# Report on Dec 2002 sampling on Gnangara Mound springs

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## Sampling

Three sites were sampled on the 5th Dec 2002 by Robyn Luu and Adrian Pinder.

*Edgerton Mound Spring* (31º46'17"S, 115.58º52"E). One invertebrate sample (A) was taken from the stream arising from the spring with a 50µm pore-size net held downstream while agitating the sediment and vegetation. Another sample (B) was taken by scooping water from a small puddle of water in a boggy part of the mound itself and filtering this through a 50 µm mesh net. No water chemistry measurements were made. Jasinska and Knott (1994) sampled this site.

*Muchea Mound Spring (=Peters spring)* (31º35'18"S, 115º57'52" E). Since the mound was very dry, the only invertebrate sample taken was water scooped out of a small puddle on the edge of the firebreak along the western side of the mound and passed through a 50 µm mesh net. Measurements of pH and conductivity and a water sample were taken prior to sampling invertebrates. Jasinska and Knott (1994) and Jasinsksa (1998) sampled several sites associated with this spring area.

*King's Mound Spring* (31º39'04" S, 115º57'11" E). One invertebrate sample was taken by scooping water from a small shallow (<3cm deep) pool and filtering it through a 50 µm mesh net. Measurements of pH and conductivity and a water sample were taken prior to sampling invertebrates. This site was sampled by Jasinska (1998).

## Identification and curation.

Samples were sorted in the laboratory by Melita Pennifold and Nadine Guthrie and identified by Melita Pennifold, except for the copepods which were identified by Jane McRae and the oligochaetes (A. Pinder). Specimens are presently stored in alcohol in the laboratory of Stuart Halse at DCLM.

## Results

### Water chemistry (Table 1)

Water sampled at both the Muchea and King's mound springs was fresh. At King's mound spring, conductivity was 23 $\mu S.cm^{-1}$, which is similar to that recorded by Jasinska (1998) though lower than would be expected given the concentrations of ions. Absolute and relative ion concentrations were similar to previous records. pH at King's (6.06) was higher than recorded by Jasinska (1998) (4.2 and 4.5). For the Muchea site, we recorded higher conductivity (198 $\mu S.cm^{-1}$) than either Jasinska (1998) and Jasinska and Knott (1994) (16 to 150 $\mu S.cm^{-1}$), though concentrations of major ions were generally within ranges recorded by these authors. pH at Muchea was also higher than recorded previously (3.2 to 4.7). For both sites, the high total dissolved solids compared to conductivity and concentrations of major ions suggests there were significant concentrations of other dissolved material (such as humic acids) in the water, as suggested by Jasinska and Knott (1994).

### Invertebrates (Table 2)

At least 43 aquatic invertebrate species were collected. This is lower than the 72 collected from Muchea and Egerton springs by Jasinska and Knott (1994), but that study involved collection at more sub-sites and on more occasions than the present study and collection in winter and spring when more surface water would often have been present. Total richness is more comparable to collections from King's and Muchea springs made by Jasinska (1998) (40 species). I have not had time to identify the rotifers but these were not identified in these previous studies and I have not attempted to identify the oribatid and trombidioid mites and nematodes. The ostracods will be identified shortly but will not add greatly to the species list.

Species richness in individual samples (7 to 21, average 14) was lower than recorded by Jasinska and Knott (1994) (6 to 31, average 20: for Muchea and Egerton samples) and Jasinska (1998) (19 to 23, average 21: for Muchea and King's samples) but this is probably a result of the small water volumes present.

Comparison of species lists is hampered by morphospecies coding that is not compatible with previous studies: a problem arising from a lack of available voucher collections from previous collections (there is no faunal equivalent of a herbarium). Many of the invertebrates collected during this study were not collected from these sites previously and many species collected previously were not collected by in this survey, though this is not unexpected considering the time of year we sampled. Many species, especially the insects, are widespread in south-western Australia, though taxonomic uncertainty constrains what can be said about distributions of some taxa.

*Notes by taxa*

Water mites: Four species of mites were collected. Two of these, an oribatid and an Astigmatid closely resemble species found in groundwater from the Pilbara during the Pilbara Biological Survey (unpublished data) and may be the same as species recorded in previous studies of these springs

Annelids: Only enchytraeids were collected and these may be species of moist earth rather than truly aquatic.

