was 1.3 times the long-term median, following a large discharge year in 2023–24. Discharge from the Tully-Murray-Herbert basins was 2.0 times the long-term median which also followed an above-average year in 2023–24.

Notable flood events

The Tully River at the Euramo gauge measured total discharge of 4.2 million ML for the 2024–25 water year (approximately 1.35 times the long-term median). The gauge recorded two flow events that exceeded flood threshold levels, with the first event peaking above the moderate flood level (8.0 m) at 8.7 m on 2 February 2025 (85,000 ML/day), and the second event peaking above the minor flood level (6.0 m) at 7.8 m on 17 March 2025.

The Herbert River at the Ingham gauge measured the flow event on 2 February 2025 as reaching a peak of 14.9 m, well above the major flood level (12.0 m), which caused major flooding in the Ingham district. This was one of the highest peaks measured in the gauge's 110 years of flow monitoring. Peak flows on 2-3 February reached a volume of around 495,000 ML/day. The river exceeded the flood level for ~10-14 days during this event.

Water quality

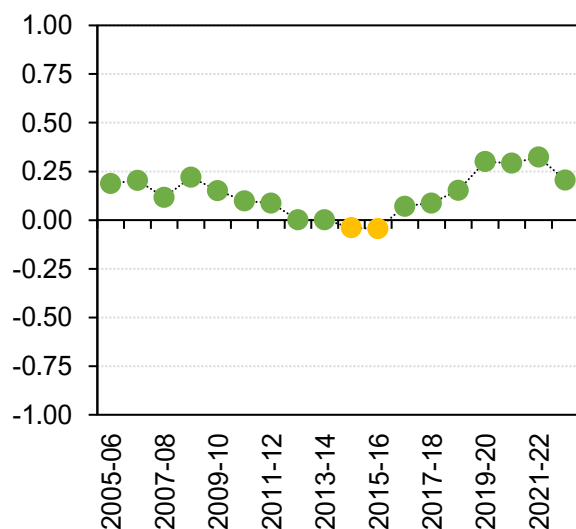
The Annual Water Quality Index for the Wet Tropics region was ‘moderate’ but deteriorating for the 2024–25 monitoring year (Fig. 19), which is related to high river discharge over the past 2 years. The Long-term Water Quality Index trend has seen a decline in all sub-regions in 2024–25 after a period of stability and improvement.

Subregion	Long-term Water Quality index	Annual condition Water Quality index
Barron-Daintree	‘good’	‘moderate’, declined
Johnstone Russell-Mulgrave	‘good’	‘moderate’, stable
Herbert-Tully	‘moderate’	‘moderate’, stable

Progress towards Water Quality Guideline Values:

- TSS and PN met GVs in all subregions.
- Chl-a met GVs for two of the three subregions.
- NO_x, PO₄, PP, Secchi depth, and turbidity did not meet water quality GVs in any subregions in the Wet Tropics. However, NO_x has showed a trend of improvement in the Tully subregion over the period from 2015–2025, despite recent wet years.
- Many water quality indicators showed a trend of stability (no net improvement or deterioration). However, PN, PO₄, PP, and Secchi depth showed trends of deterioration in one or more subregions.

(a) Long-term Water Quality Index



(b) Annual Condition Water Quality Index

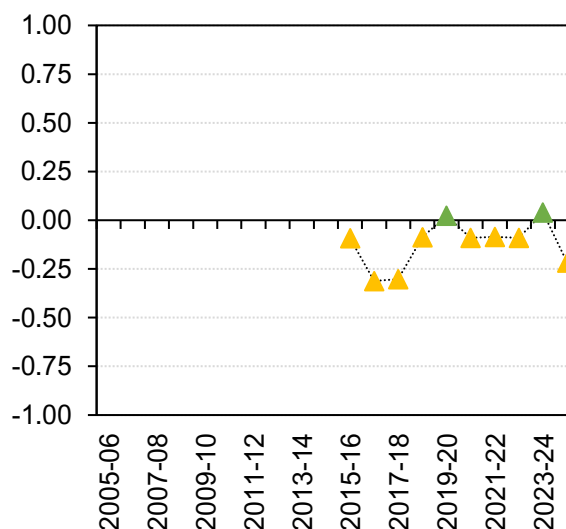


Figure 19. Temporal trends in (a) Long-term and (b) Annual Water Quality Indices for the Wet Tropics region. The long-term Index is insensitive to year-to-year variability, while the annual Index is sensitive to year-to-year variability. Values are scaled from -1.0 to 1.0 and graded: **very good** (1 to 0.5), **good** (0.5 to 0), **moderate** (< 0 to -1/3), **poor** (< -1/3 to -2/3), **very poor** (< -2/3 to -1). Note scores are unitless. Data source: Gruber *et al.* (2026).

Potential exposure of coastal waters and ecosystems to pollutants (assessed using remote sensing techniques):

- Approximately 79% of the Wet Tropics region was not exposed to a potential risk, which was below the long-term average (88%), indicating wetter-than-average conditions. This is potentially an underestimate due to extensive cloud cover limiting satellite data collection this year. The mid-shelf and offshore waterbodies were largely exposed to no/very low risk (99% for both). Conversely, 97% of enclosed coastal waters and 41% of open coastal waters were exposed to the highest categories of potential risk (III and IV).
- Approximately 94% of coral reefs in the Wet Tropics region were not exposed to a potential risk. However, 2% (58 km²) of reefs were exposed to the highest categories of potential risk (III and IV), and they were all enclosed coastal or open coastal reefs. Note: Only 3% (~80 km²) of Wet Tropics corals occur in inshore waters.
- Approximately 89% (208 km²) of seagrasses in the Wet Tropics were exposed to the highest categories of potential risk (III and IV). Note: 98% (~230 km²) of Wet Tropics seagrass occurs in inshore waters.

Routine pesticide monitoring

- The highest total pesticide concentrations observed in this region were found at Dunk Island in January and February 2025 (81 ng·L⁻¹ in passive samplers and 173 ng·L⁻¹ in grab samples respectively). This was the highest total pesticide concentration of all grab samples taken during the 2024–25 monitoring season (Fig. 4b). Of the 3 routine sites in the Wet Tropics, Low Isles typically had the lowest pesticide concentrations in both passive and grab samples.
- Dunk Island had the highest diuron concentration (47 ng·L⁻¹) of all 2024–25 routine monitoring sites.

Flood event monitoring

Water quality sampling was undertaken from the 6-9 February 2025 in response to major flooding in the Herbert River. Monitoring across Halifax Bay, Palm Islands, and mid-shelf reefs showed strong salinity gradients, high suspended sediments, variable nutrients, and elevated Chl-a in mid-salinity zones, reflecting typical plume dynamics and productivity responses.

The Tully River flood plumes were not specifically targeted for event sampling in 2025, as routine sampling of the Tully transect was conducted close to several discharge peaks.

Satellite imagery captured the extensive flood plume in the southern Wet Tropics region during the February event, illustrating the extent of turbid waters as well as the presence of 'island wakes' which show less turbid waters on the offshore side of several islands (Fig. 20).



Figure 20. Copernicus Sentinel-2 data of the Tully plume (6 February 2025, True colour image). Snapshot extracted from the Copernicus Browser (@Sentinel Hub) by TropWATER, James Cook University <https://browser.dataspace.copernicus.eu/> Image extracted from Gruber et al. (2026).

Pesticide sampling was undertaken in response to the high flow event in the Herbert River catchment and adjacent areas in February 2025. Additional sampling at routine sites in the Tully subregion was also undertaken close to when the discharge peaks occurred (Fig. 18).

Pesticides were detected in all flood plume samples, with the herbicides diuron, hexazinone and metolachlor most commonly detected. Metolachlor exceeded the 99% freshwater species protection guidelines (Halifax Bay and Palm Island Group). Diuron values remained slightly below the marine guideline value.

The Pesticide Risk Metric (PRM) showed a low risk in the majority of samples. However, the PRM was greatly exceeded at Pandora Reef (PRM of 7.8%) and Forrest Beach (PRM of 5.4%) during the peak of the flood events. This represents a moderate risk (>5%) to aquatic species. Also of note was a site at Dunk Island with a PRM of 2.5% (remaining within the low-risk PRM category).



Figure 21. Flood plumes in the Herbert region following the high flow event in February 2025 (©TropWATER, James Cook University).

Seagrass

The Wet Tropics Seagrass Index experienced a marginal decline in 2024–25 and is still ‘poor’. Seagrass condition showed a minor drop in both the northern and southern Wet Tropics subregions, maintaining a status of ‘moderate’ and ‘poor’, respectively.

In the northern Wet Tropics, seagrass abundance was ‘moderate’ and resilience was ‘poor’. Seagrass abundance marginally improved compared to the previous year, driven by increasing scores for reef intertidal and subtidal habitats, as scores for the coastal intertidal habitat declined by a third from the previous period.

In the southern Wet Tropics, seagrass abundance was ‘very poor’ and resilience was ‘poor’. The abundance score marginally improved, but the indicator remained ‘very poor’. The improvement was related to marginal increases in abundance at the coastal intertidal site (Lugger Bay) and reef intertidal habitat (Dunk Island).

Resilience in the seagrass meadows of the northern Wet Tropics continued to decline. While there was an improvement in the resilience of the inshore reef meadows at Green Island, this was overshadowed by a deterioration in the resilience of the coastal intertidal meadows at Yule Point and the reef meadows at Low Isles. Resilience in the northern and southern Wet Tropics declined to ‘poor’ in 2024–25, continuing a three-year downward trend driven by low abundance and the absence of reproductive structures at coastal sites.

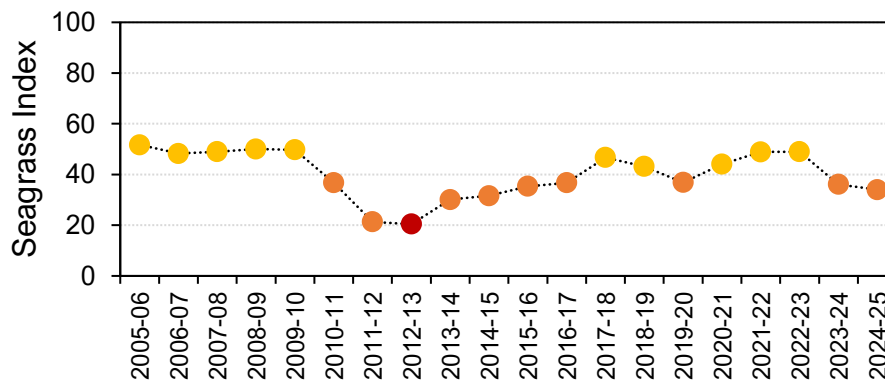


Figure 22. Seagrass Condition Index for the Wet Tropics region from 2005–06 to 2024–25. Black line with circles represents the index and values are scaled from 0–100 and graded: **very good** (81–100), **good** (61–80), **moderate** (41–60), **poor** (21–40), **very poor** (0–20). Note, scores are unitless. Data source: McKenzie *et al.* (2026).

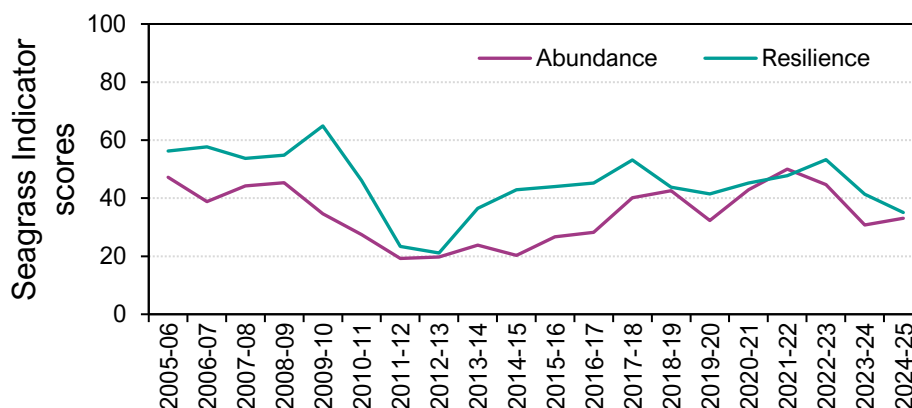


Figure 23. Temporal trends in the Seagrass Indicator scores of abundance and resilience for the Wet Tropics region from 2005–06 to 2024–25. Values are scaled from 0–100 and graded: **very good** (81–100), **good** (61–80), **moderate** (41–60), **poor** (21–40), and **very poor** (0–20). Note, scores are unitless. Data source: McKenzie *et al.* (2026).

