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Rainpools of the rangelands: hidden diversity and episodic production

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Abstract

Rangeland rainpools fill from direct heavy rain helped by local runoff and usually persist for only a few weeks or months. They are of many types including rock pools (gnammas), grassy pools and gilgai, claypans and cane grass swamps, small freshwater and saline lakes, and various treed and vegetated swamps such as Blackbox swamps. Myriads of invertebrates come and go, various crustaceans hatching from resistant eggs in the subtsrate and an array of insects by flying in and out. All breed prolifically so that production usually peaks early in the hydroperiod. Generally rainpools are too episodic for management issues to arise, but mosquito production and cattle pugging can be problems.

Introduction

Ponded water in the inland provides pleasant relief in a landscape dominated by dryness, whether of plains, hills or vegetation. The problem is such water is rarely permanent and it is a real joy when rain results in new waters. These temporary waters can be a nuisance, but they can also be a source of wonder and investigation as they usually support a myriad of diverse invertebrates with various life styles, life cycles and life moments. This talk is concerned with the denizens of the rainpools.

Rainpool Origins

All natural ponded water in the inland, whether pond, swamp or lake, is the result of rain on the landscape (Fig. 1). Rain may either infiltrate into the ground and become groundwater, or it stays on the surface to become standing water or runs off as flowing waters. In the inland, except for brief periods during rain events, groundwater rarely contributes to wetlands. Rain directly on the surface is the main source of water in a few situations such as rock holes, grassy pools and, to some extent, claypans. However generally overland flow in small catchments supply water to other 'rainpools' such as small lakes and various swamps such as blackbox swamps. Where overland flow is markedly channelized and flows well away from the rained area, it ends up in riverine waterholes and especially in terminal lakes and wetlands, Lake Eyre being the ultimate example. These are hardly rainpools and are not considered here. Besides small size, rainpools are further united by having short hydroperiods of days to weeks to a few months at most.

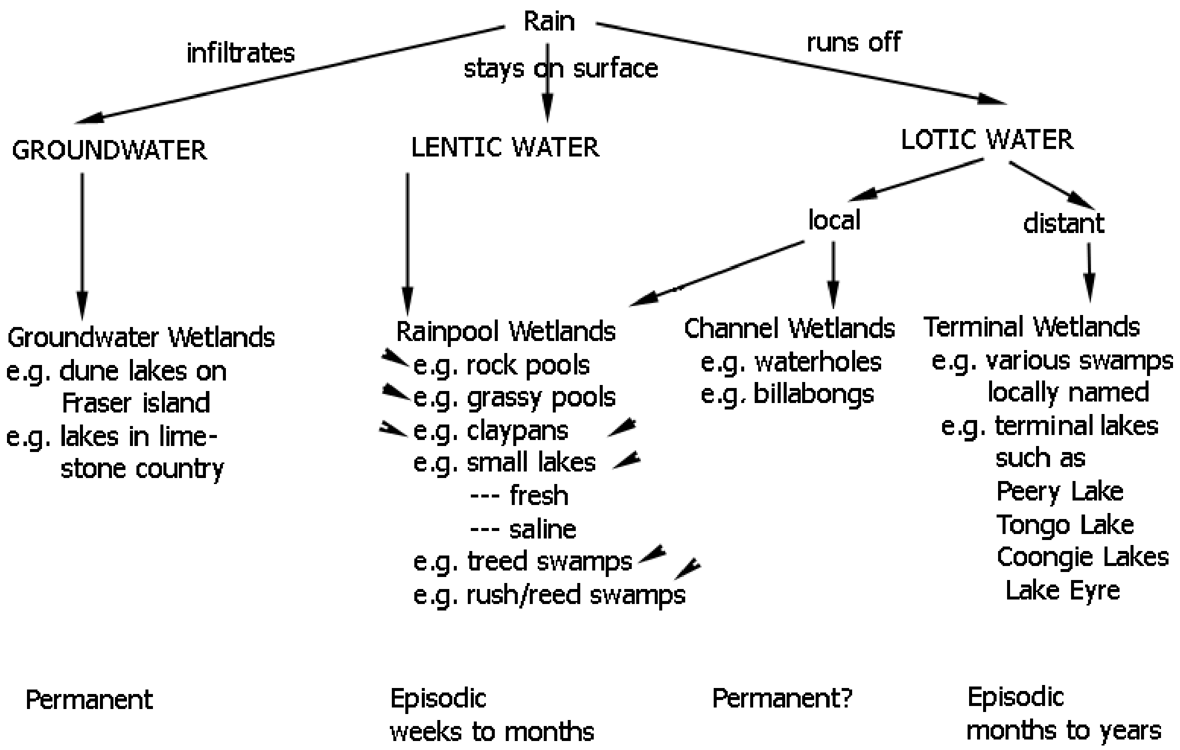

Fig. 1. Concepts of rainpool origins and relationships

Typology

Rainpools vary tremendous in size, substrate and nature of the ponded water, but nevertheless some distinct types across the continent are recognisable.

