National Environmental Research Program

MARINE BIODIVERSITY hub

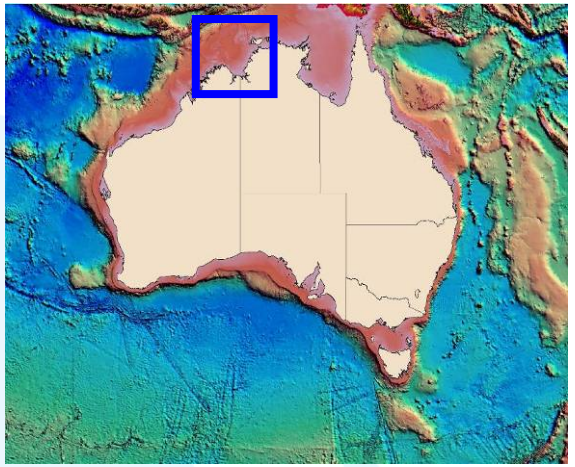
Theme 3 – National Ecosystems Knowledge

Project 1: Shelf and Canyon Ecosystems

Project 2: National Maps of Biodiversity & Connectivity

Presentation to SEWPaC: 22 Aug 2012

Background



Integrated Seabed Research

Seabed acoustics, Geomorphology, Sedimentology,

Benthic ecology, Oceanography, Spatial modelling

Multi-agency collaborations in Northern Australia:
Geoscience Australia, Australian Institute of Marine Science, CSIRO, Universities (UTAS, UWA, CDU), Museums (Victoria, NT, WA)