Coral

Barron-Daintree

The Coral Index remained 'poor' and declined to the lowest level recorded. Results in 2024 revealed reefs had been severely impacted by freshwater inundation and waves associated with the passage of Tropical Cyclone Jasper. The most impacted reef was Snapper South, where all corals at the monitoring site were killed. Buoying the Coral Index in 2024 were 'good' scores for the Macroalgae and Cover change indicators, and the timing of surveys for one reef, Low Isles, which was last surveyed prior to the passage of Tropical Cyclone Jasper. Results for 2025 show a further decline as: (1) the resurvey of Low Isles revealed this reef was also impacted by the 2024 events, (2) the initial rate of hard coral recovery has led to a reduction in the Cover change score, and (3) the recolonisation of parts of the reef by macroalgae has reduced the Macroalgae indicator score.

Note: The Coral Index for the 2023-24 monitoring year has been revised from 'moderate' (0.42) to 'poor' (0.40) following a change in the calculation method for the Composition indicator. Composition indicator values are now set to zero for reefs at which there is zero cover of hard corals. Historical Coral Indices have been revised accordingly.

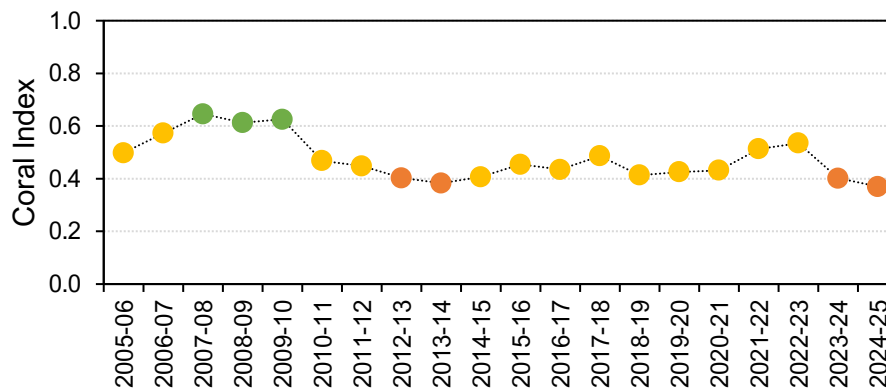


Figure 24. Temporal trend in Coral Index for the Barron-Daintree sub-region from 2005–06 to 2024–25. Values are scaled from 0.0–1.0 and graded: **very good** (0.81–1.00), **good** (0.61–0.80), **moderate** (0.41–0.60), **poor** (0.21–0.40), **very poor** (0.0–0.20). Note, scores are unitless. Data source: Thompson *et al.* (2026).

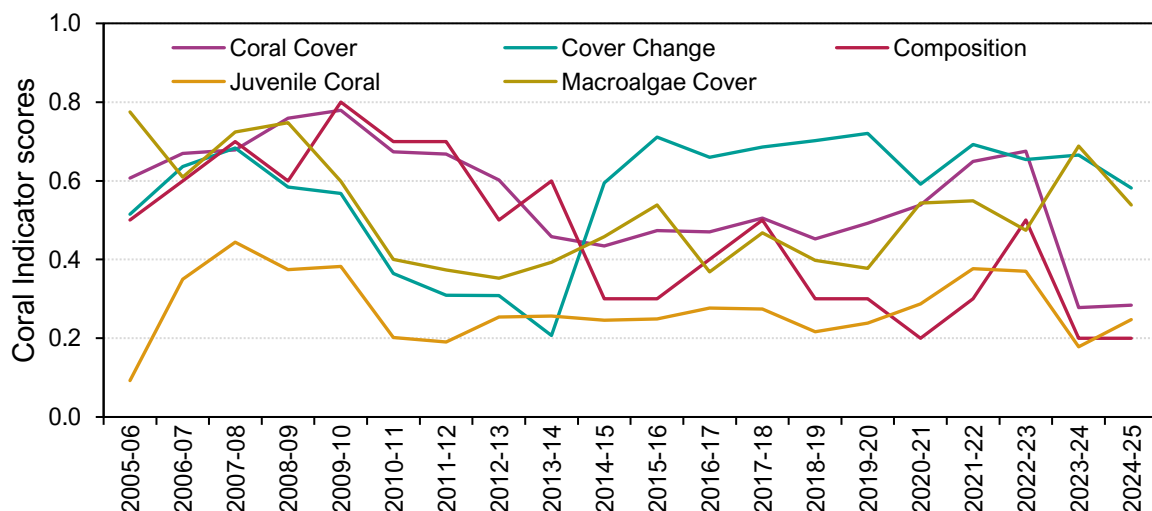


Figure 25. Temporal trends in the Coral Indicator scores of Coral cover, Cover change, Composition, Juvenile coral, and Macroalgae cover for the Barron-Daintree sub-region from 2005–06 to 2024–25. Values are scaled from 0–1.00 and graded: **very good** (0.81–1.00), **good** (0.61–0.80), **moderate** (0.41–0.60), **poor** (0.21–0.40), and **very poor** (0.00–0.20). Note, scores are unitless. Data source: Thompson *et al.* (2026).

Johnstone Russell-Mulgrave

The Coral Index remained 'moderate' and stable since declining between 2021 and 2024. The recent declines were due to the cumulative impacts of coral bleaching, Tropical Cyclone Jasper and crown-of-thorns starfish that variously reduced coral cover across the region. Since 2022, the Macroalgae indicator has declined from 'good' to 'poor', and this is likely influencing the ongoing 'poor' Juvenile indicator score. Despite the ongoing removal of crown-of-thorns starfish by the Crown-of-thorns Starfish Control Program, outbreak densities were again observed on the eastern aspects of each island, or island group.

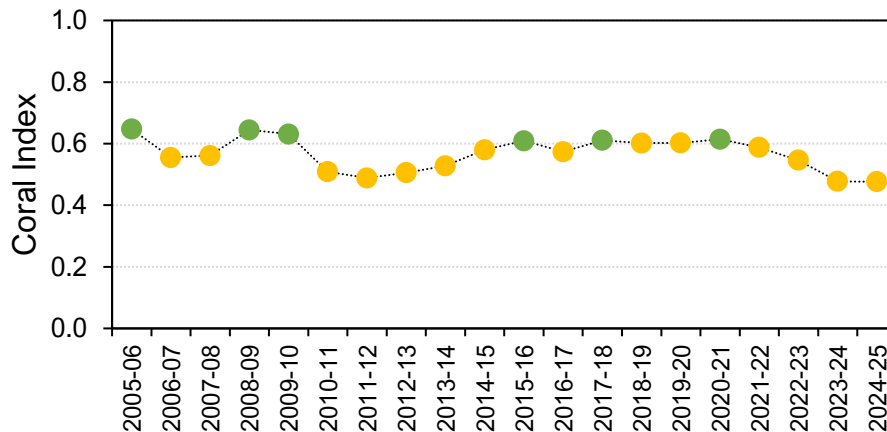


Figure 26. Temporal trend in Coral Index for the Johnstone Russell-Mulgrave sub-region from 2005–06 to 2024–25. Values are scaled from 0.0–1.0 and graded: **very good** (0.81–1.00), **good** (0.61–0.80), **moderate** (0.41–0.60), **poor** (0.21–0.40), **very poor** (0.0–0.20). Note, scores are unitless. Data source: Thompson *et al.* (2026).

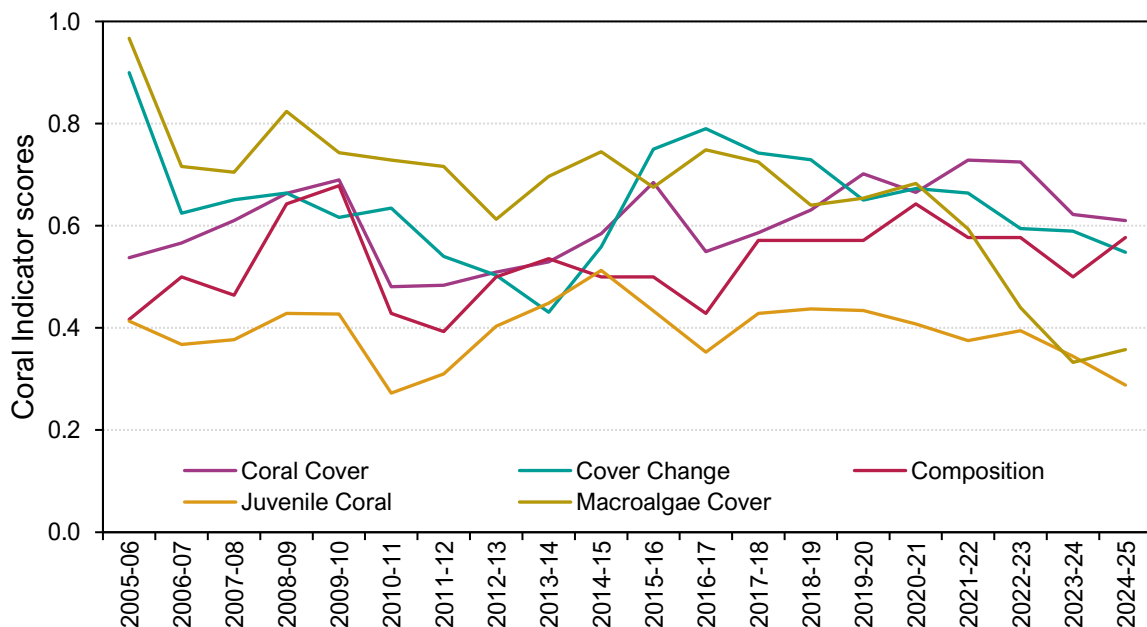


Figure 27. Temporal trends in the Coral Indicator scores of Coral cover, Cover change, Composition, Juvenile coral, and Macroalgae cover for the Johnstone Russell-Mulgrave sub-region from 2005–06 to 2024–25. Values are scaled from 0–1.00 and graded: very good (0.81–1.00), good (0.61–0.80), moderate (0.41–0.60), poor (0.21–0.40), and very poor (0.00–0.20). Note, scores are unitless. Data source: Thompson *et al.* (2026).

Herbert-Tully

The Coral Index has continued to decline but remains 'moderate'. The decline in 2025 largely captures the exposure of shallow sites at Dunk Island and Bedarra Island to low salinity floodwaters. The floods killed corals and resulted in reduced scores for the Coral cover, Juvenile coral and Composition scores but improved scores for the Macroalgae indicator as macroalgae were also impacted by the flood. In other areas such improvements in Macroalgae scores following a disturbance event have proven short-lived and it is likely scores for this indicator will decline next year as the macroalgae community becomes reestablished.

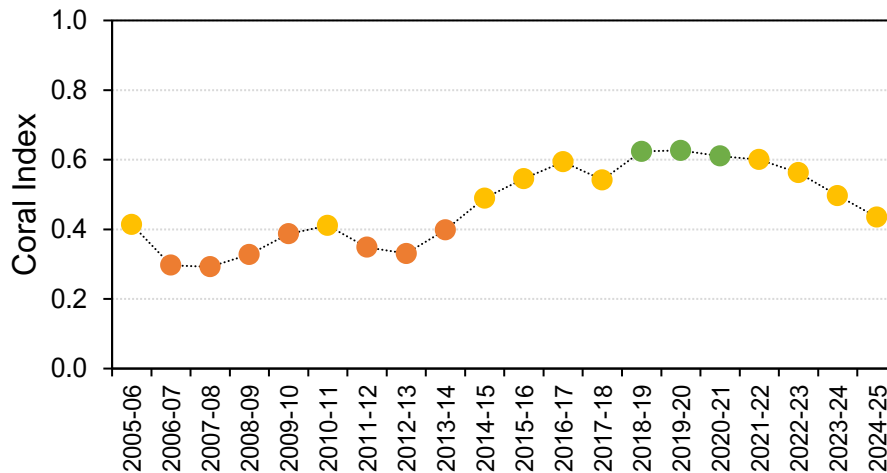


Figure 28. Temporal trend in Coral Index for the Herbert-Tully sub-region from 2005–06 to 2024–25. Values are scaled from 0.0–1.0 and graded: **very good** (0.81–1.00), **good** (0.61–0.80), **moderate** (0.41–0.60), **poor** (0.21–0.40), **very poor** (0.0–0.20). Note, scores are unitless. Data source: Thompson *et al.* (2026).

