Critical water needs to sustain freshwater ecosystems in the Mitchell and emerging risks from tilapia invasions

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Collaborations with Traditional Custodians in the Mitchell

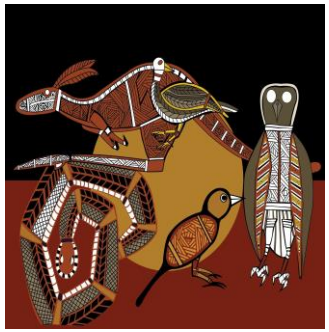
We acknowledge the Traditional Owners of the Country of the Mitchell Catchment: Western Yalanji, Kuku Djungan, Mbarbaram, Wokomin, Kokominjena, Kokoberra, Kunjen.

Kowanyama Aboriginal Land and Natural Resource Management Office

- Floodplain site selection and access to sampling locations

Mitchell River Traditional Custodians Advisory Group

- Managed by Traditional Owners from clans from four tribal groups in the Middle and Upper Mitchell
  - Mbabaram
  - Wokomin,
  - Kuku Djangan and
  - Western Yalanji
- Provided Bama Cultural Intelligence Training
- Site selection and access to sampling for parallel project on tilapia invasion



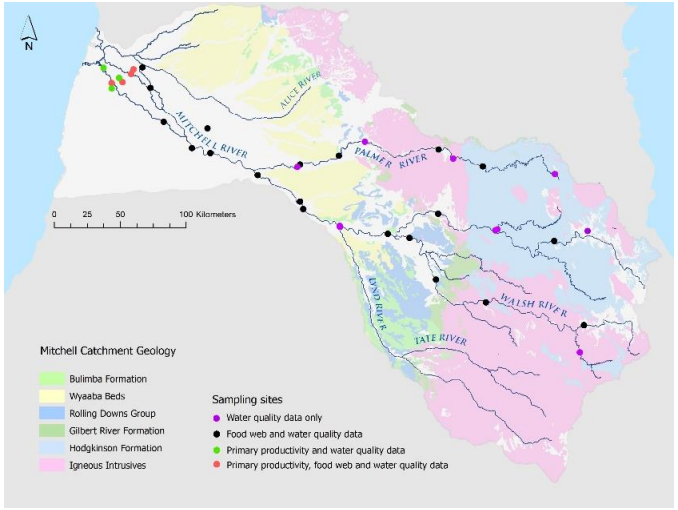
General approach

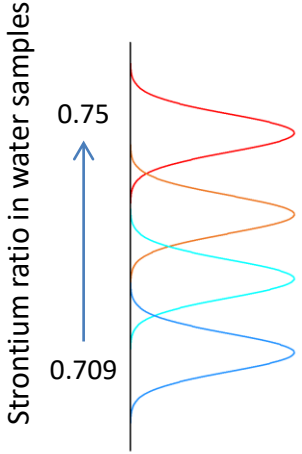
- Aquatic ecosystem connectivity - fish movements across the entire catchment
  - Otolith microchemistry
  - Stable isotopes
- Tilapia population extent and movement
  - Electrofishing surveys
  - Otolith microchemistry
- Preferred tilapia habitat and risk areas for spread
  - Habitat assessments across the catchment
- Tilapia diet
  - Stomach contents analysis

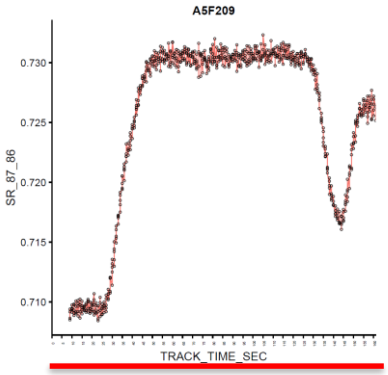
Connectivity of the Mitchell River Catchment

- Otolith microchemistry
  - Catchment geology produces spatial variation in ratio of strontium isotopes
  - Trace the migration history of freshwater fish
  - Trace growth and migration of fishery caught barramundi

