# Effect of flow alteration on estuaries in the Gulf of Carpentaria

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**Griffith University**

Griffith UNIVERSITY

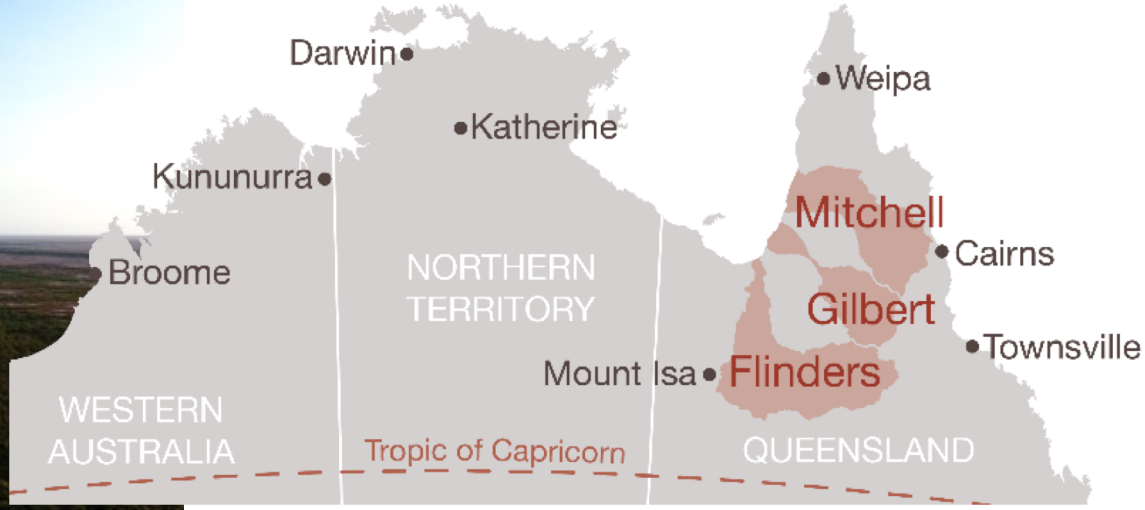
Queensland Government

Northern Australia Environmental Resources Hub

National Environmental Science Programme

*World-class research to support sustainable development in northern Australia*

Mitchell River


Darwin
Katherine
Kununurra
Broome
Weipa
Mitchell
Cairns
Gilbert
Townsville
Mount Isa
Flinders
NORTHERN TERRITORY
WESTERN AUSTRALIA
Tropic of Capricorn
QUEENSLAND

Gilbert River

Flinders River

# Importance of southern Gulf for shorebirds

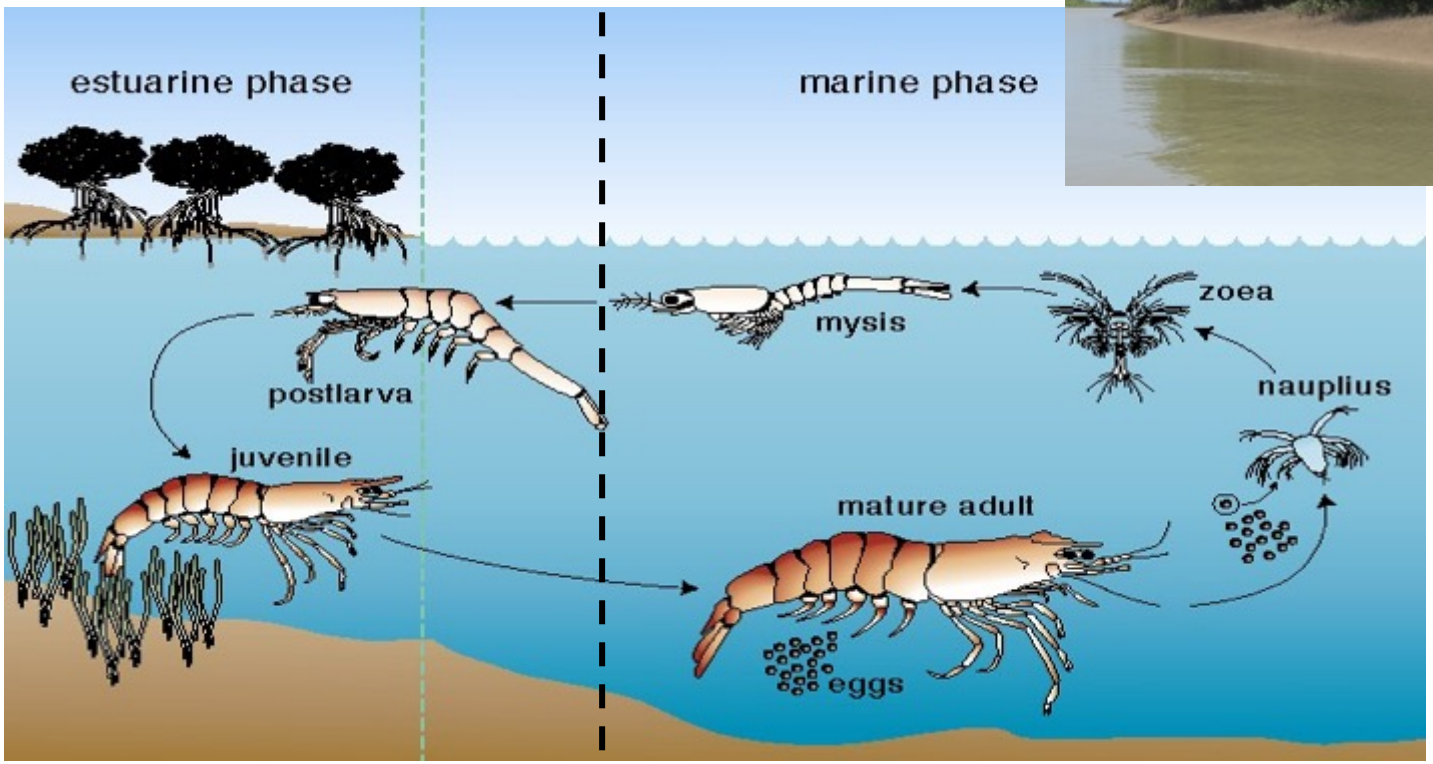
2nd most important shorebird site of International importance in Australia