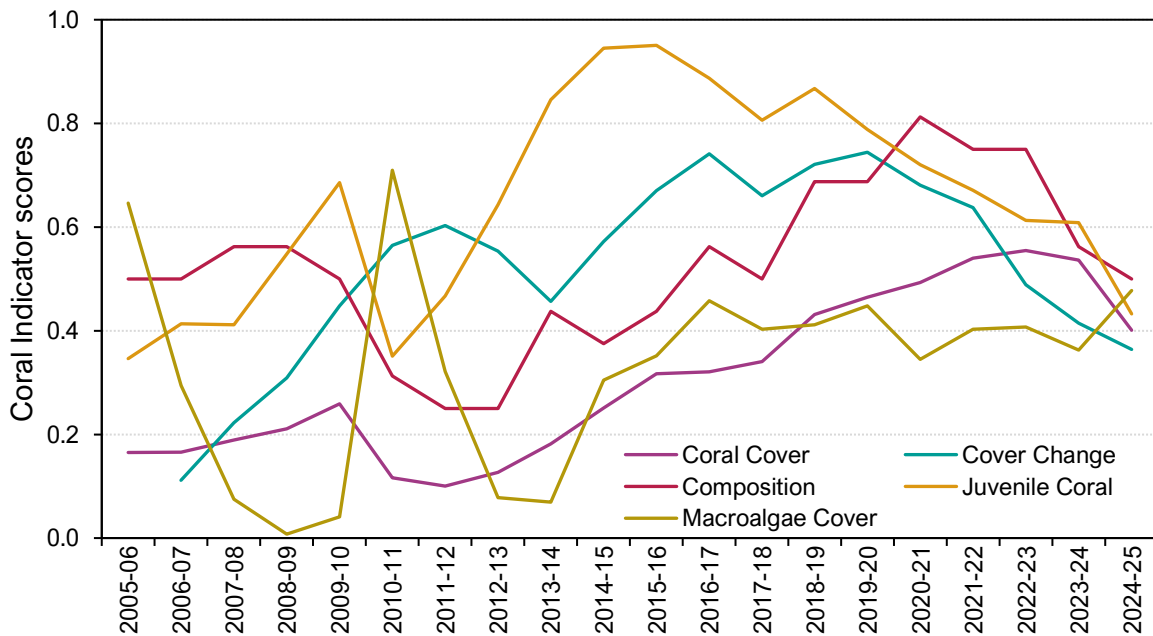


Figure 29. Temporal trends in the Coral Indicator scores of Coral cover, Cover change, Composition, Juvenile coral, and Macroalgae cover for the Herbert-Tully sub-region from 2005–06 to 2024–25. Values are scaled from 0–1.00 and graded: very good (0.81–1.00), good (0.61–0.80), moderate (0.41–0.60), poor (0.21–0.40), and very poor (0.00–0.20). Note, scores are unitless. Data source: Thompson *et al.* (2026).

Burdekin

In the 2024–25 monitoring season, *in situ* water quality monitoring was conducted at 6 routine sites, during both the dry and wet seasons, and at 9 additional sites during major flood events. Pesticide sampling was undertaken at one routine site over the wet season and at additional sites during the high flow events in the Burdekin region. Seagrass was monitored at 4 locations in the late dry and 3 in the late wet seasons. Corals were monitored at 6 locations by the MMP, and at 2 locations by the AIMS' LTMP, all in the dry season (Fig. 30).

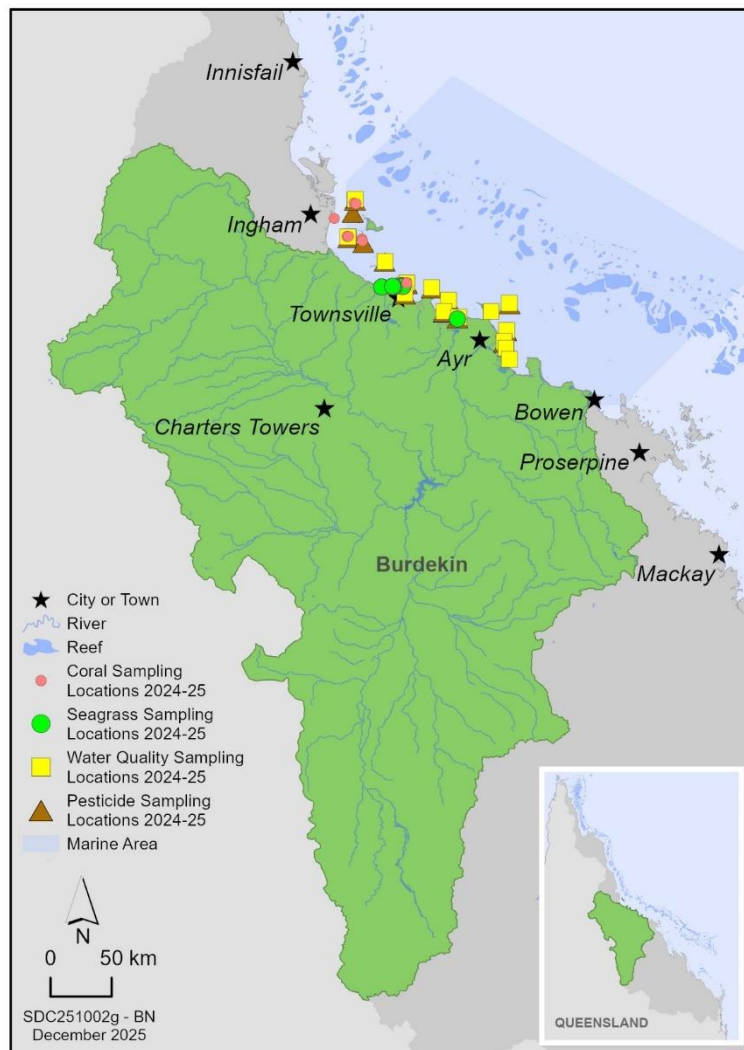


Figure 30. Map showing sampling locations in the Burdekin region. Note that water quality sites shown include flood event monitoring sites in addition to routine monitoring sites.

Environmental conditions

Temperature stress was minimal in the Burdekin region during the 2024-25 monitoring season. Intertidal seagrass within-canopy temperatures were below the long-term average. Maximum intertidal within-canopy temperatures exceeded 35°C for a total of 27 days.

The combined discharge from the Burdekin and Haughton basins was around 6.9 times the long-term median, and follows 4 years of above-median discharge (2020–21, 2021–22, 2022–23, 2023–24).

Notable flood events

The Burdekin River recorded 2 major flood events in 2024–25. The largest flow event reached 15.04 m on 11 February 2025, peaking above the moderate flood level (13.0 m) at the Burdekin River at Clare gauge. The Burdekin River remained above the moderate flood level for 7 consecutive days and above the minor flood level for 13 consecutive days. The peak daily flow volume was just over 1,600,000 ML/day, the largest daily discharge since 2008–09. On 2 April 2025, the Burdekin River experienced another notable flow event, recording a peak above the minor flood level (9.0 m) at 10.9 m.

The total discharge measured at the Burdekin River at Clare gauge for the 2024–25 water year was 30.6 million ML, making it the fourth largest discharge on the 104-year record, and the highest discharge year since 2010–11.

Water quality

The Annual Condition Water Quality Index for the Burdekin region was ‘good’ for the 2024–25 monitoring year, which was similar to 2023–24. The long-term Water Quality index for this region is stable, after improving during the late 2010s.

Progress towards Water Quality Guideline Values:

- GVs were met for Chl-*a*, TSS, PN, and PP.
- GVs were exceeded for NO_x, Secchi depth, turbidity, and PO₄

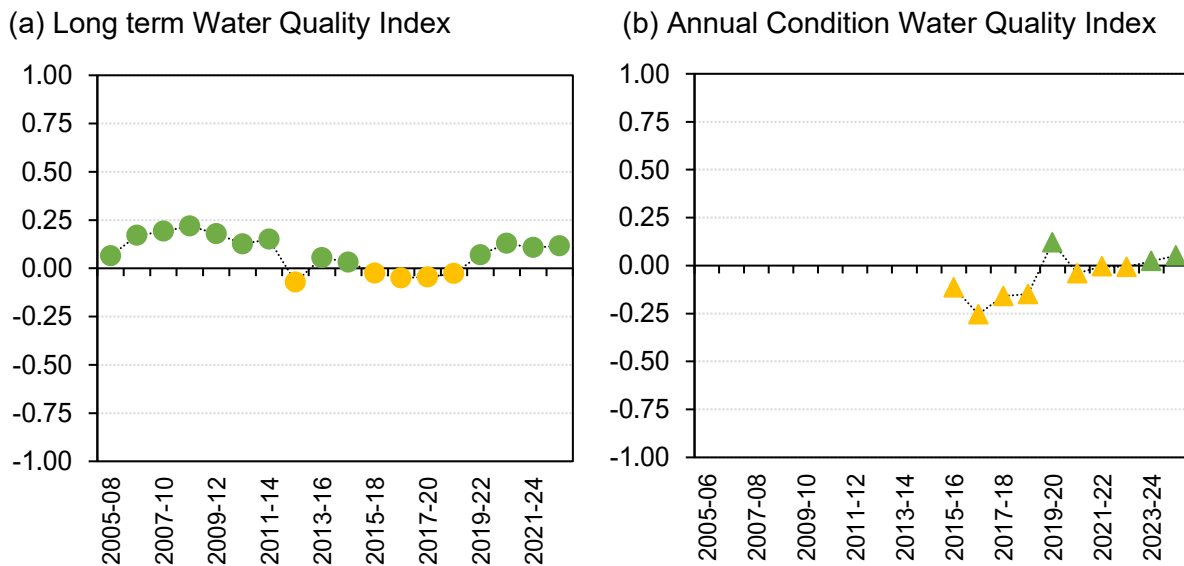


Figure 31. Temporal trends in (a) Long-term and (b) Annual Water Quality Indices for the Burdekin region. The long-term Index is insensitive to year-to-year variability, while the annual Index is sensitive to year-to-year variability. Values are scaled from -1.0 to 1.0 and graded: **very good** (1 to 0.5), **good** (0.5 to 0), **moderate** (< 0 to -1/3), **poor** (< -1/3 to -2/3), **very poor** (< -2/3 to -1). Note scores are unitless. Data source: Gruber *et al.* (2026).

Potential exposure of coastal waters and ecosystems to pollutants (assessed using remote sensing techniques):

- Approximately 15% (7,093 km²) of Burdekin waters were exposed to a potential risk, which exceeded the long-term average (10%). This is potentially an underestimate due to extensive cloud cover limiting satellite data collection. 99% of enclosed coastal waters were exposed to the highest risk categories (III and IV), along with 18% of mid-shelf waters, but <1% of offshore waters.
- Approximately 99% of coral reefs in the Burdekin region were not exposed to a potential risk (this is because only 1% (<40 km²) of the Burdekin corals occur in inshore waters).
- 65% (457 km²) of seagrasses in the Burdekin region were exposed to the highest risk categories (III and IV). Almost all (99%, ~700km²) seagrasses in the Burdekin region are in inshore waters.

Routine pesticide monitoring

- The highest total pesticide concentrations observed at the monitoring site in this region (Haughton River Mouth) was 95 ng·L⁻¹ in the December 2024 passive sample and 54 ng·L⁻¹ in the grab sample taken 2 January 2025.