Halliday et al. 2011. Proc. Roy Soc QLD

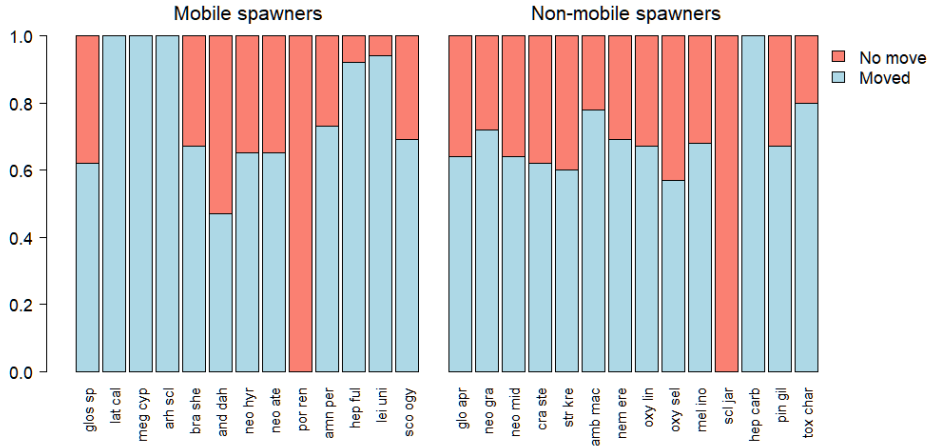




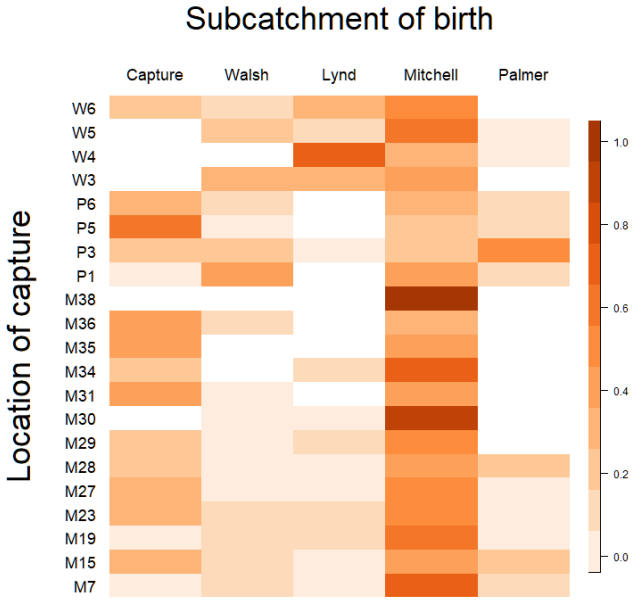


Fish movement over their lifetimes

- Generally high levels of fish across all species
  - Over 900 fish analysed



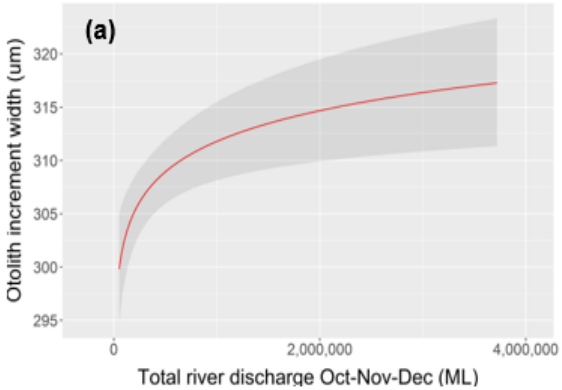
- Mitchell main channel is a key source habitat for fish

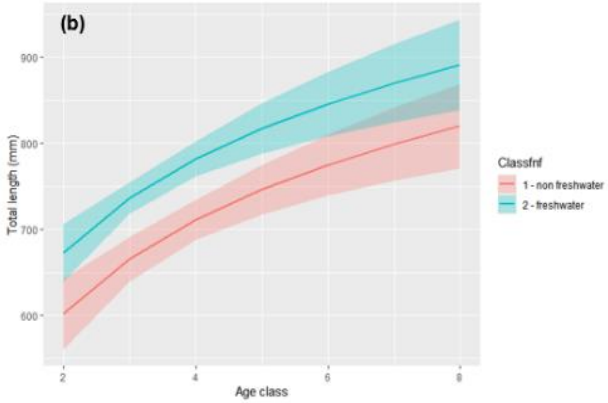


Barramundi growth - freshwater

Access to freshwater on the floodplain is critical for fishery caught barramundi

- Years with higher river discharge result in greater barramundi growth
- Barramundi that reside in freshwater have higher growth than those in the estuary