Multiple Programmes: e.g. CERF (2007-2010), NERP (2011-present) and others

Background

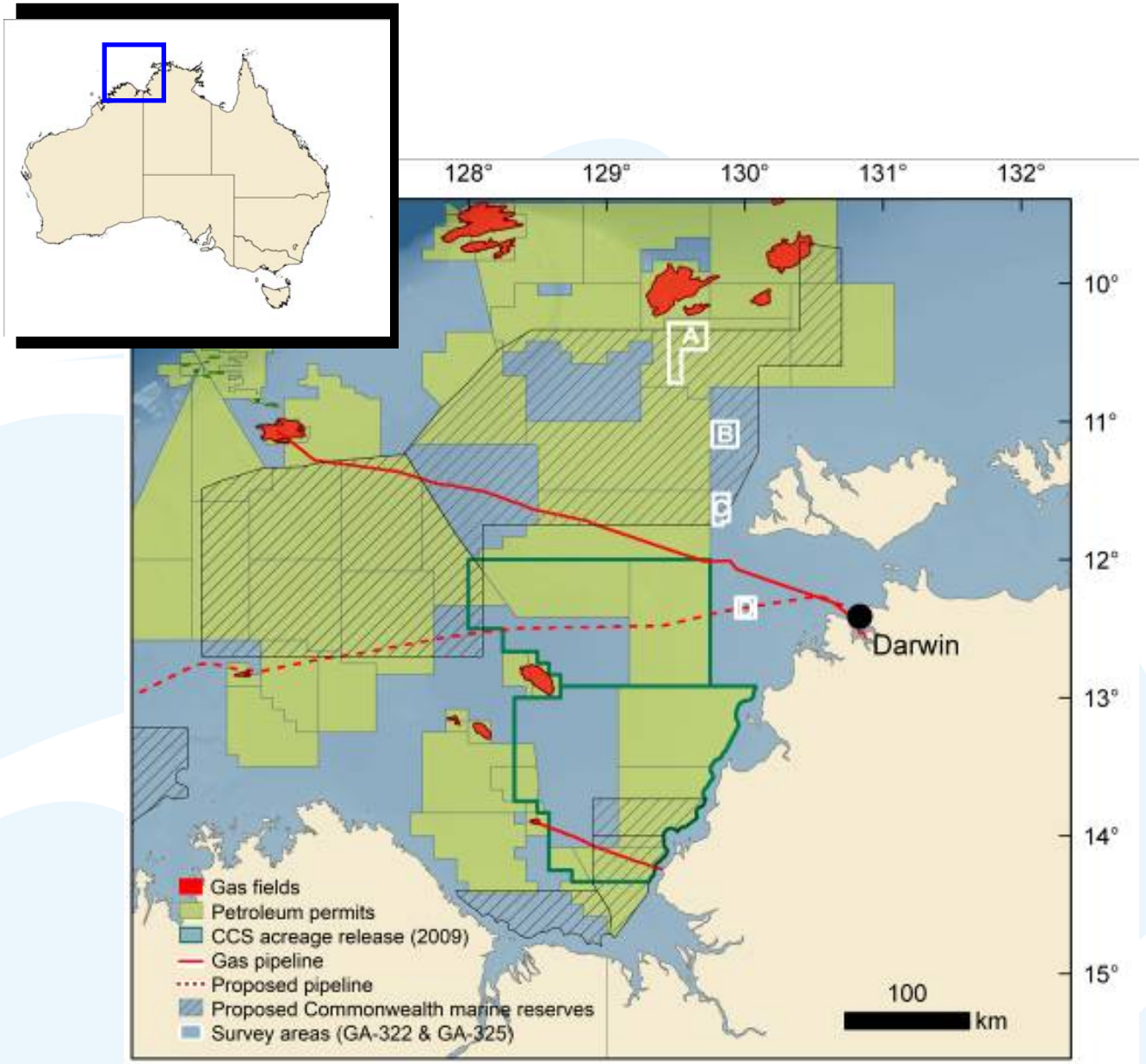
Timor Sea Region

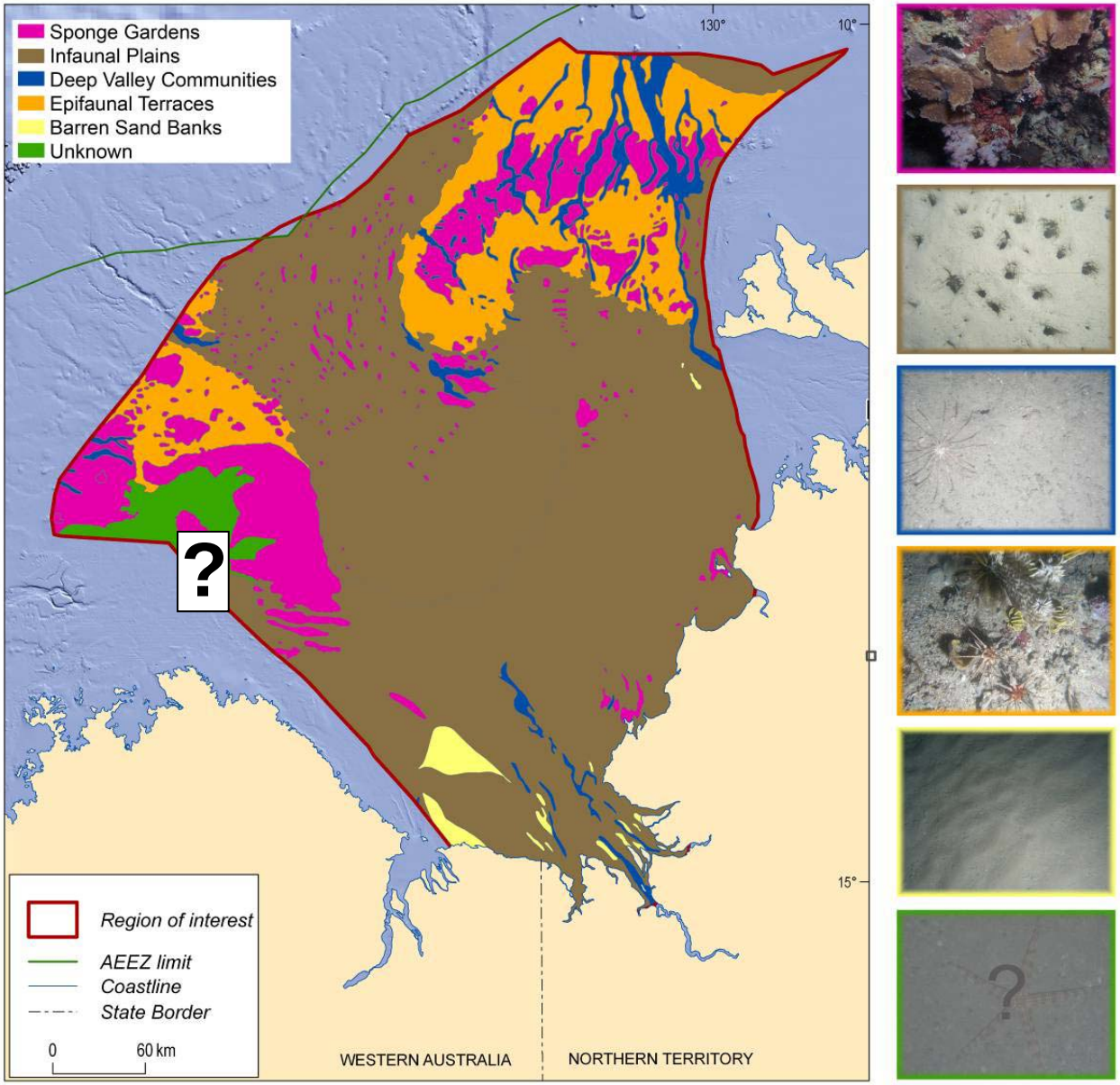
Tropical carbonate shelf province

Complex seabed geomorphology

High endemic biodiversity

Competing offshore industries & activities



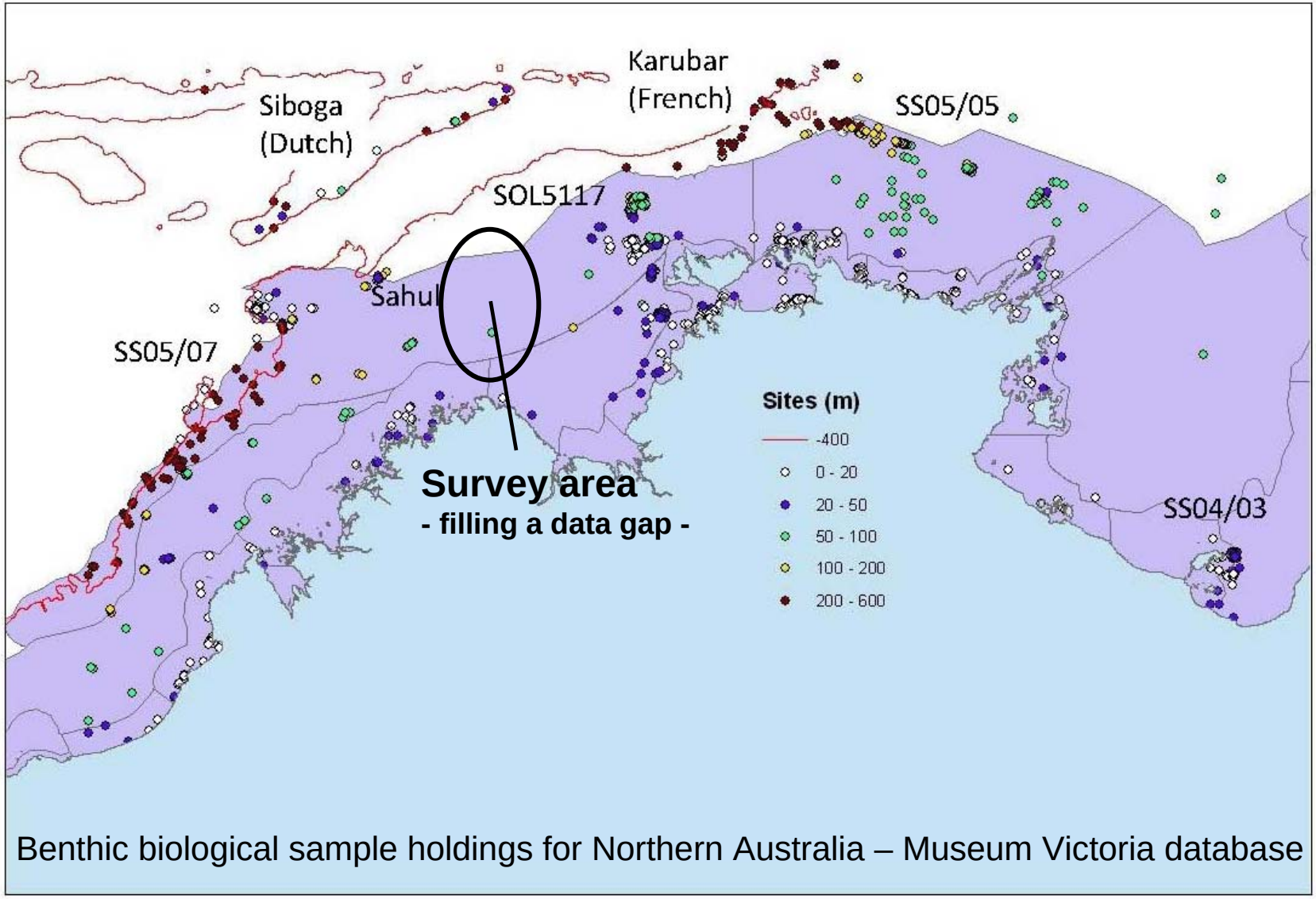


Timor Sea

Predicted Benthic Habitats

Przeslawski et al. 2011. Seabed Habitats & Hazards of the Joseph Bonaparte Gulf and Timor Sea, Northern Australia Geoscience Australia Record 2011/40

https://www.ga.gov.au/products/servlet/controller?event=GEOCAT_DETAILS&catno=72805



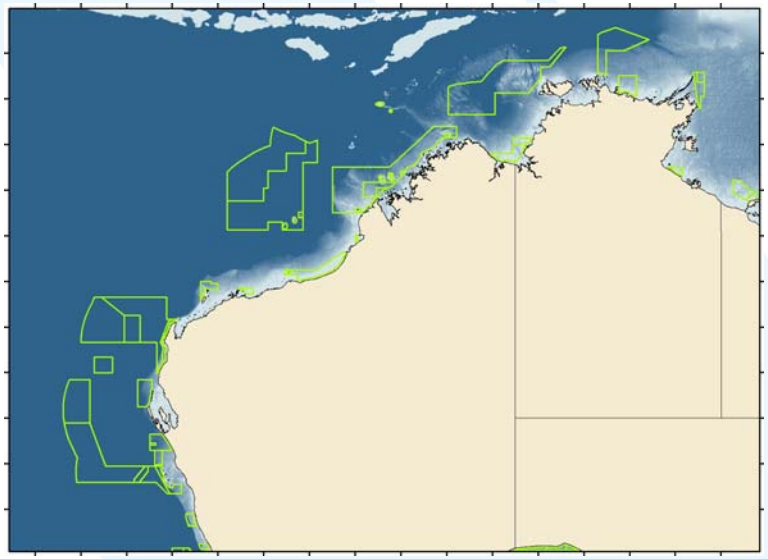
Benthic biological sample holdings for Northern Australia – Museum Victoria database

Project 3.1 – Shelf and Canyon Ecosystems

Objective – improved knowledge of the influence that large-scale shelf and canyon features have on patterns of marine biodiversity

Regional Focus - Northern Australia

- Northwest and North Marine Regions
- KEFs (e.g. 125 m ancient coastline, canyons)



National Focus - Canyon Classification

- How do canyons differ wrt biodiversity ?
    - Canyon vs non-canyon biodiversity