1. Rockholes (or gnammas). With a substrate of solid rock and a water source of direct rainfall supplemented by local runoff, these are the quintessential rainpools. Their water is usually clear, of low conductivity and neutral pH. They harbour a variety of

invertebrates, especially in WA (up to 40 species per pool, 65 species per rock and 250+ species overall), and can be important indigenous water sources. For an introduction to the biology of gnammas see Pinder et al. 2000; Timms, 2006.

2. Grassy pools, including gilgais. Rainwater with some local runoff can accumulate regularly enough in hollows for grass (often couch *Sporobolus mitchelli*) to grow and be invigorated by occasional inundation. Such pools tend also contain clear water of low conductivity and neutral pH, but unlike gnammas, they generally are short lived. A largely different set of invertebrates live in such pools, all with short life cycles. I am unaware of any studies specifically on such pools.

3. Claypans and canegrass swamps are distinctive because of their very turbid waters and general shallowness and of course hard floors dominated by clay substrates. They fill by various mixtures of direct rainfall and local overland flow and persist for weeks to even months in good seasons. Despite the high turbidity, claypans support a diverse array of invertebrates, largely different from those in gnammas and gilgais. Life in them is supported by algal growth in the shallows and allochthonous (i.e. washed in) organic matter. Information on claypans is available in Hancock and Timms, 2002; Pinder et al. 2004; Timms and Boulton, 2001.

4. Small lakes. Generally direct rainwater input is almost insignificant compared with local overland flow input. If these lakes are hydrologically closed they can accumulate salt, and be saline, though when they first fill after rain, waters can be almost fresh (e.g. Gidgee Lake, Bloodwood Station, varies from 2 g/L to > 100g/L). Freshwater lakes have an invertebrate fauna allied to that of large terminal lakes (but no fish), and also to claypans (due to turbidity), while salt lakes have a limited, but abundant fauna mainly of crustaceans. Studies on them include Kingsford and Porter, 1999; Timms, 1997, 2008.

5. Treed swamps. The common local example is a blackbox swamp, but in other areas there are similar titree swamps, red gum swamps, etc. Waters tend to be clear or slightly turbid, of low conductivity and neutral to alkaline pH. Substrates are of generally of cracking clays that swell and shrink. Invertebrates are not well studied, but seem to be somewhat differentiated from that of other wetland types; certainly they breed a

host of mosquitoes, which claypans and salt lakes do not. Some generalised information on them is in Kingsford and Porter, 1999 and in Timms and Boulton, 2001.

Biodiversity

Many species of invertebrates live in temporary inland waters, with some of them specialists for this habitat. In studies from Western Australia around 1000 species from protistians to snails have been found in pools in both the Wheatbelt and in the Pilbara (Pinder et al, 2004). In the Paroo I have found 215 macroinvertebrates (Timms and Boulton, 2001), a total that does not include the smaller members including diverse protistians and rotifers. The common components include:

1. Fairy, clam and shield shrimps (i.e. the large branchiopods)
2. Water fleas (i.e. the small branchiopods—Cladocera)
3. Seed shrimps (Ostracoda)
4. Copepods
5. There are no higher crustaceans (shrimps, crabs) as they have no method of surviving the dry period. The four crustacean groups above are largely filter feeders and all produce resting eggs that can survive many years of drought
6. Rotifers and protistians
7. Insects: mudeyes (Odonata)
8. Insects: mayflies (Ephemeroptera)
9. Insects: true bugs (Hemiptera)
10. Insects: caddisflies (Trichoptera)
11. Insects: moth larvae (Lepidoptera)
12. Insects: beetles (Coleoptera). Most of the insects above are predators, except the herbivorous moth larvae and mayflies and some bugs which process organic matter
13. Insects: maggots, midge larvae and mosquito wrigglers (Diptera). Most of these eat organic matter
14. Snails (Mollusca).