50% (ca. 2,000,000) use Gulf from Oct-March

Endangered & critically endangered species

# Shorebird habitat

# Banana prawn life cycle



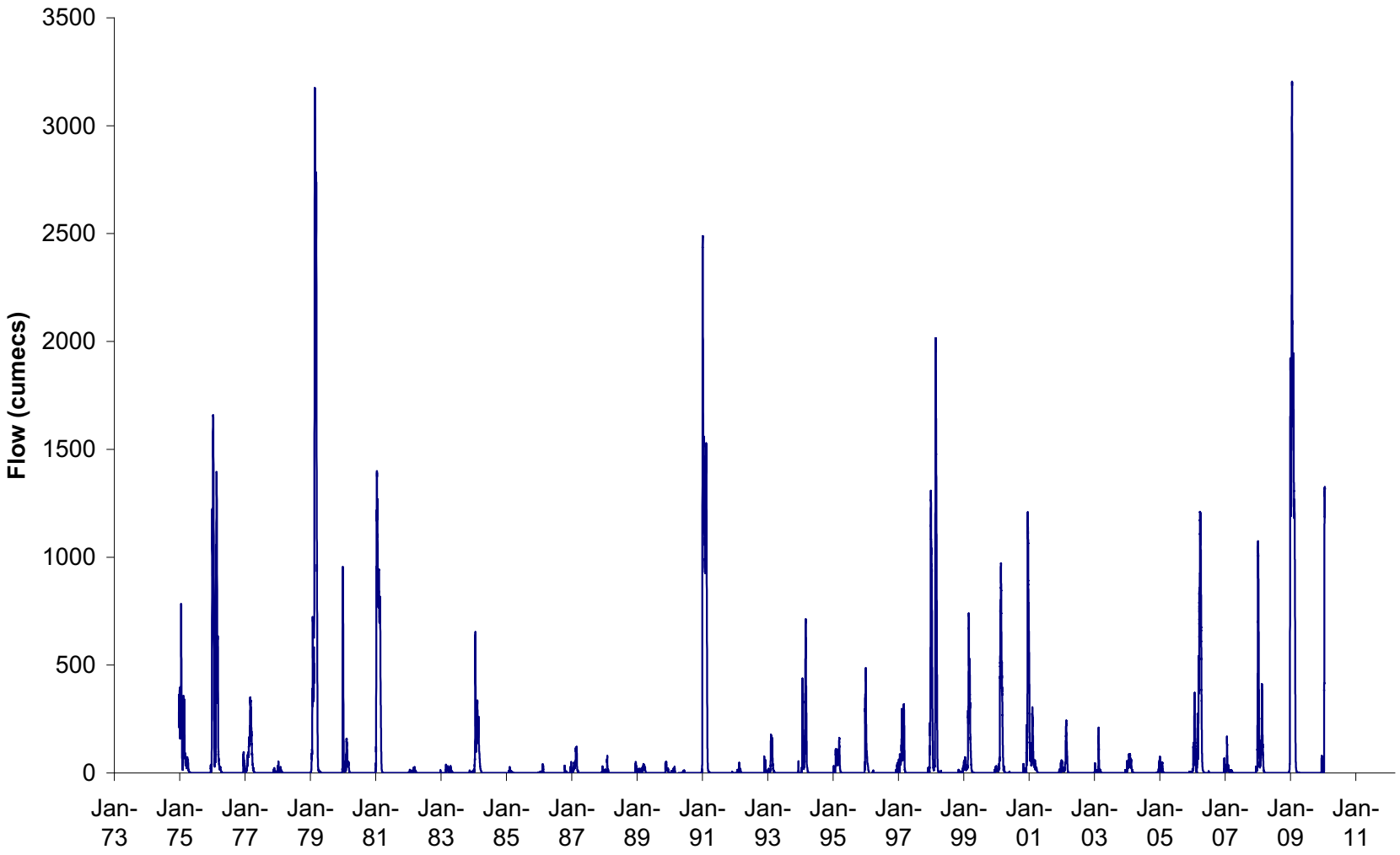

L. Bell

# Effect of flow on coastal productivity

Which of three estuaries with planned water development is most important for threatened species & fisheries?

# Typical southern Gulf river

# Highly variable flow regimes



Gilbert River
Google Earth
Image © 2018 TerraMetrics
Image © 2018 DigitalGlobe
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
N
5 km