Data Discovery for Areas of Management Interest

→ Outputs: integrated GIS products & supporting documentation (metadata report due early 2013)

Physical data

- bathymetry
- geomorphology
- sediments
- oceanography → remote sensing data (MODUS, including time series)

Biological data

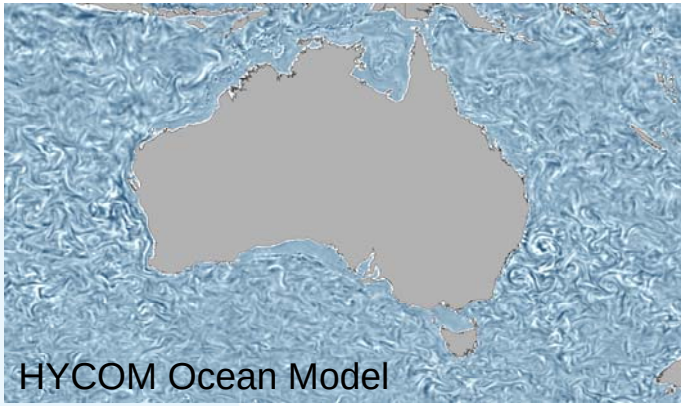
- pelagic species (fish catch data, other…)
- primary productivity (remote sensing data)
- benthic communities (new video analysis for canyons; new survey data; OBIS, ALA)
- predicted patterns of biodiversity (RAD 0.01 d grids)

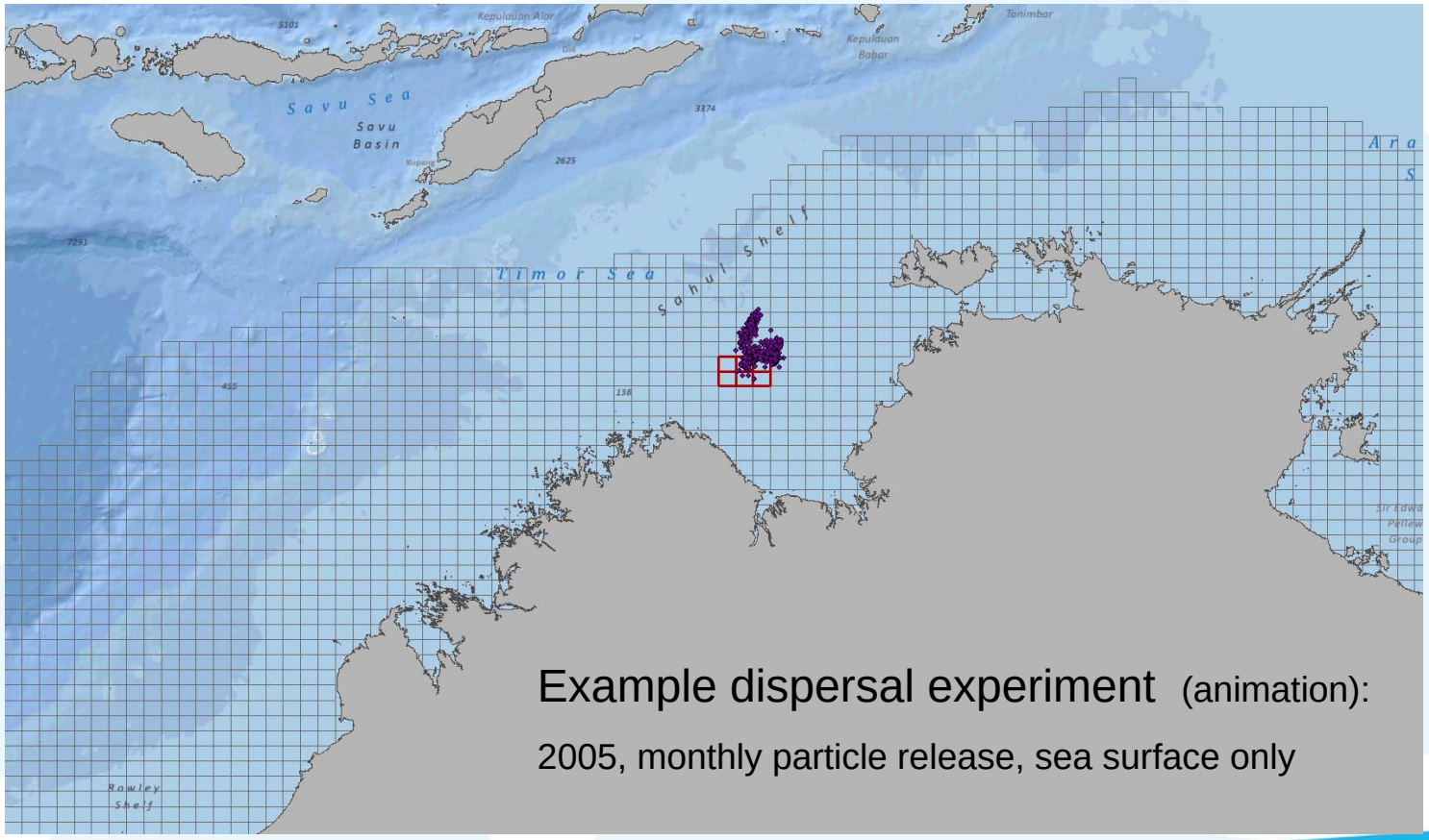
Larval dispersal modelling

- informed by ocean models & bathymetry
- fully 3D
- national scale

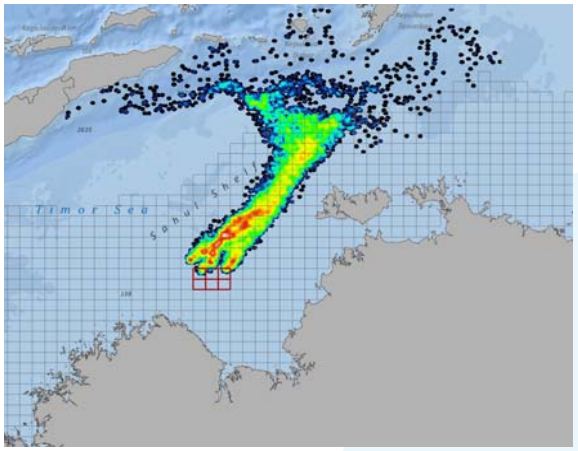
Larval dispersal model – pilot study

- National scale model at 25 km^2 grid resolution
- Plan to down scale to 9 km^2
- 3D structure → will allow analysis of seabed features

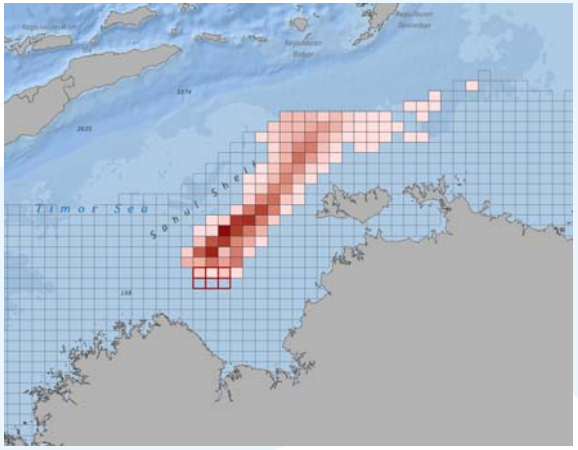




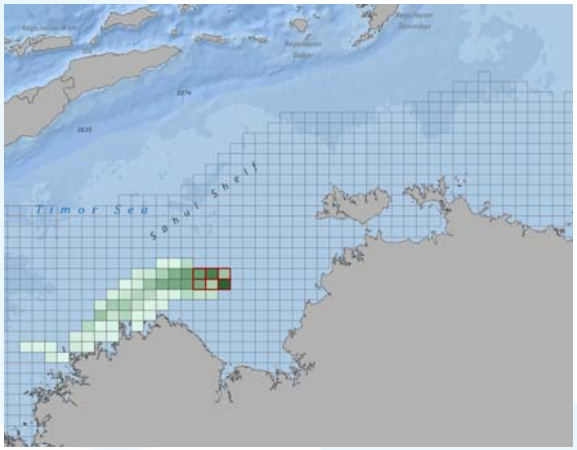
Larval dispersal model – pilot study



Particle density



Recipient cells



Contributor cells

Data Analysis & Synthesis for Areas of Management Interest

National Canyon Classification

→ Based on physical metrics & large-scale oceanography

Seabed Feature & Biodiversity Analysis

→ Do canyon and non-canyon habitats function differently with respect to biodiversity?

