

Responses of aquatic invertebrate communities in Western Australia's Pilbara river pools to invasive redclaw crayfish

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Acknowledgment of Country

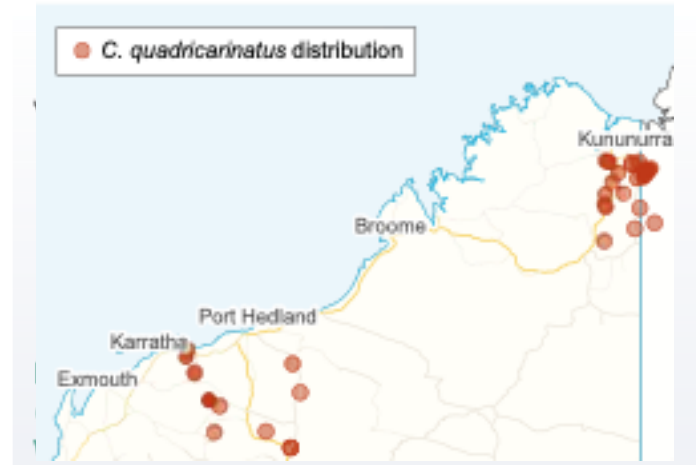
Firstly, I would like to acknowledge the Whadjuk people as the traditional owners of the lands and waters upon which I live and work in Boorloo (Perth), as well as the Yindjibarndi, Ngarluma, Martuthunira, Nhuwala, Kurrama, Yinhawangka, Banjima, and Palyku people, custodians of the Country where fieldwork was conducted for this project.

I pay my respects to elders past, present and emerging and acknowledge their continuing connection to land, water, sea and community.

Background

- Redclaw are not native to WA
- First population detected in 2000 in Lake Kununurra
- Spread to Harding River in 2013 and to Karijini and Millstream national parks
- Currently in 5 catchments in the Pilbara

Redclaw crayfish distribution in Northern WA



Management issue

- Tolerant to a wide variety of habitats
- Females spawn multiple times a year
- Can survive >48 hours out of water and move between water bodies
- Very difficult to get rid of once established

Impact

- Generalist predators that feed on small aquatic invertebrates, molluscs and aquatic plants
- Can have significant direct (predation/competition) or indirect effects (habitat modification)



Pinder et al. (2019), *BioInvasions Records* 8(4): 882–897, <https://doi.org/10.3391/bir.2019.8.4.17>

Research Article

Spread of the non-native redclaw crayfish *Cherax quadricarinatus* (von Martens, 1868) into natural waters of the Pilbara region of Western Australia, with observations on potential adverse ecological effects

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● present
● absent

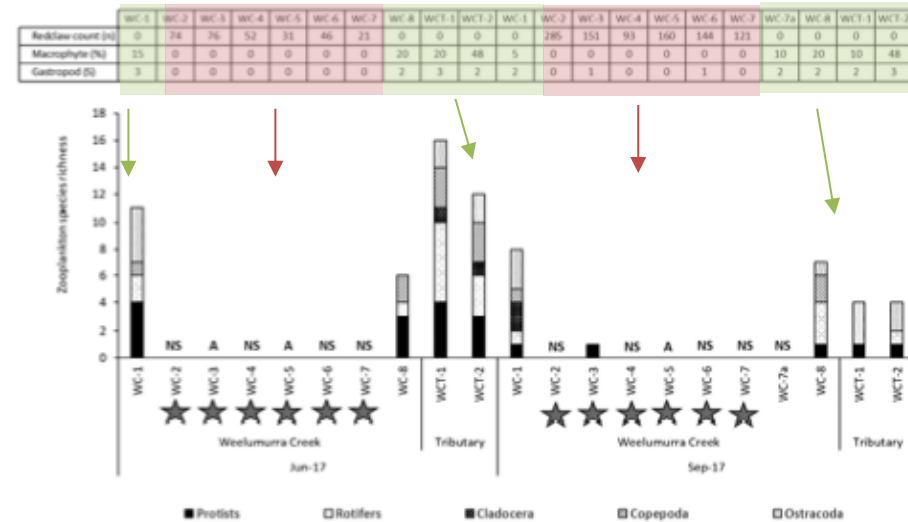


Figure 4. Composition of aquatic invertebrate taxa recorded from pools at Weelumurra Creek and its tributary in June and September 2017. Sites not sampled for zooplankton are denoted by “NS” and absence of zooplankton fauna is denoted as A. Redclaw presence at each site is denoted by a grey star, with number of redclaws (n) captured provided in the grid above, along with percent cover of submerged aquatic macrophytes and gastropod species richness.

