Project 2.3: Monitoring the Health of Torres Strait Reefs

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Coral Reefs and the Torres Strait

- People of the Torres Strait rely on coral reefs for **cultural, economic and social resources** – the ocean is a prime part of their culture.

- The **main economic resource** in the Torres Strait is **coral reef based fishing** (Tropical Rock Lobster, mackerel, reef fish).

- Much of the **local subsistence food** comes from local reef based fisheries.

- Biodiversity wise the Torres Strait sits at the **southern end of the Coral Triangle** – the global centre of coral bio-diversity.

- Many of the **pressures on reefs** in the central and southern GBR (coastal run-off, fishing pressure, etc.) are either **not present** or **present at lower levels**.

Measuring the Health of Reefs

How would you measure the health of reefs?

1. **What's there**?

   - Satellite Mapping (eAtlas)
   - Reef Surveys (including historical work)

2. **What state is it in?**

   - Reef Surveys
   - Local knowledge

3. **What are the main threats?**

   - Local knowledge
   - Global knowledge – experience from the GBR

4. **How are these threats impacting the reefs?**

   - Reef Monitoring
   - Ocean Monitoring
   - Satellite Monitoring

Project Components

1. **Reef Biodiversity Surveys** (Hugh Sweatman)

   – Reef surveys of corals, fish and benthos at five locations and two times

2. **Temperature Loggers** (Ray Berkelmans)

   – Deployment of small temperature loggers at 15 sites, two depths per site

3. **Real Time Ocean Monitoring Stations** (Scott Bainbridge)

   – Installation of three real time ocean monitoring stations

4. **Satellite Forecasts** (Scarla Weeks)

   – Monthly analysis of a number of satellite images to develop measures of temperature 'hot-spots', chlorophyll levels and water clarity

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Technical Report

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Preliminary report on surveys of biodiversity of fishes and corals in Torres Strait

Kate Osborne, Ian Miller, Kerryn Johns, Michelle Jonker and Hugh Sweatman

Australian Government
Department of Sustainability, Environment, Water, Population and Communities

Reef & Rainforest
RESEARCH CENTRE

50km

Ocean Monitoring Stations

- Provide **real time** (every ten minutes) data on **above-water weather** and **in-water water temperature, salinity and depth**.

- Three stations have been installed, one off **Thursday Island** (southern TS), one on **Masig Island** (central-eastern TS) and one on **Bramble Cay** (north-eastern TS).

- Provide inputs into **coral bleaching models** that are run each night using the daily data to deliver measures of the current and future **coral bleaching risk**.

- Provide important **weather data** to supplement the two BoM stations, via **publically accessible web pages** and **data kiosks**.

Thursday Island Station
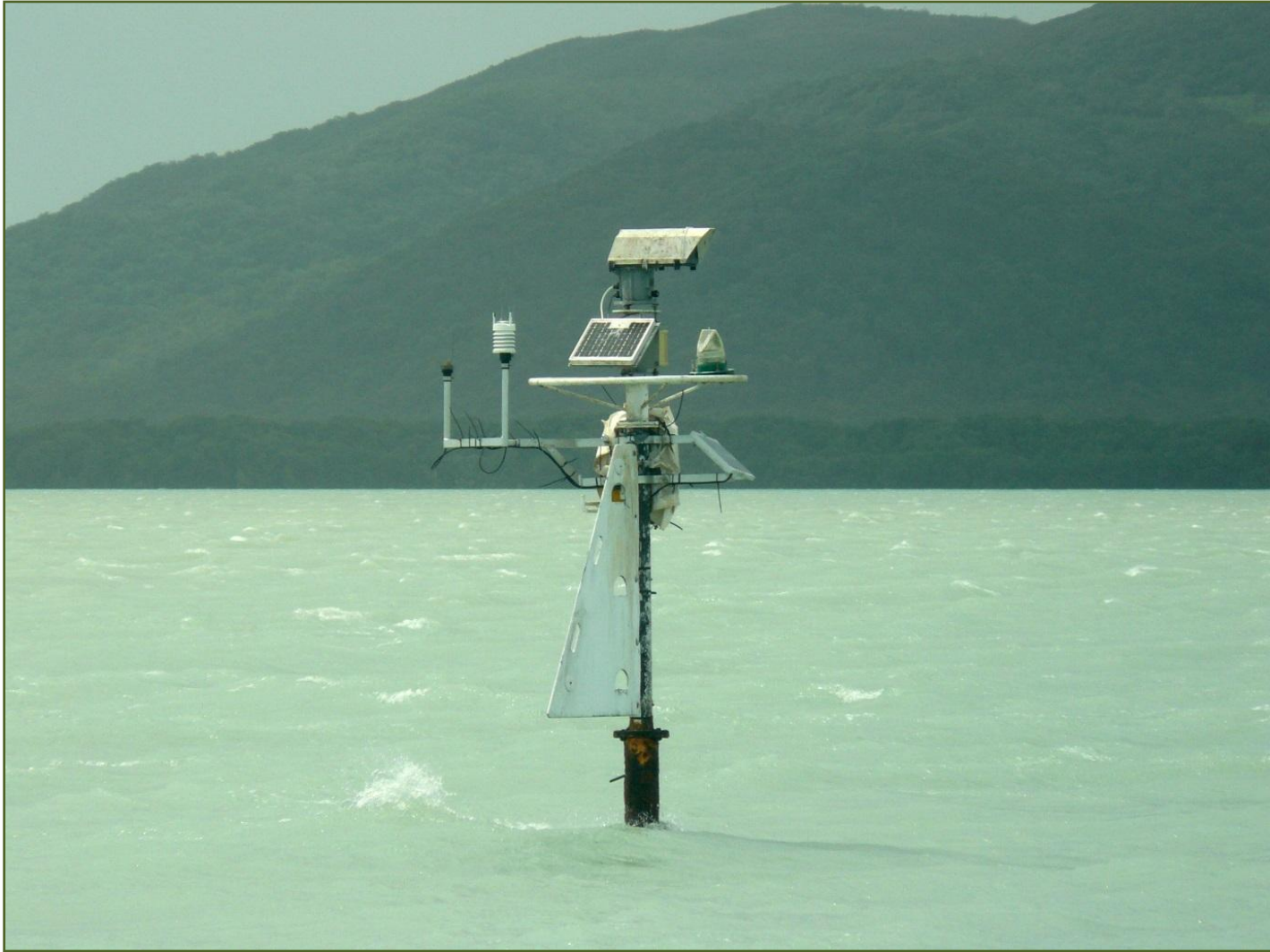
Masig Island Station