→ How does canyon & non-canyon structure interact with connectivity and biodiversity?

→ Can we use this information to predict biodiversity on shelf habitats where data is lacking?

Outputs –

Publications

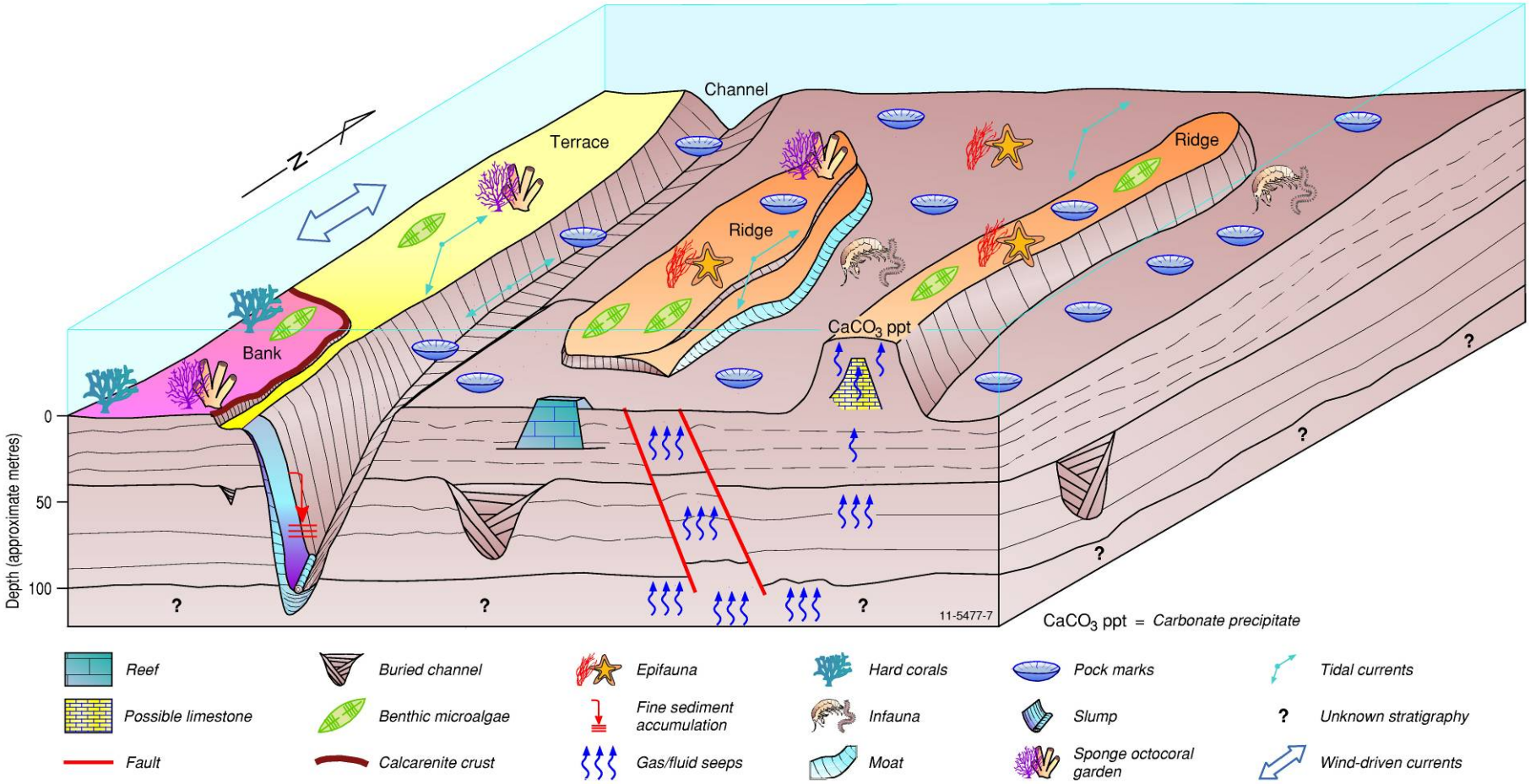
Descriptions of shelf & canyon features and related oceanographic processes

