Long-term *in situ* temperature monitoring within inshore GBR seagrass meadows

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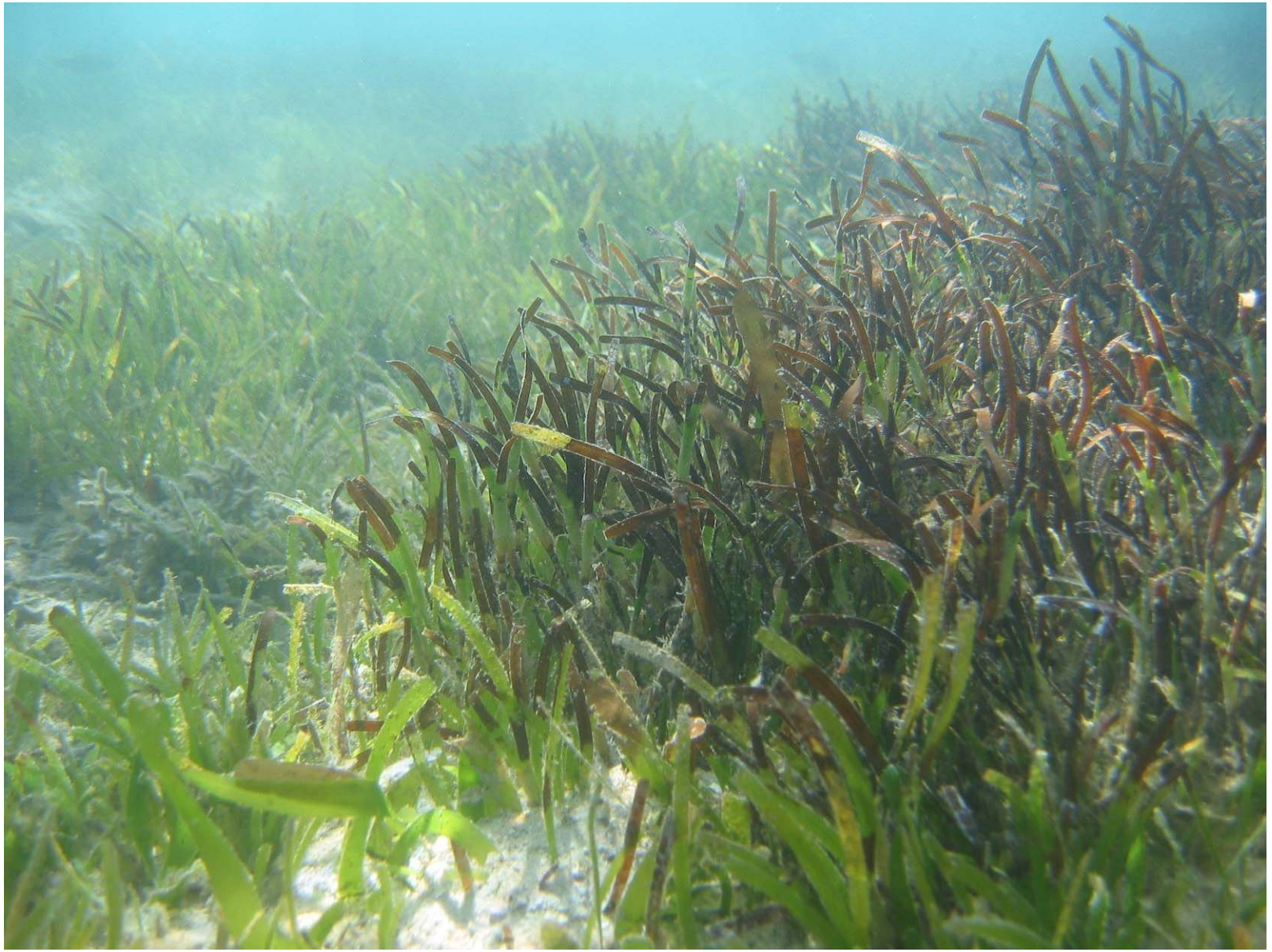
Community Compositional Changes and Temperature Thresholds workshop
Great Barrier Reef Foundation project "Seagrass connectivity, community composition and growth: attributes of a resilient GBR". Global Change Institute, University of Queensland, St Lucia,
8th October 2013.