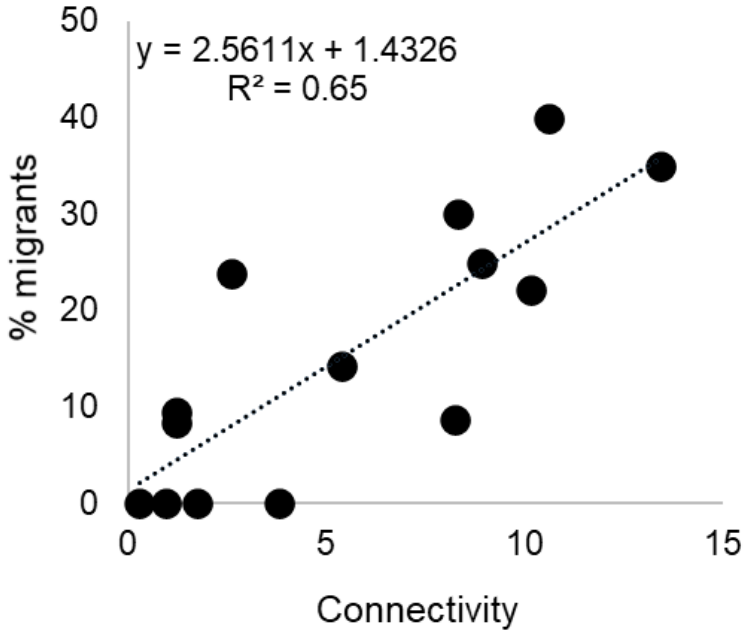


Robins, et al. 2021, *Analyses of finfish catch and growth*

Potential impact of dams on fish migration

- We used an analysis of connectivity and fish migration to predict the impact of dams, if no environmental flow measures are taken

- Scenarios of 1-5 dams built around the Mitchell catchment
  - Up to 60% loss of fish migration due to loss of connectivity from flow alteration



O'Mara et al. (2021) *Science of the Total Environment*

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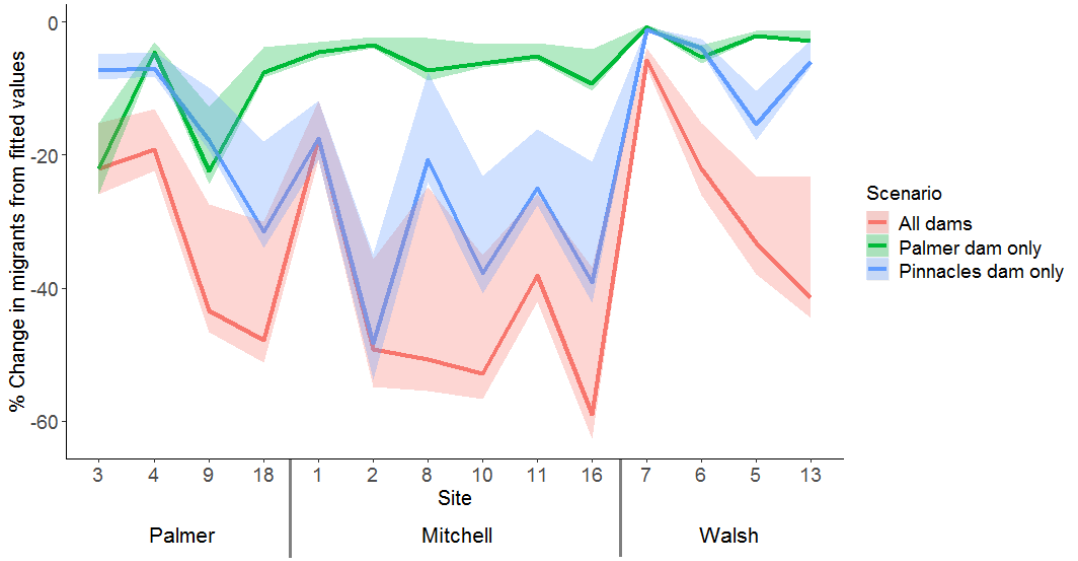

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Tilapia

- Tropical freshwater fish from the Cichlidae family, native to Africa and the southwestern Middle East
- Tolerant to a range of environmental conditions including high salinity and low oxygen
- Can reproduce year round in water temperatures >25°C
- Rapid population growth - 12.5 ton of tilapia were removed from a pond in Cairns after it was stocked with 6-8 individuals 18 months prior

