



# 11. Invertebrates in Arid NT Wetlands

## Scope

Aquatic invertebrates are important elements of the wetland biota, however, there has been little systematic survey in the arid NT. The exceptions are long-term waterholes in the West MacDonnell Ranges and in the George Gill Range.

This chapter provides a brief introduction to some aspects of the invertebrate fauna of arid NT wetlands, and to existing studies and reviews from elsewhere in the Australian arid zone.

The invertebrate flora of temporary wetlands changes significantly through an inundation event (R.Henderson pers. comm.) and considerable sampling effort is required to characterise their invertebrate communities. Invertebrate work is particularly time consuming, with a pilot study in Victoria recording processing time of up to 50 hours for 2 minutes of field sampling (Butcher 1999). Accordingly, no detailed study of invertebrates was undertaken in this inventory, however opportunistic observations and samples may have added a little to a relatively sparse knowledge base.

## 11.1 Summaries of Pre-existing Surveys and Reviews

### General Reviews of Inland Aquatic Invertebrates

There are various publications reviewing the range of aquatic fauna in inland Australia, including identifications guides. These include: *Life in Inland Waters* (Williams 1983); *Australian Freshwater Life* (Williams 1980); the *Colour Guide to Invertebrates of Australian Inland Waters* (Hawking & Smith 1997); Williams and Campbell (1987); Williams and Allen (1987); Williams (1985, 1998a, 1998b, 1998c, 1999); and Yen and Butcher (1997).

Williams (1998a, 1998b & 1998c) summarises knowledge of the invertebrate fauna of Australian inland wetlands including the origins of the fauna (Williams 1998c).

### Salt Lakes

Williams (1998b) summarises the fauna of Australian salt lakes, however, most of the information appears to be from South Australia and Western Australia.

Williams (1998) suggests that the aquatic fauna of arid zone salt lakes is distinctive but that it may not vary much between different lakes:

‘The aquatic fauna occurring in them is much less regionally restricted. Many of its taxa have wide distributions. It is also taxonomically different from the fauna of south-western and south-eastern salt lakes.’ Williams (1998b, p.163)

The distinctive fauna of salt lakes in Australia may have evolved in the more predictably wet salt lakes of south-eastern and south-western Australia, whilst those in central Australia went through periods of such aridity as to preclude this (Williams 1998b).

Much of the data on central Australian salt lakes is from Lake Eyre, which probably had and has a more predictably filling regime than many others due to inflow from the tropics via the Georgina and Diamantina Rivers. Williams (1998b, p.165) suggests that:

‘The fauna of central lakes, therefore has evolved elsewhere and occurs there only because it has (i) good dispersal mechanisms which enable it to take rapid advantage of the presence of suitable habitats, as well as (ii) mechanisms to survive long periods between major inundations ...’

There is some evidence that there is a distinctive and predominantly terrestrial fauna also associated with playa lakes, particularly beetles which use the lakes when dry (P.Hudson pers. comm.; Williams 1999). This dry phase fauna may be more regionally restricted than the aquatic fauna (Williams 1998b).

Williams (1985) reviews physical and chemical characteristics of temporary inland (standing) lentic waters and the adaptations of the biota that live there. This includes strategies for surviving desiccation, avoidance by highly mobile taxa (birds and some insects), dormancy or drought resistance as adults, eggs, cysts, seeds and spores and vegetative parts in some plants.

## Rivers and Springs in the MacDonnell Range Bioregions

The 1894 Horn Expedition sampled invertebrates in the spring-fed pools at the base of the George Gill Range, and in waterholes in the Finke River. The results of the Horn expedition are compared with more recent data by Davis (1996).

Williams and Siebert (1963) published the first report on the chemical composition of permanent and semi-permanent waterholes in central Australia, including an indication of those thought to be recharged from ground-water. They included a preliminary list of invertebrates from 5 of the West MacDonnell Ranges waterholes.