New models → understanding physical linkages within & between ecosystems

Analytical/methodological **template** for regional/national application

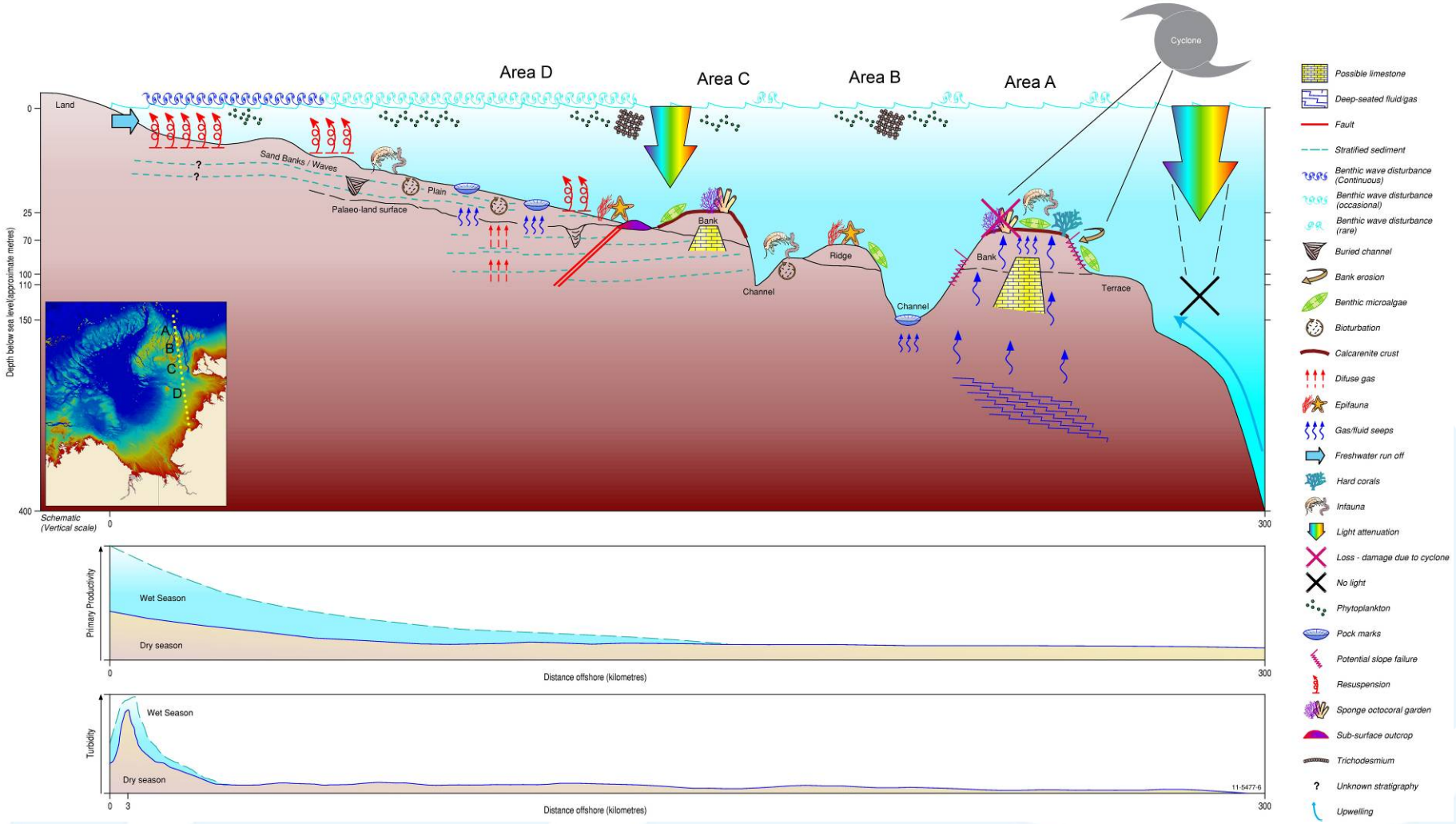
Example 1: Conceptual Models

Habitats



Example 2: Conceptual Models

Shelf Scale Seabed and Oceanographic Processes



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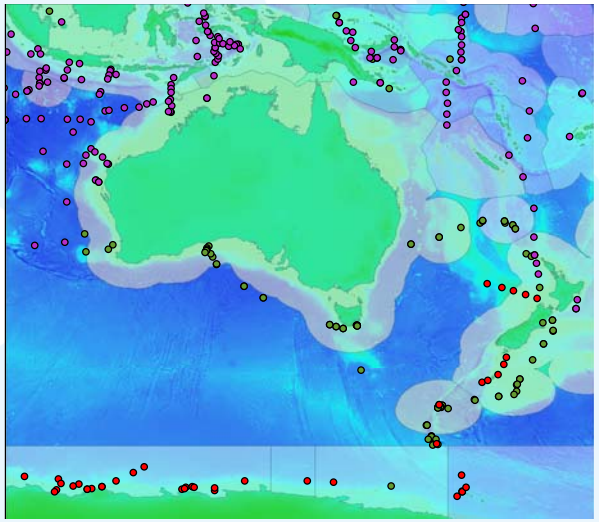
Project 3.2: National Maps of Biodiversity & Connectivity

Mapping biodiversity metrics:

- Beta diversity, species richness, endemism, rare species
- Phylogenetic endemism

Data:

- Two seafloor and one pelagic group of animals
- Spanning Australia's marine domain, including Antarctica
- Incorporating international datasets



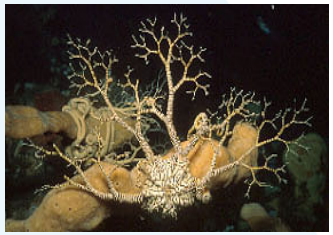
USSR sample sites (1960-1980)

National Environmental Research Program

Project 3.2: National Maps of Biodiversity & Connectivity

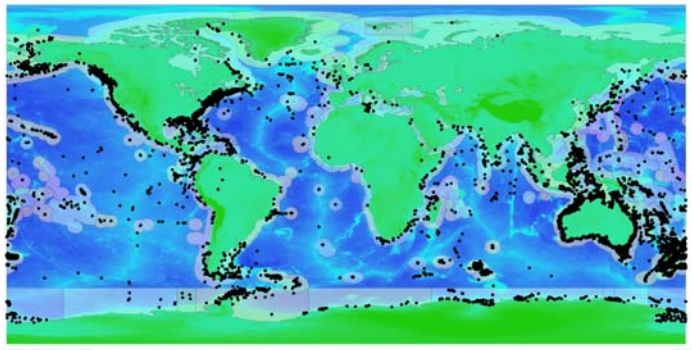
Management outcomes:

- National biodiversity datasets
- Mapping biodiversity hotspots
- Baseline data informing KEFs, BIAs, heritage assessments, CMR management,
- Baseline data informing EPBC strategic assessments



Global initiatives:

- An associated project (funded by the Census of Marine Life), taking the methodology global