Tilapia in the Mitchell catchment

Spotted tilapia

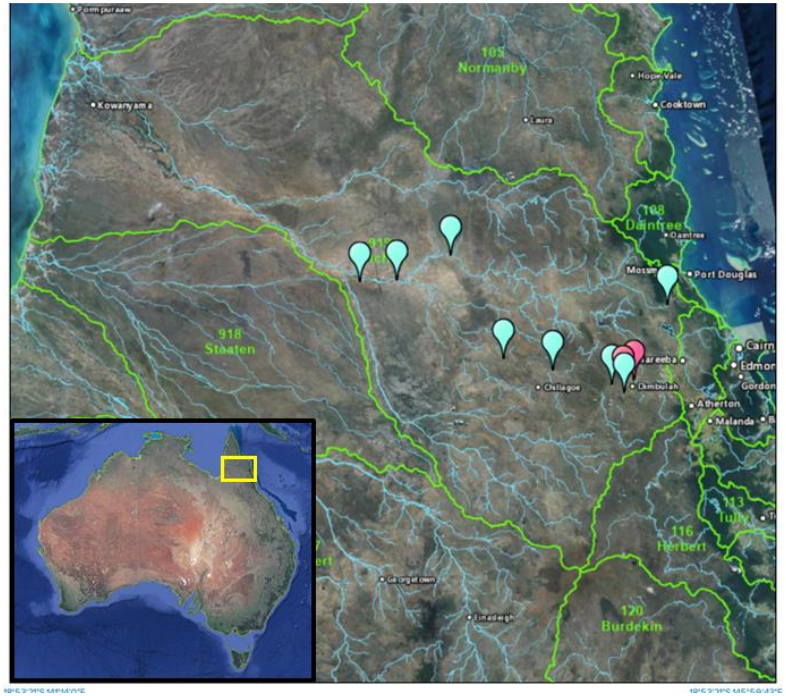
- Grows to 25-30 cm
- Nest builder and guarder
- Brood guarder
- Established in Aus in 1990’s

Mozambique tilapia

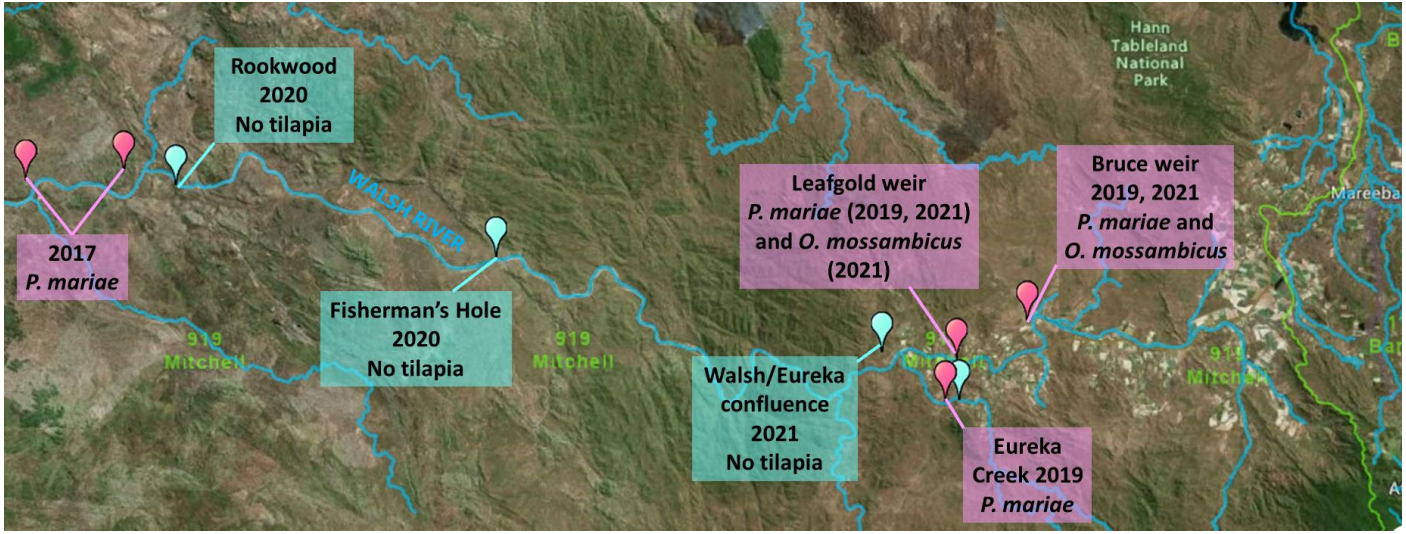
- Grows to 33 cm (females) – 44 cm (males)
- Nest builder and guarder
- Maternal mouthbrooder
- Established in Aus in 1970’s