The only systematic surveys of aquatic fauna have been in the long-term pools of the George Gill Range and in the West MacDonnell Ranges. The survey in the George Gill Range is reported in Davis *et al.* (1991 and 1993) and the West MacDonnell's work in Davis (1995) and comparisons of the two areas are presented in Davis (1997). Although they are the best available, most of the sites were only sampled once. The work so far shows that both the George Gill pools and those in the West MacDonnell's have a diverse fauna, which are distinct from each other, and have relictual components (Davis 1997).

A great deal of further work is required to record the changes in species abundance and activity at different times of the year and through variations in water level and chemistry at temporary waterholes in the upper Finke River System. Semi-permanent spring-fed pools in the Palm Valley area are likely to have different aquatic fauna assemblages due to their generally shallow nature and relatively high salinity compared to most of those others sampled by Davis *et al.* (1991) and Davis (1995). However, they were not included in the reported numerical analysis by Davis (1997).

An important result of the surveys in the George Gill Range and West MacDonnell's was the identification of a group of sites termed 'relict streams'. These are small streams and pools created by permanent flowing springs with low salinity which had populations of the Water Penny (*Sclerocyphon fuscus*).

The Water Penny (*Sclerocyphon fuscus*) is an aquatic larvae of a terrestrial beetle that requires fresh water. It is believed to be a relict of moister climate which depends on permanent fresh water. In central arid Australia it is only known from a few locations in the West MacDonnell Ranges (7 sites) and the George Gill Ranges (Watarra-Kings canyon area: 2 sites) (Davis 1995). The West MacDonnell sites are, from west to east: Talipata Springs; Talipata Gorge; Bowmans Gap area ('Possum Springs'); (Mount) Giles Springs; Giles Yard Springs; upper Serpentine Gorge; and upper Hugh Gorge. The George Gill sites are upper Stokes Creek and Penny Springs. Its main population range is in Victoria and southern South Australia (Davis *et al.* 1993). The Mount Giles Spring record referred to by Davis (1995) was apparently from 1986 and may be dubious given the confusion between that spring and Giles Yard Springs. At some sites there are moderately high flows of spring water compared to the other sites where flow may be just a trickle, such as the George Gill sites (D.Schunke pers. comm.).

## Other Surface Wetland Types

There has been virtually no systematic sampling of the aquatic invertebrate fauna of other wetland types. Bayly (2001) undertook repeated sampling of invertebrates in a small gnamma hole on a granitic outcrop near Papunya and compares the invertebrate fauna to gnamma holes in south-western Australia. Fauna at the Papunya site included a species that was previously thought not to occur in Australia and new species

of ostracods and nematodes. The nematodes are described in Nicholas and Hodda (2000, cited in Bayly 2001). These results are indicative of the extremely poor knowledge of the invertebrate fauna.

Sampling by school and community groups involved in the Waterwatch Program has indicated large changes in faunal assemblages through time, in temporary waterbodies (R.Henderson pers. comm.). Environmental education in various Aboriginal community schools has also involved sampling aquatic invertebrates (T.Nano pers. comm.).

## Underground Aquatic Fauna

A unique group of aquatic invertebrate fauna live only in underground habitats and are called 'stygo fauna' (Humphreys 2001). Whether or not such fauna should be included under the wetlands banner may be vigorously debated, however, subterranean karst wetlands are clearly included under the Ramsar Convention.

To date the only work on stygo fauna in the arid NT is sampling done by Humphreys in 2001 and 2002 (R.Read pers. comm.). Two bores in Proterozoic limestone near Alice Springs yielded no stygo fauna. However sampling in calcrete aquifers in the Ngalia Basin found many species, including eight new species of diving beetle.

A special edition of the *Records of the Western Australian Museum* is devoted to Australian subterranean fauna: *Subterranean Biology in Australia 2000* (Humphreys & Harvey 2001). It includes results of far more extensive sampling of calcrete aquifers in paleovalleys in West Australian areas of the Australian arid zone (Humphreys 2001) which are summarised here as follows. Paleovalleys or paleodrainage systems in the Western Shield are hydrologically isolated from each other and each one sampled contains a unique and diverse stygo fauna. Further more, within the paleodrainage systems hypersaline sections, often associated with surface salt lakes, appear to serve as barriers that isolate stygo fauna in separate sections of the same system.