# Mitchell – larger estuary, coastal delta

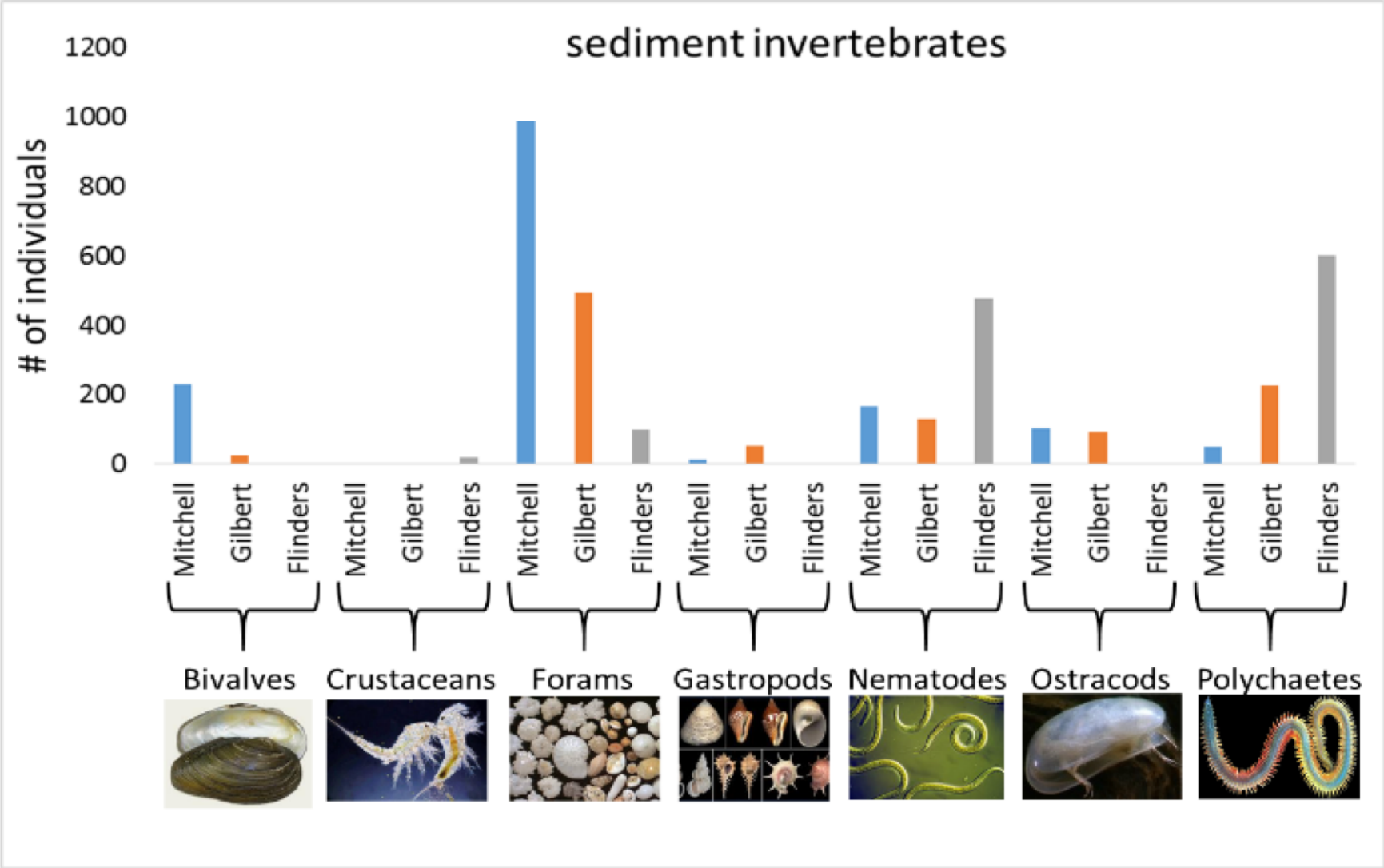
# Field work – November 2016, 2017

## Burford, Faggotter, Venarsky, Kenyon

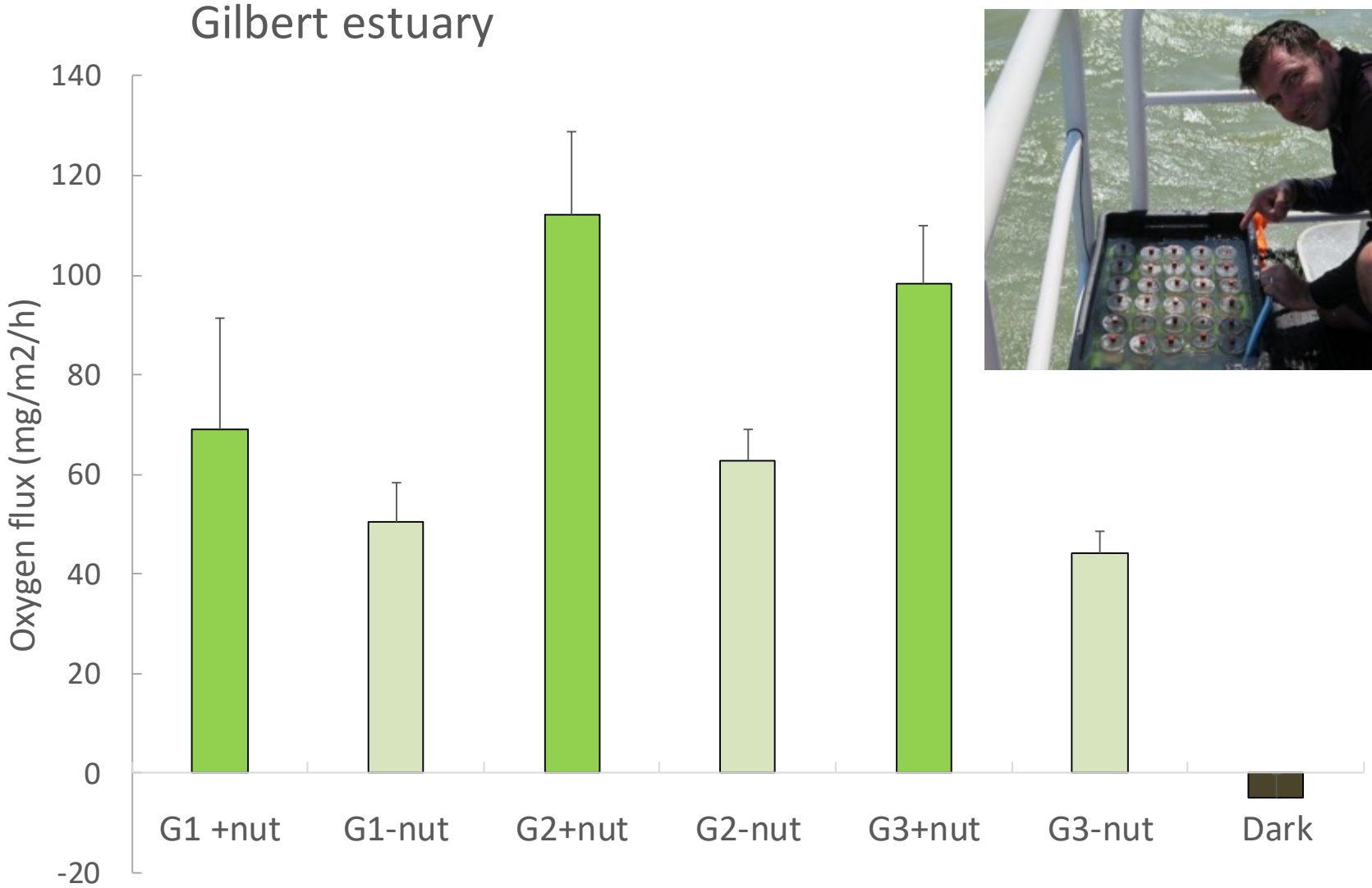
Sampling in estuary

- Prawns
- Food supply in mud
- Primary production in mud
- Salinity over a year
- Food supply in sand
- Response of biota to low salinity & nutrients