Tilapia in the Mitchell catchment

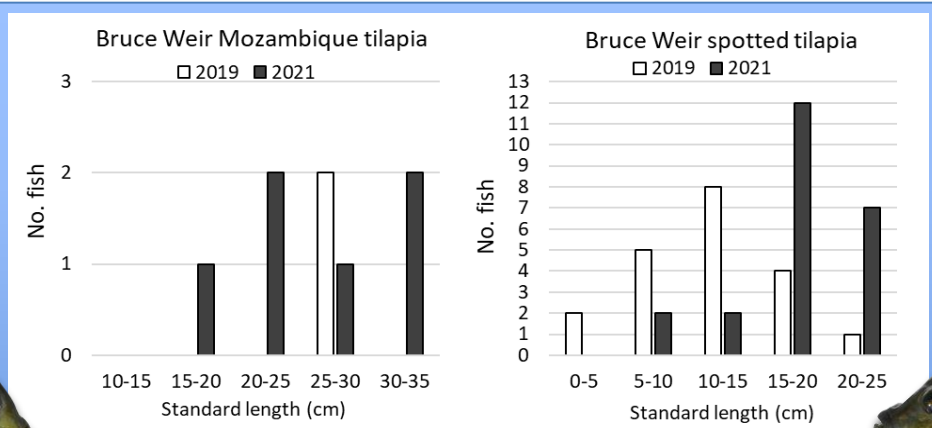
- Found throughout Queensland in eastern draining catchments
- In 2008, tilapia were found in Eureka Creek, Walsh River.
- Rotenone poisoning of Eureka Creek.
- In 2017 tilapia were found in the Walsh River