It is expected that there is also a substantial aquatic invertebrate fauna in saturated soil and sand below and adjacent to rivers and swamps (the hyporheic zone), based on work interstate (reviewed by Boulton 2001). It seems possible that endemic species may exist in the hyporheic zone in areas of permanent surface or subsurface ground water discharge, particularly in the Finke River.

## 11.2 Inventory Survey

### Overview

Aquatic invertebrates were sampled opportunistically in the survey component of the arid NT wetlands inventory. The main methods were dip netting and seining with a 2 m wide seine net. Samples were stored in 70% ethanol and sorted to order and family. Our sampling was rapid, did not target different sub-habitats and was based on a single visit to each site. Therefore, it was insufficient to document faunal assemblages for wetland types. Some of the invertebrate work was a collaboration with Bernadette Bostock of Deakin University and some specimens of *Branchinella sp.* were retained at Deakin University for further research. All other specimens will be either lodged with the Northern Territory Museum, or retained as reference material at the Arid Zone Research Institute.

The data from the survey are listed in Volume 2 of this report.

Most of the sampling undertaken was in relatively open and shallow waters, including riverine waterholes, claypans and other freshwater lakes. Such sites were generally seined providing a reasonably effective one off sample of the limnetic zone. At a few sites, dip netting was conducted around emergent vegetation and on the margins of deeper water, including some rock holes. Drop nets, mesh cages and funnel traps were also used at a few sites.

The abundance of invertebrates was not quantitatively measured, but was observed to vary greatly between sites. At one claypan in the Barkly Tableland, by far the highest abundance was observed with many thousand individuals caught in each sweep of the seine net. Abundance was generally highest in the Barkly Tableland, which was presumed to be due to generally higher temperatures than at more

southerly sites. Most of the sampling was in cooler months (April-September), but Lake Mackay was sampled in October.

## Distribution of Crustaceans

Various crustaceans are recorded from the arid NT including brine shrimps (*Parartemia spp.*), shield shrimps (*Triops australiensis*), fairy shrimps (e.g. *Branchinella spp.*), freshwater prawns (*Macrobrachium spp.*), Ostracods (Ostracoda), crabs (*Holthuisiana transversa*) and yabbies (*Cherax spp.*). Apparently collections of a fairy shrimp (*Branchinella sp.*) from the south-east of the study area have attracted interest from aquaculture researchers (B.Bostock pers. comm.).

In addition to opportunistic sampling, observations were made regarding larger invertebrates and their impacts. This mostly applied to burrows/holes in earth banks that were assumed to be from crustaceans, either the Yabby (*Cherax destructor*) or the Inland Crab (*Holthuisiana transversa*), or both. A third (introduced) large crustacean is known: Redclaw (*Cherax quadricarinatus*). It was only recorded once, at Wycliffe Creek, where it has apparently formed a self sustaining population since introduction over 10 years ago (D.Debney pers. comm.). There is also anecdotal evidence that introduced Redclaw are persisting in Kurundi Creek (P.Saint pers. comm.).

Due to relative ease of observation and abundance of records, the distributions of crabs and yabbies are discussed here in some detail.

## Observations of Burrows/Holes

Two forms of burrow were observed. The most common were simple holes in earth banks of drainage lines, including waterholes. Less often, conical mounds had been constructed to elevate the burrow entrance. Both types were assumed to be either from Yabbies or Crabs, however, excavation showed them to be very deep and none were excavated to their full extent and no animals were observed in the holes. At one site with conical burrows, Crabs were caught in the adjacent waterholes (Wall Hole on Coglein Creek). It is likely that most of the holes seen were from crabs.