Flood event monitoring

The Burdekin River discharge event in February 2025 resulted in a large flood plume that extended along the inshore Reef from the Burdekin River mouth as far north as (and potentially beyond) the Palm Islands, and reaching offshore to the mid and outer shelf reefs (Fig. 32). The plume persisted for several weeks.

Additional intensive water quality sampling was undertaken in response to this high flow event on 8-9 February and 13-15 February, with monitoring efforts capturing the flood rise, peak and fall. Water quality results showed strong salinity gradients, high suspended sediment concentrations and elevated Chl-a concentrations extending well beyond the inshore Reef.



Figure 32. Copernicus Sentinel-2 data of the Burdekin plume (13 February 2025, True colour image). Snapshot extracted from the Copernicus Browser (@Sentinel Hub) by TropWATER, James Cook University (<https://browser.dataspace.copernicus.eu/>). Image extracted from Gruber et al. (2026).

Pesticide sampling was also undertaken during the February high flow event (Fig. 30). Pesticides were detected in all samples across the flood plume. The herbicide tebuthiuron exceeded the 99% freshwater species protection guidelines, and had the highest concentrations at the Burdekin River mouth, consistent with previous event sampling and confirming the Burdekin River as its primary source.

The Pesticide Risk Metric (PRM) threshold was exceeded at 6 event sampling sites, (i.e. greater than 1% species affected at 6 event sampling sites). The PRM for the sites was mainly influenced by non-PSII herbicides such as 2,4-D and metolachlor, with lesser contribution from PSII herbicides. Repeated sampling at two sites during the flood event showed changes to the PRM as the flood plume moved north.

Seagrass

The condition of seagrass meadows throughout the Burdekin region continued to decline in 2024–25, ultimately remaining in a ‘poor’ state. Condition indicators contributing to this were:

- abundance score was ‘poor’
- resilience score was ‘poor’.

The abundance indicator declined for the third consecutive year in a row, resulting in a drop from ‘moderate’ to ‘poor’ in 2024–25. This decline was a consequence of the deterioration in coastal intertidal and reef intertidal habitats, particularly those adjacent to Townsville and Magnetic Island. Conversely, seagrass abundance in reef subtidal habitats has increased at Magnetic Island. Overall, seagrass abundances have remained below the long-term average for the seventh year in a row.

The resilience indicator declined in 2024–25, reaching its third lowest score on record and the lowest since 2013. This decline was driven largely by reduced abundance of and lack of sexual reproduction among foundational species at reef intertidal habitats.

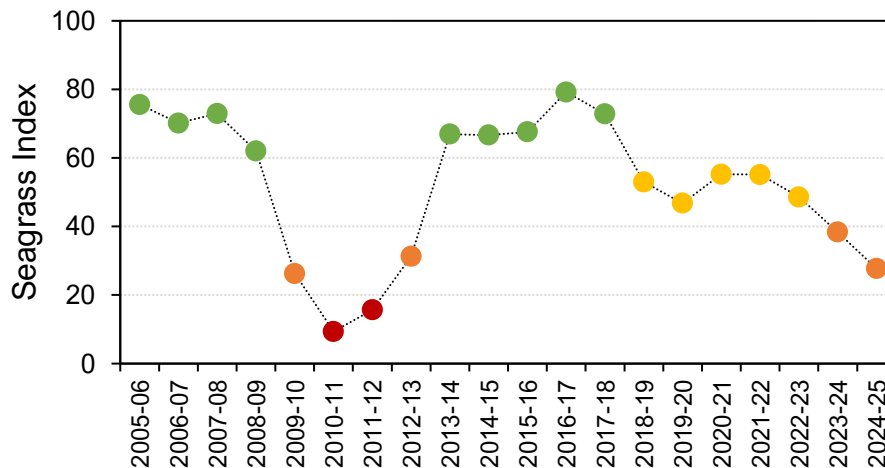


Figure 33. Seagrass Index for the Burdekin region from 2005–06 to 2024–25. Black line with circles represents the index and values are scaled from 0–100 and graded: **very good** (81–100), **good** (61–80), **moderate** (41–60), **poor** (21–40), **very poor** (0–20). Note, scores are unitless. Data source: McKenzie *et al.* (2026).

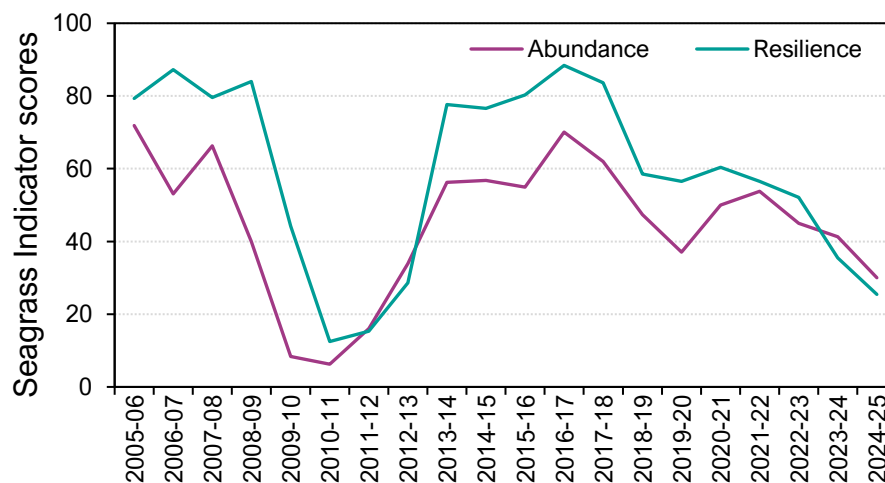


Figure 34. Temporal trends in the Seagrass Indicator scores of abundance and resilience for the Burdekin region from 2005–06 to 2024–25. Values are scaled from 0–100 and graded: very good (81–100), good (61–80), moderate (41–60), poor (21–40), and very poor (0–20). Note, scores are unitless. Data source: McKenzie *et al.* (2026).

Coral

In early 2025 reefs were exposed to both low salinity floodwaters and wave damage associated with a localised storm, both stemming from a particularly active monsoon. These events caused reductions in the Coral cover score at both 2 m and 5 m depths, and reductions in the Coral Composition and Juvenile coral scores at 2 m depths. The influence of these impacts was moderated by improved scores for the Macroalgae indicator as levels of macroalgae were also reduced by the summer's events. This marked improvement in the Macroalgae indicator score is likely to be temporary, as macroalgae typically recolonise swiftly following a disturbance event.

Burdekin reefs incurred minor impacts from thermal stress in 2020 and 2024 and were impacted by Tropical Cyclone Kirrily in the 2023–24 season. Despite these events, regional-scale coral cover has remained reasonably stable, with these events slowing further recovery rather than causing additional declines. Recovery was further constrained by regionally 'poor' scores for the Juvenile coral and Macroalgae indicators, suggesting water quality related pressures that continue to limit these reefs' recovery potential.

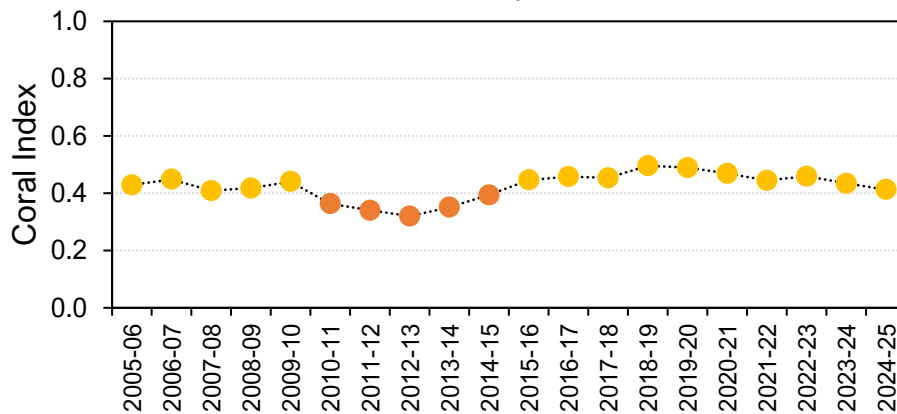


Figure 35. Temporal trend in Coral Index for the Burdekin region from 2005–06 to 2024–25. Values are scaled from 0.0–1.0 and graded: **very good** (0.81–1.00), **good** (0.61–0.80), **moderate** (0.41–0.60), **poor** (0.21–0.40), **very poor** (0.0–0.20). Note, scores are unitless. Data source: Thompson *et al.* (2026).

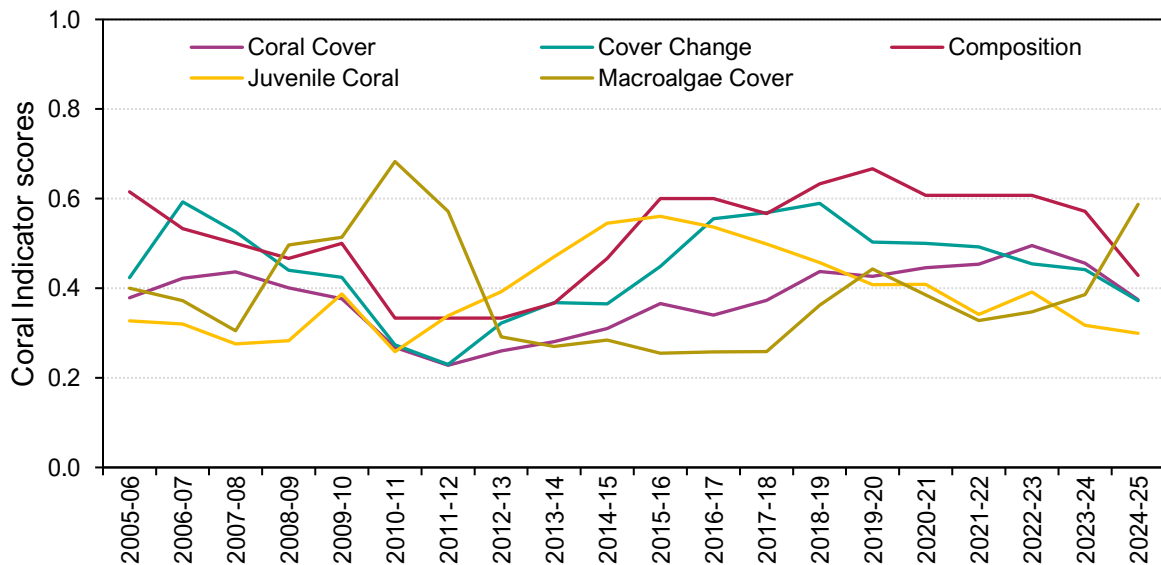


Figure 36. Temporal trends in the Coral Indicator scores of coral cover, cover change, coral composition, juvenile coral, and macroalgae cover for the Burdekin region from 2005–06 to 2024–25. Values are scaled from 0–100 and graded: very good (0.81–1.00), good (0.61–0.80), moderate (0.41–0.60), poor (0.21–0.40), and very poor (0.00–0.20). Note, scores are unitless. Data source: Thompson *et al.* (2026).

Mackay-Whitsunday

In the 2024–25 monitoring season, *in situ* water quality was monitored at 5 routine sites under ambient conditions 5 times across the year. Pesticide sampling was undertaken at 4 routine sites over the wet season. Seagrass condition was monitored at 12 locations up to twice a year, once in the late dry season and once in the late wet season. Coral communities were assessed at 7 reef locations in the dry season by the MMP, and a further 2 sites by the AIMS' LTMP in the wet season (Fig. 37). Flood event monitoring was not undertaken in the Mackay-Whitsunday region in 2024-25 due to resource constraints.