Maizab Kaur (Bramble Cay) Station

Bayesian Coral Bleaching Models

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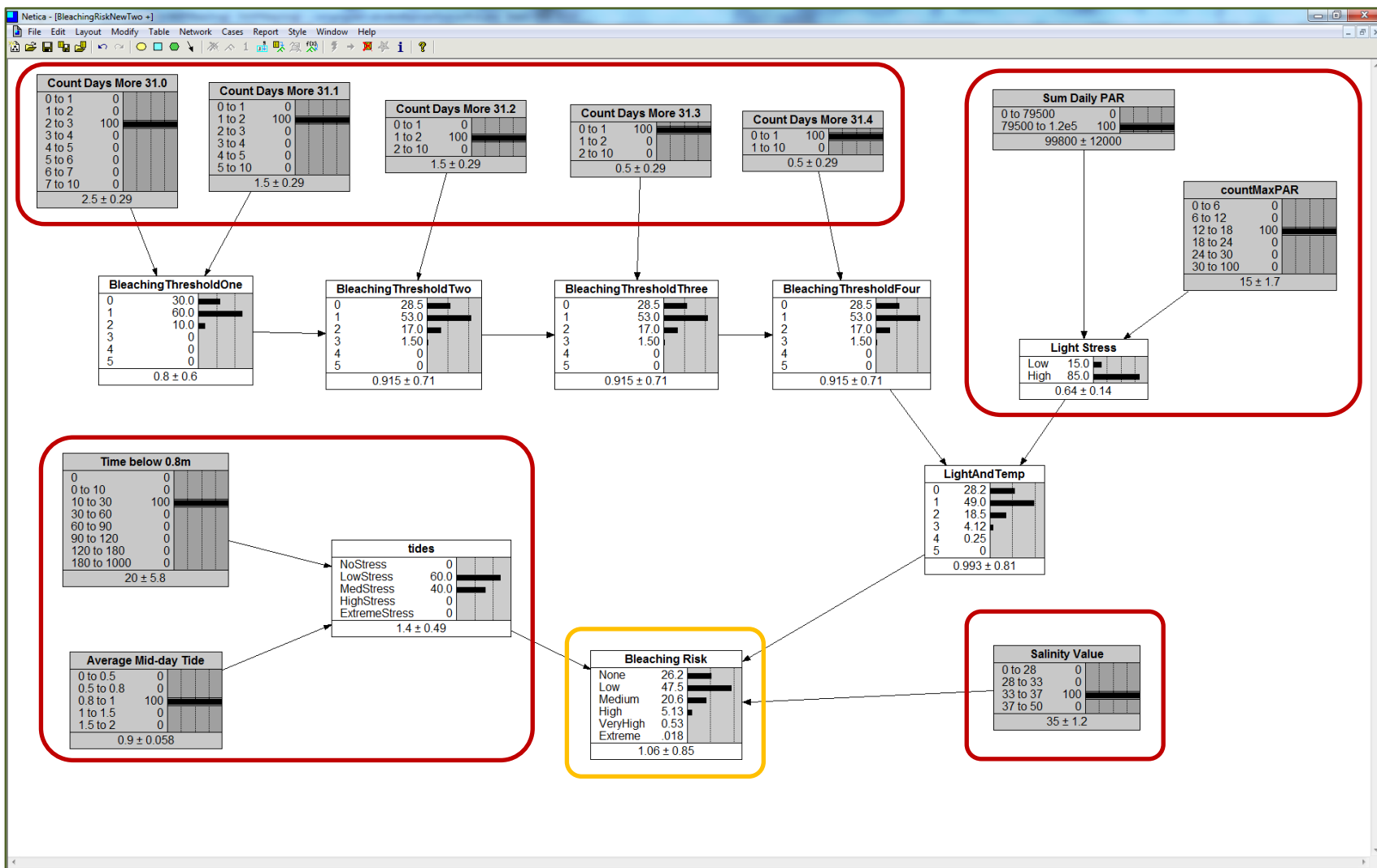
Satellite Ocean Condition Reports

- Using Satellite imagery scientists at the University of Queensland were able to compare the **current conditions against historical data**.

- From this able to produce temperature anomaly maps, that is maps of areas that are **cooler or warmer than the long term mean**.

- This can help identify areas where **coral bleaching may occur**.