Seagrass & water temperature

Background

- **temperature influences growth rate**
- **as water temperatures increase (up to 35ºC) the rate of photorespiration increases reducing the efficiency of photosynthesis at a given CO_2 concentration**
- **thermal stress at 36ºC to 40ºC inactivates oxygen producing enzymes (proteins) of photosystem II.**
- **>40˚ C inhibits photosystem II**
- **controls the range of pH and dissolved carbon dioxide (CO_2) concentrations in the water column**
- **most tropical seagrasses exposed to max temp >40˚ C for 1-3hrs will die** *(Campbell et al. 2006)*
- **Seagrass growth at temperatures >33˚ C in limiting light result in C balance deficit** *(Collier et al. 2011)*

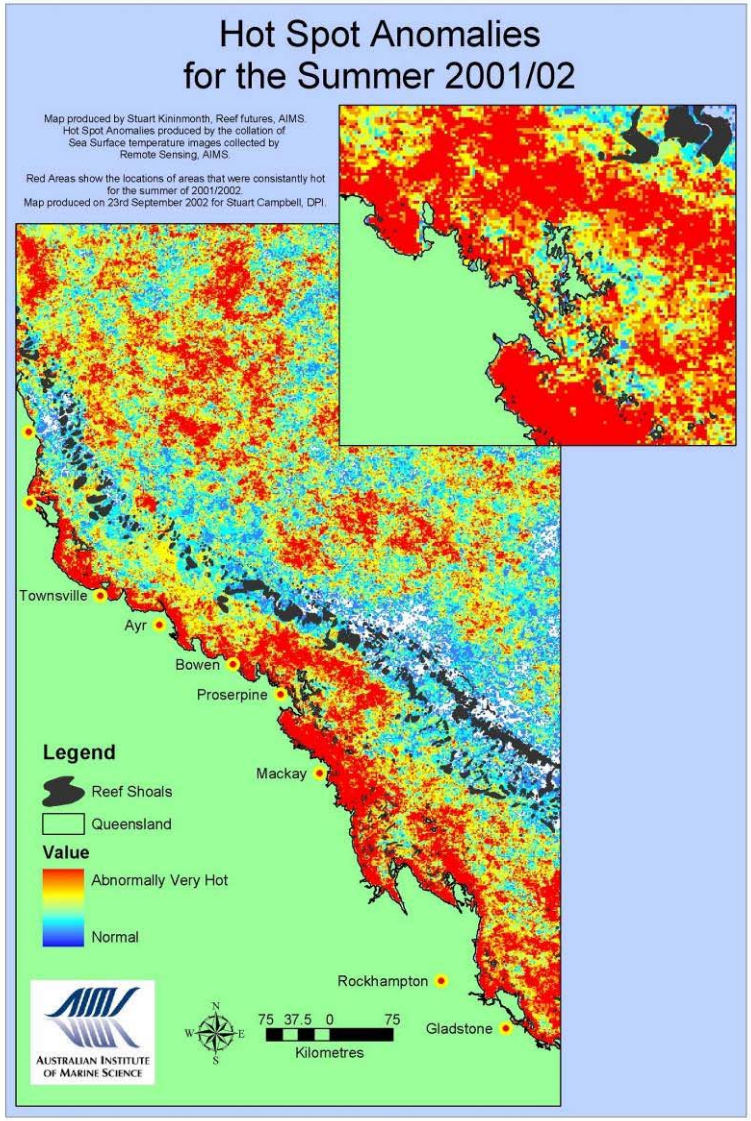
Elevated temperature



Seagrass & water temperature

Background

- low seagrass cover and patches of blackened seagrass in shallow water (not exposed to air) was observed in 2001-02 at Hydeaway Bay and Dingo Beach (Whitsundays) which coincided with high seawater temperatures and coral bleaching
- in 2003, *in situ* seawater temperature monitoring was introduced as part of the Seagrass-Watch program