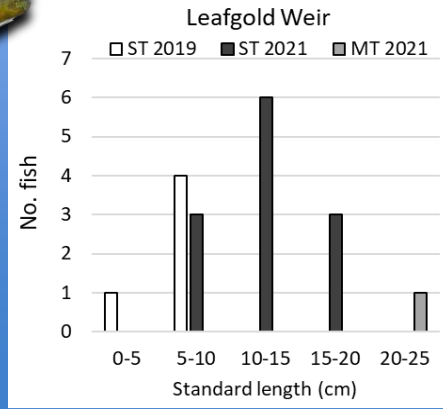


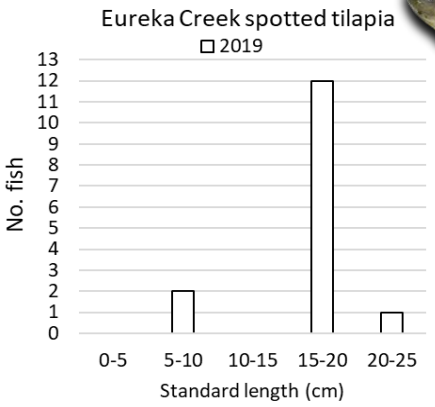
Current extent of Mitchell tilapia



Tilapia population growth

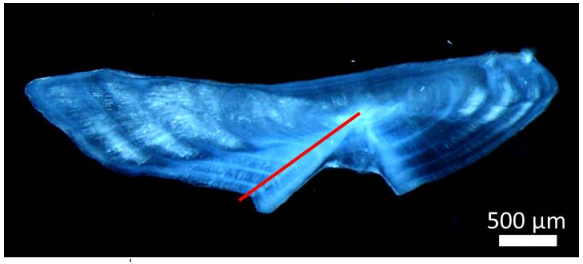


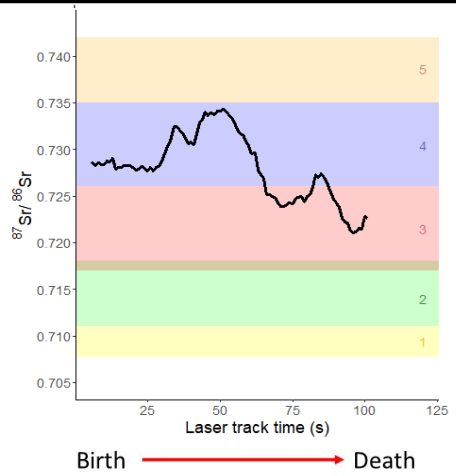


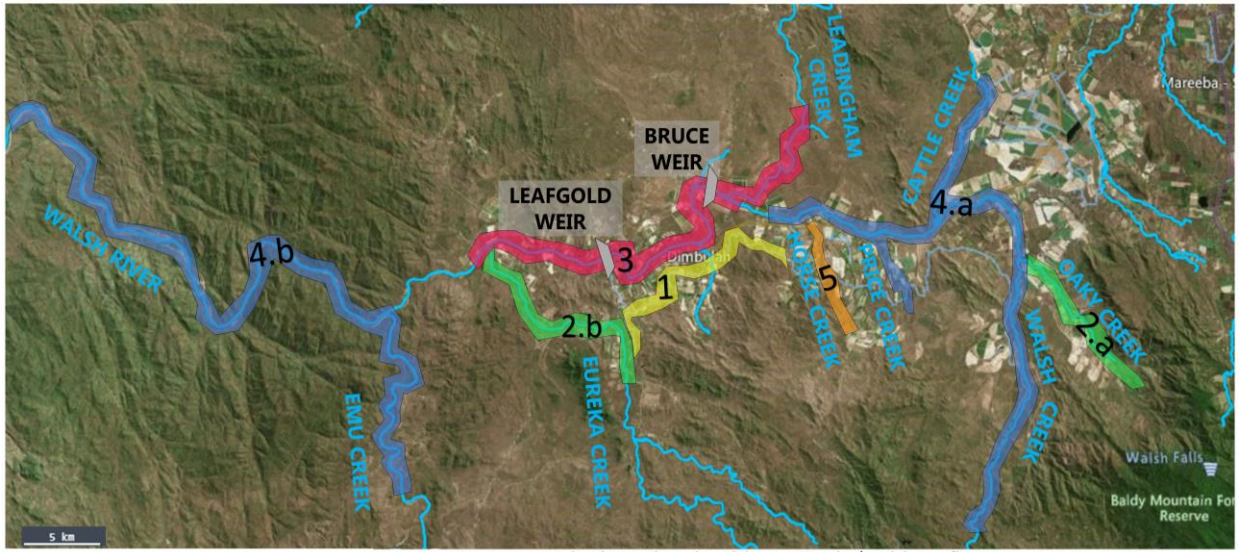


Tilapia movement

$^{87}Sr/^{86}Sr$







1. Tinaroo Dam & irrigation channel
$^{87}Sr/^{86}Sr$ = 0.7077 - 0.711

2.a & 2.b Oaky Ck & Eureka Ck
$^{87}Sr/^{86}Sr$ = 0.711 - 0.718