- Satellite data also shows what is happening across the Pacific including any signs **of impending El Niño or La Niña conditions**.
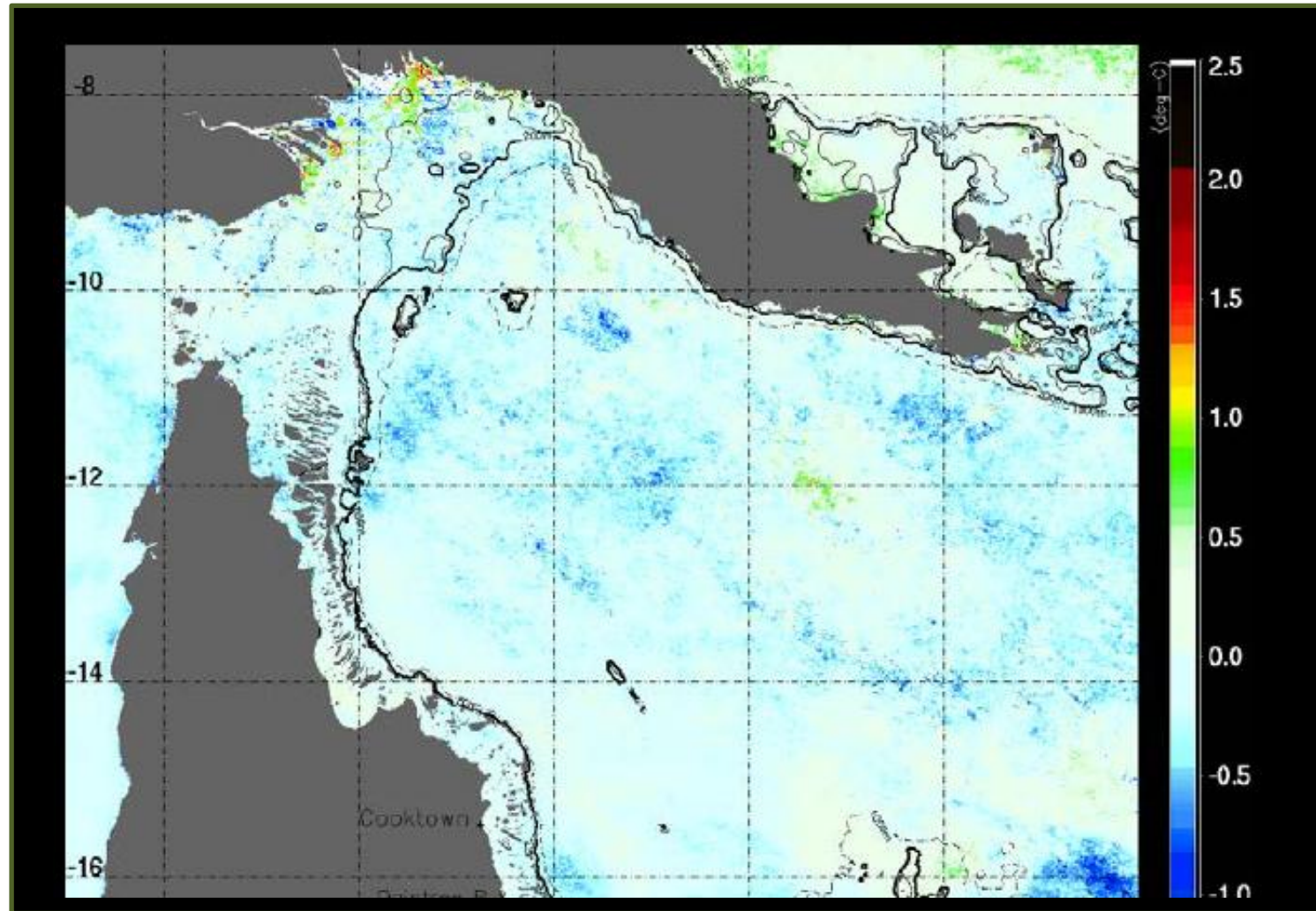
Satellite Sea Surface Temperature Maps
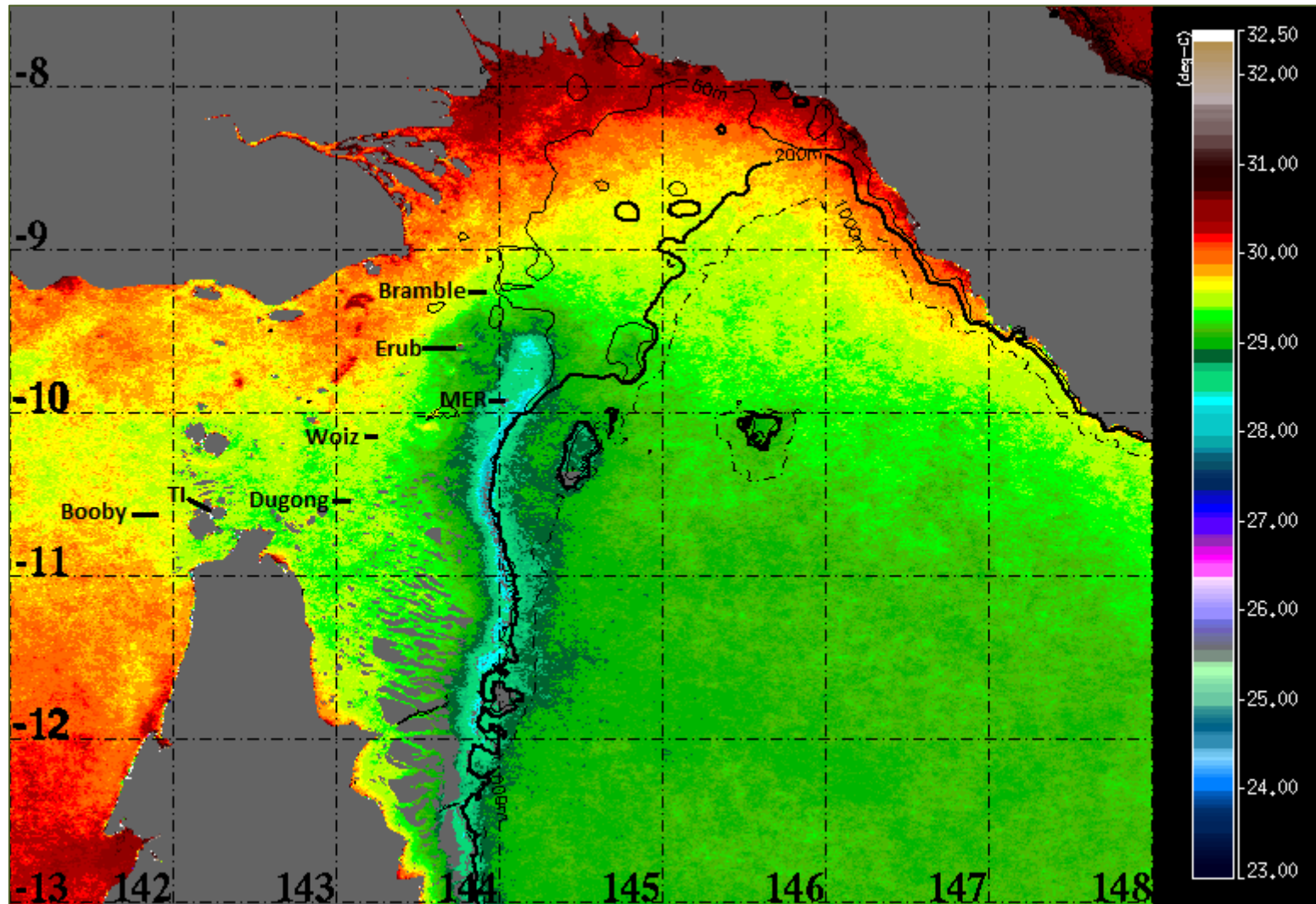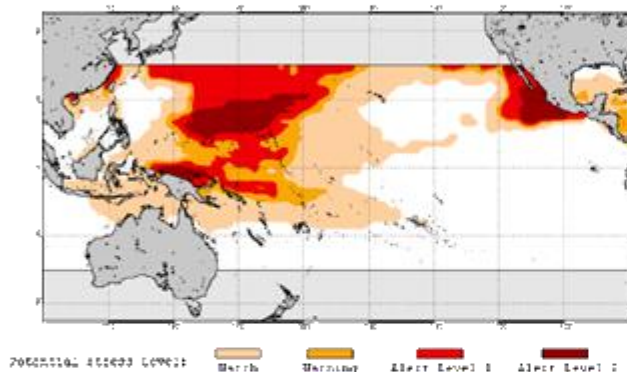
Satellite Sea Temperature Anomaly Maps

Satellite Coral-Bleaching risk predictions

NOAA Coral Reef Watch
Seasonal coral bleaching thermal stress outlook
September to December 2014
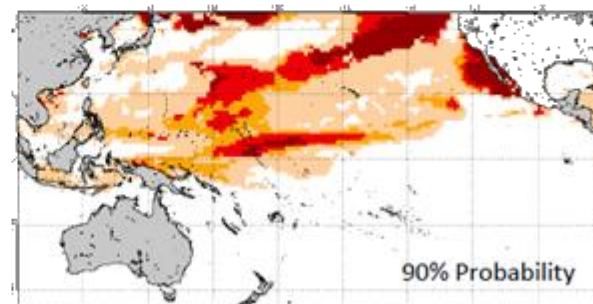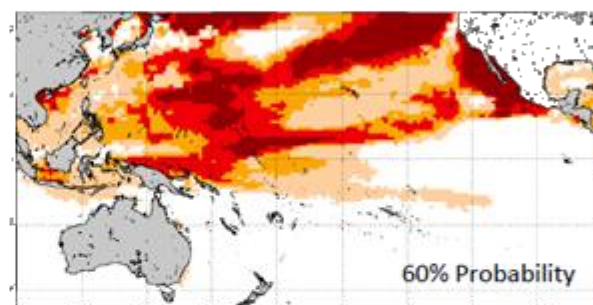
Satellite measured Pacific Warming

Key Outcomes and What They Mean

Outcome: Torres Strait has one of the richest coral reef systems in Australia

- Biodiversity surveys for fish and corals were done under the project at five locations with **279 species of corals** identified and **301 species of reef fish**.

