

#### Water Quality Hazard Assessment and Monitoring in the Torres Strait

Presented by Jon Brodie on behalf of the project teams:

Team 1. (NERP project) Jane Waterhouse, Will Higham, Eric Wolanski, Caroline Petus, John Rainbird, Jo Johnson, Matt Brodbeck, Frank Loban, Vic McGrath, Jonathan Lambrechts

Team 2. (TSRA project) Jane Mellors, Dominique O'Brien, John Rainbird, Flávio Martins, TSRA Rangers, Vic McGrath, Eric Wolanski, Emma Johnstone, collaboration with AIMS.





## Background

Project was initially funded through NERP for 2 years – hazard assessment of water quality in the region

- Developed hydrodynamic model for the region
- Identified greatest potential threats to the region
- Scoped out the use of remote sensing as a tool
- Completed island visits to assess local water quality issues
- Designed a monitoring program for future work

### Ok Tedi

### Massive problems with sediment, copper, other metals to the end of the Fly River

Waste Rock – 60 million Erosion Rock – 10 million Tailings - 30 million TOTAL – 100 million tonnes

Natural Sediment – 15 million



# Shipping



#### Through the Strait

#### Terminals





#### Prince of Wales Channel charted route. Source: AMSA.



# Modelling

Eric Wolanski, Fernando Andutta, Flavio Martens, Jon Brodie - SLIM and MOHID models

Paper: The net water circulation through Torres strait. Eric Wolanski, Jonathan Lambrechts, Christopher Thomas, Eric Deleersnijder



#### **General findings (SLIM):**

- General movement east and north, and PNG coastal current (along the coast east to west).
- Net current is unpredictable, driven by far field storms / large offshore events.
- Shallow water in Torres Strait region reduces the amount of wind driven current.



# **Project Conclusions**

- The greatest water quality threats are associated with the risks from the passage of large ships through the Region and increasing numbers of such ships. Ship groundings, oil spills, toxic cargoes.
  - Limited and complex water exchange in and out of Torres Strait concerns that if Torres Strait water became polluted it would probably remain in the Strait for some time.
  - Ship grounding and oil spill on island/reef in TS catastrophic for small island communities. Limited response capability.
- Localised issues with wastewater (sewage) management (and marine outfalls) and general waste (rubbish) management exist.
- Marine litter is also a major issue e.g. ghost nets, plastics





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# **Project Conclusions**

- Large development in PNG including continued OK Tedi operation, gas platforms, oil palm expansion and Daru port development may also be significant.
- Preliminary analysis suggest that adverse effects in the Australian part of the Torres Strait are likely to be restricted to the northern islands – Boigu, Saibai, Erub and Ugar.
  - Water excursions from the Fly River predominantly moves to the east into the northern Coral Sea and along the PNG coast towards Port Moresby and are uncommon to the west of the river mouth - *hydrodynamic modelling and remote sensing analysis*
  - The currents in this western region are generally from east to west in the central TS but a coastal current flows east to west close to the PNG coast. Construction and operation of a major port at Daru has the potential to lead to excursions of contaminated water along the PNG SW coast



## **Current Project**

Testing the heavy metal content of the water quality of the Torres Straits. This was last done 20 years ago.

It will give us a new understanding of the risks to Torres Strait sea country from future large scale development in PNG.

#### **Activities:**

- Measure how far the Fly River run-off stretches into the Torres Strait
- Measure the amount of heavy metals that may possibly be carried into the Torres Strait via this run-off
- This will be measured along a gradient away from the Fly River through the Torres Strait





# How?



- Using satellite images and models of tides and currents to trace sediment plumes
- Using Diffusive Gradients in Thin Films (DGT) or artificial bivalves to measure heavy metals in the water column
- Biomonitoring using oysters
- Deploy standard water quality loggers measuring temperature, salinity and turbidity
- Further modelling (MOHID)







# Where?

Bramble Cay

#### Heavy metal sampling:

- Boigu
- Saibai
- Thursday Island
- Horn Island
- Wednesday Island
- Data loggers:
- Bramble Cay
- Masig
- Saibai or Dauan



# Progress so far

#### **Trace metal sampling**

- First deployment in June at 4 sites (three in the waters off Thursday and Horn Island and one off Badu).
- Deployments were successful and all samplers were retrieved without incident; we are awaiting results from the lab on metal concentrations detected.
- Further deployments September, November with Rangers heavily involved.









#### **Data loggers**

- Data loggers have been purchased for installation at Bramble Cay, Masig and Saibai/Dauan Islands – collaboration with TSRA and AIMS
- Purchased two turbidity loggers (WETLABS ECO-NTU-S turbidity logger obtained from Imbros) – Bramble Cay and Masig. Liaising with AIMS re: compatibility with telemetry.
- Third logger records conductivity, temperature and turbidity Saibai/Dauan





# Remote sensing

- The compilation of a 7-year database of MODIS true colour images (imported into ARCGIS for post-processing)
- A selection of cloud-free images provided for validation of the 3D hydro-dynamic model developed by Flavio as part of this project
- The successful test of the method to automatically map the Fly river turbid plume using MODIS true colour images

### Added benefits!







### **MOHID** modelling

#### Flávio Martins, Eric Wolanski, Jon Brodie



# Continuing

- Publish: The pattern and intrusion of the Fly River plume to the Gulf of Papua and the Torres Strait (MOHID modelling)
- Coordinate with John and the TSRA rangers (Sea and Land teams) to ensure that DGTs are deployed at the selected islands when working trips are being undertaken.
- Liaise the Saibai Rangers to facilitate the installation of the turbidity loggers.
- Coordinate with Emma Johnson to undertake the deployment of oysters at three sites to assess the use of bivalves as water quality monitoring tools within the Torres Strait.
- Remote sensing : (1) daily river plume maps and (2) masks representing dense clouds and intense sun glint, used to eliminate areas with insufficient information to map plumes.

#### **TORRES STRAIT MARINE WATER QUALITY MONITORING PROJECT**

MALAN BY KENE SHAWING

**OPERATE?** 

#### A.E.E. Ut WHAT WILL THE PROJECT DO?

The TSRA will be testing the water guality of the Torres Straits. This was last done 20 years ago. The new project will:

- Measure how far the Fly River run-off stretches into the Torres Strait
- Measure the amount of heavy metals that may possibly be carried into the Torres Strait via this run-off.

It will give us a new understanding of the risks to Torres Strait sea country from future large scale development in PNG.

#### WHY

Knowing the status of water quality is important for the health of people, turtles, dugongs, fish and the sea.

#### HOW We will be using satellite images

and models of tides and currents. Heavy metals will be measured using sample

detectors anchored in the



water for 5 days. Temperature, salinity and turbidity will be measured using data logger instruments

#### THE PROJECT TEAM

















Vic McGrath





We would also like to install the data loggers at Bramble Cay, Masig and Saibai. PAPUA NEW GUINE

and Wednesday Island.



WHERE AND WHEN WILL THE PROJECT

We hope to start this project in June 2014 once

the support and approvals from relevant PBCs

It is anticipated that heavy metal sampling can

be done along the predicted run-off of the Fly

Warraber, Badu, Thursday Island, Horn Island

River at Boigu, Saibai, Erub, Mer, Masig,

and other stakeholders have been finalised.



#### Acknowledgements: Torres Strait Regional Authority National Environment Research Program Torres Shire Council Torres Strait Islands Regional Council



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