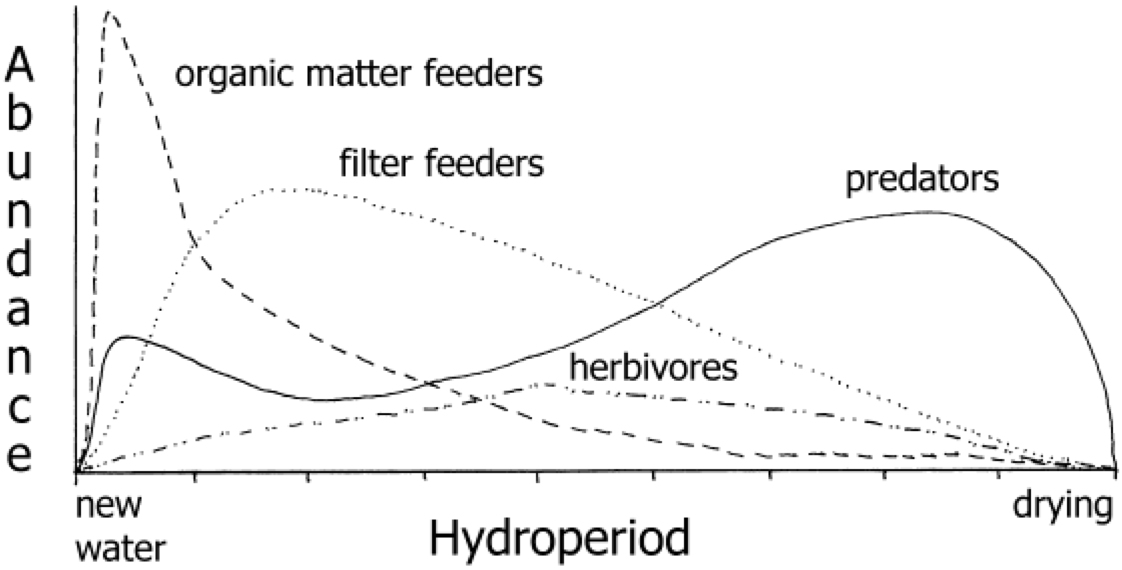

Fig. 2. Changes in dominant feeding types in a generalised rainpool

Processes

When rainpools first fill, nutrients are relatively high. This is partly due to nitrates and phosphates being released from the sediments and partly due to the incoming water and/or the detritus it carries containing nutrients. If studies on claypans are any guide (Hancock and Timms, 2002) phosphates are soon utilized, but nitrates may be readily available throughout the life if the pool. Generally rainpools are extremely productive because of this flush in nutrients.

Variation in life cycle lengths and food availability result in a succession of dominant species/ feeding groups during a pool's hydroperiod (Fig. 2). In most pools (claypans are an exception) there is an early burst of organic matter feeders such as mosquito larvae. This is followed in many pools by population peaks of filter feeders such as the branchiopods, water fleas and a little later the ostracods. Predators are always present, often with an early peak as many are good dispersers and arrive early to breed and then move on. Some stay, others arrive and together with their offspring, they dominate pond waters as they dry.

The major ecological factors operating in rainpools are hydroperiod, turbidity and salinity (Timms and Boulton, 2001). The short hydroperiod of grassy pools prevents species like odonatans with longer life cycles from living there and encourages fairy and clam shrimps with short life histories. Turbidity is the major factor responsible for the unique fauna of claypans, while salinity differentiates the fauna of lakes into fresh and saline assemblages.

Generally birds are transient members of the rainpool fauna. There may be a few waders, small (dotterels) and big (herons) feeding on invertebrates and a few ducks, especially in blackbox swamps. Though most of the avian visitors are predators, piscivores are of course absent. The rainpool types most likely to have waterbirds are the larger treed swamps and the least likely to have waterbirds are the shortlived grasspools and gnammas.

Management

Rainpools and small wetlands present few management issues. Certainly for a few weeks after rain, many breed mosquitoes, and to venture into a blackbox swamp at such times is foolhardy. Like some of the larger wetlands of the inland, some claypans are filling with sediment from erosion of their catchments, as are some of the small lakes. The value of some gnammas has been diminished by stock dying in them, and cattle pug rainpools, but this probably does not affect invertebrates.

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