- The sites in the central Torres Strait tended to be similar with the **eastern sites being different** – this may relate to water conditions (turbidity).

- **A significant number of coral species unknown** to the Torres Strait were found with potentially new records for Australia.

- Some **coral disease** was recorded at some sites as were **crown-of-thorns starfish**.

- Some of the **temperature sensitive** species at Mer Island seemed to have declined in comparison to an earlier survey.
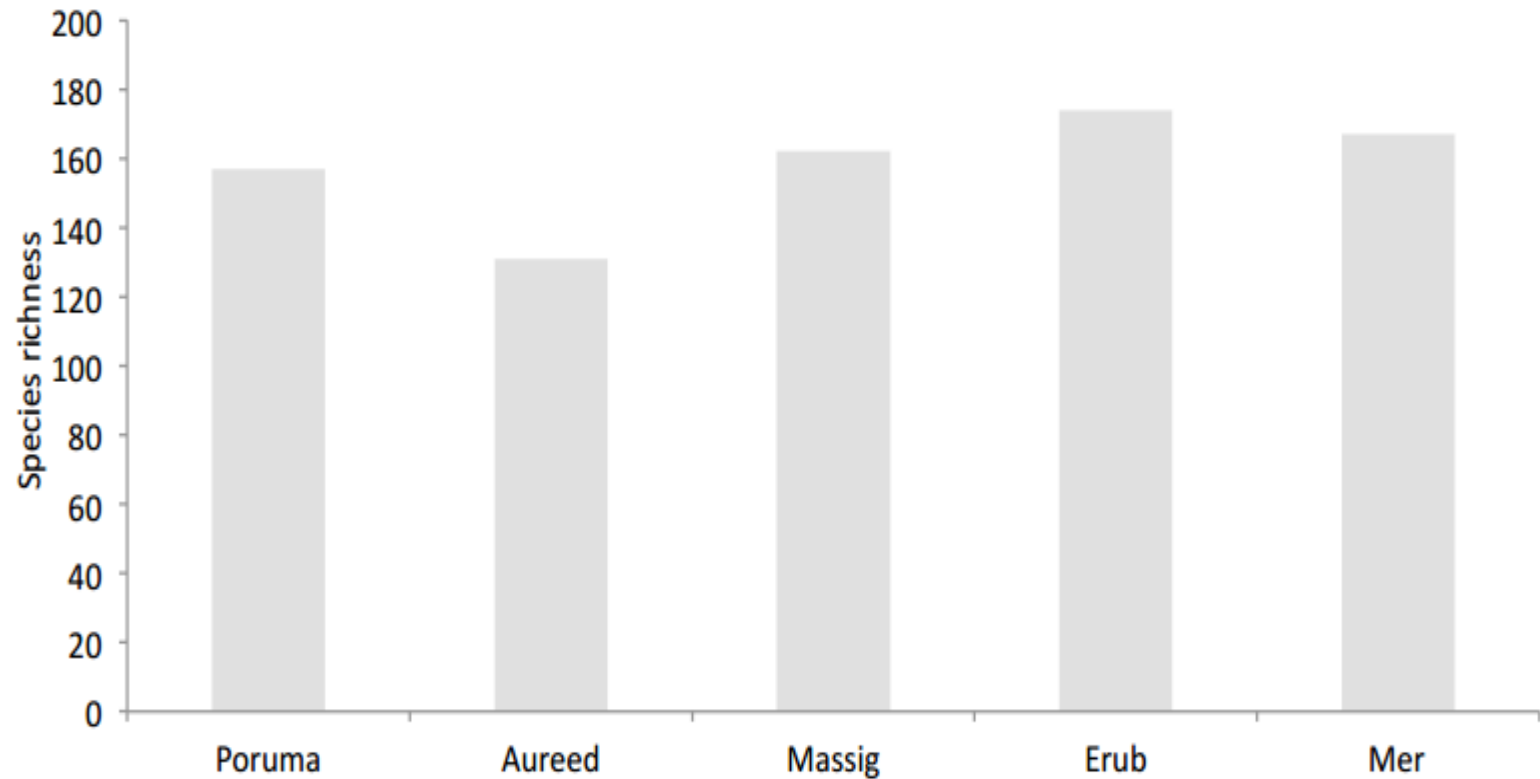
Coral Richness

Figure 2 Species richness of scleractinian corals on five reefs in the Torres Strait, arranged from west (Poruma) to east (Mer).