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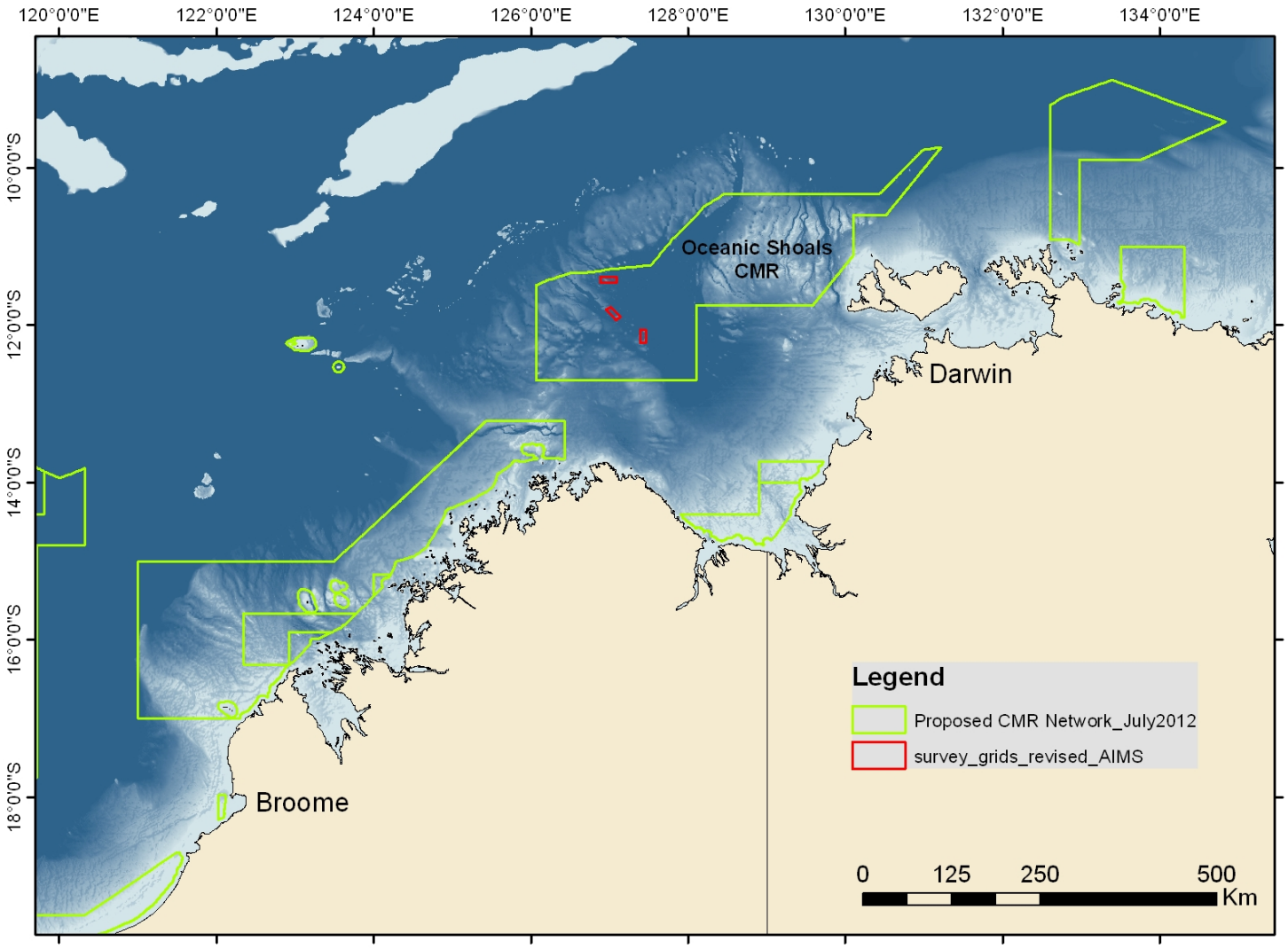
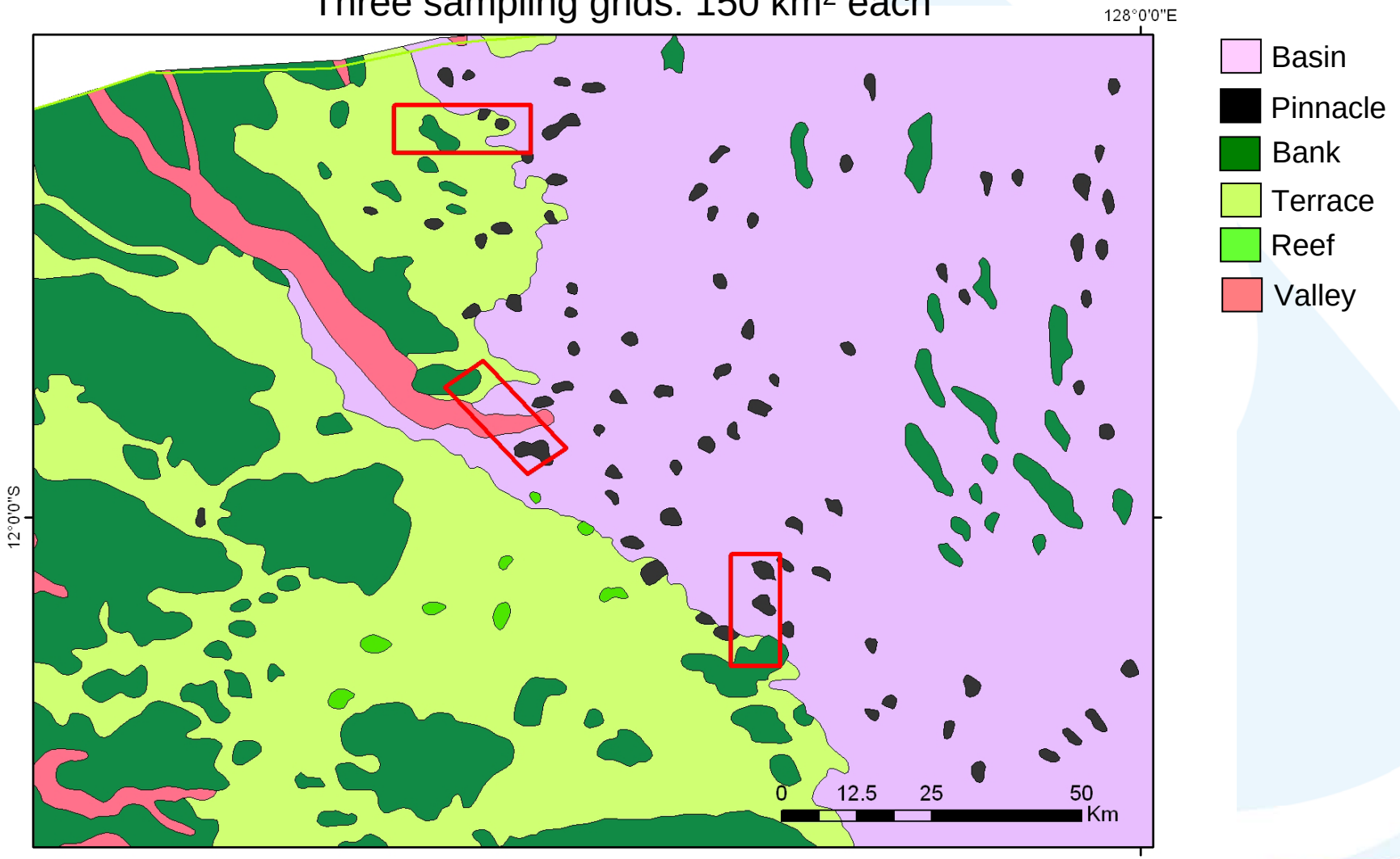
Theme 4: Regional Biodiversity Discovery

21-day Survey: Oceanic Shoals - A CMR and KEF



21-day Survey: Oceanic Shoals CMR

Three sampling grids: 150 km^2 each



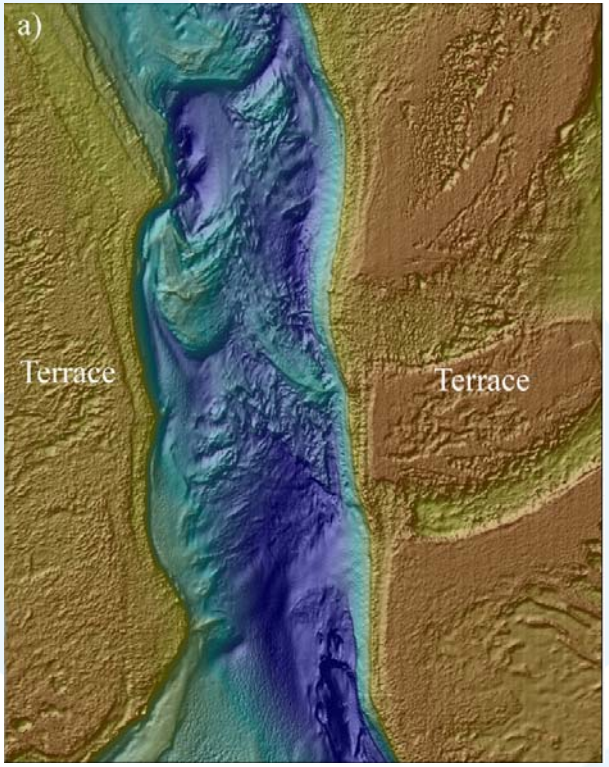
21-day Survey: Timing and Design

Voyage

- 11 Sept – 6 Oct 2012
- RV Solander
- AIMS, GA, UWA, Museum NT

Sampling Methods

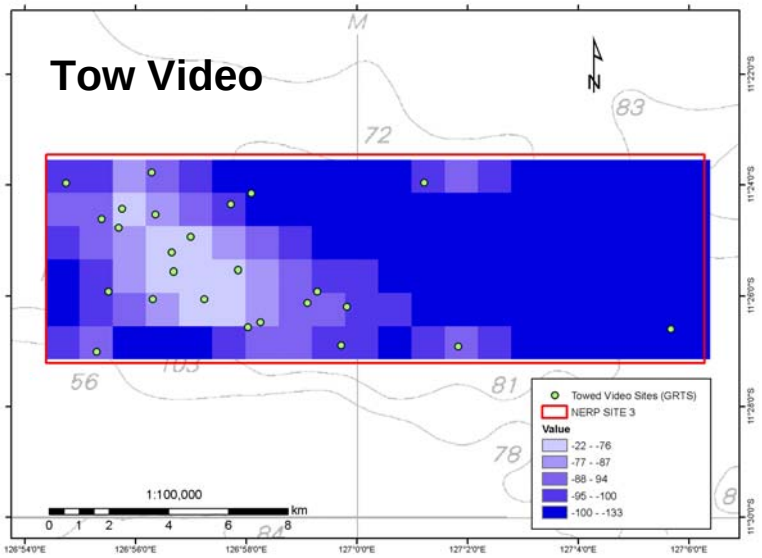
- Multibeam sonar bathymetry & backscatter
- Sub-bottom profiles
- Seabed sampling
  - geological, biological, geochemical
- Underwater video & stills of benthic communities
- Baited Underwater Video
  - pelagic & demersal & reef fish