Copepods: Both *Paracyclops* and *Mixocyclops* have been recorded from Gnangara Mound springs previously, though the harpacticoid genera *Australocamptus* and *Canthocamptus* have not, at least not named as such. The latter two species may represent one of the un-named harpacticoids of Jasinska and Knott (1994) or harpacticoid sp. 1 of Jasinska (1998), but neither have previously been collected by the CALM wetlands group so their distributions are unknown. The *Paracyclops* from King's Mound Spring resembles specimens (*Paracyclops* sp. 2) collected from Lake Poorginup (Lake Muir region) but this is not necessarily the same as the 'sp. 2' of Jasinska (1998) which she also found in the Yanchep caves. Jasinska (1998) also found an *Atheyella* copepod at King's which was not present in Dec 2002.

Cladocera. Only one species was found: a tentatively identified chydorid from King's. Chydorid carapaces were collected by Jasinska (1998), but from the Muchea spring not King's. Jasinska (1998) also found other cladoceran families (Ilyocryptidae from Muchea and Macrothricidae from King's and Muchea).

Mosquitoes. Interestingly, mosquitoes were not listed in the previous studies of Gnangara springs mentioned above. *Culiseta atra* and *Anopheles atratipes* are uncommon but widespread in south-western Australia. While the latter is not restricted to WA the former is a south-west endemic and was collected from the Three Springs Mound Springs by Pinder and Pennifold (2002) and Pinder (2003). Both tend to occur in coloured freshwater swamps (Liehne 1991). *Culex australicus* is a common Australasian species.

Dragonflies. Neither *Austrogomphus lateralis* nor *Hemicordulia tau* have been recorded from Gnangara springs in the past. The former is a species of permanent fast flowing streams (Watson 1962) whereas the latter is a very common species inhabiting a wide range of habitats. Both were only recorded in the stream flowing from the Edgerton spring.

Trichoptera. Two families, (Hydroptilidae: *Oxyethira* and Ecnomidae: *Ecnomina*) have not previously been recorded from Gnangara springs. The *Ecnomina* (group F sp. AV18) is common in the far south-west but not normally encountered on the Swan Coastal Plain.

## Summary

Although the sampling occurred when the springs had very little water, a considerable number of species were collected, including some new records for the sites, indicating that sampling in a variety of conditions is required to fully document the fauna of these habitats. The *Ecnomina* is a further example of the springs supporting species normally found much further south, as noted by Jasinska (1998).

## References

Jasinska, E. J., 1998. Monitoring of tumulus spring invertebrates. Report to the WA Threatened Species and Communities Unit and the Water and Rivers Commission. Soil Science and Plant Nutrition, The University of Western Australia, Nedlands.

Jasinska, E. J. & B. Knott, 1994. Aquatic fauna in Gnangara Mound discharge areas of the Ellen Brook catchment, Western Australia. A report submitted to the Water Authority of Western Australia. Dept. Zoology, The University of Western Australia, Nedlands.

Pinder, A. M., 2003. Interim report on invertebrate sampling at the organic mound springs at Three Springs in August 2001., Department of Conservation and Land Management, Perth.

Pinder, A. M. & M. G. Pennifold, 2002. A survey of the aquatic invertebrates of some tumulus springs in the Shire of Three Springs, Western Australia. Department of Conservation and Land Management, Perth.

**Table 1. Water chemistry for two of the springs sampled in Dec 2002**

| | King's Spring | Muchea Spring |
|---|---|---|
| Alkalinity (mg $L^{-1}$ $CaCO_3$ equiv) | <2 | 8 |
| Hardness (mg $L^{-1}$) | 26 | 24 |
| Colour (True Colour Units) | 1100 | 1300 |
| Total dissolved solids (mg $L^{-1}$) | 280 | 280 |
| Conductivity (µS $cm^{-1}$) | 23 | 198 |
| pH | 6.06 | 6.45 |
| Calcium (mg $L^{-1}$) | 2.1 | 3.2 |
| Sodium (mg $L^{-1}$) | 31.1 | 21 |
| Potassium (mg $L^{-1}$) | 2.2 | 15.1 |
| Magnesium (mg $L^{-1}$) | 5 | 3.9 |
| Manganese | 0.028 | 0.017 |
| Chloride (mg $L^{-1}$) | 53 | 43 |
| Sulphate (mg $L^{-1}$) | 17.1 | 8.3 |
| Carbonate (mg $L^{-1}$) | <2 | <2 |
| Bicarbonate (mg $L^{-1}$) | <2 | 9 |
| Nitrate/Nitrite (mg $L^{-1}$) | 1.5 | 0.21 |
| Silica (as $SiO_2$) (mg $L^{-1}$) | 11 | 6.6 |
| Iron (mg $L^{-1}$) | 0.42 | 0.33 |