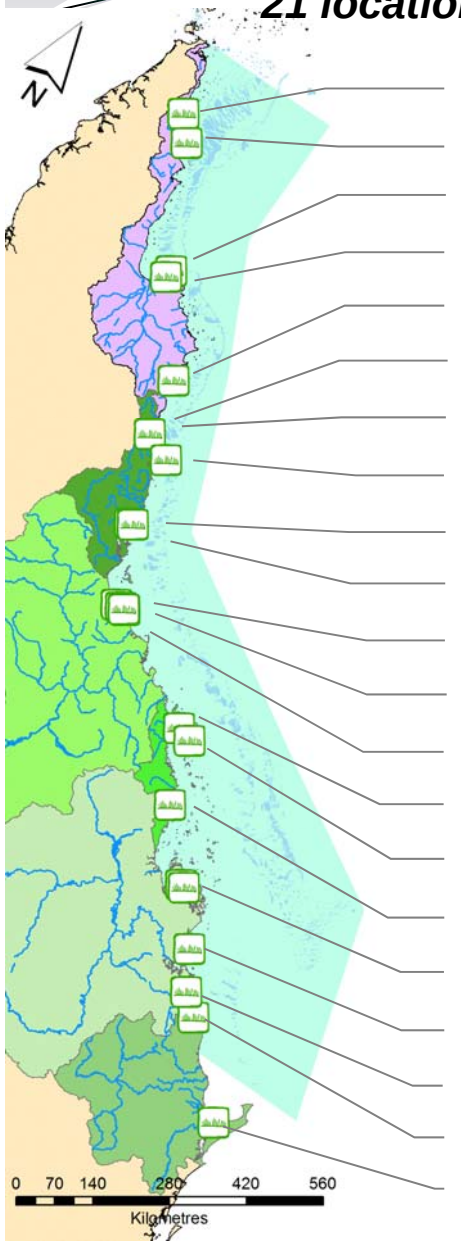


in situ temperature monitoring

- Autonomous iBTag™ submersible temperature loggers
- loggers record temperature (degrees Celsius) within the seagrass canopy
- Main features of the iBCod 22L include:
  - operating temperature range: -40 to +85˚ C
  - resolution of readings: 0.0625˚ C
  - accuracy: ±0.5˚ C from -10˚ C to +65˚ C
- 171 days of readings at 30 minute intervals.
- loggers are placed above the sediment-water interface at the permanent marker at each site for three to six months (depending on monitoring frequency)

GBR Seagrass monitoring locations

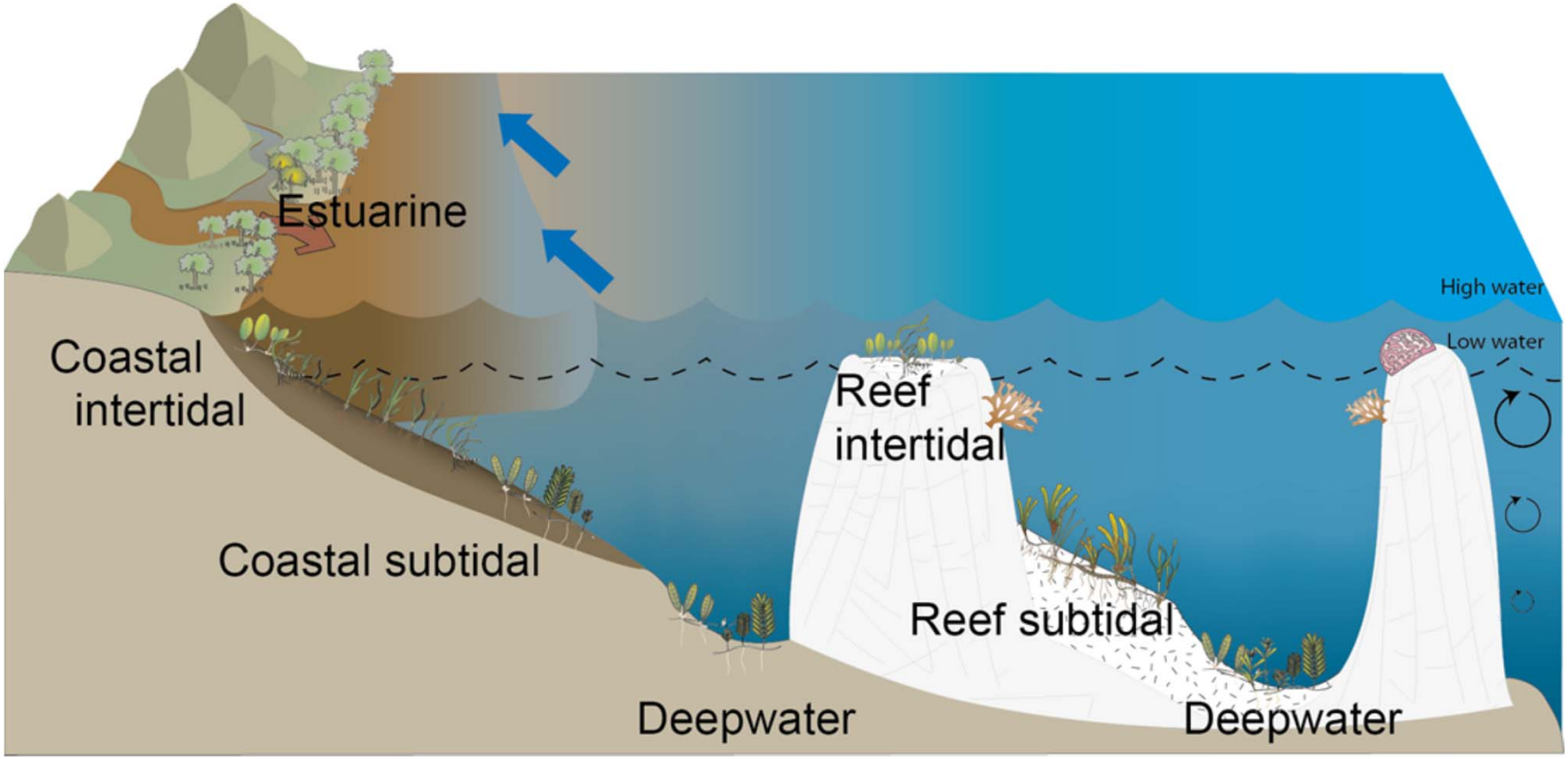
21 locations across 6 regions (2 sites per location)



