

The migration of aquatic macrocrustaceans over an artificial barrier in the uThukela River, South Africa

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Introduction

- Diadromous river-swimming crabs *Varuna litterata* and freshwater prawns *Macrobrachium* spp. are restricted to water or wetted surfaces to move in the aquatic environment
- They migrate from estuaries into low-lying reaches of rivers.
- Timing and duration of these migrations vary across their distribution range, with little known about what cues these.
- Importantly, the connection between the low-lying reaches of a river and its estuary needs to be maintained to facilitate aquatic macrocrustacean migrations.



Varuna litterata



Introduction

- Construction of the Lower Thukela Bulk Water Supply Scheme (LTBWSS) instream weir was built and commissioned in 2017.
- The LTBWSS Weir potentially obstructed migratory pathways of both fish and aquatic macrocrustaceans.
- To mitigate against connectivity loss a vertical slot fishway and a rock ramp was fitted to facilitate the movement of aquatic organisms over or through the LTBWSS Weir

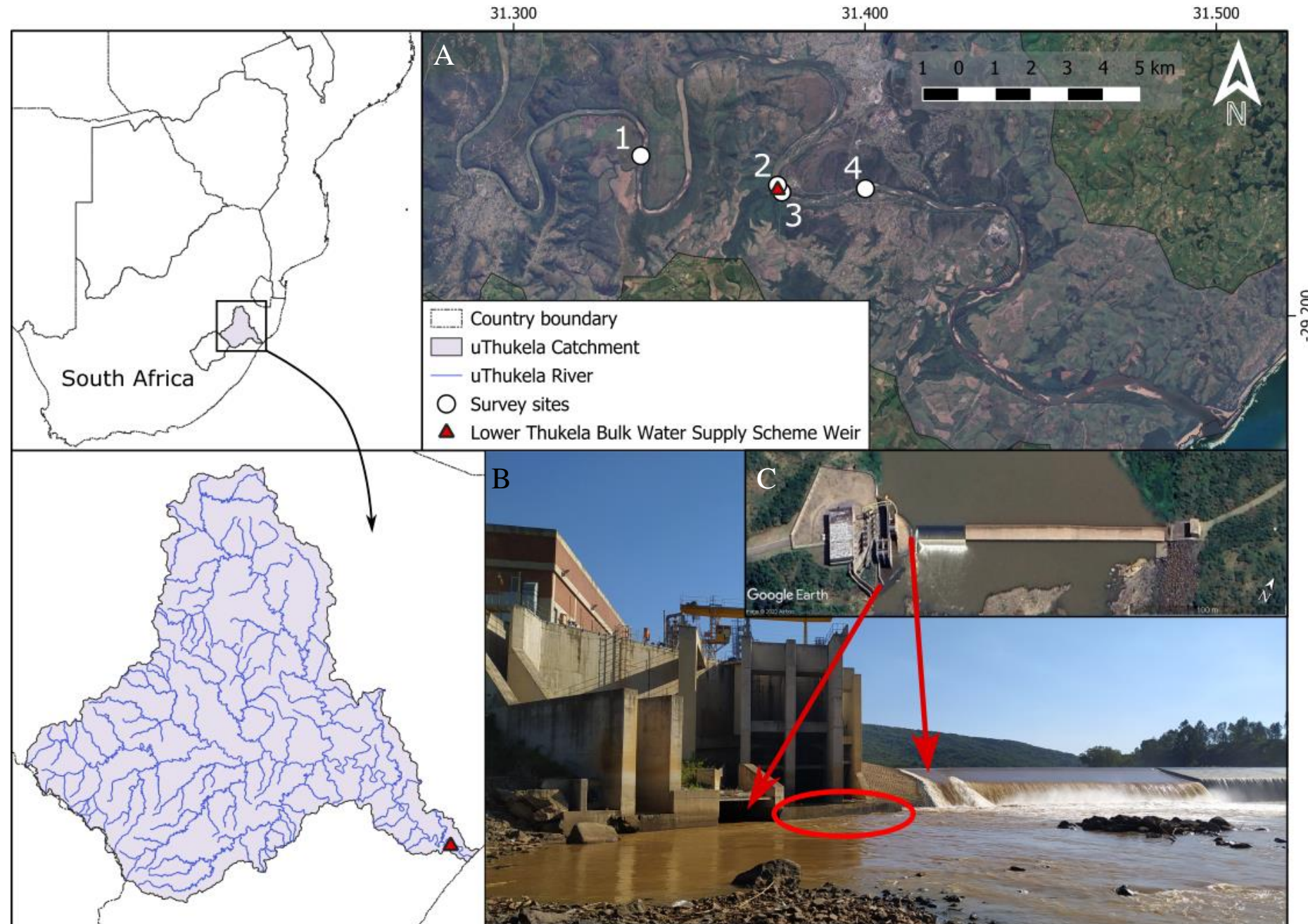


Aims

- To document the presence and absence of macrocrustaceans around the LTBWSS.
- Record migration events of *V. litterata*.
- We hypothesised that macrocrustaceans could migrate over the LTBWSS Weir with the use of a rock ramp as the design intended,

Study Site

The Lower Thukela Bulk Water Supply Scheme (LTBWSS) on the Lower uThukela River, KwaZulu-Natal, South Africa. Detailing the mitigation measures for river connectivity



Methods

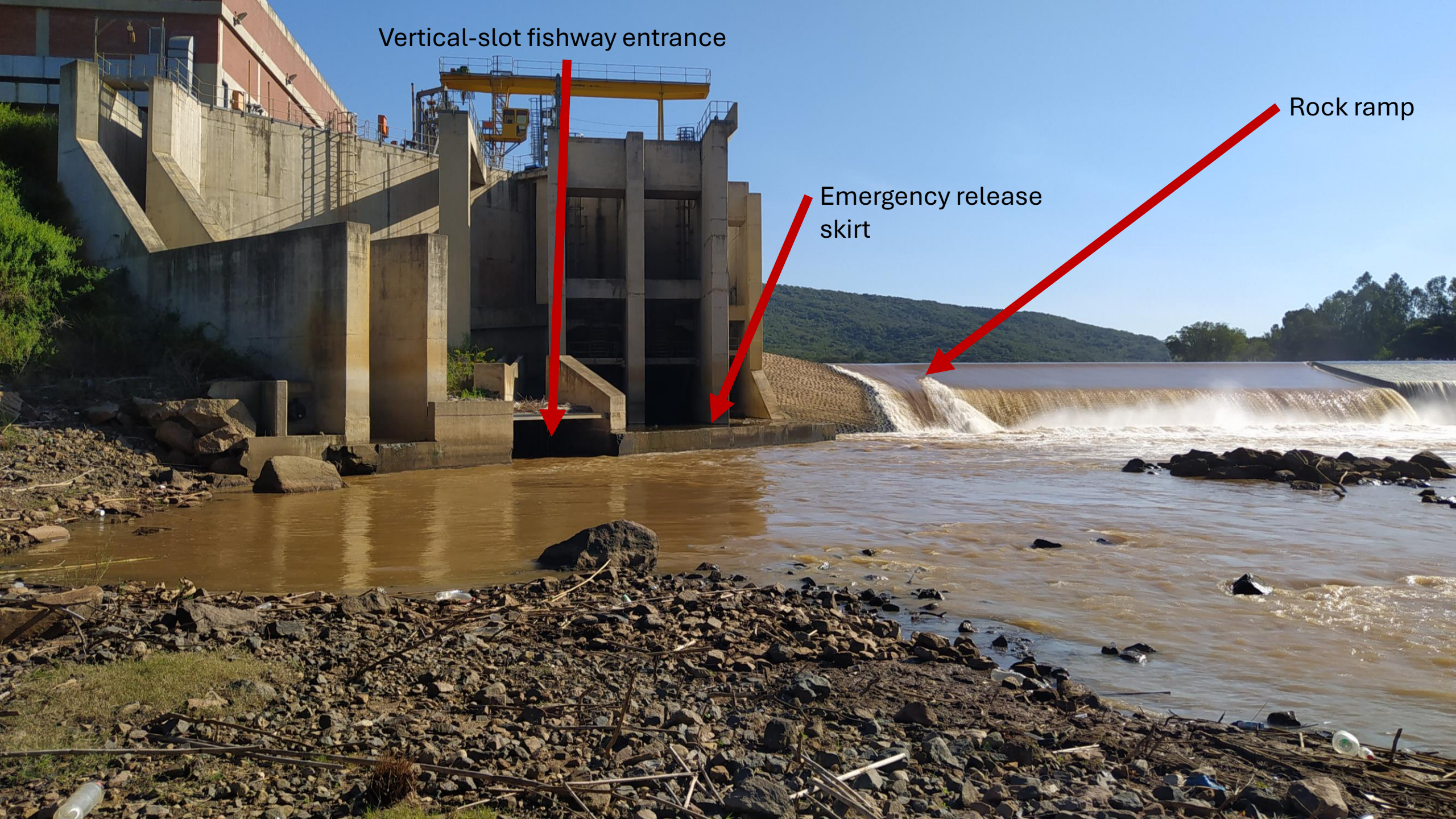
- Record the presence of macrocrustaceans and observed migrating *V. litterata*
- We sampled four sites extensively,
 - 18th - 23rd May 2021,
 - 23rd August to 3rd September 2021, and
 - 3rd -7th December 2021.
- Monthly visits to the LBTWSS Weir from May to June 2022.
- Sampling techniques included electrofishing, with a landing net (mesh size of 0.5 mm), fyke nets (23 mm mesh size) and a glass eel running seine net (2 mm mesh).