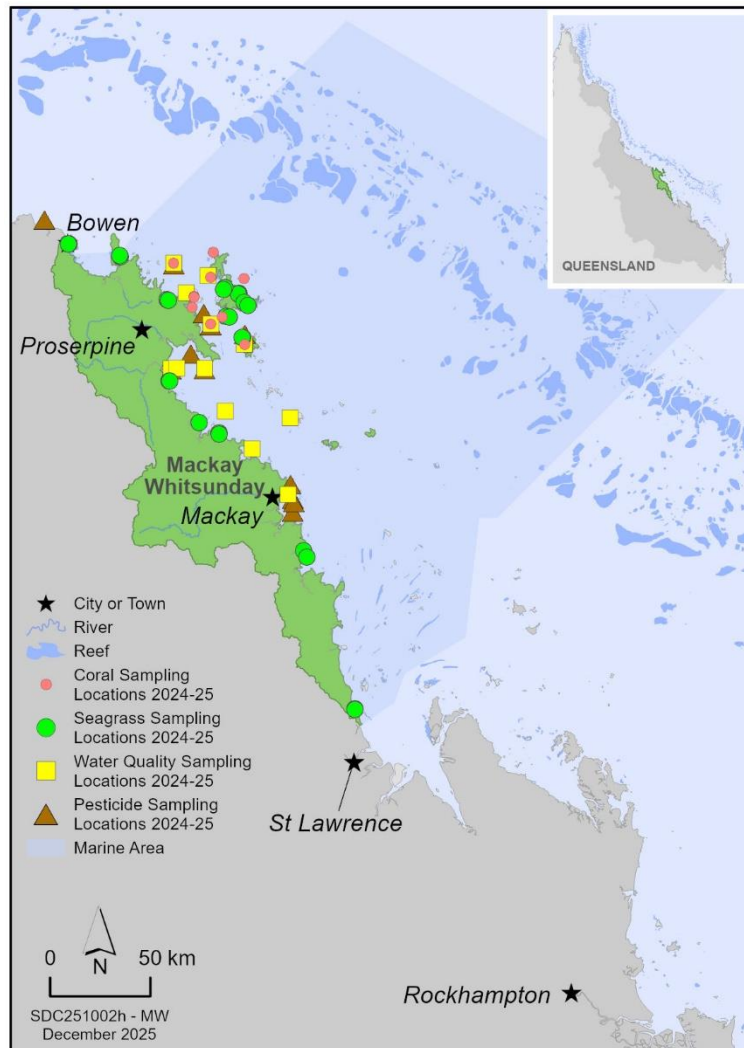


Figure 37. Map showing sampling sites in the Mackay-Whitsunday region.

Environmental conditions

During the 2024–25 reporting period, intertidal seagrass within-canopy temperatures were above the long-term average. Maximum temperatures exceeded 35°C for a total of 55 days, including reaching a maximum of 40.0°C (Midge Point on 23 January 25).

Rainfall was above the long-term average across all basins in the Mackay-Whitsunday region, with the largest anomalies recorded in the northern catchments. The combined discharge from the Proserpine, O'Connell, Pioneer, and Plane Basins was 2.6 times the long-term median, with all basins showing above-average flows.

Water quality

The Annual Condition Water Quality Index for the Mackay-Whitsunday region was ‘moderate’ for the 2024–25 monitoring year. The long-term Water Quality Index in the Mackay-Whitsunday region has deteriorated due to high river discharge during the 2024–25 wet season. This interrupts the gradual improvement in the region observed since Tropical Cyclone Debbie in March 2017.

Progress towards Water Quality Guideline Values:

- PN was the only indicator that met GV within the Mackay-Whitsunday region.
- NO_x, PO₄, Chl-*a*, TSS, turbidity, PN, PP, and Secchi depth did not meet water quality GV. However, turbidity improved and no indicators showed a trend of deterioration, despite high river discharge in 2024–25.

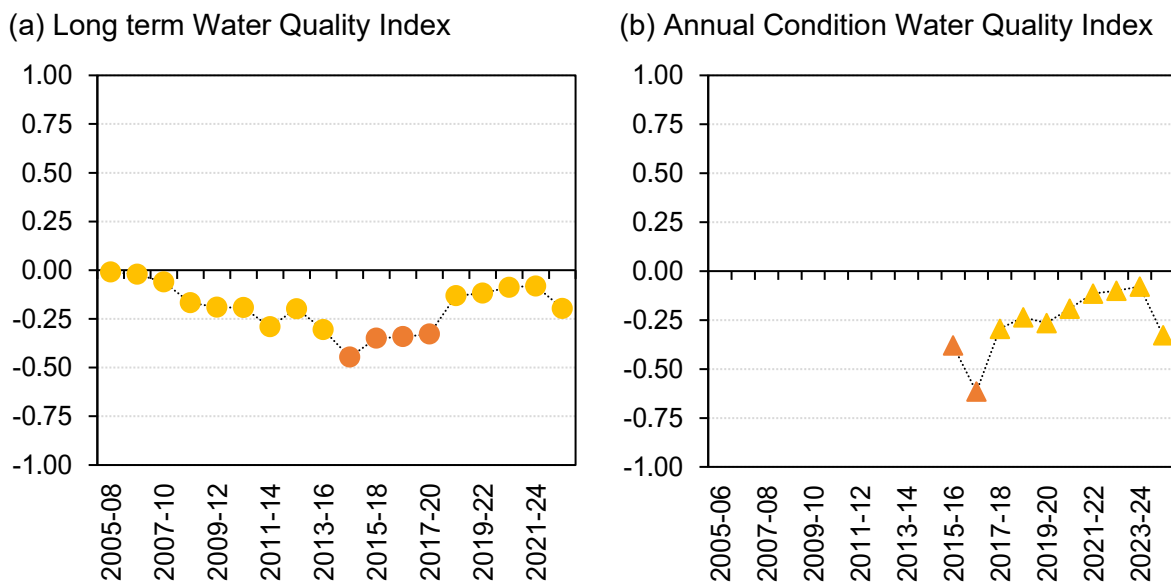


Figure 38. Temporal trends in (a) Long-term and (b) Annual Water Quality Indices for the Mackay-Whitsunday region. The long-term Index is insensitive to year-to-year variability, while the annual Index is sensitive to year-to-year variability. Values are scaled from -1.0 to 1.0 and graded: **very good** (1 to 0.5), **good** (0.5 to 0), **moderate** (< 0 to -1/3), **poor** (< -1/3 to -2/3), **very poor** (< -2/3 to -1). Note scores are unitless. Data source: Gruber *et al.* (2026).

Potential exposure of coastal waters and ecosystems to pollutants (assessed using remote sensing techniques):

- Approximately 89% of Mackay-Whitsunday waters were not exposed to a potential risk, which was above the long-term patterns (87%) and indicates relatively drier conditions in this region. Mid-shelf and offshore waterbodies were not exposed to potential risk. However, 95% enclosed coastal waters were exposed to the highest categories of potential risk (III and IV).
- Less than 2% (52 km²) of coral reefs in the Mackay-Whitsunday region were exposed to the highest categories of potential risk (III and IV).
- Approximately 40% (124 km²) of seagrasses in the Mackay-Whitsunday region were exposed to the highest categories of potential risk (III and IV). Note: all of the surveyed seagrass meadows in the Mackay-Whitsunday region are located in inshore areas.

Routine pesticide monitoring

- The highest total pesticide concentrations observed in this region were found at Sandringham Bay in January 2025 (135 ng·L⁻¹ in a passive sample and 131 ng·L⁻¹ in a grab sample). This was the highest total pesticide concentration for passive samples found in the 2024–25 monitoring season. Samples from the Whitsunday Channel had the lowest total pesticide concentrations in this region in both passive and grab samples.
- The passive sampler at Sandringham Bay in January 2025 had the highest calculated PRM of 2.1% species affected, strongly influenced by the relatively high levels of imidacloprid.

Seagrass

Overall condition of inshore seagrass meadows across the Mackay–Whitsunday region marginally declined in 2024–25, but condition remained ‘moderate’. Indicators were:

- abundance was ‘poor’
- resilience was ‘moderate’.

Seagrass condition in the Mackay–Whitsunday region has fluctuated between ‘poor’ and ‘moderate’ since 2010–11, which appears to be due to a range of environmental pressures at both regional and local scales. Seagrass abundance deteriorated to ‘poor’ in 2024–25 after showing improvements in the previous two years. Declines were driven by deterioration in seagrass abundance at reef intertidal and subtidal habitats.

Resilience in the Mackay–Whitsunday region remained moderate and stable for the fourth consecutive year in 2024–25, with slight increases at coastal sites and declines at estuarine habitats. Seagrass at reef intertidal and subtidal sites remained stable but continued to lack reproductive structures, indicating limited recovery potential despite adequate abundance and species composition. Seeds of foundational species were also absent from reef sites.

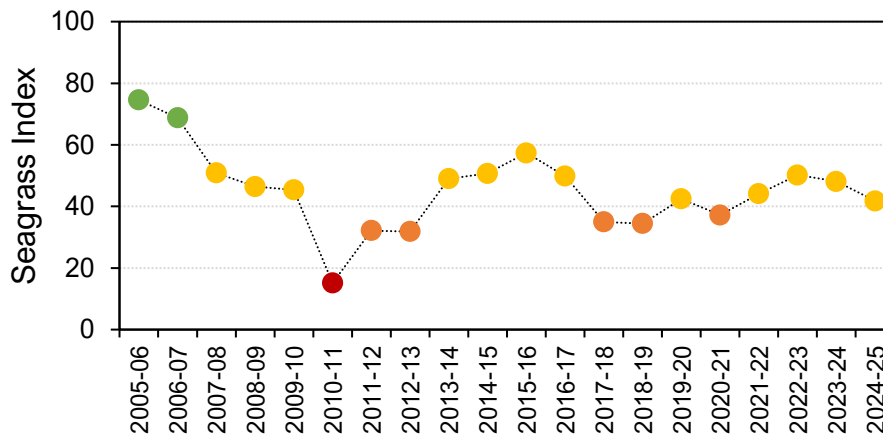


Figure 39. Seagrass Condition Index for the Mackay-Whitsunday region from 2005–06 to 2024–25. Black line with circles represents the index and values are scaled from 0–100 and graded: **very good** (81–100), **good** (61–80), **moderate** (41–60), **poor** (21–40), **very poor** (0–20). Note, scores are unitless. Data source: McKenzie *et al.* (2026).

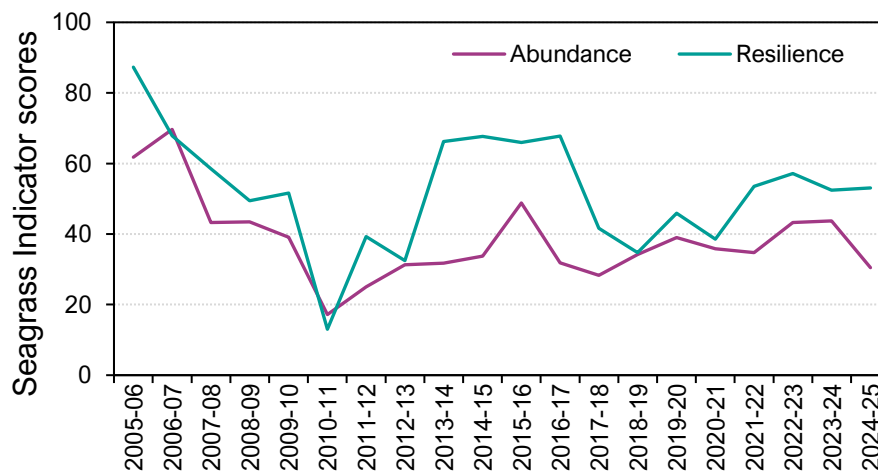


Figure 40. Temporal trends in the Seagrass Indicator scores of abundance and resilience for the Mackay-Whitsunday region from 2005–06 to 2024–25. Values are scaled from 0–100 and graded: **very good** (81–100), **good** (61–80), **moderate** (41–60), **poor** (21–40), and **very poor** (0–20). Note, scores are unitless. Data source: McKenzie *et al.* (2026).

Coral

The Coral Index increased to ‘moderate’ as the recovery of coral communities from the severe impacts of Tropical Cyclone Debbie accelerated (Fig. 41). Driving this recovery has been the continued increase in the density of juvenile corals, with scores for the Juvenile indicator increasing within the ‘moderate range’ since 2022 (Fig. 42). While still ‘poor’, the Coral cover indicator has consistently improved as juvenile and surviving corals grow. However, the Cover change score remains ‘poor’ as the rate of increase in coral cover remains slightly below modelled expectations. It should be noted here that the Cover change indicator is a rolling mean of interannual scores over the last four years and as such the current score is partially influenced by slower recovery in recent years. The Macroalgae indicator score remains ‘poor’ with high levels of macroalgae persisting at several reefs; however, this indicator showed the most improvement over the last year and is close to ‘moderate’.