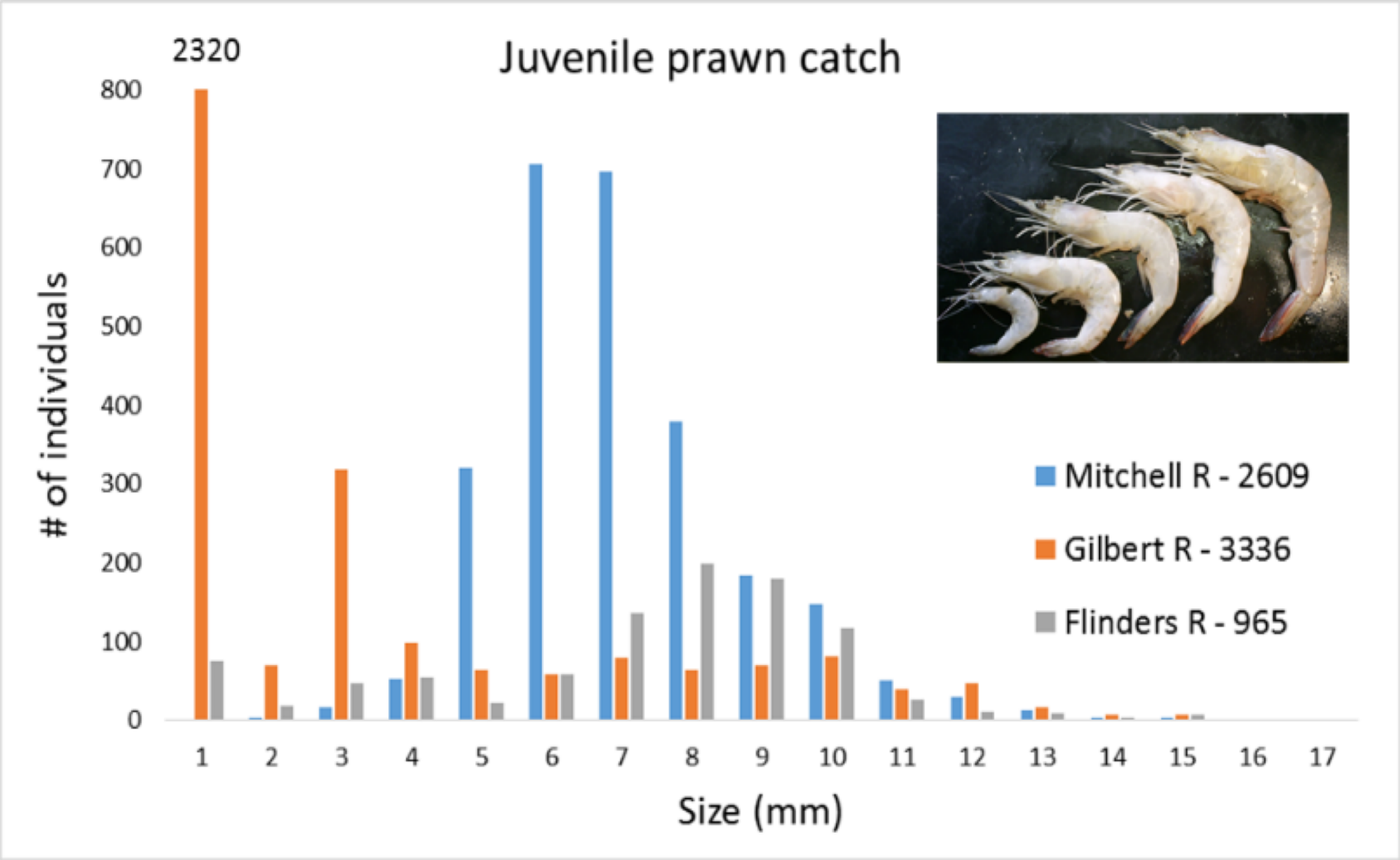
# Estuaries vary in the types of food available