Boulton and Brock (1999) discuss a group of invertebrate fauna which utilise crayfish and crab burrows, called 'phoeteros'. Jones and Morgan (2002, p. 204) note that *H. transversa* burrows 'may extend 1m into the ground and during the dry season they are plugged with earth by the crab. Within its damp burrow the crab can survive until the following wet season'. It is possible to 'attract' crabs out of their burrows by pouring water into the holes (Lynn Day pers.comm.).

## Distribution of *Cherax destructor*

Populations of Yabbies (*Cherax destructor*) that were encountered by the Horn Expedition are considered to be indigenous, although it is possible they were previously translocated by workers on the Overland Telegraph Line or by early non-aboriginal travelers. The Horn Expedition recorded *C. destructor* at Running Waters and Hermannsburg in the upper Finke River.

Yabbies were recorded at five locations in our survey. Those at Two Mile Waterhole on the upper Finke River and at Nora Waterhole in the Georgina River system (Toko Ranges tributary), are considered indigenous. Three other records are presumed to be introductions. One, at Allungara Waterhole, is presumed to be from a stock dam as the drainage system is isolated in the Burt Plain and has no long-term natural waterbodies. One, in the upper catchment of Lilla Creek in the lower Finke River system was confirmed as resulting from introduction to a stock dam. The third was at Conlans Lagoon, a claypan/swamp near Alice Springs. This swamp is adjacent to Roe Creek, which in high flows may link Conlans Lagoon to swamps and pans in the Illparpa Valley, where yabbies have also been introduced.

Populations at Bagot Creek and Stokes Creek in the George Gill Range are considered to be re-introductions at some time since the Horn Expedition (Davis 1996).

The populations that are considered indigenous are all in systems with permanent waterbodies. The species was recorded at Nora Waterhole in the Toko Ranges by Fogarty *et al.* (1995) which is possibly permanent. The large near-seasonal waterholes in rivers of the Georgina System in the Mitchell Grass Downs bioregion may not have Yabbies, despite holding water for many months in most years. A station worker at Sudan reported catching only crabs in a cage trap at One Mile Waterhole on the Rankin River.

### **Distribution of *Holthusiana transversa***

In comparison to Yabbies, Crabs are much more widespread and were observed either directly, or by burrows, in a great many temporary watercourses as well as in temporary waterholes in watercourses. Crabs have been recorded in a variety of locations north of about 22° 44' latitude. To the south of this, the only records in the arid NT are from the Stony Plains Bioregion at Wall Hole (25° 57' 43"; this survey) and downstream at Charlotte Waters on the lower Coglein Creek (Horn Expedition). There is no record of *Holthusiana* in the MacDonnell Ranges Bioregion, either in the more elevated MacDonnell Ranges or in the other ranges with lower elevation and less relief (height above the plain), such as the George Gill Range.

Crabs are considered to be abundant in the Dulcie Ranges and Davenport Ranges. Of records to the north of the MacDonnell Ranges bioregion, the most southerly records were specimens from the Dulcie Ranges and observation of burrows at a large claypan and Bluebush swamp on Tarlton Downs Station (both at about 22° 44' S). Specimens or body parts were collected at various other locations including, Junction Waterhole on the Sandover River, creeks in the Reynolds and Yundurbulu Ranges, including some very temporary waterholes, waterholes in the eastern and northern drainages of the Davenport Range, both major and minor drainage lines in the Mitchell Grass Downs and Channel Country bioregions, and a claypan in the Mitchell Grass Downs.

Holes in banks were also observed in clay/loam banks of minor upland creeks in the Dulcie Ranges and Reynolds Range; and in a bank of a sandy river bed (Woodforde River) with no waterholes in the vicinity. Although these observations cannot be confirmed as being burrows of *Holthusiana*, if they are, then they may be indicative of a broad range of inundation regimes that the inland crab can tolerate. Alternatively, they may indicate surprisingly long range dispersal from areas with more frequent inundation regimes. The distribution and physiology of inland crabs (*Holthusiana transversa*) were reviewed by Greenaway (1984) and report that they survive dry periods in 'dry' burrows but may depend on some soil moisture to prevent unsustainable loss of body moisture.