Number of Fish Species
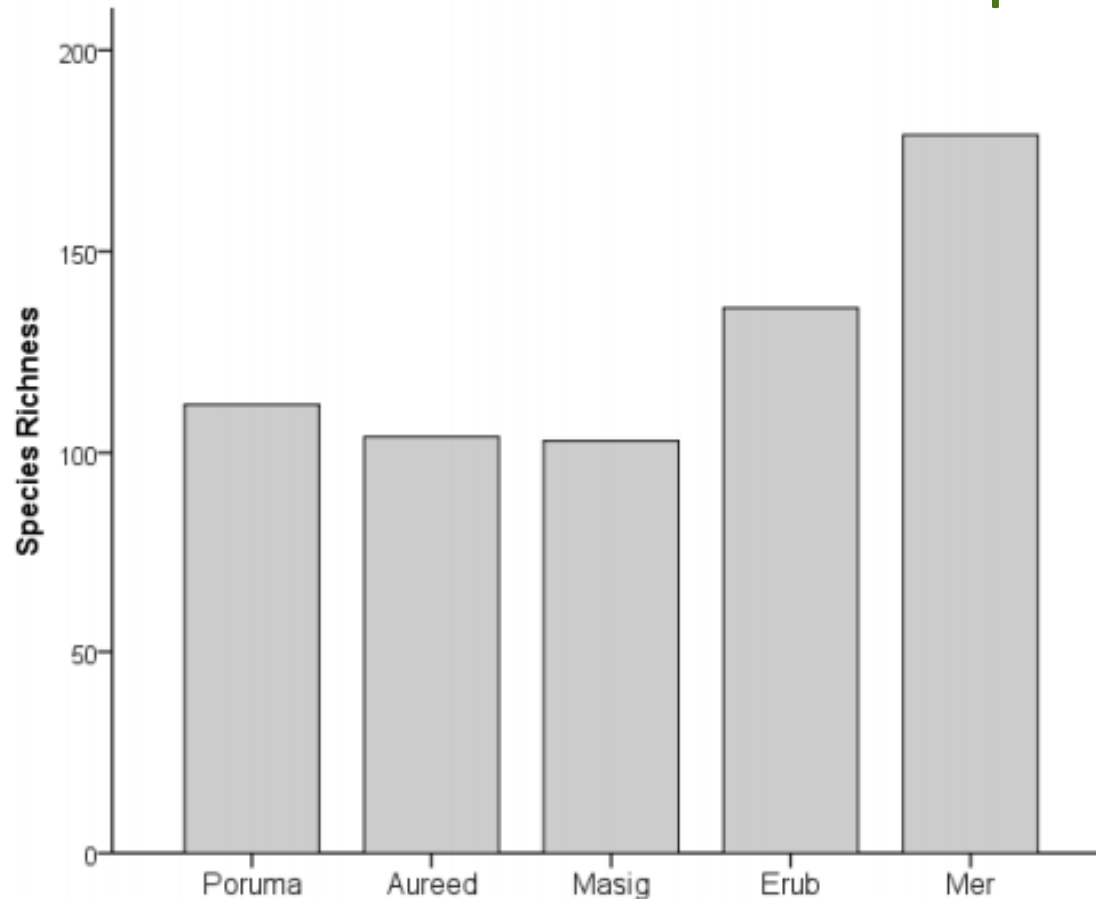
Figure 7 Species richness of conspicuous reef fish species on five survey locations in the Torres Strait, arranged from west (Poruma) to east (Mer).

Implication: Torres Strait has one of the richest coral reef systems in Australia

- Changes **how we view the Torres Strait**, its role in maintaining the **health of the whole GBR** and what focus we should place on managing and maintaining this system.

- Shows **how little we know** about the Torres Strait and highlights the need to do more, including routine monitoring.

- Is a result with **high community interest** and one that should be important in **developing policy** in the region.

- This leads to a need to **continue to develop capability** in the Torres Strait to continue the work and to link in **monitoring to management** outcomes.

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Outcome: Ocean Temperatures have remained constant for the last decade

- For the best data we have, ocean temperatures in the Torres Strait have **remained about the same** for the last 15 years (no significant trend).

- What we did see was **one hotter year** (2010) which resulted in **widespread coral bleaching** in the Torres Strait, we think this was caused by higher temperatures globally in 2010 along with an extended period of calm weather (doldrums).

- 2010 was not that much hotter than other years showing it **doesn't take much for corals to bleach**.

Daily Water Temperatures – Thursday Island
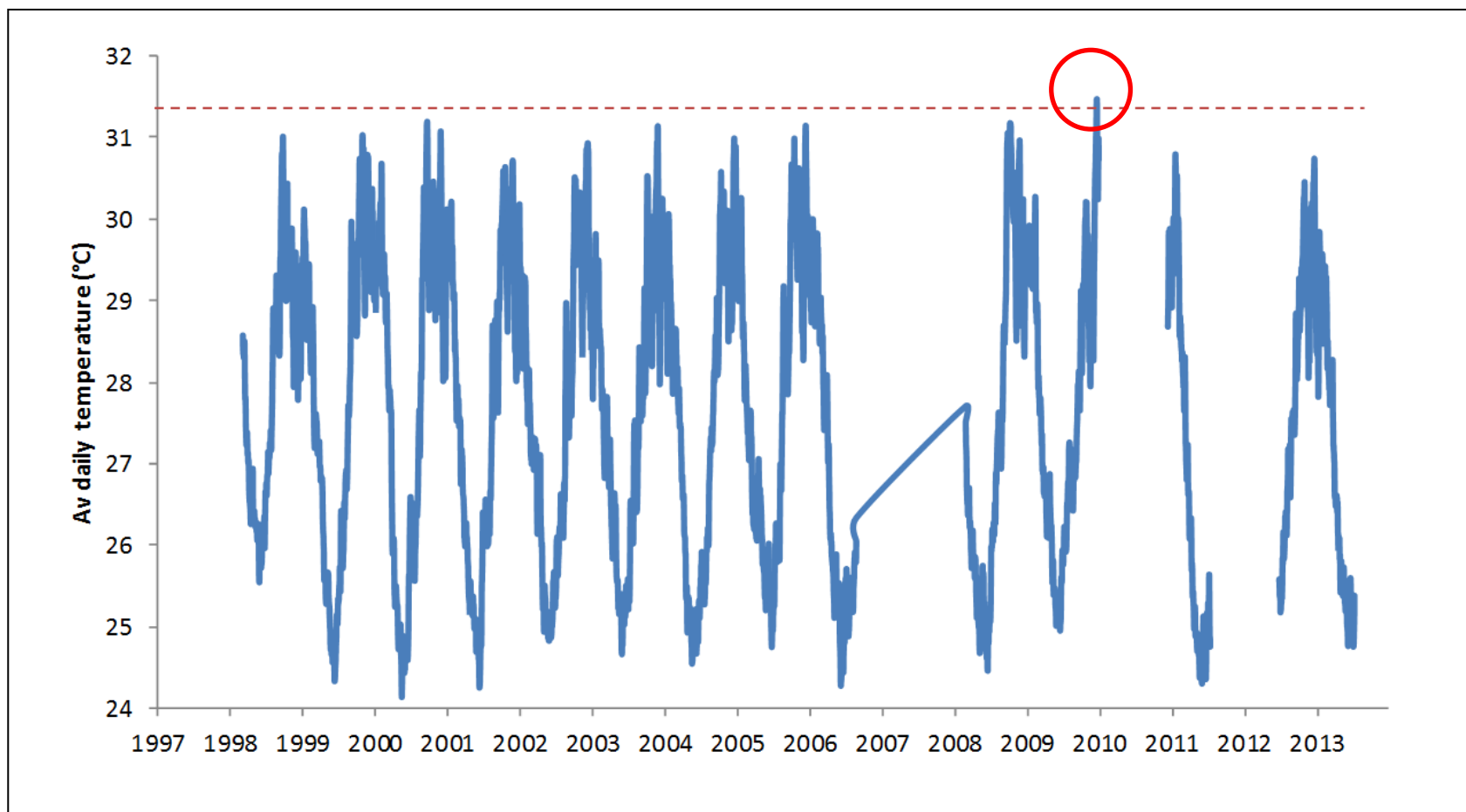
Implication: Ocean Temperatures have remained constant for the last decade

- There is **no immediate threat of elevated temperatures** in the Torres Strait given the limited data we have.