Vertical-slot fishway entrance

Rock ramp

Emergency release skirt



Results

- Some efficacy of the rock ramp facilitating migration upstream.
- Utilisation of the emergency release skirt by *macrobranchium* spp. was observed.
- *Macrobranchium* spp. were found in the vertical slot fishway in low abundance.
- *V. litterata* responded to the presence of researchers by moving off the wetted surface and into the current.
- *V. litterata* abundance dropped significantly in the vertical slot fishway after the first baffle.



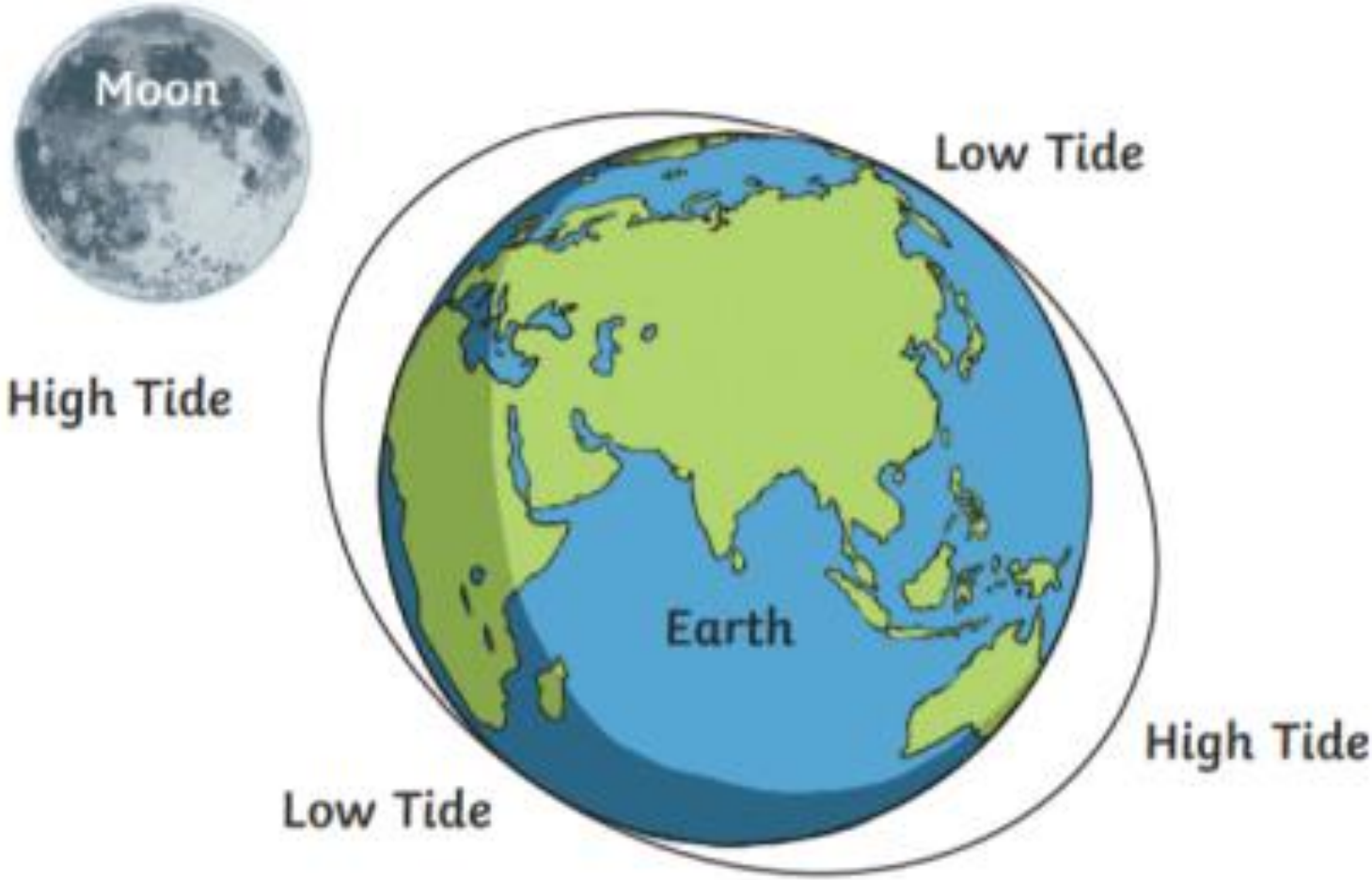
↓ Entrance to the fishway



↓ Second baffle in the fishway



Tracking known events



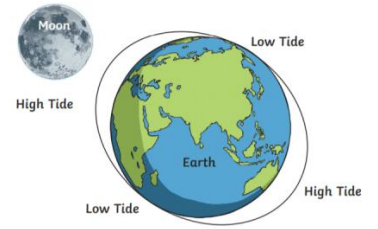
Date	Time	Moon Phase	Date of moon phase	Tide	Tide time	River/ Estuary	Province	Reference
12 to 17-June-2024	Continuous	First Quarter	14-June-2024	-	-	Mgobezeleni	KwaZulu-Natal	Pers. comm. Grant Brokensha 2024
4-June-2024	08:42	New Moon	06-June-2024	Low tide	09:22	St Lucia	KwaZulu-Natal	Pers. comm. Ian Ferreira 2024
8-April-2024	16:00	New Moon	08-April-2024	High tide	15:42	St Lucia	KwaZulu-Natal	Pers. comm. Ian Ferreira 2024
5-May-2023	-	Full Moon	05-May-2023	-	-	St Lucia	KwaZulu-Natal	Head 2023
