

# Trophic substitution: a mechanism for invasion-driven ecosystem change

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Ecological theory predicts that adding or subtracting trophic levels will change an ecosystem to be resource limited or predator limited (bottom-up or top-down control).

We show that replacement (substitution) of native predatory species by an invasive predatory species with different life history traits changes the control of an ecosystem by uncoupling the strength of trophic interactions.

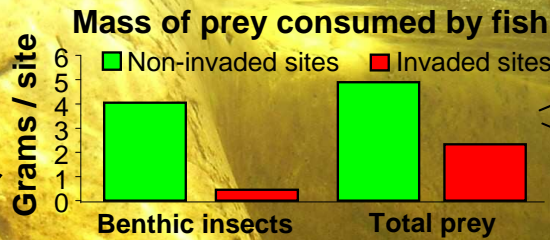
Study sites:

Witte, Ratels and Rondegat Rivers

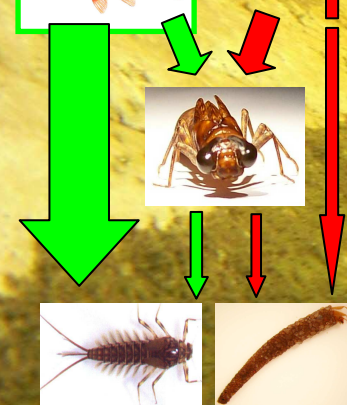
**Indigenous** **Invasive**



Fish



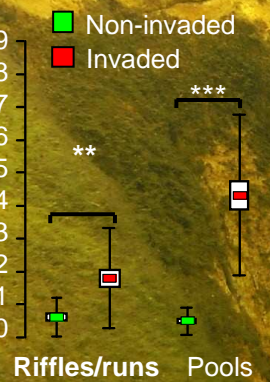
1. Invasive bass displace indigenous fishes
2. Bass consume less benthic invertebrate prey (e.g. baetid mayfly nymphs)



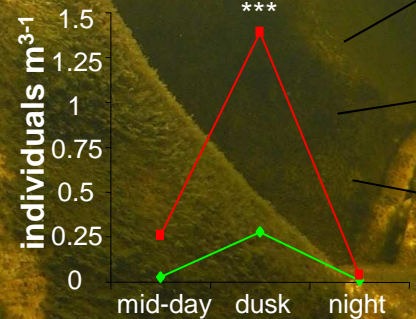
Predatory inverts

Grazers

Baetidae density



Baetidae drift behaviour (corrected for relative density between sites)

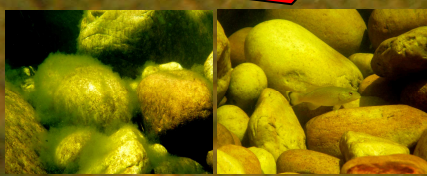


3. The invertebrate community composition and diversity is altered (not shown)
4. The abundance of many grazing invertebrate taxa increases
5. The drifting and foraging behaviour and development of these taxa increases

Epilithic algae (chlorophyll A  $\mu\text{g}/\text{cm}^2$ )



6. The standing crop and diversity of algae is greatly reduced
7. Removal of bass and recolonisation by indigenous fishes is necessary to restore ecosystem function



Primary Productivity (algae)