- Macrophyte cover, gastropod species richness and aquatic zooplankton species richness were drastically lower in pools with redclaw
- Depauperate zooplankton fauna for these pools is exceptional in comparison to similar aquatic systems in the region

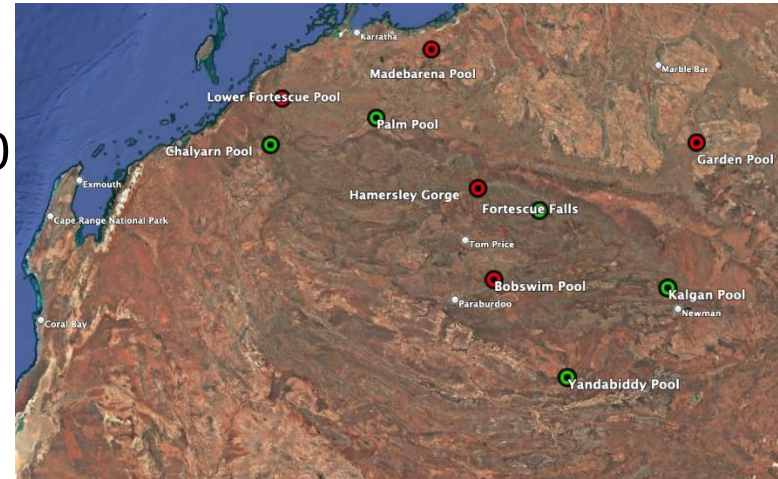
Sampling

● present



● absent

- Expanded sampling to 10 Pilbara river pools
 - 5 with redclaw
 - 5 without redclaw
- All locations previously redclaw-free in 2010
- Are the impacts of redclaw widespread?
- Does metabarcoding data match morphological data?



Methods

Zooplankton from the water column collected using 53 μ m mesh net over ~50m distance

Morphology

1 sweep per location

10 samples

Samples sieved and sorted
under microscopes

IDs to lowest taxonomic level
possible



Metabarcoding

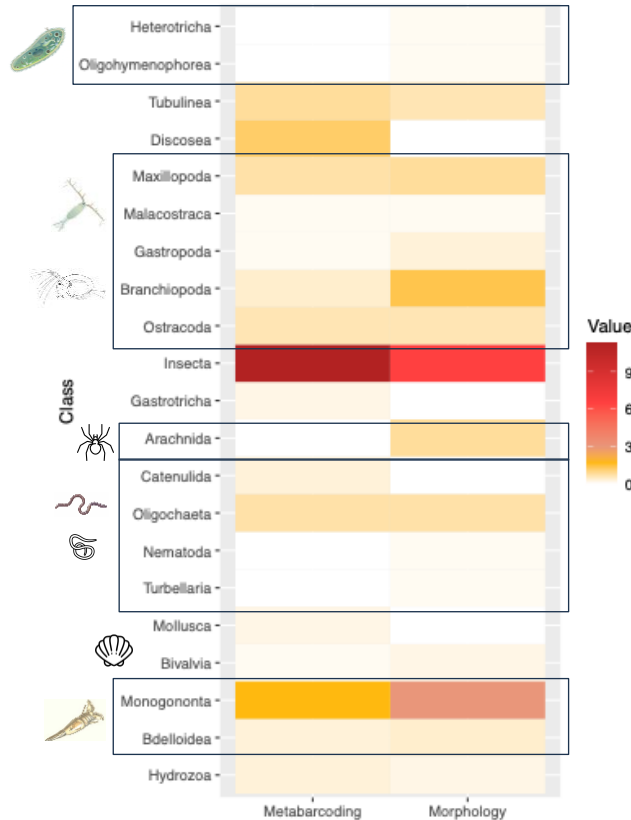
2 sweeps per location

20 samples

Samples sieved - filter papers
and sample blended for DNA
extraction

CO1 primers:
mlCOLintF/HCO2198 (Leray et al.
2013)