25-April-2023	13:48	First Quarter	27-April-2023	Low tide	12:20	Mgobezeleni	KwaZulu-Natal	Pers. comm. Grant Brokensha 2023
22-May-2021	16:34	Full Moon	24-May-2021	Low tide	16:52	uThukela	KwaZulu-Natal	Present study
8-Apr-2019	-	New Moon	05-April-2019	-	-	uMvoti	KwaZulu-Natal	O'Brien and Wade 2019
†2013	-	Full Moon	-	-	-	Mgobezeleni	KwaZulu-Natal	Brokensha 2013
‡August 2007 to June 2008	-	Full Moon	-	-	-	Mzingazi	KwaZulu-Natal	Moloi 2010
May-2002	-	-	-	-	-	Nhlabane	KwaZulu-Natal	Mastenbroek 2002
May-1985	-	-	-	-	-	Msikaba	East London	Connell and Robertson 1986
(late) June-1984	-	New Moon	29-June-1984	-	-	Mpambanyoni	KwaZulu-Natal	Connell and Robertson 1986
29-June-1984	-	New Moon	29-June-1984	-	-	uMngeni	KwaZulu-Natal	Connell and Robertson 1986
16-July-1984	-	Full Moon	13-July-1984	-	-	Mzingazi	KwaZulu-Natal	Connell and Robertson 1986
24-July-1984	-	Third Quarter	21-July-1984	-	-	uMkomaas	KwaZulu-Natal	Connell and Robertson 1986

† In winter (June/July/August) after a flood causing an estuary breach

‡ Description lack details to exact dates between this period, other than migrations events peaked in June and August.