# Nutrients can stimulate benthic primary production



# Mitchell R estuary has highest # of juveniles per unit area

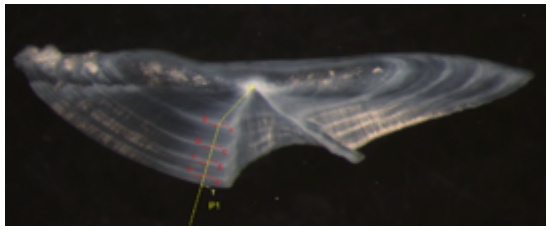


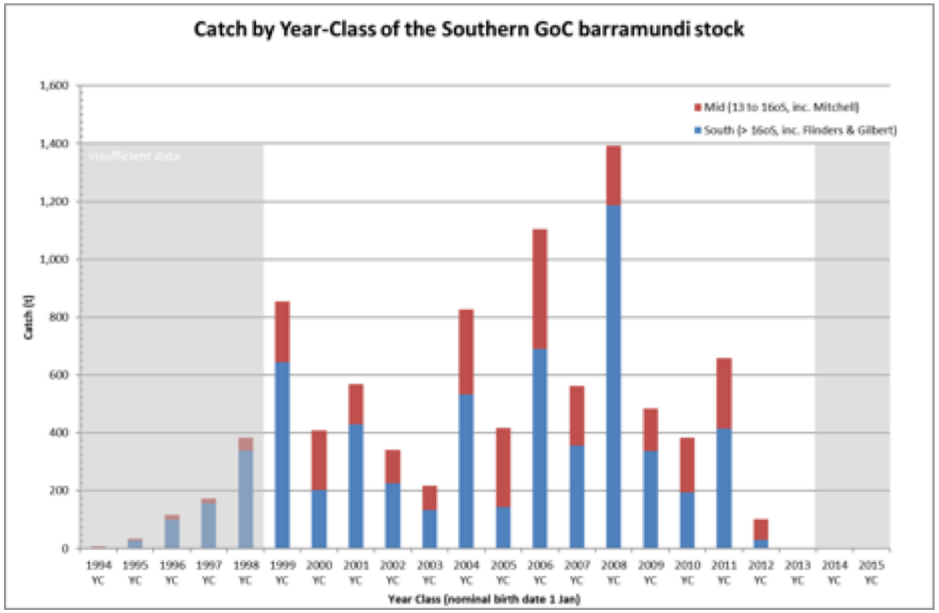
# Linking flow to inshore finfish (barramundi)

**Julie Robins, DAF**

Capitalises on DAF data and samples collected since 1989 for catch,~2000 for age

1. **Catch/Year-Class Strength**
   overall impact of flow pattern
2. **Otolith microchemistry**
   connectivity (timing, magnitude, duration) freshwater use by year class
3. **Otolith chronology**
   growth ~habitat condition/ "productivity"





# Key links between assets & freshwater flow

- Is food a limiting resource for shorebirds?
- How does food supply compare between estuaries?
- What is the impact of freshwater flow + nutrients on food availability
- What are the beneficial effects of flow on barramundi & banana prawns?

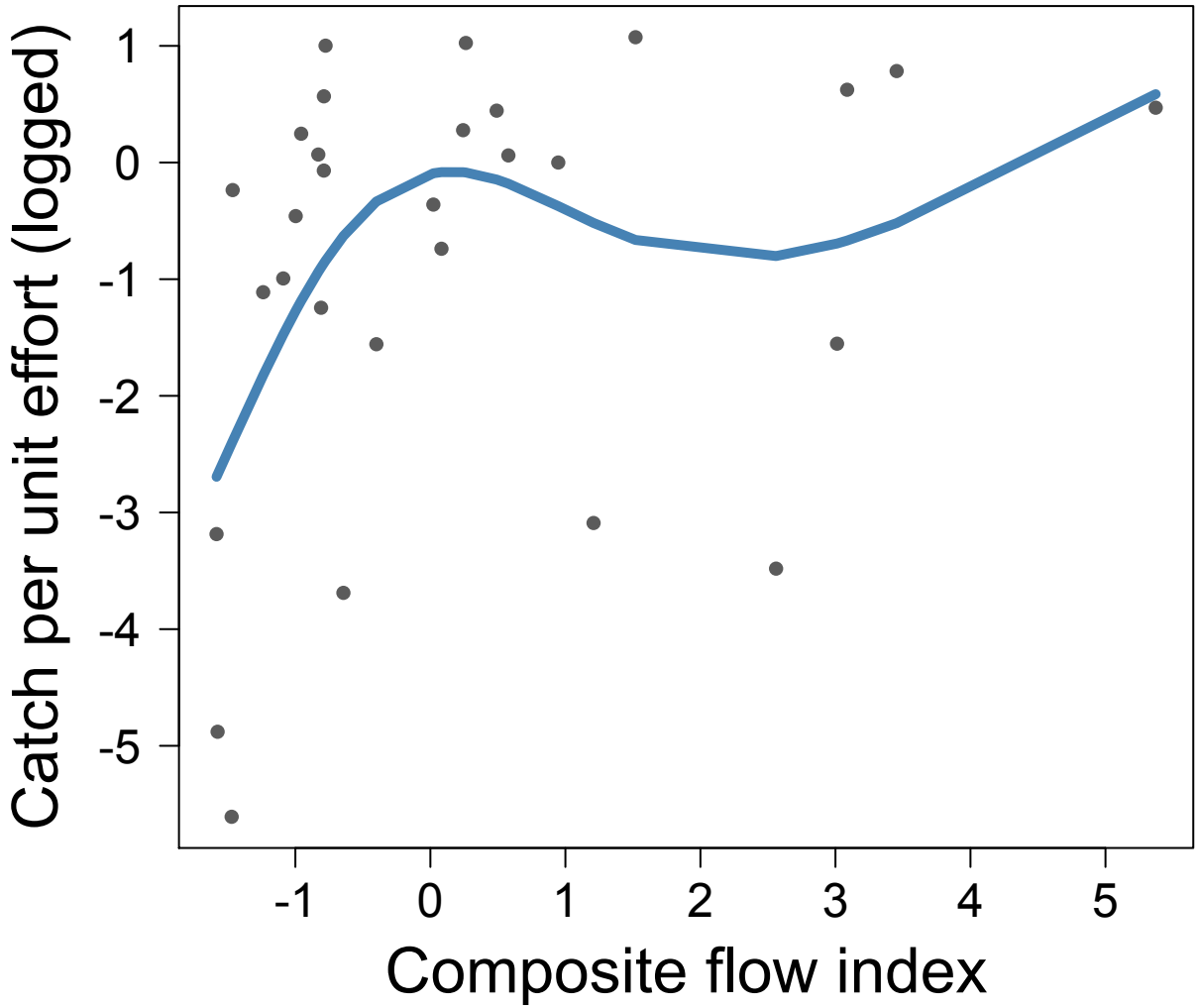
# Looking at the tradeoffs for water development