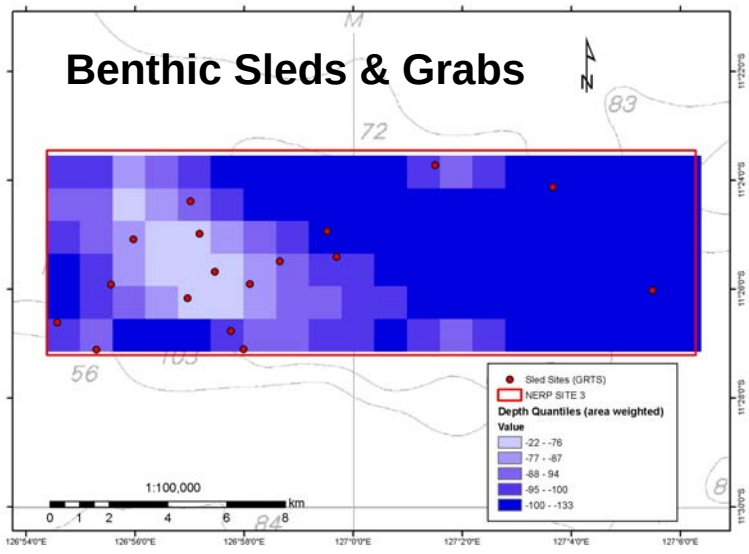


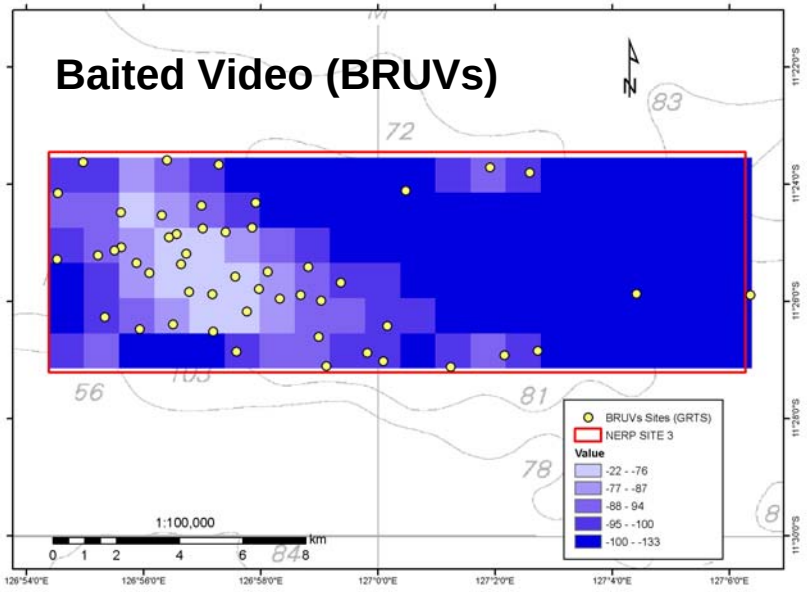
Sampling Design

- GRTS design
- cross-shelf transect
- on and off geomorphic features
- bathymetric gradients
- varied aspects / exposures

Spatially Balanced – Draft GRTS sampling design (link to Theme 1)

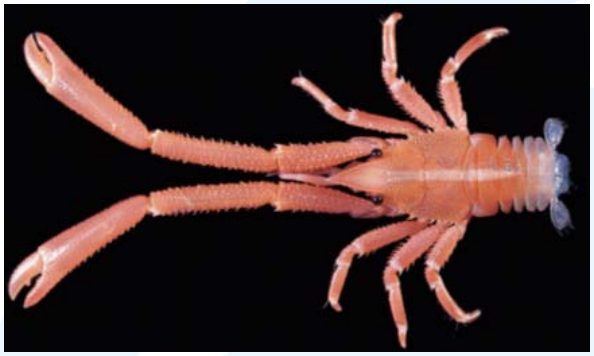


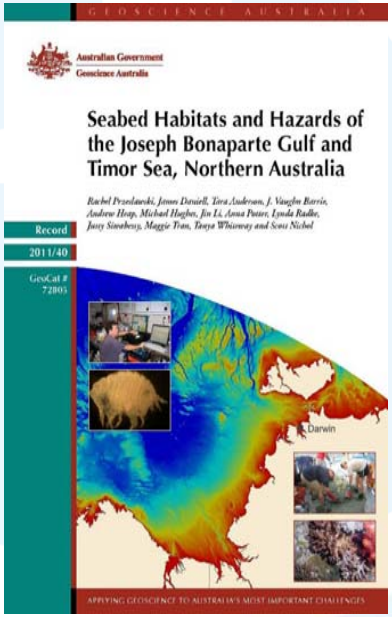




Combined Theme Outputs

- New physical and biological data for poorly known marine ecosystems
- Data to support analysis & synthesis of biodiversity patterns and ecosystems processes in Theme 3
- Knowledge for select sites and their regional context
- New datasets and improved (interactive) maps to represent physical features, biodiversity and connectivity
- Reports, images, vision, fly-throughs





Next Steps

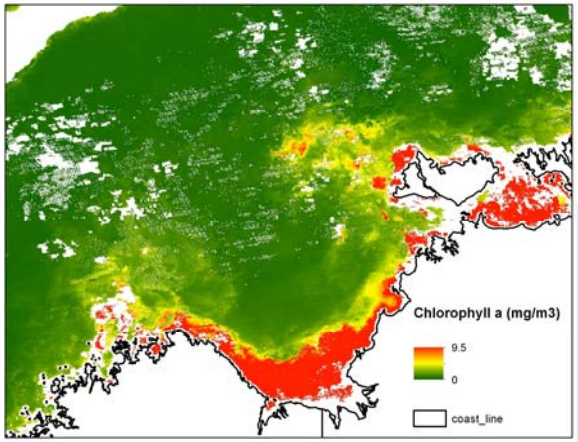
- Progress collation of new & existing data
- Progress the connectivity modelling
- Progress the canyon classification

- For discussion: capturing opportunities to address management needs
  - Furthering today's conversation

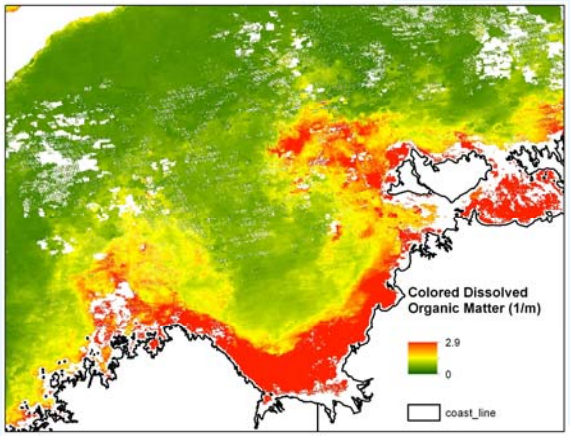
additional maps follow
for discussion

New satellite-derived products – pilot study

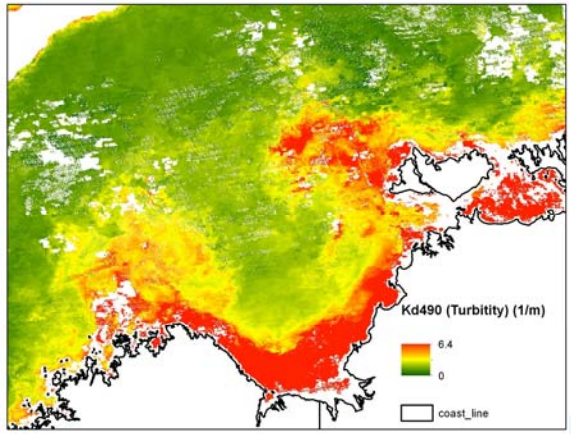
April 2010 (one point in a time series)