Location	NRM
Shelburne Bay	Cape York
Piper Reef	
Stanley Is.	
Bathurst Bay	
Cooktown	
Low Isles	Wet Tropics
Yule Point	
Green Island	
Mission Beach	
Dunk Island	
Townsville	Burdekin Dry Tropics
Magnetic Island	
Bowling Green Bay	
Pioneer Bay	Mackay Whitsundays
Hamilton Is.	
Sarina Inlet	
Shoalwater Bay	Fitzroy
Great Keppel Is.	
Gladstone outer Harbour	
Rodds Bay	Burnett Mary
Hervey Bay	

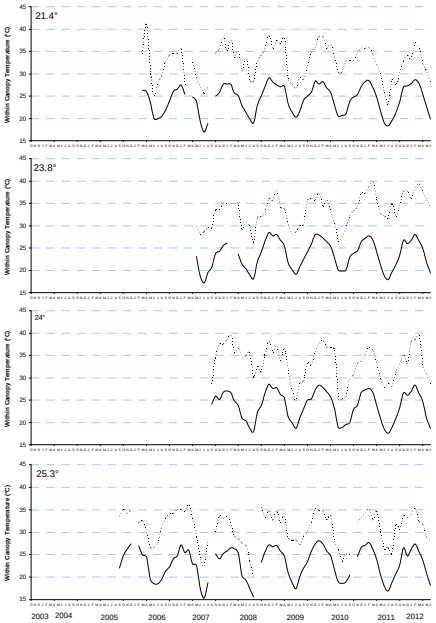
Conceptual model for habitats

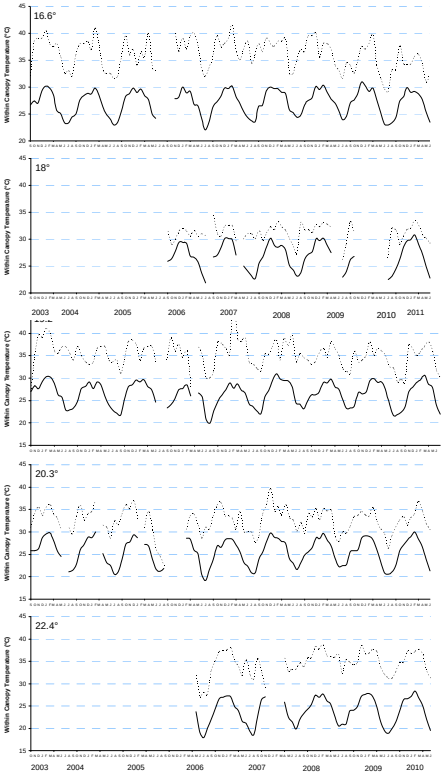
representative meadows across seagrass habitats within each region