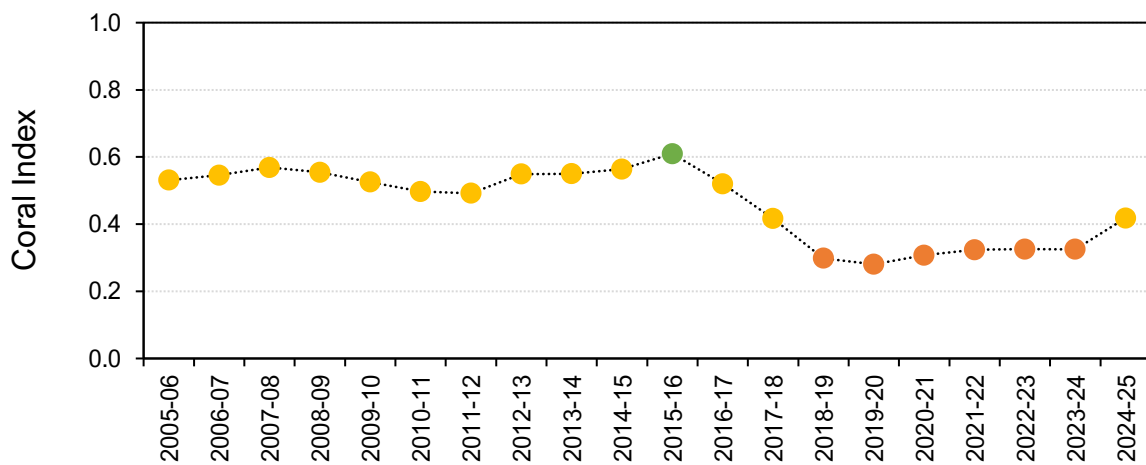


Figure 41. Temporal trend in Coral Index for the Mackay-Whitsunday region from 2005–06 to 2024–25. Values are scaled from 0–1 and graded: **very good** (0.81–1.00), **good** (0.61–0.80), **moderate** (0.41–0.60), **poor** (0.21–0.40), **very poor** (0.0–0.20). Note, scores are unitless. Data source: Thompson *et al.* (2026).

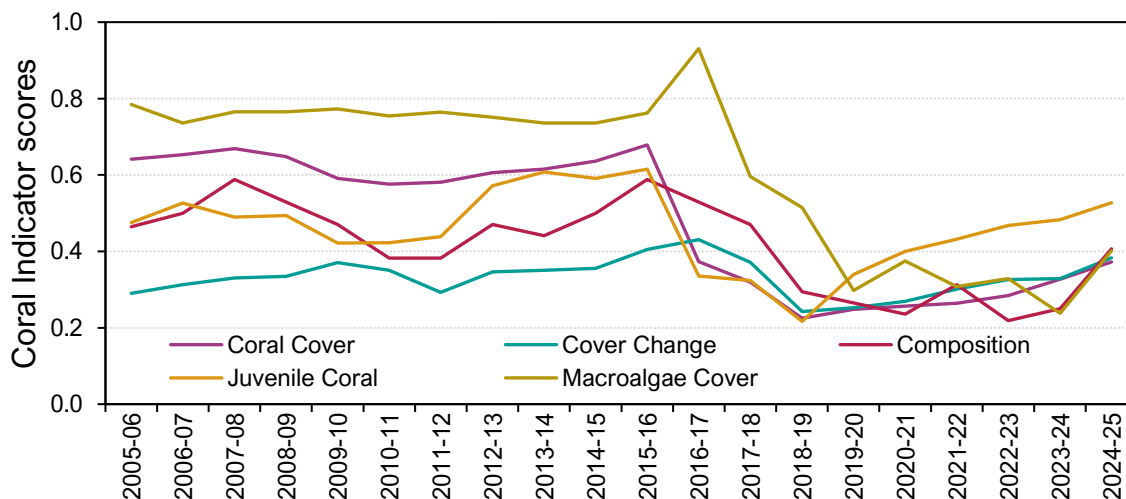


Figure 42. Temporal trends in the Coral Indicator scores of coral cover, cover change, coral composition, juvenile coral, and macroalgae cover for the Mackay-Whitsunday region from 2005–06 to 2024–25. Values are scaled from 0–100 and graded: very good (0.81–1.00), good (0.61–0.80), moderate (0.41–0.60), poor (0.21–0.40), and very poor (0.00–0.20). Note, scores are unitless. Data source: Thompson *et al.* (2026).

Fitzroy

In the 2024–25 monitoring season, *in situ* water quality was monitored at 6 routine sites under ambient conditions 10 times a year. Seagrass condition was monitored at 3 locations in the late dry season. Coral communities were assessed by the MMP at 5 locations in the dry season (Fig. 43).

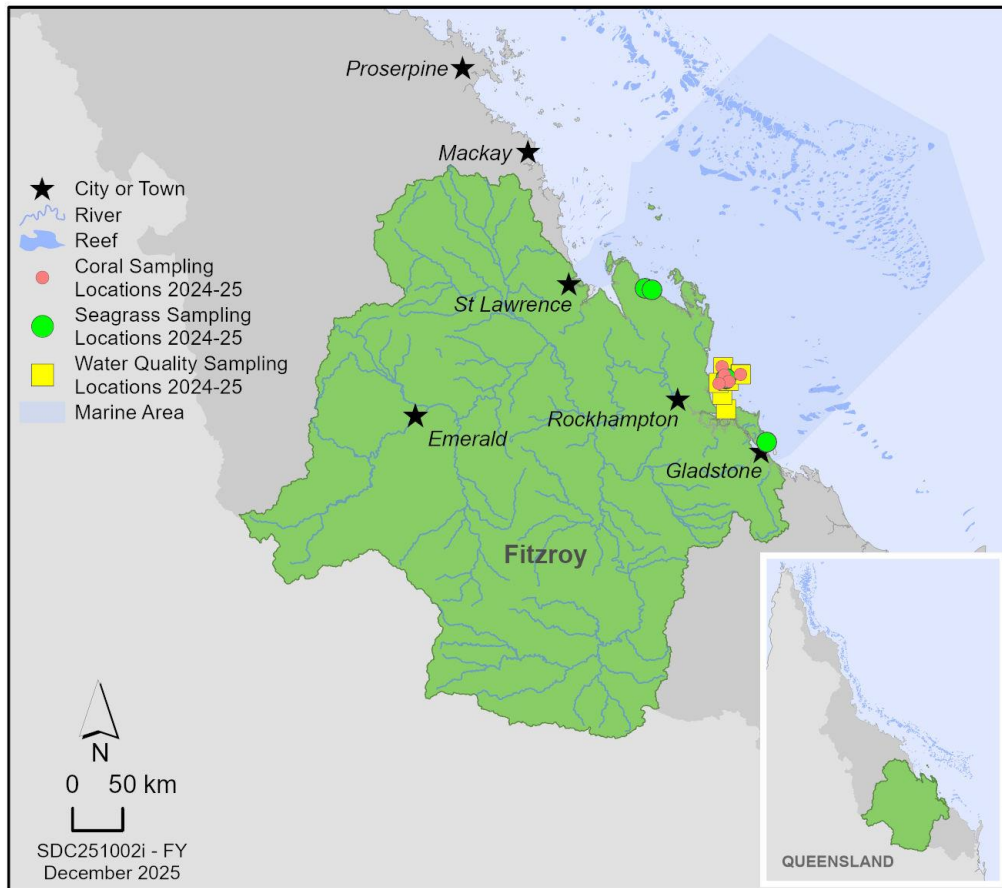


Figure 43. Map showing sampling sites in the Fitzroy region.

Environmental conditions

During the 2024–25 period, intertidal seagrass within-canopy temperatures were above the long-term average for the Fitzroy region, although they were less extreme compared to previous years. Maximum intertidal within-canopy temperatures only surpassed 35°C on 21 days. The peak temperature reached 40.02°C (Great Keppel Island on 17 October 24).

The discharge and loads calculated for the 2024–25 water year from the Fitzroy River were just above the long-term median. River discharge in this region has been near or below-median for the past eight years.

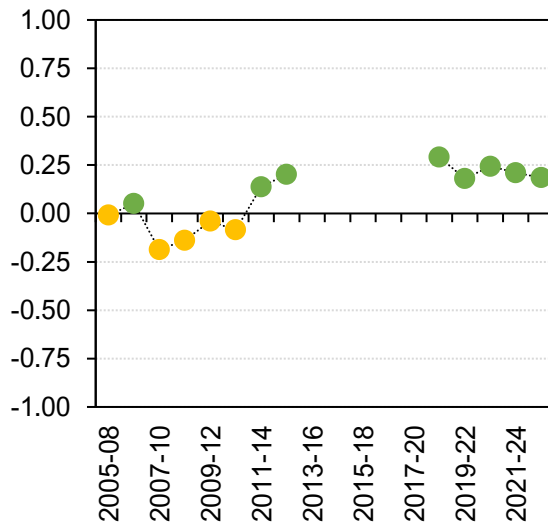
Water quality

The Annual Condition Water Quality Index for the Fitzroy region was ‘good’ for the 2024–25 monitoring year, resulting in a stable long-term Water Quality Index over the last 5 years.

Progress towards Water Quality Guideline Values:

- PO₄, PN, PP, TSS, and Chl-a met GVs in the region.
- NO_x, Secchi depth, and turbidity did not meet GVs in the region, but NO_x and Secchi depth are showing signs of improvement.

(a) Long term Water Quality Index



(b) Annual Condition Water Quality Index

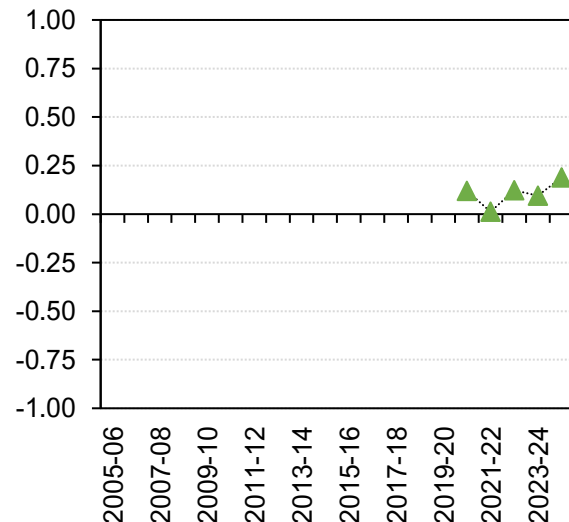


Figure 44. Temporal trends in (a) Long-term and (b) Annual Water Quality Indices for the Fitzroy region. The long-term Index is insensitive to year-to-year variability, while the annual Index is sensitive to year-to-year variability. Values are scaled from -1.0 to 1.0 and graded: **very good** (1 to 0.5), **good** (0.5 to 0), **moderate** (< 0 to -1/3), **poor** (< -1/3 to -2/3), **very poor** (< -2/3 to -1). Note scores are unitless. Data source: Gruber *et al.* (2026).

Potential exposure of coastal waters and ecosystems to pollutants (assessed using remote sensing techniques):

- 92% of the Fitzroy region was not exposed to a potential risk, similar to the long-term average (91%). The mid-shelf and offshore waterbodies were largely exposed to no/very low risk (98% and 100%, respectively). However, 96% of coastal waters were exposed to the highest categories of potential risk (III and IV).
- Approximately 2% (70 km²) of coral reefs in the Fitzroy region were exposed to the highest categories of potential risk (III and IV). Only 4% (<200 km²) of Fitzroy corals occur in inshore waters.
- Approximately 35% (169 km²) of seagrasses in the Fitzroy region were exposed to the highest categories of potential risk (III and IV), and they were all inshore seagrasses.