### **Relative Distributions of Crabs and Yabbies**

Specimen records of *Cherax destructor* and *Holthusiana transversa* from the Northern Territory Museum do not add to the distribution ranges described above, apart from a record of Yabby from the Todd River in Alice Springs, which is almost certainly an introduction.

The relative distributions of Crabs and Yabbies are somewhat enigmatic. Both are believed to be indigenous to the study area, but there have been many introductions and translocations of both Yabbies and Redclaw.

Three factors are proposed as possible contributors to the apparent absence of crabs between the latitudes of 22° 44' S and 25° 57' S. Firstly, frosts may be more frequent and severe in the MacDonnell Ranges than elsewhere in the arid NT. The substantial heights of some ranges may produce cold air drainage such that drainage depressions at their bases are particularly frost prone. Temperatures are generally warmer at more northerly latitudes and frosts are rare. The second factor is the extreme variation in rainfall in the area such that the majority of the riverine environment is dry most of the time and possibly to a greater extent than those further north in the study area. The third factor is the relative isolation of the greater MacDonnell Ranges from less arid parts of the continent.

There is no record of the co-existence of crabs and yabbies in the study area, but this cannot be ruled out. Both are recorded from the Georgina River system in the NT, and it is possible that their ranges overlap, even if their habitat preferences are sufficiently different that they do not directly compete. The most likely area of overlap is in the Toko Ranges. Further study of their possible interaction may assist with assessing the impacts of introductions and translocations of crustaceans, particularly Yabby and Redclaw,

and the potential risks to natural ecosystems of aquaculture enterprises. Crab shells were found at a waterhole on Wycliffe Creek where Redclaw were collected indicating co-existence.

Yabbies (*Cherax destructor*) were apparently translocated to the Henbury / Palmer Valley area of the Finke River in the 1950s (M.Lines pers. comm.). It is possible that they have interbred with what may have been a long isolated population of *Cherax destructor* that was already present in parts of the Finke as recorded by the 1894 Horn Scientific Expedition.

