

Critter Catalogue

A guide to the aquatic invertebrates
of South Australian inland waters.



Critter Catalogue

A guide to the aquatic invertebrates
of South Australian inland waters.



Authors

Sam Wade, Environment Protection Authority

Tracy Corbin, Australian Water Quality Centre

Linda-Marie McDowell, Environment Protection Authority

Original illustrations by John Bradbury

Scientific editing by Alice Wells – Australian Biological Resources Survey,
Environment Australia

Project Management by Simone Williams,
Environment Protection Authority

ISBN 1 876562 67 6

June 2004

For further information please contact:

Environment Protection Authority

GPO Box 2607

Adelaide SA 5001

Telephone: (08) 8204 2004

Facsimile: (08) 8204 9393

Freecall (country): 1800 623 445

© Environment Protection Authority

This document, including illustrations, may be reproduced in whole or part for the purpose of study or training, subject to the inclusion of an acknowledgment of the source and to its not being used for commercial purposes or sale. Reproduction for purposes other than those given above requires the prior written permission of the Environment Protection Authority.

Dedication

WD (Bill) Williams, AO, DSc, PhD

21 August 1936—26 January 2002

This guide is dedicated to the memory of Bill Williams, an internationally noted aquatic ecologist and Professor of Zoology at the University of Adelaide. Bill was active in the science and conservation of aquatic ecosystems both in Australia and internationally.

Bill wrote *Australian Freshwater Life*, the first comprehensive guide to the fauna of Australian inland waters. It was initially published in 1968 and continues to be used by students, scientists and naturalists to this day. Bill generously allowed illustrations from his book to be used in earlier versions of this guide.

Bill actively promoted the study of aquatic science to managers and politicians, with the aim of improving the way we manage our waters. Consistent with Bill's approach, we hope that this guide promotes a greater understanding of aquatic invertebrates and enthusiasm for the protection of our aquatic ecosystems amongst a wide audience.

Acknowledgments

This South Australian *Critter Catalogue* has evolved over a number of years. Earlier editions and drafts of the Critter Catalogue have been widely used by Waterwatch participants, and feedback from readers has contributed to this final version. The authors would also like to thank the following contributors.

Past and present Waterwatch staff:

- Ross Wissing for initially supporting this project and Deb Thomas for managing tenders and progressing the project. Many other past and present South Australian Waterwatch staff also provided feedback that has improved this guide.
- Simone Williams, EPA Community Education and Monitoring, for an outstanding job pulling it all together – this guide would not have been published without her managing most of the pre-publication tasks.

David Thorpe from Jamestown Community School and Mike Schultz from Glossop High School for their comments.

Jackie Griggs and Chris Madden for scientific review.

Various other Australian Water Quality Centre and the Environment Protection Authority staff who contributed.

Australian Water Quality Centre for the loan of invertebrate specimens and The Murray Darling Freshwater Research Centre.

CSIRO for the photographs that have been reproduced on the front cover of this document – © Edward Tsyrlin & John Gooderham – reproduced from *The Waterbug Book: A guide to the freshwater Macroinvertebrates of Temperate Australia* (2002), with permission of the publisher of the book – CSIRO Publishing.

Alice Wells, Australian Biological Resources Study, Environment Australia, for scientific editing.

John Bradbury for doing a great job with the illustrations.

Foreword

Our creeks, rivers, ponds and wetlands contain a vast diversity of living creatures. They are not just homes for fish, frogs and birds. These systems are dominated by aquatic invertebrates – animals without backbones. They are an important part of the aquatic food web and essential to the healthy function of aquatic ecosystems. Without them our waters would be almost lifeless.

These aquatic invertebrates are good ‘biological indicators’, and studying them can tell us about the health of our aquatic ecosystems. It also educates us about broader biological and ecological issues. Many of these creatures have evolved remarkable adaptations to solve some of the challenges of life in water, such as the jet propulsion used by dragonfly larvae to escape danger!