Seagrass

Overall, the seagrass condition for the Fitzroy region improved to ‘moderate’ in 2024–25. There were improvements in both indicators:

- abundance score was ‘moderate’
- resilience was ‘moderate’.

Seagrass abundance score significantly improved from the previous period, achieving its highest score since 2007–08. The increase can be attributed to improved conditions in estuarine and coastal habitats, while the status of reef habitats has remained unchanged.

The resilience score in the Fitzroy region improved to ‘moderate’ in 2024–25, the highest level since 2009–10, with increases observed across all habitat types. Estuarine and coastal sites showed strong gains due to increased abundance of reproductive structures, while modest improvements at Great Keppel Island were driven by slight increases in cover despite continued dominance of colonising species. Seed banks persisted across these habitats, with high densities at estuarine sites but reduced levels at coastal sites compared to previous years. In contrast, reef meadows at Great Keppel Island again showed no reproductive structures or seeds of foundational species (*Halodule uninervis*), indicating severely limited recovery capacity and heightened vulnerability to disturbance.

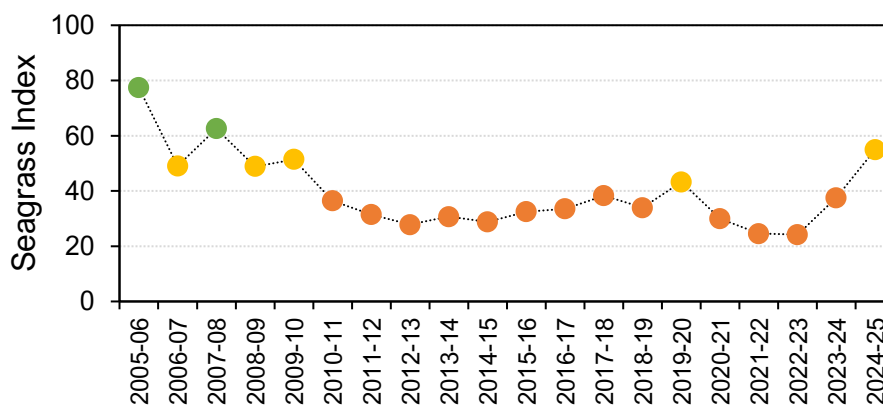


Figure 45. Seagrass Condition Index for the Fitzroy region from 2005–06 to 2024–25. Black line with circles represents the index and values are scaled from 0–100 and graded: **very good** (81–100), **good** (61–80), **moderate** (41–60), **poor** (21–40), **very poor** (0–20). Note, scores are unitless. Data source: McKenzie *et al.* (2026).

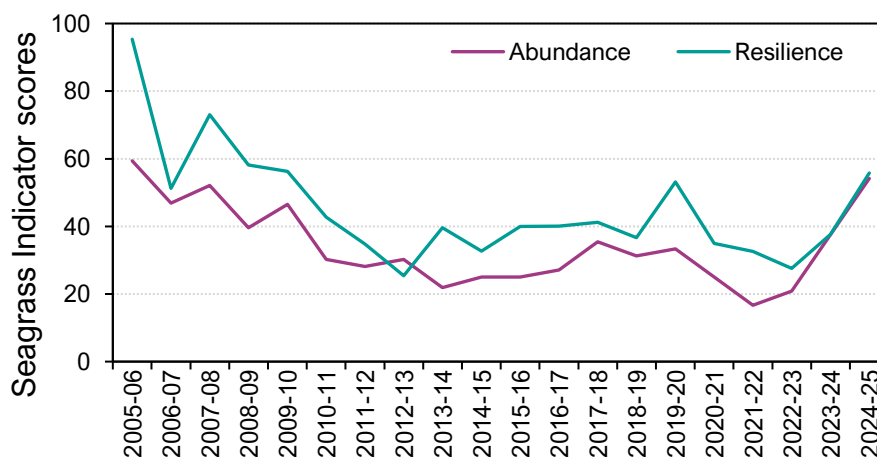


Figure 46. Temporal trends in the Seagrass Indicator scores of abundance and resilience for the Fitzroy region from 2005–06 to 2024–25. Values are scaled from 0–100 and graded: very good (81–100), good (61–80), moderate (41–60), poor (21–40), and very poor (0–20). Note, scores are unitless. Data source: McKenzie *et al.* (2026).

Coral

The marine heatwave of 2024 had a severe impact on coral communities in this region, reflected by the Coral Index declining to ‘very poor’ in 2025 (Fig. 47). During surveys in 2024 many corals were still bleached and initial declines in coral cover were evident. However, the full impact of the heat stress only became clear in 2025, when surveys revealed a 57% loss of hard coral cover compared to 2023 levels. A large proportion of the coral killed was of the genus *Acropora*, which resulted in the Composition Indicator being downgraded to ‘very poor’. Of added concern are the current ‘very poor’ scores for Juvenile coral and Macroalgae indicators, both of which have been consistently rated as ‘poor’ or ‘very poor’ in this region, signifying a clear bottleneck for coral community recovery.

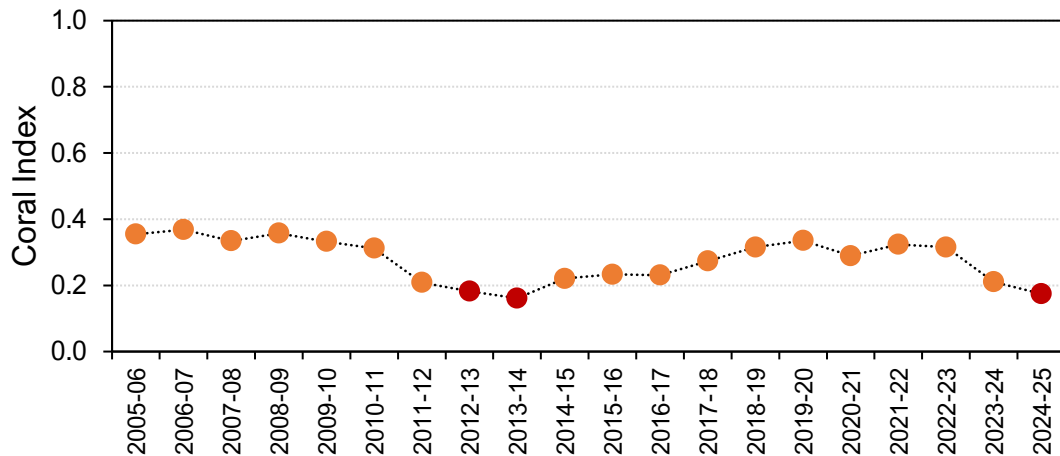


Figure 47. Temporal trend in Coral Index for the Fitzroy region from 2005–06 to 2024–25. Values are scaled from 0–1 and graded: **very good** (0.81–1.00), **good** (0.61–80), **moderate** (41–60), **poor** (21–40), **very poor** (0–20). Note, scores are unitless. Data source: Thompson *et al.* (2026).

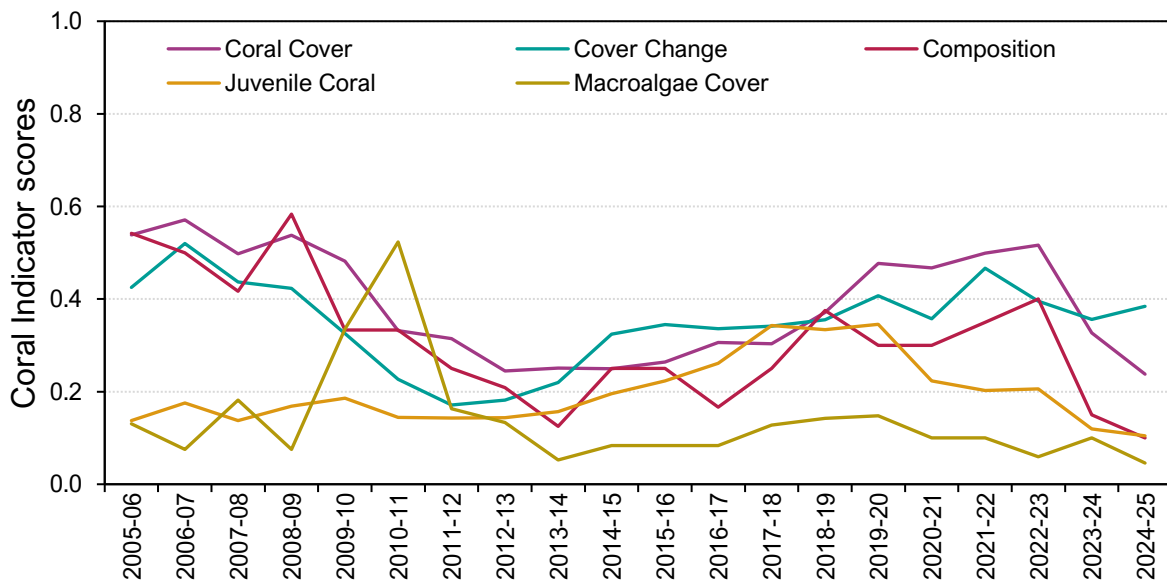


Figure 48. Temporal trends in the Coral Indicator scores of coral cover, cover change, coral composition, juvenile coral, and macroalgae cover for the Fitzroy region from 2005–06 to 2024–25. Values are scaled from 0–100 and graded: very good (0.81–1.00), good (0.61–0.80), moderate (0.41–0.60), poor (0.21–0.40), and very poor (0.00–0.20). Note, scores are unitless. Data source: Thompson *et al.* (2026).

Burnett-Mary

In the 2024–25 monitoring season, seagrass condition was monitored at 3 locations in the late dry season and 2 locations in the late wet season. The MMP does not monitor *in situ* water quality or coral reef condition in the Burnett-Mary region (Fig. 49).

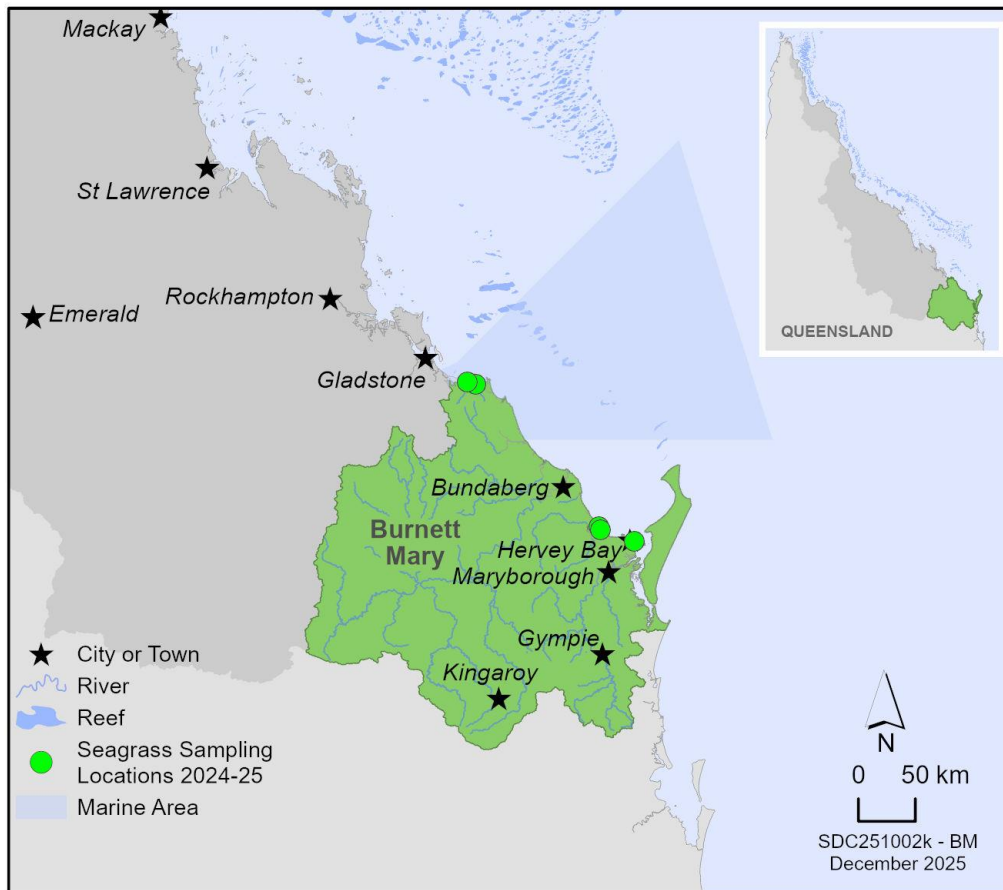


Figure 49. Map showing sampling sites in the Burnett-Mary region.