**Table 2. List of species present at the mound springs sampled in Dec 2002, numbers in cells are log abundance**

| Identification | | Comments | Firebreak | Kings | Edgerton site A | Edgerton site B (stream) |
|---|---|---|---|---|---|---|
| | | | GMS001 | GMS002 | GMS003A | GMS003B |
| Nematodes | | | 2 | 2 | 1 | |
| Rotifers | | | 2 | 2 | 2 | 2 |
| Oligochaetes | Enchytraeidae | immature | 1 | 1 | | |
| Water mites | Oribatid sp. 3 | possibly same as species from Pilbara stygofauna sur | 1 | | | |
| | Astigmata sp. 2 | possibly same as species from Pilbara stygofauna sur | 1 | | | |
| | Mesostigmata | | | 1 | | |
| | Trombidioidea spp. | | | | | 1 |
| Cladocerans | Alona sp. | juvenile | | | | 1 |
| Ostracods | Ostracoda (Unident.) | | | | 1 | |
| Copepods | *Paracyclops* (nr. sp. 2) | | | 1 | | |
| | *Paracyclops* sp. | juvenile, but not same as specimens from King's | | | 1 | |
| | *Mixocyclops* sp. | juvenile | 1 | | | |
| | juvenile cyclopoids | | | | | 1 |
| | *Canthocamptus* sp. 3 | possibly new species | | 1 | 1 | |
| | *Australocamptus* sp. 7 | possibly new species | 1 | 1 | | |
| Crayfish | *Cherax quinquecarinatus* | juvenile | | | | 1 |
| Beetles | *Sternopriscus browni* | | 1 | | | |
| | *Sternopriscus* sp. | larvae | | | | 1 |
| | *Rhantus* sp. | larvae | 1 | | | |
| | *Paracymus pygmaeus* | | 1 | | | |
| | Scirtidae sp. | larvae | | | | 1 |
| Mosquitoes | *Anopheles atratipes* | | | 1 | | |
| | *Culiseta atra* | | | 2 | | |
| | *Culex* (*Culex*) *australicus* | | 3 | | | |
| Biting Midge | *Clinohelea* sp. 1 | tentative generic id | | | | 1 |
| | *Monohelea* sp. 4 | tentative generic id | | | 1 | |
| March Flies | Tabanidae | | | | | 1 |
| Chironomids | *Procladius paludicola* | | | | | 2 |
| | *Paramerina levidensis* | | | 2 | | |
| | *Paralimnophyes pullulus* | | | 1 | | 1 |
| | Orthocladiinae | early instar, cannot id further | 1 | 1 | 1 | |
| | Orthocladiinae S03 sp. A | | | | | 1 |
| | *Tanytarsus barbitarsis* | | | | | 1 |
| | *Tanytarsus* sp. C (*bispinosus*) | | | | | 2 |
| | *Chironomus* aff. *alternans* (V24) | | 2 | 1 | | |
| | *Cryptochironomus griseidorsum* | | 1 | 1 | | |
| Hemipterans | *Microvelia* sp. | juvenile | | 1 | | 1 |
| Moth larvae | Lepidoptera | early instar, cannot id further | | | | 1 |
| Dragonflies | *Austrogomphus lateralis* | | | | | 1 |
| | *Hemicordulia tau* | | | | | 1 |
| Caddisflies | *Oxyethira* sp. | | | | | 1 |
| | *Ecnomina* F group (sp. AV18?) | | | | | 1 |
| | Leptoceridae | early instar, cannot id further | | | | 1 |
| | | | 14 | 15 | 7 | 21 |