Understanding these critters and how they survive is interesting in its own right; however, it also encourages us to appreciate the value of aquatic systems from a perspective other than human use. Hopefully this will promote better custodianship of our aquatic resources and encourage behaviour that minimises pollution. This will lead to better quality waters for humans as well as the natural ecosystems that depend on them.

On behalf of the Environment Protection Authority (EPA) I am pleased to release this *Critter Catalogue*. It is a scientific resource for the community that provides an informative guide to the natural history of the aquatic invertebrates of South Australia. The *Critter Catalogue* is a valuable tool for Waterwatch participants, teachers, high school students and community groups, providing them with information on South Australian aquatic invertebrates to help them more effectively monitor, understand and protect their local aquatic environments.

Dr Paul Vogel

Chief Executive

Environment Protection Authority

Contents

1	Introduction	1
2	Phylum Porifera – sponges	9
3	Phylum Cnidaria – hydras and jellyfish	12
4	Phylum Platyhelminthes – flatworms, planarians and temnocephalids	16
4.1	Class Turbellaria – flatworms and planarians	16
4.2	Class Temnocephalidea – temnocephalids	20
5	Phylum Nematoda – round worms	22
6	Phylum Annelida – bristle worms, segmented worms and leeches	25
6.1	Class Oligochaeta – segmented worms	28
6.2	Class Hirudinea – leeches	30
7	Phylum Mollusca – molluscs	33
7.1	Class Gastropoda – water snails	35
7.2	Class Bivalvia – mussels, little basket shells and pea shells	38
8	Phylum Arthropoda – arthropods including water mites, water spiders, crustaceans, insects	41
9	Class Arachnida – water mites and water spiders	43
9.1	Orders Acariformes and Parasitiformes – water mites	45
9.2	Order Araneae – water spiders or fishing spiders	48
10	Class Crustacea – crustaceans	51
10.1	Order Anostraca – fairy shrimps or brine shrimps	53
10.2	Order Notostraca – shield or tadpole shrimps	56
10.3	Suborder Cladocera – water fleas	59
10.4	Subclass Ostracoda – seed shrimps	62
10.5	Subclass Copepoda – copepods	65
10.6	Order Amphipoda – scuds or side-swimmers	68
10.7	Order Isopoda – water slaters and sow bugs	71
10.8	Order Decapoda – crabs, crayfish, yabbies, freshwater prawns and freshwater shrimps	74
	Family Atyidae – freshwater shrimps	76
	Family Palaemonidae – freshwater prawns	78
	Family Hymenosomatidae – small spider crabs	81
	Family Parastacidae – freshwater crayfish and yabbies	84

Contents

11 Class Collembola – springtails	87
12 Class Insecta – insects	90
12.1 Order Ephemeroptera – mayflies	93
12.2 Order Plecoptera – stoneflies	97
12.3 Order Odonata – damselflies and dragonflies	100
12.4 Order Trichoptera – caddis flies	104
12.5 Order Hemiptera – true bugs	109
Family Pleidae – pygmy back swimmers	112
Family Veliidae – small water striders or riffle bugs	114
Family Naucoridae – creeping water bugs	116
Family Belostomatidae – giant water bugs	118
Family Gerridae – water striders	121
Family Notonectidae – back swimmers	124
Family Corixidae – water boatmen	126
Family Hydrometridae – water measurers	129
Family Nepidae – water scorpions or needle bugs	131
12.6 Order Coleoptera – beetles	135
Family Scirtidae – marsh beetles	138
Family Psephenidae – water pennies	140
Family Elmidae – riffle beetle or long-toed beetles	142
Family Hydrophilidae – water scavenger beetles	144
Family Gyrinidae – whirligig beetles	147
Family Dytiscidae – predacious diving beetles	150
12.7 Order Diptera – true flies	153
Family Syrphidae – hoverflies	156
Family Tabanidae – march or horse flies	158
Family Simuliidae – black flies	160
Family Culicidae – mosquitoes	164
Family Tipulidae – crane flies	167
Family Ceratopogonidae – biting midges	169
Family Stratiomyidae – soldier flies	17
Family Chironomidae – non-biting midges and bloodworms	173
13 Glossary	177
14 Bibliography	181

1 Introduction

The *Critter Catalogue* is an information guide to the aquatic invertebrates of South Australia's inland waters. This guide is aimed at Waterwatch staff and participants, teachers, secondary students and community groups.