**Jim Smart, GU**

1. Quantify links between annual banana prawn catches, river flows, estuarine conditions and fishing effort
2. Collate economic assessments on agricultural development opportunities from previous (FGARA, AFFSCP) and on-going (NAWRA) evaluations
3. Incorporate Indigenous resource harvesting data from previous projects: collate, compare and consult

# Linking banana prawn catch with river flows,

**Andrew Broadley, Chris Brown, GU**



# Outputs

Reports, factsheets & scientific papers

- Identification of role of three river systems
- Conceptual model of key flow-related functions
- Flow – prawn models (need flow data)
- Tradeoff agriculture vs fisheries

Presentations/communications to stakeholders

Northern Australia Environmental Resources Hub

National Environmental Science Programme

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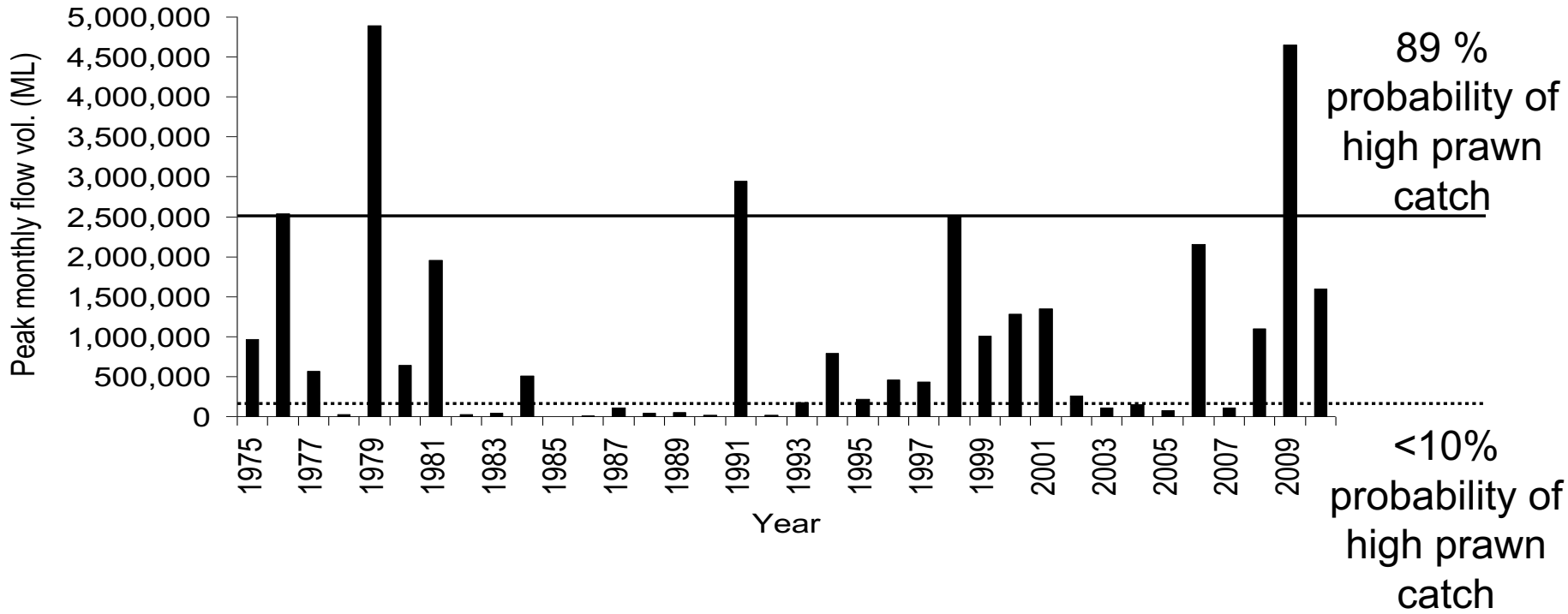
# Agricultural development