3. Leadingham Ck and Walsh R to Eureka/Walsh confluence
$^{87}Sr/^{86}Sr$ = 0.717 - 0.726

4.a & 4.b Walsh R & Emu Ck
$^{87}Sr/^{86}Sr$ = 0.726 - 0.735

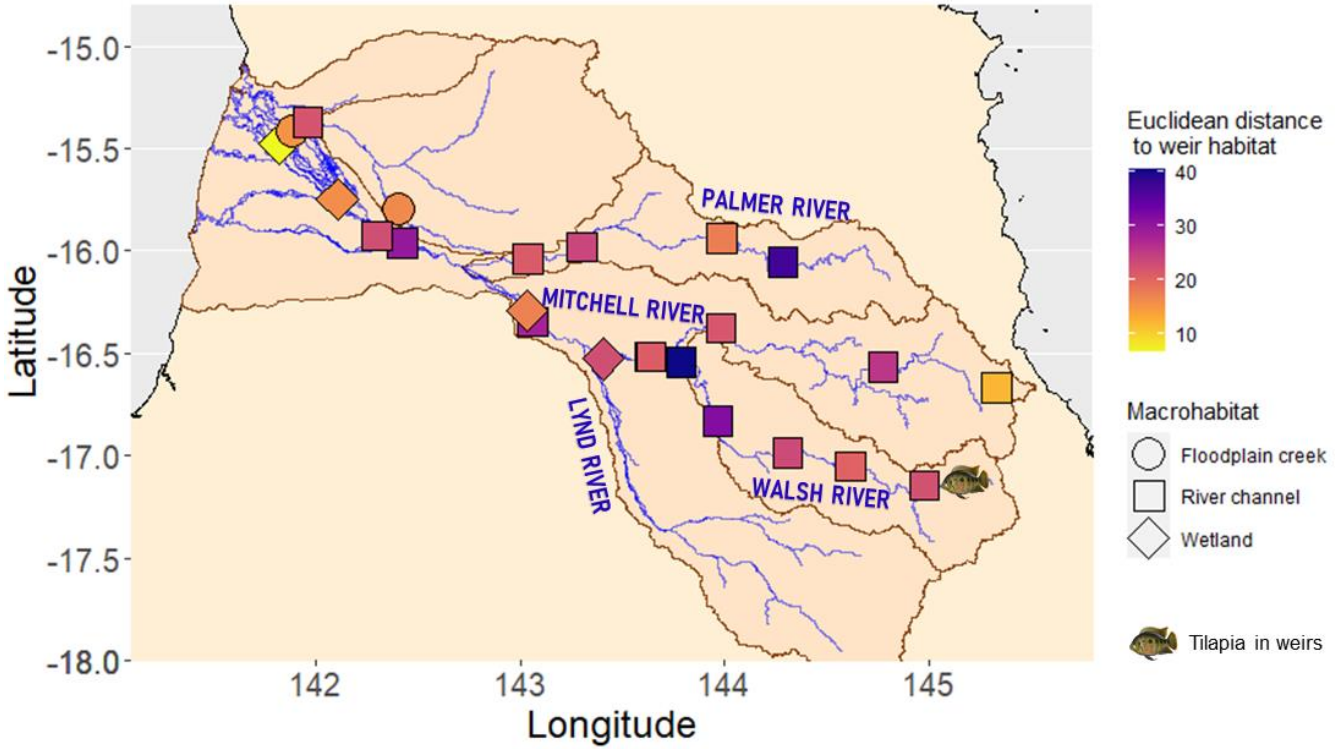
5. Horse Ck
$^{87}Sr/^{86}Sr$ = 0.735 - 0.742

Tilapia movement

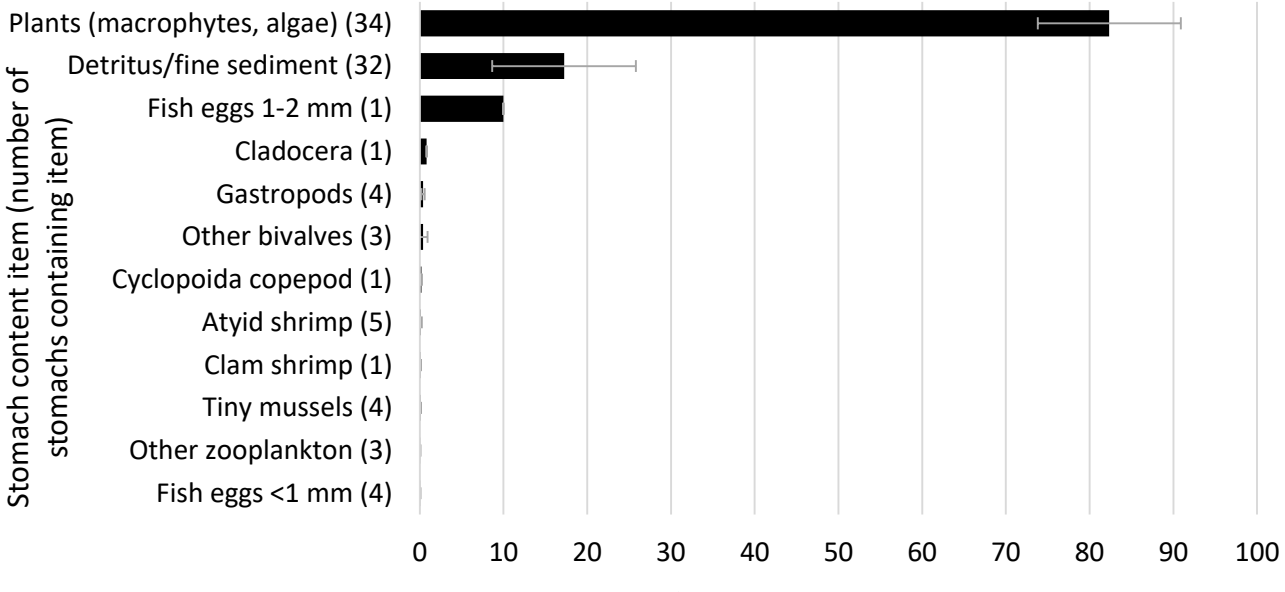
- All fish caught in Leafgold Weir in 2019 likely originated from Eureka Creek
- Eureka Creek tilapia highly resident
- No evidence of movement downstream of Eureka Creek