Environmental conditions

Intertidal seagrass within-canopy temperatures in 2024–25 were 0.6 °C above the long-term average for the Burnett-Mary region, marking the second consecutive warm year, with intertidal temperatures exceeding 35 °C on 4 days and reaching a maximum of 38.7 °C at Rodds Bay.

Discharge from rivers in the Burnett-Mary region was 3.4 times the long-term median. While there was high discharge across the wet season, there were no major above-average magnitude flood events.

Water quality

There is no formal water quality monitoring program in the Burnett-Mary region that is reported as part of the Paddock to Reef program. As a result, water quality indices are not available for this region. Remote sensing of water type and exposure was carried out, but has a higher degree of uncertainty due to limited validation from *in situ* monitoring.

Potential exposure of coastal waters and ecosystems to pollutants (assessed using remote sensing techniques):

- Approximately 95% of the Burnett-Mary region waters were not exposed to a potential risk, which is similar long-term patterns (96%). The mid-shelf and offshore waterbodies were largely exposed to no/very low risk (>94% and 100%, respectively). 91% of enclosed coastal waters and 29% of open coastal waters were exposed to the highest categories of potential risk (III and IV).
- Approximately 3% (6 km²) of coral reefs in the Burnett-Mary region were exposed to the highest categories of potential risk (III and IV), and they were all enclosed coastal or open coastal reefs. Note: only 2% (<10 km²) of Burnett-Mary corals occur in inshore waters.
- Approximately 34% (89 km²) of seagrasses in the Burnett-Mary region were exposed to the highest categories of potential risk (III and IV), and they were all enclosed coastal or open coastal seagrasses. Compared to long-term trends, there was a net increase of 13% in the total seagrass area in the Burnett-Mary region exposed to potential risk during 2024–25.

Seagrass

Inshore seagrass meadows across the Burnett–Mary region improved in overall condition in 2024–25, with the Seagrass Index increasing to ‘good’. Contributing indicators were:

- abundance score was ‘moderate’
- resilience score was ‘good’.

The seagrass abundance score for the region increased to its highest level since the MMP commenced, remaining moderate in 2024–25. This improvement was observed throughout the region, covering all locations, with abundances surpassing long-term averages for both estuarine and coastal habitats.

Resilience in the Burnett–Mary region improved to ‘good’ in 2024–25, up from poor in 2023–24, driven largely by strong recovery in estuarine habitats. High reproductive output of foundational species at Rodds Bay and Urangan contributed most to the improvement. In contrast, coastal sites at Burrum Heads remained constrained by a continued lack of reproductive effort, leading to a slight local decline. Despite that, seeds banks remain at estuarine and coastal habitats.

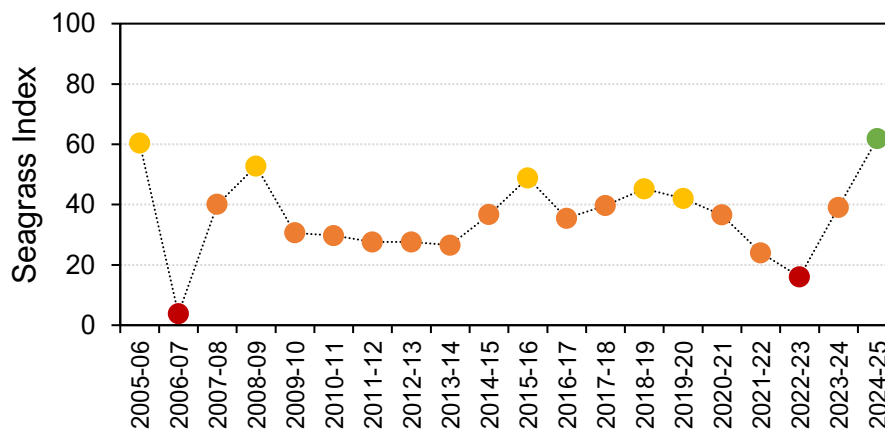


Figure 50. Seagrass Condition Index for the Burnett–Mary region from 2005–06 to 2024–25. Black line with circles represents the index and values are scaled from 0–100 and graded: **very good** (81–100), **good** (61–80), **moderate** (41–60), **poor** (21–40), **very poor** (0–20). Note, scores are unitless. Data source: McKenzie *et al.* (2026).

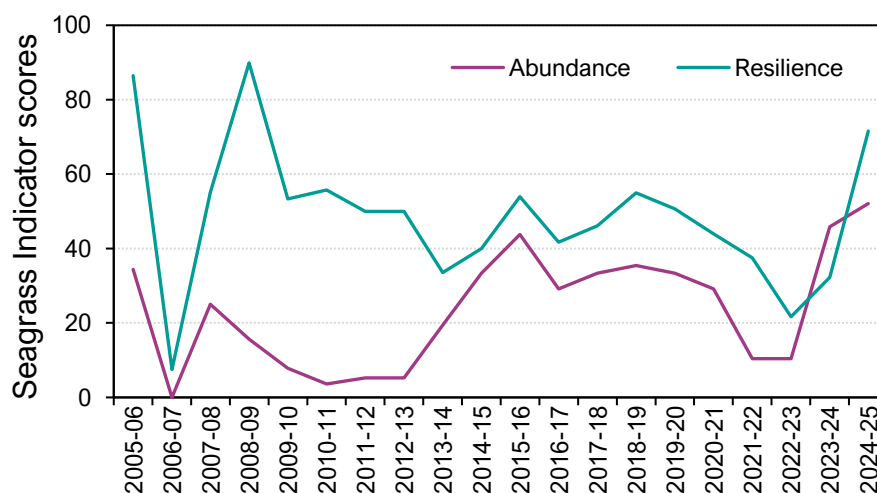


Figure 51. Temporal trends in the Seagrass Indicator scores of abundance and resilience for the Burnett–Mary region from 2005–06 to 2024–25. Values are scaled from 0–100 and graded: **very good** (81–100), **good** (61–80), **moderate** (41–60), **poor** (21–40), and **very poor** (0–20). Note, scores are unitless. Data source: McKenzie *et al.* (2026).

Discussion

The 2024-25 monitoring season represents the 20th year of data collection for many components of the Marine Monitoring Program. Such an extensive, consistent, high-quality monitoring dataset is exceptional, and a powerful analytical resource from which long-term trends can be distinguished from short-term interannual variability. For example, below-average annual rainfall can incidentally improve inshore marine water quality as a result of lower river discharges which typically carry sediment, nutrients, and pesticides downstream from the catchment to the Reef. Conversely, above-average annual rainfall and river discharge typically reduce water quality as more sediment, nutrients, and pesticides are transported out of the catchment and downstream into the marine environment.

2024-25 was a significant wet season, with historic flooding in the Herbert and Burdekin Rivers resulting in extensive flood plumes reaching well beyond the inshore Reef, out to mid-shelf and even some offshore parts of the Wet Tropics and Burdekin marine regions. Despite these conditions, incremental, measurable improvements in water quality indicators such as nitrate/nitrite (NO_x) were detected in monitoring of the Tully and Burdekin transects. While this pattern of gradual improvement has persisted over the past 5 years, Guideline Values are still exceeded for many parameters.

Water quality in the tropical marine environment is highly variable, and is impacted by a number of factors, including catchment management, the magnitude of a wet season, wind and tide-driven resuspension of sediments, and complex coastal currents. Improvements in catchment management practices can take many years to be reflected in Reef water quality conditions, but are expected to improve water quality on the inshore Reef on the scale of years to decades, depending on the pollutant and local landscape characteristics. With a long-term statistically-robust monitoring regime, the contribution of those land-based improvements can be detected among the inherent variability in tropical coastal water quality. Improvement in indicators such as NO_x identified in the routine Burdekin and Tully transects is a promising trend that has persisted despite two years of well above-average river discharge in these regions.

Despite strong progress in certain regions and water quality metrics, many water quality parameters continue to exceed Water Quality Guideline Values. For example, pesticides, particularly in the Mackay-Whitsunday region, remain a high priority in terms of catchment management. The highest maximum concentration of pesticides detected in the 2024–25 wet season was at Sandringham Bay, south of Mackay, for the third year in a row. Detailed pesticide profiles are available in the *Great Barrier Reef Marine Monitoring Program Inshore Water Quality Monitoring: Annual Report 2024–25* (Gruber *et al.* 2026). Together with knowledge of pesticide use in adjacent catchments, this information can be used to guide targeted on-ground interventions at priority locations.

While climate change and associated increases in sea surface temperature are well-established as the leading cause of stress and decline of inshore marine habitats (Commonwealth of Australia 2023, Great Barrier Reef Marine Park Authority 2024, Waterhouse *et al.* 2024), the Marine Monitoring Program's focus on water quality and its effects on inshore seagrass and coral reef condition is associated with identifying and supporting the resilience of these habitats to climate change (Fig. 52). The speed and extent of habitat recovery following acute temperature stresses can be enhanced or hampered by water quality. As concluded in the 2022 Scientific Consensus Statement:

“Human-induced climate change is the primary threat to the Great Barrier Reef and poor water quality can exacerbate climate-related impacts. Good water quality is critical for healthy and resilient ecosystems and supports recovery from disturbances such as mass bleaching and extreme weather events.”

This is the case in the Fitzroy and Burnett-Mary regions, where several years of minimal water quality stress have enabled rapid and extensive recovery of seagrass meadows (Fig. 5). Similarly, by this 2024–25 monitoring year, coral reefs in the Mackay-Whitsunday region that were badly damaged during Tropical Cyclone Debbie in 2017 are finally showing good numbers of juvenile corals, potentially turning a corner in their path to recovery.

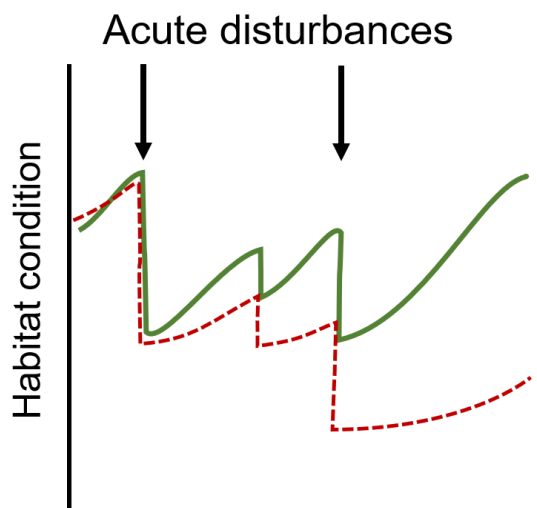


Figure 52. Visual representation of a habitat's resilience – it's ability to recover following an acute disturbance. Green: resilient, red: not resilient. Figure from Thompson *et al.* (2026).

Now at the start of its 21st year, the Marine Monitoring Program continues to provide a high value, long-term dataset to inform management of the Reef. The Marine Monitoring Program's outputs have a wide application across scientific, management, government, and public audiences. Findings from the Marine Monitoring Program were used extensively in the recent update of the 2022 Scientific Consensus Statement, the Great Barrier Reef Outlook Report 2024, the updated Reef Spatial Management Prioritisation, the review of the Reef water quality targets, and continue to be used in Regional Report Cards. The Marine Monitoring Program measurements are crucial for validating CSIRO's eReefs modelling suite (a core tool for management and decision-making for the Reef). Continuation of the Marine Monitoring Program and strengthening of linkages with the broader Paddock to Reef Integrated Monitoring, Modelling and Reporting (Paddock to Reef) program to evaluate progress towards the Reef 2050 Water Quality Improvement Plan (Australia and Queensland Governments 2018) will further enhance the value of long-term monitoring efforts of the Reef.

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