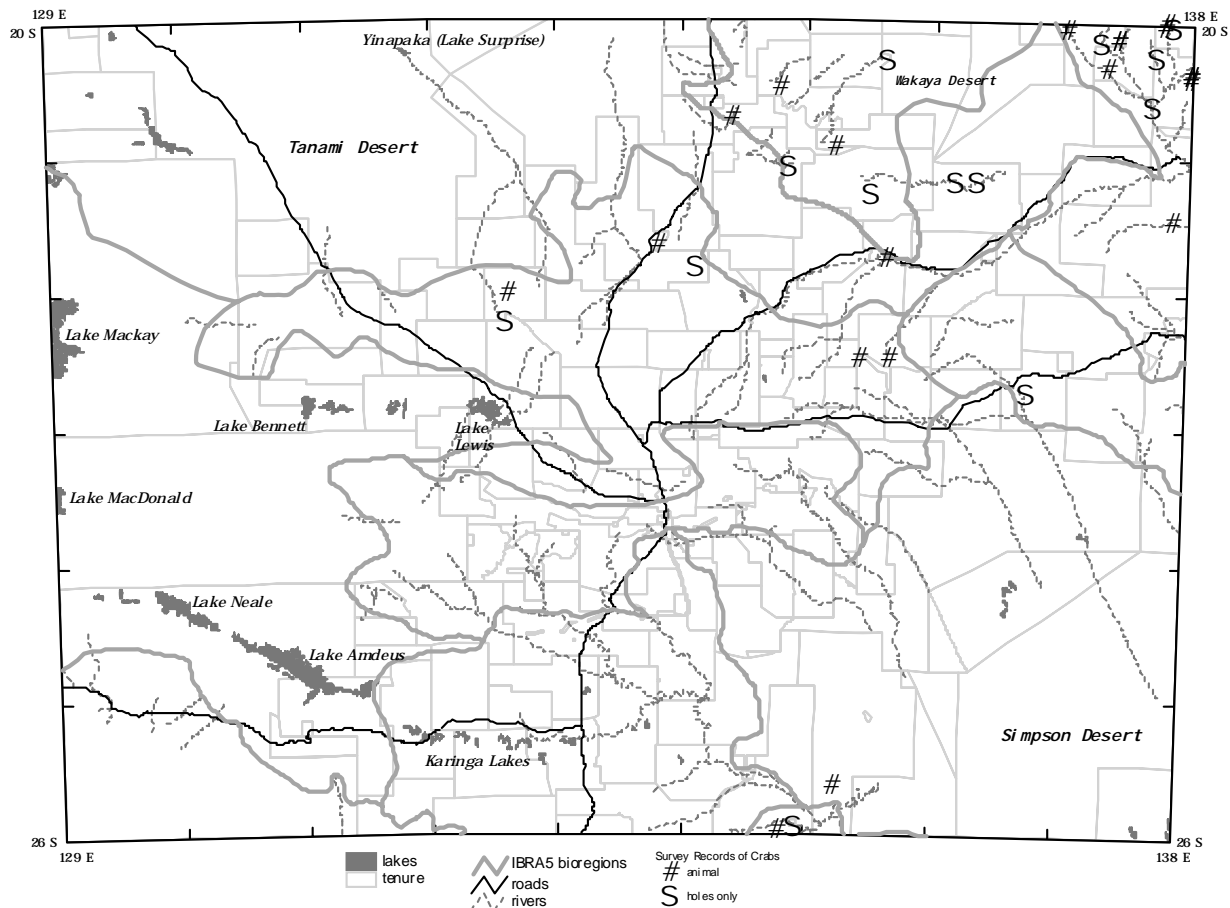


Figure 13. Survey records of inland crabs

### Distribution of Mollusca (Snails and Mussels)

Gastropods were recorded at various sites including a long-term and possibly permanent spring-fed stream in the Dulcie Ranges, several floodout swamps, a non-permanent waterhole in the MacDonnell Ranges and a semi-saline lake. One station owner reported that aquatic snails were absent until about 20 years ago which may indicate dispersal by birds.

Freshwater mussels were abundant in the waterholes of the Georgina River system in both the Mitchell Grass Downs and Channel Country bioregions. Although not identified to genus, two distinct morphotypes were seen. The most abundant were large dark blue-grey shells, typically 10 cm by 5 cm of the family *Hyriidae*. These are probably *Vesunio wilsonii*, based on distribution maps in Williams and Campbell (1987) and on a NT Museum record of *V. wilsonii* from the Lake Nash area. The other morphotype were much smaller, pale to mid brown and probably of the family *Corbiculidae*. Anecdotal evidence suggests that large mussels occur in a single creek on Elkedra Station on the south of the Davenport Ranges. No other records of large mussels have been found indicating that in the arid NT they are virtually restricted to the Georgina River system.

## **Observations of Other Taxa**

Leeches were observed at several sites with fish and have been reported from temporary rockholes in ranges. They seem to be able to colonise temporary waterbodies, possibly via hosts such as fish and frogs as well as by swimming.

Long thin worms, inconclusively identified as Horsehair Worms (Nematomorpha) were found in three disparate locations and habitats, all with shallow temporary water: temporary spring-fed pools in bedrock in the Dulcie Ranges, a minor rocky-alluvial creek in the Davenport Ranges and a small Lignum Swamp in the Finke Bioregion.

## **11.3 Aquatic Invertebrates and Waterbody Health**

The knowledge of the invertebrate fauna of aquatic environments in the arid NT is insufficient for them to be used as indicators of 'environmental health' as is proposed for less temporary rivers elsewhere in Australia (e.g. Davis 1997b). Even the better-sampled long-term waterbodies in the MacDonnell Ranges bioregion have mostly been sampled a single time. Also the extreme variations in water level and in some cases in salinity mean that invertebrate assemblages for most wetlands are expected to be very changeable even without human related disturbances.