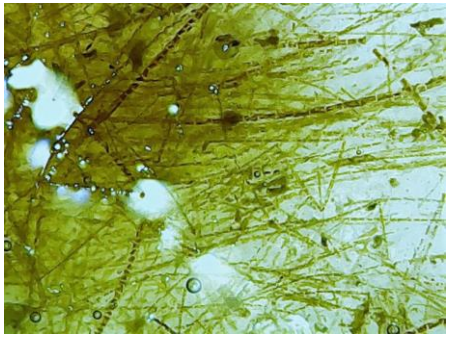
Preferred tilapia habitat and catchment areas most at risk of colonisation

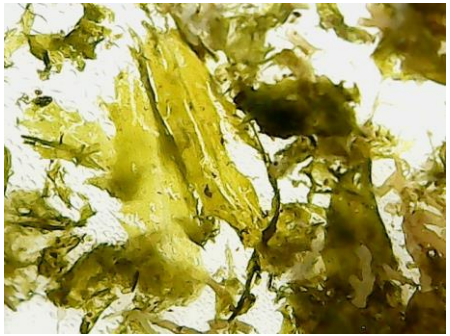
- Abundant macrophytes
- Lower flow
- Deeper areas (>1m)

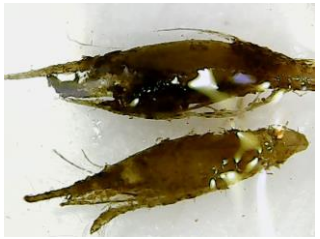


Tilapia diet









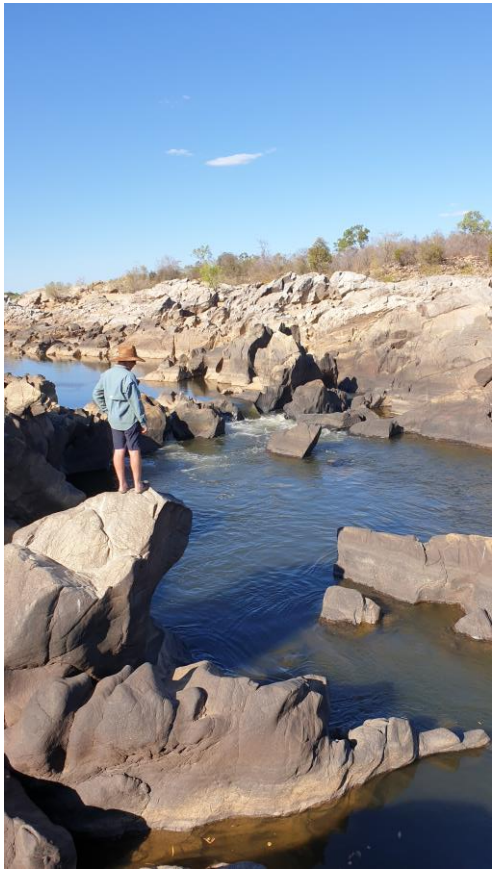
Conclusions…

- The biodiversity and ecosystem function of the Mitchell River catchment is dependent on flow-mediated connectivity
- The fish movement around the catchment indicates that planning for WRD needs to consider potential impacts across the entire catchment

- There is an established and growing tilapia population in the Walsh catchment
- Creeks and wetlands are at risk of tilapia colonisation
- Movement of tilapia varies between the established locations but occurs in both species and at all ages
- Tilapia primarily consume plant material

Recommendations

- Early warning through effective reporting protocols and control existing populations through manual removal
- Maintain ecosystem integrity of middle and upper catchment main-channels where ideal tilapia habitat is naturally rare/absent
- Weirs and dams throughout the catchment may provide ideal stepping-stone habitat for the species



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