- Farm-scale and scheme-scale assessments of economic viability of agri developments in Flinders and Gilbert from FGARA and Northern Australia Food & Fibre Supply Chain project, and on-going work in Mitchell via NAWRA
- Utilise river system modelling results from previous / on-going studies to estimate impact of potential agri developments on system flows

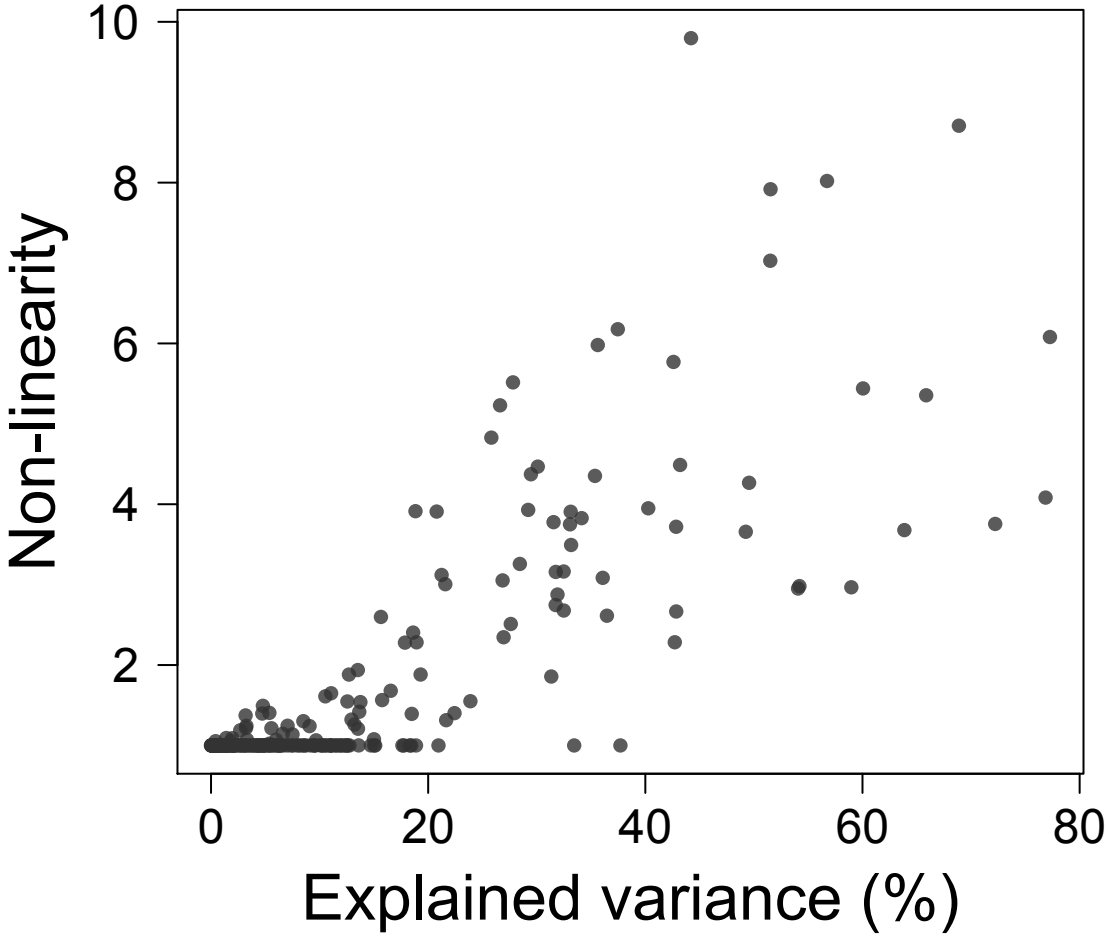
# Trade-off analysis

- Comparison of benefits of extracting water for agri developments vs downstream uses of natural flows (impacts on banana prawn fishery and Indigenous resource harvesting)
- Initial ‘static’ within-year comparison
- Dynamic multi-year comparison to identify potential effects across longer term wet / dry cycles [assuming multi-year model of stock and harvesting dynamics for prawns]

# Effect on prawn catch




Duggan PhD thesis


10
8
6
4
2
Non-linearity
0
20
40
60
80
Explained variance (%)