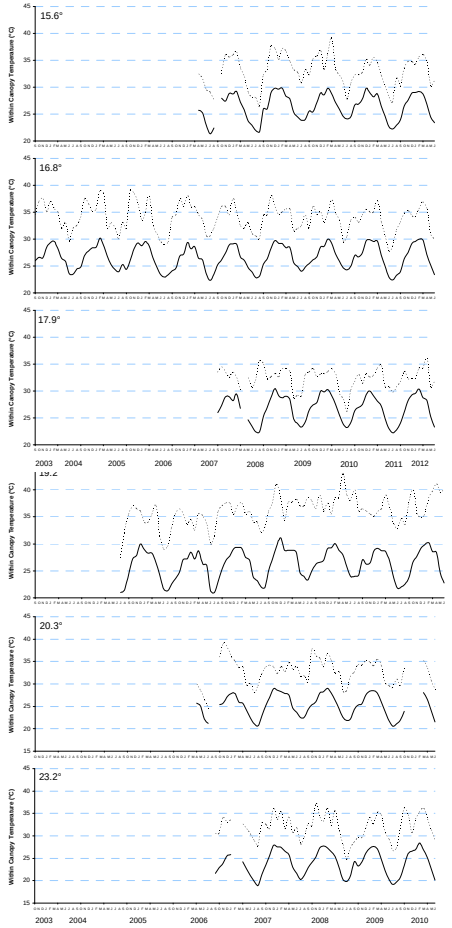


in situ temperature monitoring

estuary **coastal** **reef**

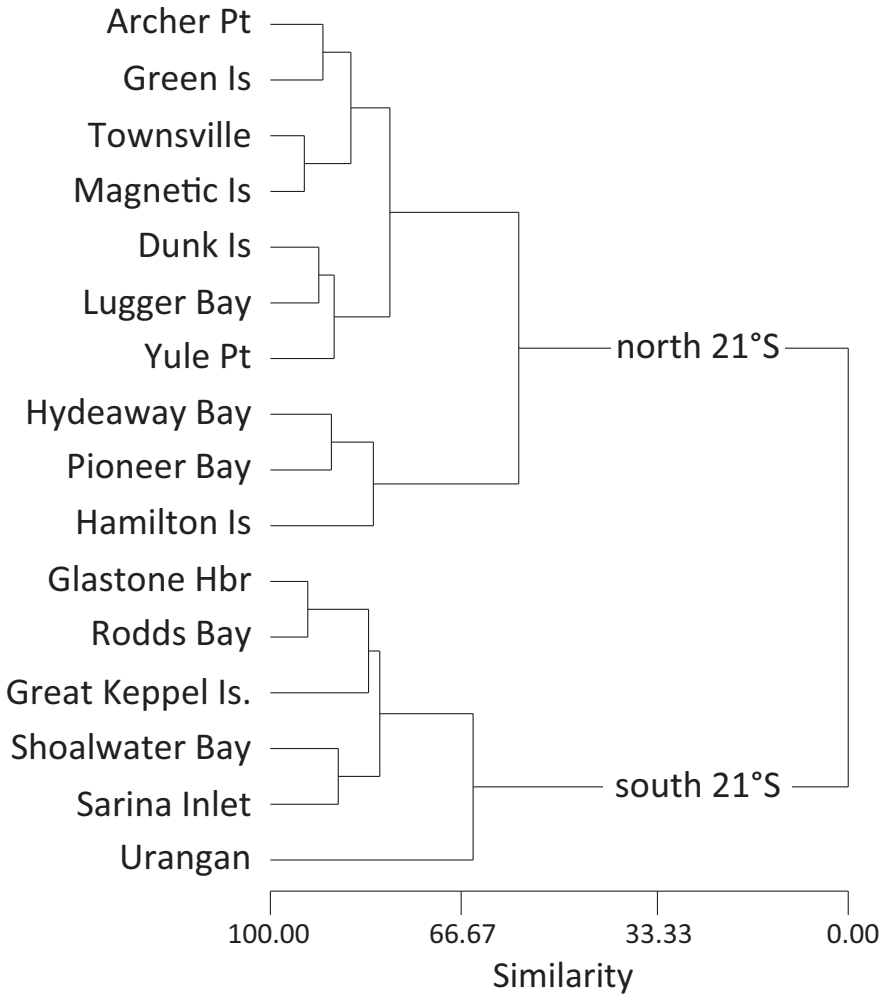






in situ temperature monitoring

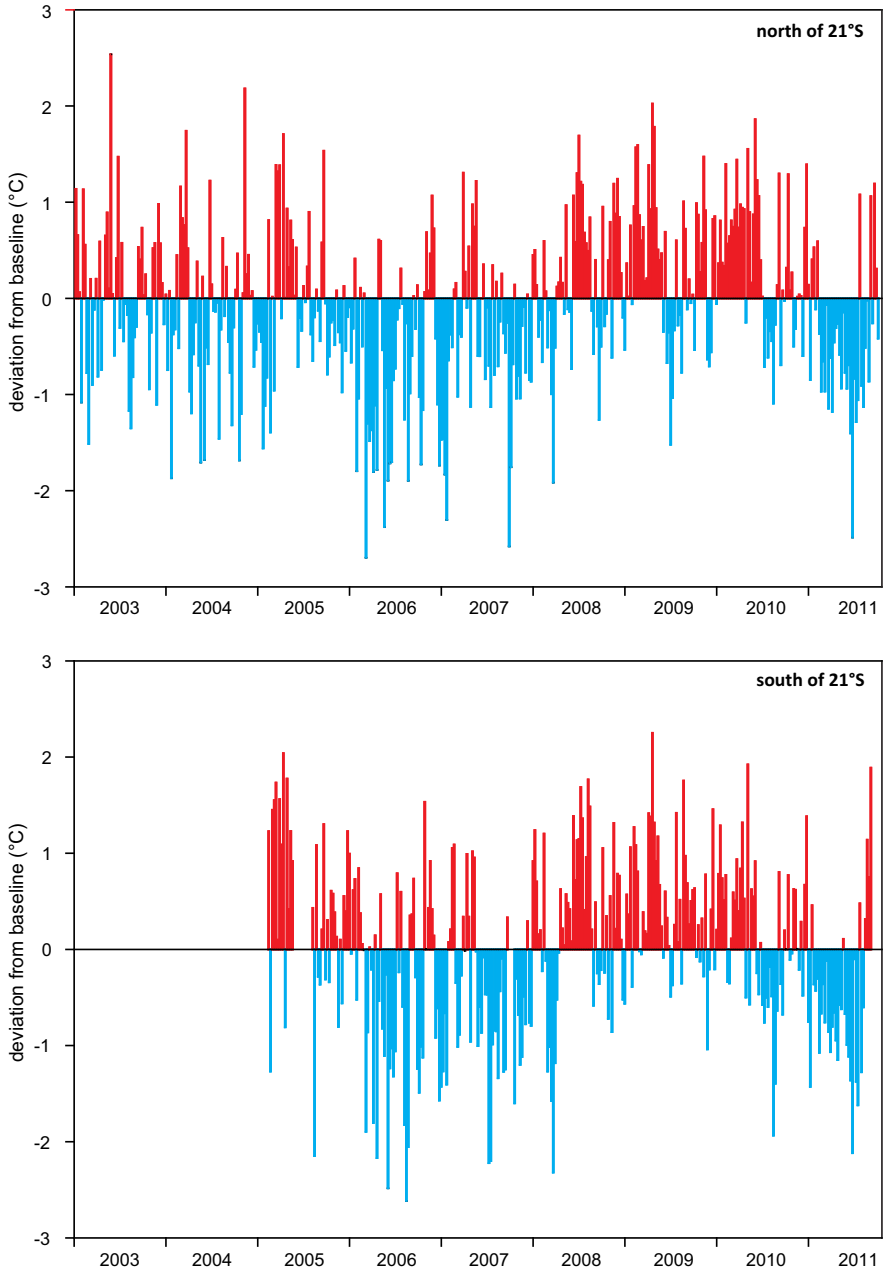
Water temperature within the seagrass canopy of inshore seagrass meadows across 16 inshore locations of the GBR, from Archer Pt (Cooktown) in the north to just below the southern limit of the park at Urangan (Hervey Bay), were examined. Locations separated at 21 degrees south, based on the first level of differentiation.



Dendrogram of similarity in water temperature (long-term average for each calendar month), measured across the inshore seagrass meadows of the Great Barrier Reef, using Euclidean distance and Complete linkage

in situ temperature monitoring

Within seagrass canopy sea temperature data are reported for the period of September 2003 to December 2011. For each region data are represented as the deviation from long-term (8 year) weekly averages. Weeks above the long-term average are represented as red bars and the magnitude of their deviation from the mean represented by the length of the bars, bars are blue for weeks with temperatures lower than the average and are plotted as negative deviations.



in situ temperature monitoring

- 2009 hottest year since monitoring began *(2003)*
- *The period from July 2009-Jun 2010 was the hottest over the last 8 years of monitoring and the 2006 calendar years was the coolest (all locations pooled).*