- The 2010 bleaching was caused by a **small temperature rise** coupled with **calm conditions**, this shows that **small changes in conditions can have a large impact**.

- Understanding the **influences on water temperature** and the thermal environment of the Torres Strait is critical in **predicting future bleaching**.

- More work needs to be done to understand the **thermal tolerance of corals** in the Torres Strait and how **close we are to that limit**.

Outcome: The last few years have been relatively cool - but this may be changing

- The real time stations on Thursday and Masig Islands have shown that the last **few years have been cooler years** with **no risk of coral bleaching**.

- This is driven by two things:

  – That the last few years have **been windy and rainy** – this tends to mean more clouds, more wind and more rain – all of which cool the ocean.

  – Driving this is a *La Niña* **weather pattern** – that is the Pacific long term weather patterns have been cool and wet and this impacts conditions in the Torres Strait.

- Satellite images show that we may be at the **end of the *La Niña***, if we move into the *El Niño* weather pattern we may see **warmer dry conditions** that may increase the risk of coral bleaching.

Ocean Temperatures at Thursday Island

Daily Average Water Temperatures for Thursday Island against Climatology Values
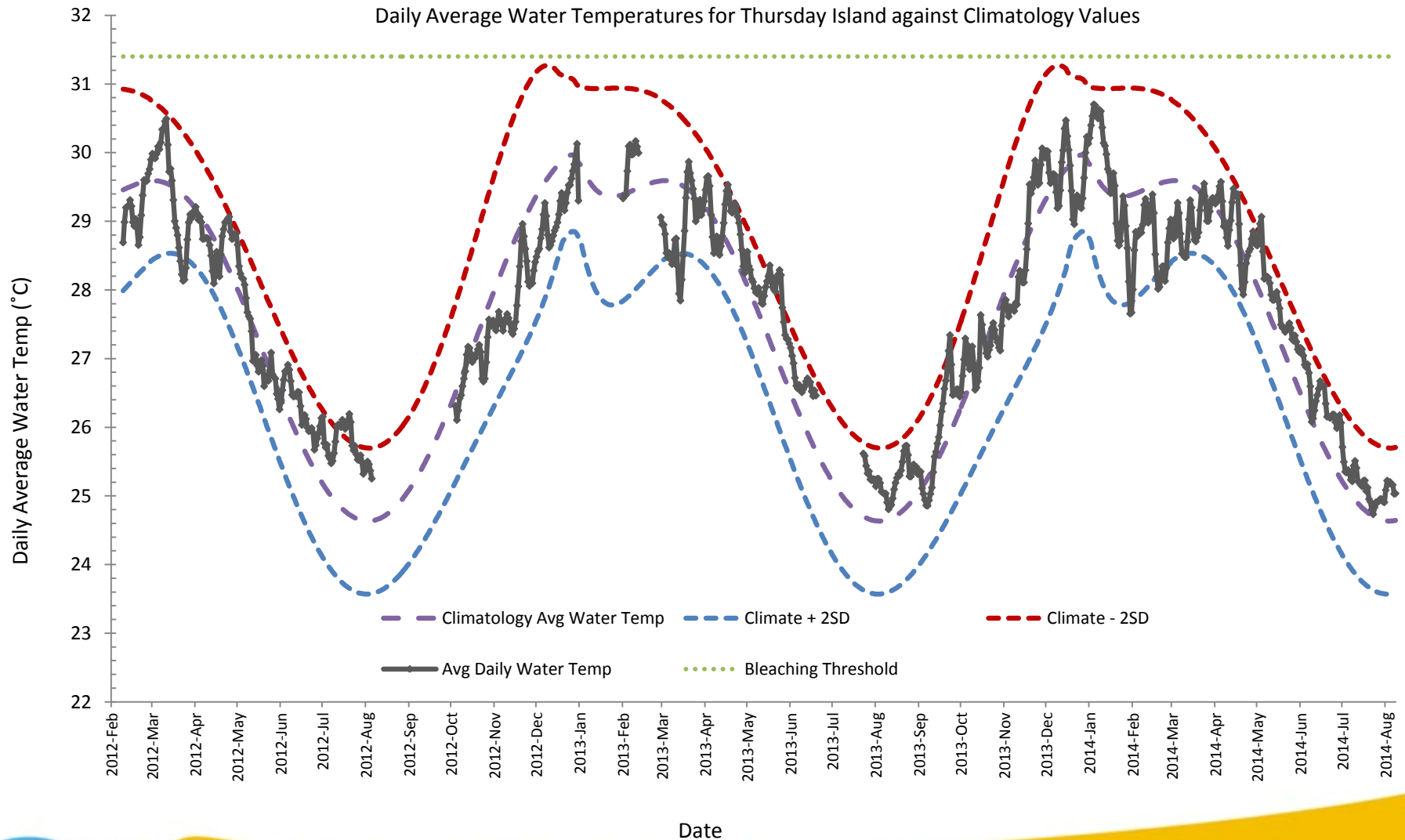
Changes in the Pacific could lead to changes in the Torres Strait