Results: Comparison between methods

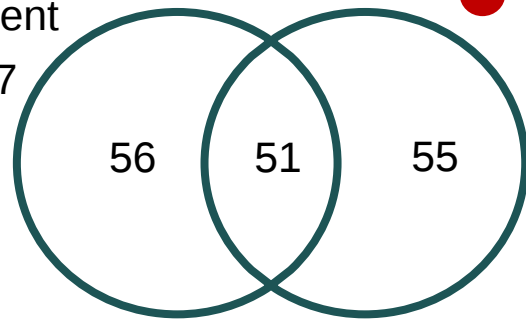


- Total zooplankton richness
 - Metabarcoding: 152 (20 samples)
 - Morphology: 162 (10 samples)
- Insects and rotifers the most diverse in both datasets
- General overlap in taxonomic classes
 - Groups like ciliates, some crustaceans, arachnids, and some worms and rotifers were best detected with morphology
 - Metabarcoding better detected molluscs, flatworms, Gastrotricha and Discosea

Results: Morphological data

Group	Redclaw 	No redclaw 
TOTAL	106	107
Rotifers	23 (5/5 sites)	22 (5/5 sites)
Worms	8 (5/5 sites)	7 (5/5 sites)
Arachnids	5 (3/5 sites)	6 (4/5 sites)
Crustaceans	22 (5/5 sites)	21 (5/5 sites)
Insects	40 (4/5 sites)	40 (5/5 sites)
Molluscs	2 (1/5 sites)	3 (2/5 sites)
Ciliates	1 (1/5 sites)	1 (2/5 sites)
Amoebozoa	4 (3/5 sites)	5 (3/5 sites)
Hydrozoans	1 (1/5 sites)	2 (4/5 sites)

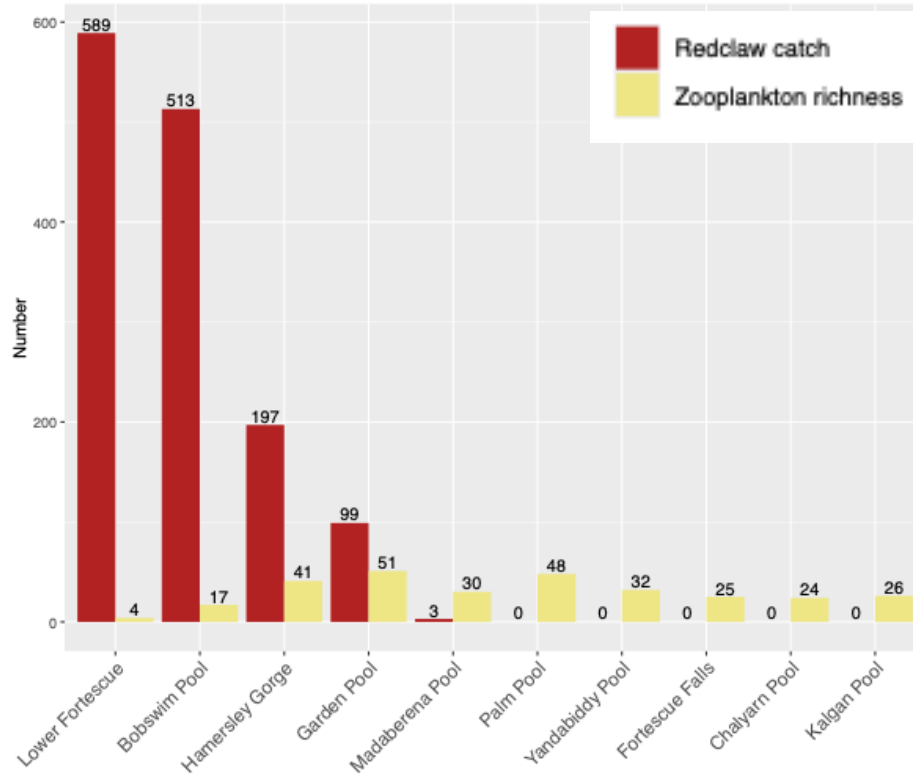
 absent
n=107



 present
n=106 

- Similar overall species richness
- Richness within major taxonomic groups also comparable, but some groups slightly more present in the sites without redclaw