Chlorophyll a



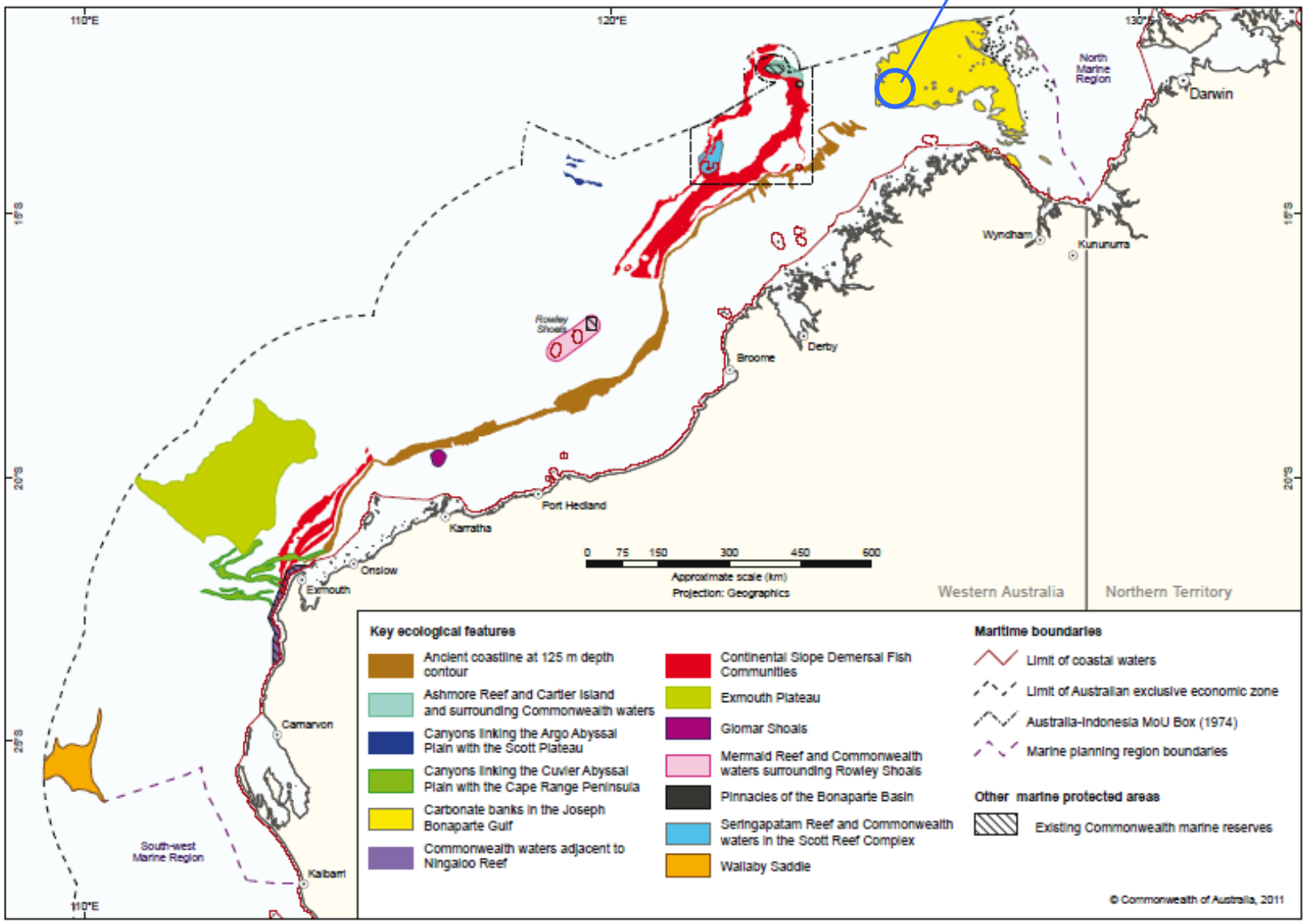
Dissolved organics



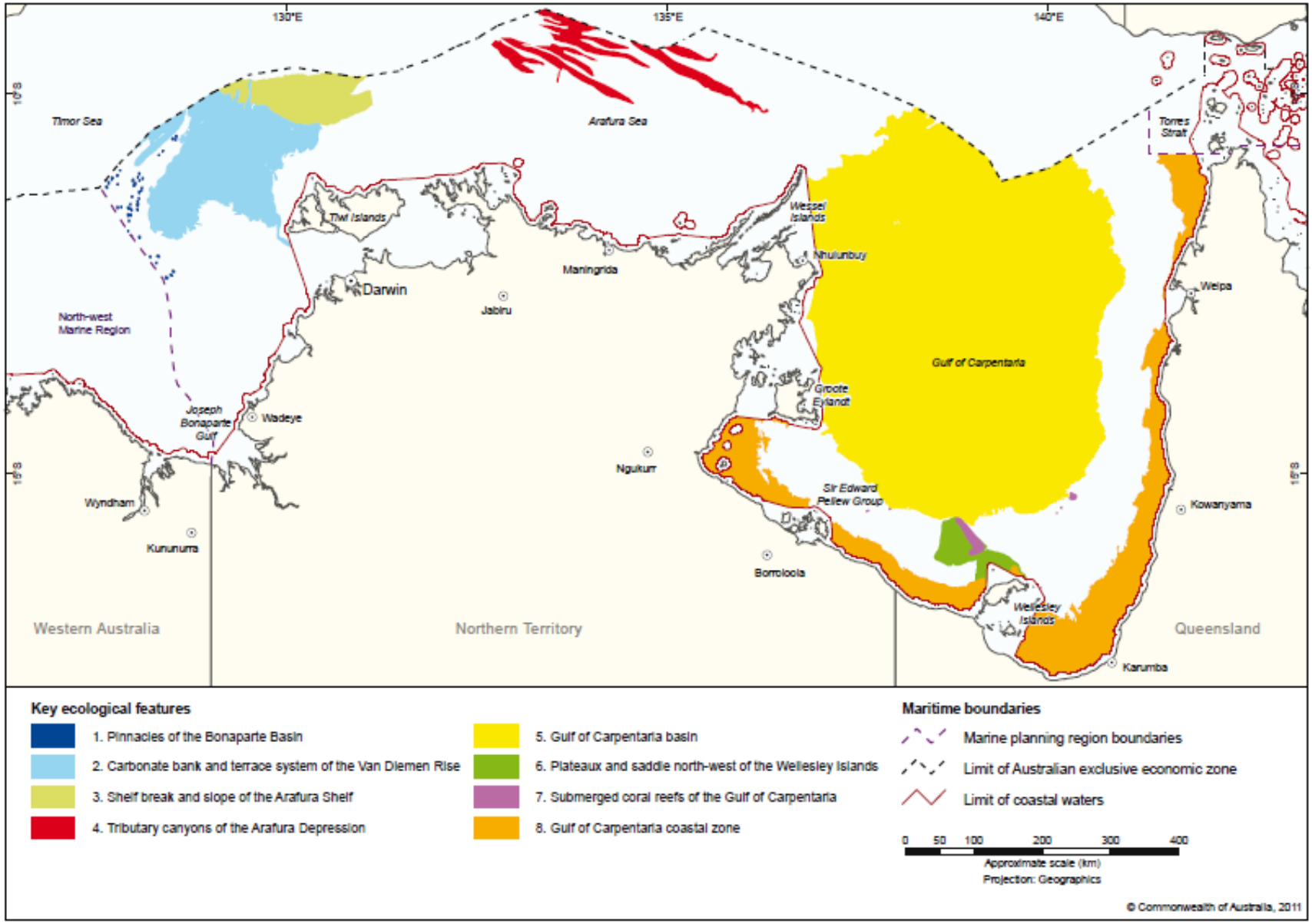
Turbidity

North-west Marine Region: KEFs

Oceanic Shoals Marine Res



North Marine Region: KEFs



Geomorphic features - North