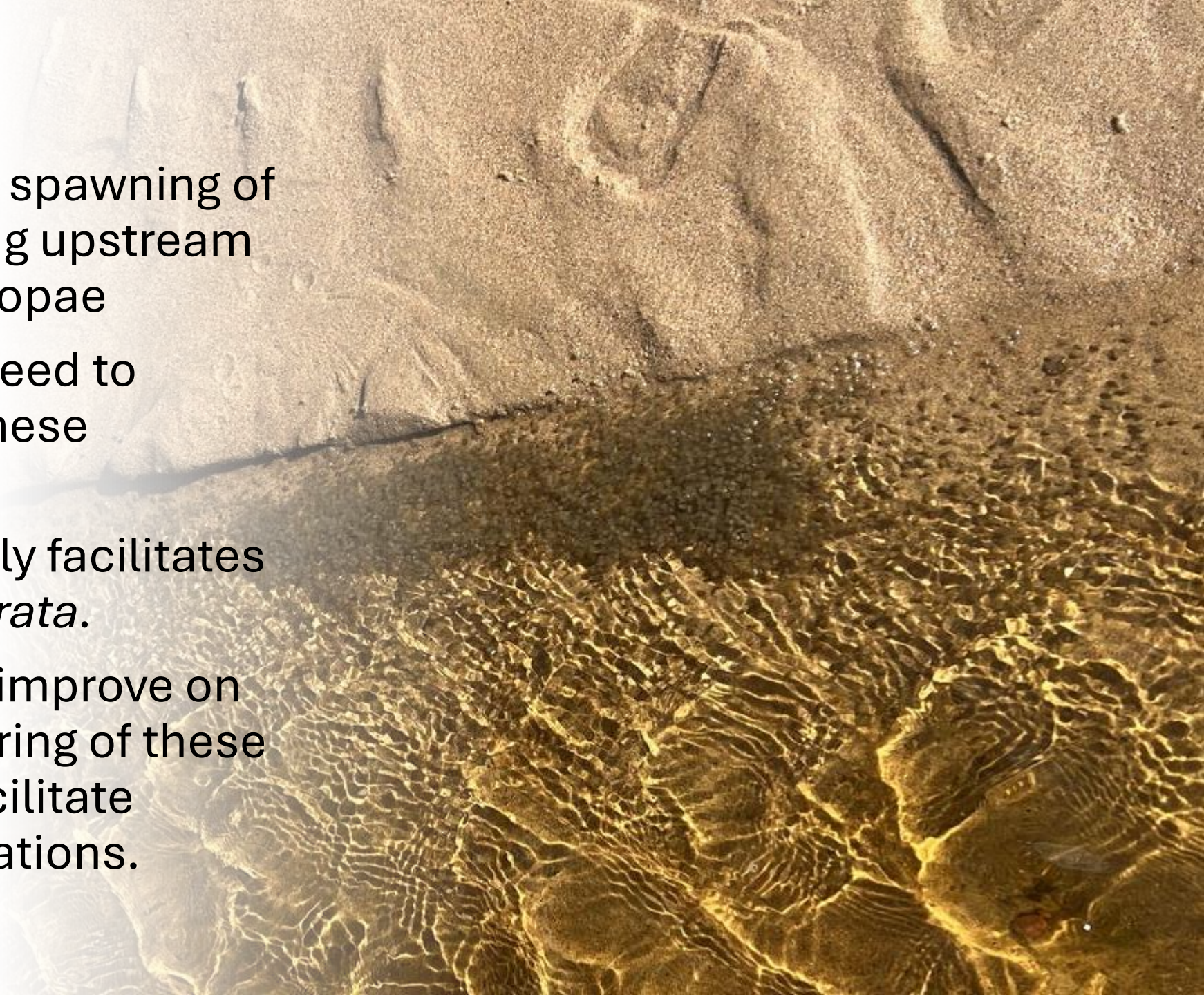
Discussion

- *V. litterata* are negative phototaxis and positive rheotaxic and this plays a role in their migrations.
- Moon phase and tide did not seem to adequately correlate to migration events.
- All events happened between April and June, and possibly linked to increased river flows and opening of temporal estuaries.
- No *V. litterata* adults were found upstream of the LTBWSS Weir, although megalopae were seen successfully moving into the weir pool.
- *Macrobranchium* spp were common throughout the study area, even at the upstream site, indicating successful migrations over the LTBWSS Weir.



Conclusion

- Unclear what cues the spawning of *V. litterata* and following upstream migration of the megalopae
- Designing structures need to adequately facilitate these movements.
- The LTBWSS Weir poorly facilitates the migration of *V. litterata*.
- Future studies should improve on the design and monitoring of these structures to better facilitate microcrustacean migrations.



Thank you!