The *Critter Catalogue* is written to accompany *The Colour Guide to Invertebrates of Australian Inland Waters* by Hawking and Smith (1997), *Australian Freshwater Life* by Williams (1980) and *The Waterbug Book* by John Gooderham and Edward Tsyrlin (2002). These books provide more detailed information on the invertebrates of Australian inland waters. *The Colour Guide to Invertebrates of Australian Inland Waters* and *The Waterbug Book* also have excellent photographs of invertebrates.

A locally relevant and user friendly guide to aquatic invertebrates

Many texts on aquatic invertebrates are aimed at scientific audiences. These often contain complicated technical language that is difficult for the everyday reader to understand. This guide provides a simpler summary of the diversity, habits and nature of aquatic invertebrates of this state.

Unfortunately, some technical language is still required – without it we could not effectively express the biological ideas contained in this guide. The glossary will help to explain these terms. If you are after further guidance or you wish to use some of the references listed at the rear of this guide, a copy of *Henderson's Dictionary of Biological Terms* (Lawrence 1995) will be very useful. It provides a comprehensive list of biological terms and includes a useful guide to the origins of some common biological words. This is a great help when trying to decipher some of the language that biologists use.

Information in this guide has been drawn from scientific textbooks, guides, identification keys, internet sources and research papers. To promote readability we have decided not to cite references in the traditional scientific manner; however, the bibliography provides a list of sources. Not all biological information, especially local observations, are published so expert advice from biologists has also been used. This local knowledge has enhanced the relevance of this guide to South Australia.

Why a guide for South Australia?

In general, South Australia's aquatic invertebrate fauna is less diverse than the eastern states: we have fewer families and often fewer species in each family. Many families found in the northern tropics, alpine regions, Tasmania, and the south-west of Western Australia are absent from South Australia.

Most of the organisms covered in this guide are present in other areas of the country, so this guide may be of use to readers from other states. However, some of the information within is specific to South Australia so interstate users should use this guide with care.

The numbers of species, families or other taxonomic groupings within each section should be considered indicative only. New species to South Australia are regularly discovered and, with most taxa having many undescribed and unknown species, numbers are likely to regularly increase within Australia and internationally. Estimates such as these are often out of date by the time they are published and some information for this guide has been taken from books that are a few years old, including CSIRO's *The insects of Australia* (1996) and Hawking and Smith's *The Colour Guide to Invertebrates of Australian Inland Waters* (1997).

Why study aquatic invertebrates?

Aquatic invertebrates are very different from the larger vertebrate animals that most people are familiar with. They are a diverse group with a vast range of different body shapes, behaviours, and life cycles. Aquatic invertebrates have adapted to a wide variety of conditions, such as developing ways of surviving during periods of drought, adapting to increased salinity, and surviving in highly polluted waters. Aquatic invertebrates are fascinating creatures in their own right but they also teach us about the quality and health of our waterways.

The number of different kinds of invertebrates (richness) and the total number of invertebrates (abundance) can be used to measure the health of aquatic ecosystems. As a general rule, the more types of invertebrates you find in an aquatic system (that is, the higher the richness) the healthier the aquatic system. Low richness may indicate that an aquatic system is under stress. Similarly, low abundance (that is, very few animals in total) often indicates that an aquatic system has been subject to an impact, while a high abundance may indicate a healthier system.

However, it is important to note that natural events can change the richness and abundance of aquatic invertebrates. If you sample a stream that has just started flowing after a dry period, you will probably find low abundance and richness as the invertebrates have not had time to colonise the stream. Likewise, a stream that has recently been scoured by a flood will probably have a low abundance and richness as the invertebrates have been swept away. Natural impacts such as these are a normal part of the functioning of aquatic systems. It is important that changes in invertebrate communities due to these events are not mistaken for human impacts such as pollution.