NINO3 SST Index
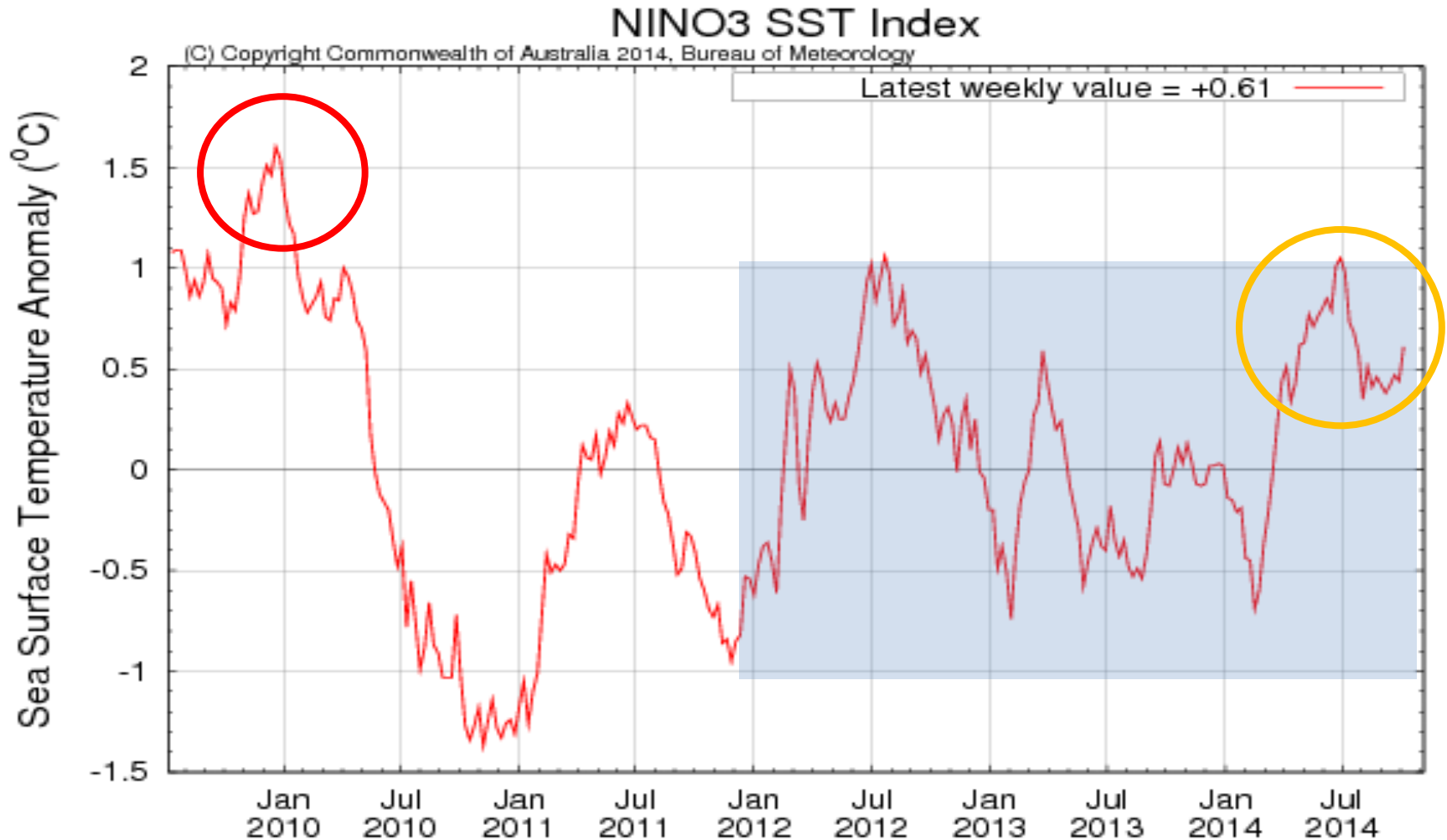
The longer term context…

SST Anomaly in Nino 3.4 Region (5N-5S,120-170W)

National Climatic Data Center / NESDIS / NOAA

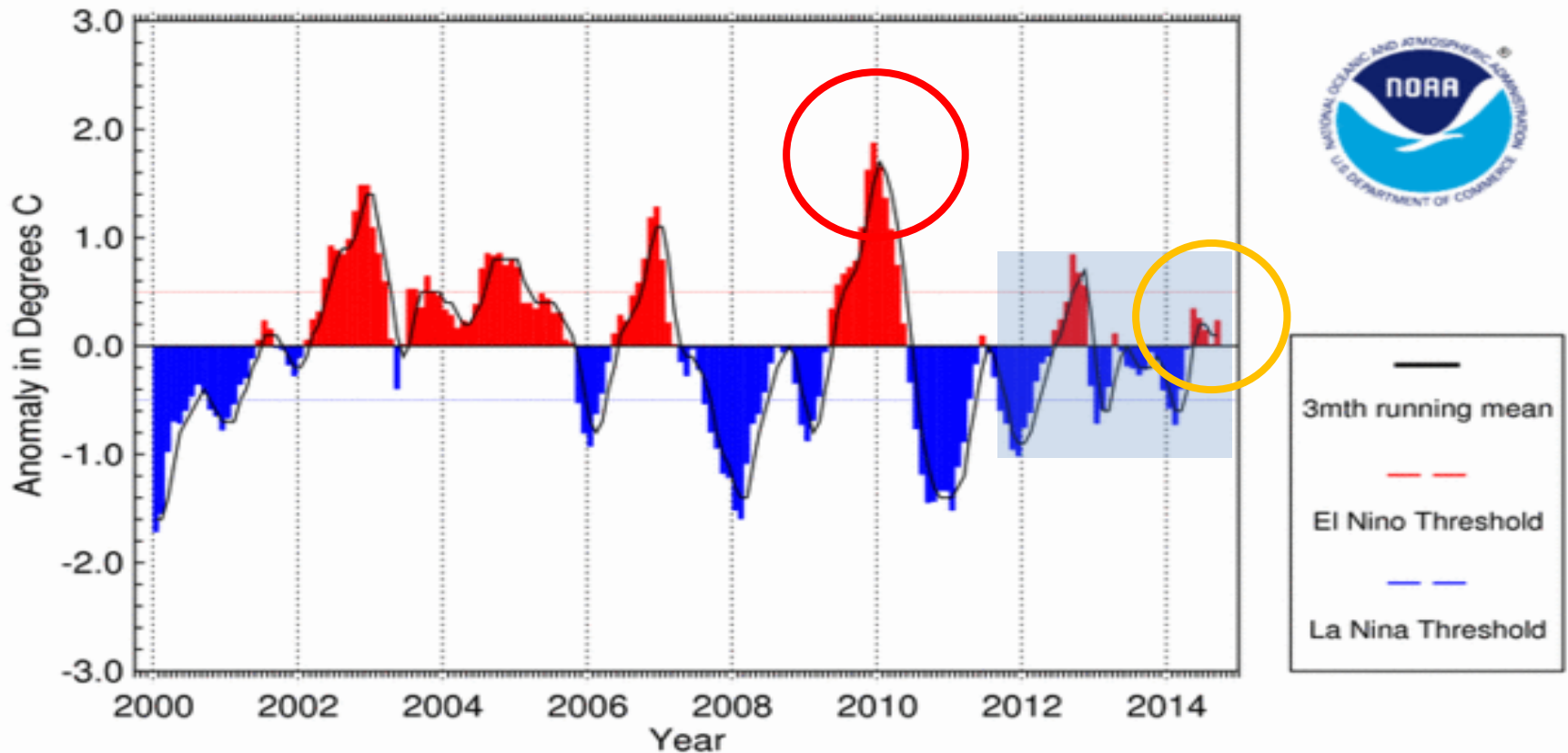## Implication: The last few years have been relatively cool - but this may be changing

- While the lack of coral bleaching in the last few years is consistent with the ocean temperature data, **changes in global weather will change the bleaching risk**.

- If El Niño conditions become established then the bleaching risk will increase and so there is a need to have **appropriate monitoring and response programs in place** before then.

- The bleaching in 2010 shows that **small changes in temperature can cause widespread impact** so the system may already be close to its thermal limit.