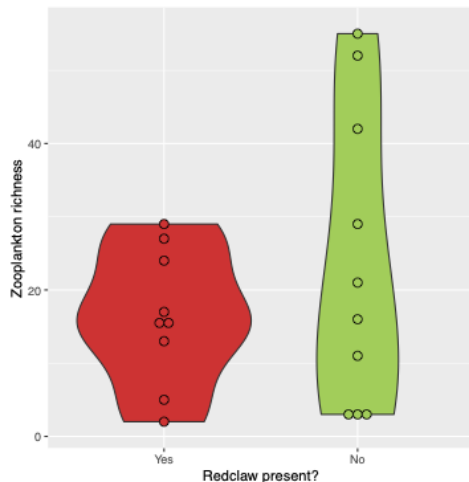
Results: Morphological data



- Pools with redclaw contained 4-51 species, whereas pools without redclaw supported 24-48 species
- Highest richness was at Garden Pool
- However, within the pools containing redclaw, zooplankton richness was lower when there were more redclaw

Results: Metabarcoding data

- Zooplankton richness was higher in pools without redclaw
 - Largely driven by Insects, especially Diptera (flies)
 - Neuroptera (net-winged insects), Coleoptera (beetles), Ephemeroptera (mayflies) and Lepidoptera (moths and butterflies) only found in sites without redclaw

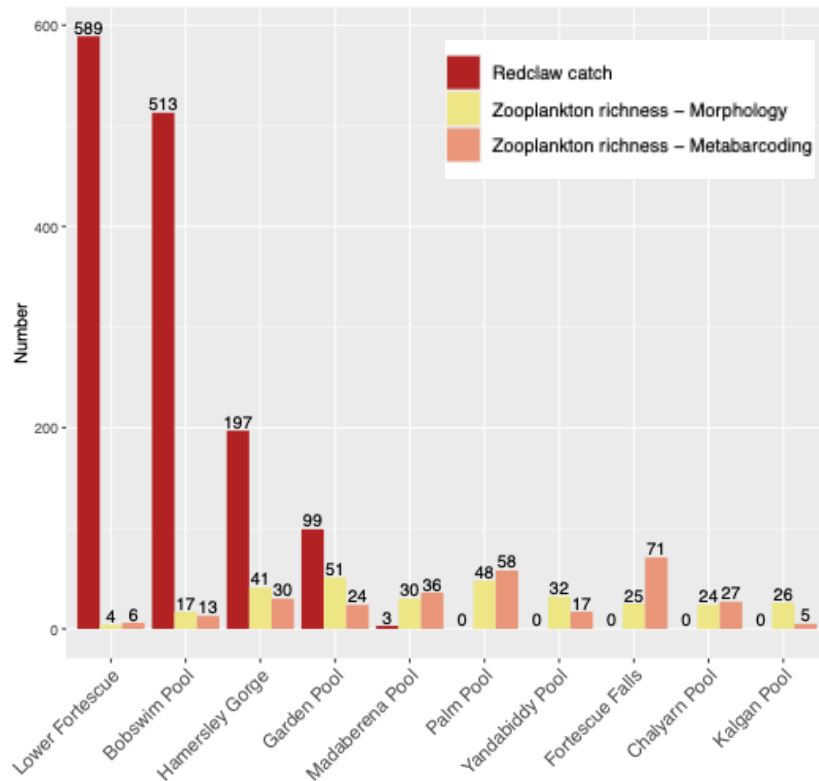


Large
variability at
the site level

Group	Redclaw 	No redclaw 
TOTAL	73	120
Rotifers	15	8
Worms	5	8
Crustaceans	9	9
Insects	34 (4 orders)	77 (8 orders)
Molluscs	0	1
Amoebozoa	7	15
Hydrozoans	2	2

Results: Metabarcoding data

- Pools with redclaw contained 6-36 taxa, whereas pools without redclaw supported 5-71 taxa (combined across replicates)
- However, within the pools containing redclaw, zooplankton richness was lower when there were more redclaw



Final thoughts

- Morphological and metabarcoding data provided similar results in terms of zooplankton richness and differences between sites with/without the invasive species
- This broader analysis of the ecological impacts of redclaw on aquatic invertebrate communities in the Pilbara seem to indicate no major resulting loss of zooplankton diversity following redclaw establishment
- We have morphological data for these same river pools from 2010, before redclaw established, as well as macrophyte cover data
- More in-depth analyses to follow

Acknowledgments

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