- While we have time, we need to need to **continue to collect baseline data**, from ocean conditions, weather, species distribution, coral health, fish abundance and so on.

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Torres Strait Observing System
Madge Reef Station
Data as of: 24-October-2012 02:40pm

Current Wind Conditions: - Updated every 10 minutes -
Average Wind Speed: **19 Knots** and Steady
Gusting to: **26 Knots**
Blowing from the: South East and steady

Current Conditions: - Updated every 10 minutes -
Air Temperature: 27.5 °C.
Rainfall since 9am: 3.6 mm
Barometric Pressure: 1,012 hPa and falling

Wind Forecast (BoM): - Updated Daily -
This afternoon: 25-30 knots -> falling
Tomorrow Morning: 20-25 knots
Tomorrow Afternoon: 20-25 knots -> steady

Ocean Forecast: - Updated Daily -
Ocean Temperatures: Within Normal range, trending steady.
Coral Bleaching Risk: No current Risk and expected to stay the same

For more information see the display inside the IBIS Supermarket on Thursday Island. Data brought to you by the TSRA via the Commonwealth National Environmental Research Program (NERP) and the Australian Institute of Marine Science (AIMS).

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Capacity Building

- Logger program field component can now be **totally supported by the local sea-rangers**.

- Coral **reef monitoring skills transferred to local sea-rangers**, two training trips completed.

- The basic maintenance and fault finding of the real time stations is currently **being transferred to TRSA LSMU staff**.

- Workshop undertaken in early October to further build capacity in the region for **reef monitoring activities**.

Future Work

- Need to continue the **data collection component** to get better baseline data (loggers and real time stations, reef surveys).

- Need to support **basic oceanographic work** in the region to gain access to good predictive oceanographic models.

- Need to continue to **develop and refine** coral bleaching models to give **greater warning of potential events** and to understand impacts of observed events.

- Coral monitoring needs to be **transitioned to a sustainable base** within the local agencies with linkages to **management actions and outcomes**.

Conclusions

1. The **reefs in the Torres Strait are in good condition** with a very high bio-diversity, although there are some signs that issues impacting the GBR may be present in the Torres Strait.

2. **Ocean temperatures do not seem to be rising** (given a limited amount of data), the last few years have been relatively cool reflecting global weather patterns but **as these change so does the local bleaching risk**.

3. We still have a very **limited understanding of the basic ocean conditions** in the region and this limits our ability to forecast future conditions or understand the impact of global weather.

4. **Local engagement has been good** with a high level of local capacity to support the project, work is underway to build on this.
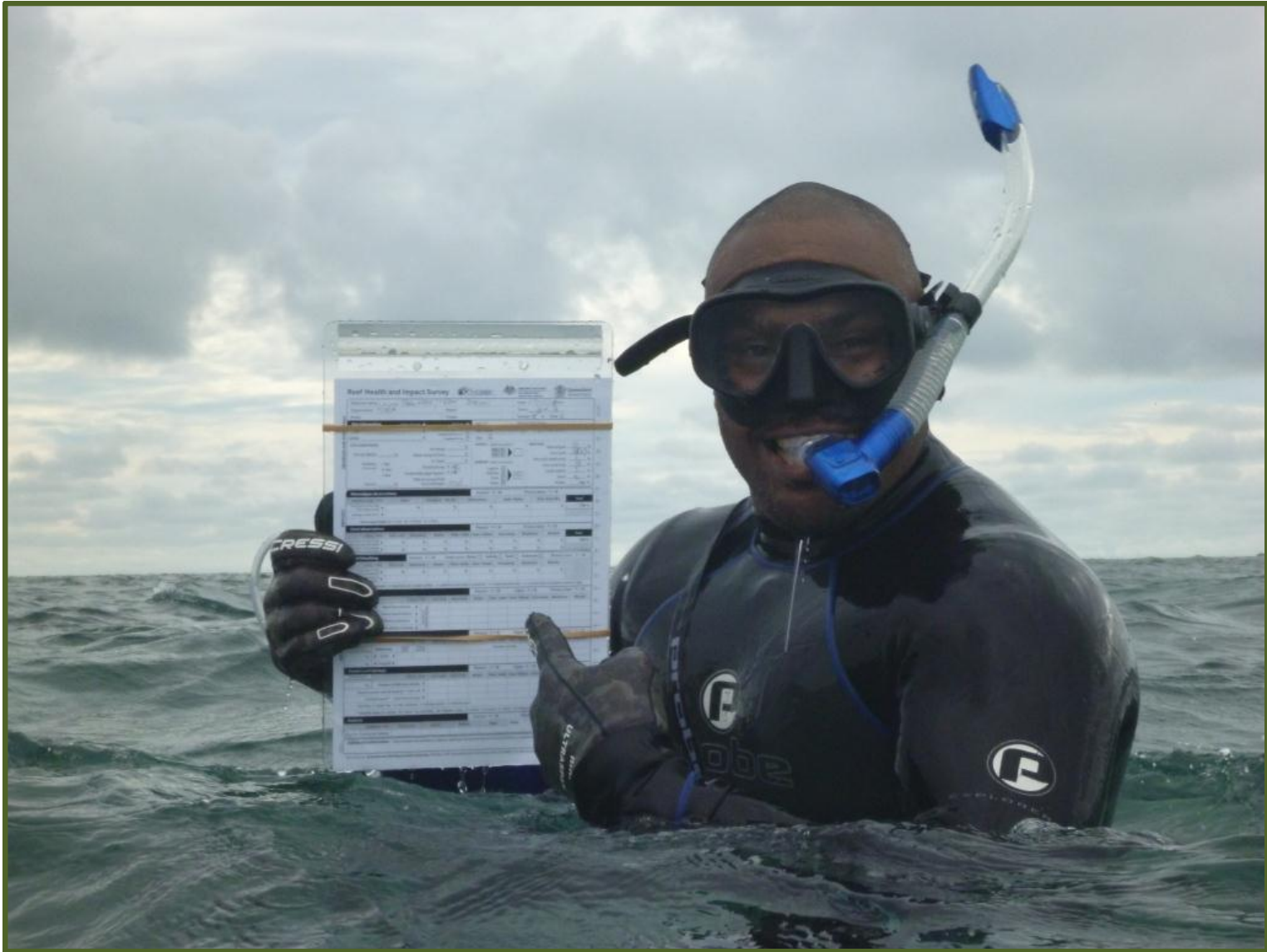
Acknowledgements & Thanks

- Our **TSRA Buddies** Frank Loban and Stan Lui;

- The staff and management of the **Land and Sea Unit** (LSU) of the TSRA;

- The various **traditional owners** for access and welcome to their country;

- The **good humour** of all the people involved!

ESSO (THANK YOU)!

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