Water bodies around our state range from near-pristine conditions to seriously degraded. Each of these water bodies will contain a different community of aquatic invertebrates. Some types of aquatic invertebrates are very sensitive to pollution and other disturbances, while some are more tolerant and are able to survive in degraded streams. The sensitivity of the invertebrates present at a location tells us about the health of that water body.

Where available, each class, order or family of aquatic invertebrates presented in this Critter Catalogue has been given a sensitivity rating. This rating is based on Bruce Chessman's Australian 'SIGNAL2' system. Ratings range between 1 and 10. A low rating means the aquatic invertebrates are able to tolerate a range of types of water pollution. A high rating indicates that the aquatic invertebrates are sensitive to most forms of pollution and prefer to live in streams with unpolluted water. See page 19 of *The Waterbug Book* for a more extensive discussion of SIGNAL2.

Collecting and observing aquatic invertebrates

To accurately assess the health of a stream or river it is important to collect aquatic invertebrates using appropriate methods. Aim to maximise your chances of collecting as many different types of invertebrates as possible. Many invertebrates live on surfaces, such as the bottom of streams or on the side bank amongst water plants. Simply waving a net through the top of the water will not be very effective. Sweeping a net through plants and against undercut banks as well as vigorously kicking the stream bed will result in a much better sample. Some aquatic invertebrates also cling to the undersides of rocks, so it is often worthwhile overturning some rocks to see what you find.

Australian Freshwater Life (1980) and *The Waterbug Book* (2002) have further information that you might find useful on collecting aquatic invertebrates.

Why not just study water chemistry, or fish, frogs and birds?

Aquatic invertebrates are generally abundant across the entire range of aquatic habitats and are easy to collect. In comparison, fish, frogs and waterbirds are often less abundant, are not distributed throughout all aquatic environments, and are more difficult to collect. They are often protected by legislation and you may require permits to collect them. While you may record the presence of these larger animals in the aquatic environment you should generally avoid collecting them.

Monitoring water chemistry provides information on water quality at the time of sampling, but sampling aquatic invertebrates can provide information on water quality and other factors at a site over the few weeks or even months before sampling. Aquatic invertebrates are a good indicator of the stresses on aquatic systems, reflecting the physical, chemical and biological interactions that take place in catchments and river systems.

For many monitoring programs an integrated approach is best. Measuring water chemistry in conjunction with biological assessment using invertebrates will give a more complete picture of the health of an aquatic system than either on its own. Water chemistry information may be helpful in explaining the presence or absence of different invertebrates.

How can I identify invertebrates?

The *Critter Catalogue* is not intended to be an identification tool. If you try to identify aquatic invertebrates by comparing them to the drawings in this guide you are highly likely to make identification errors. This is because general similarity does not guarantee a correct identification – often the characteristics used to identify an invertebrate are small and not visible to the naked eye. Magnification makes identification much easier.

If you aim to accurately identify an unknown aquatic invertebrate, an identification guide should be consulted. Guides vary in complexity – *Freshwater Invertebrates* by Ralph Miller, published by the Gould League, is a useful simple key to most groups of aquatic invertebrates.

Introduction

An excellent and easy-to-use key to most of the invertebrate groups presented in this guide starts on page 20 of *The Waterbug Book*. Through *The Waterbug Book* there are also keys to families of many groups – these are listed in the identification section for each taxa.

Identification help is also available on line. Web-based keys and general information on invertebrate groups can be found at www.lucidcentral.com/keys/lwrrdc/public/Aquatics/

This excellent resource has been developed by CSIRO Entomology and Environment Australia's Australian Biological Resources Study.

The more experienced reader might like to consult the bibliography and, in particular, the excellent range of keys from the Murray-Darling Freshwater Research Centre. *Australian Freshwater Life* is also handy for identification, although, as it was published in 1980, some keys are out of date. However, note that for some groups identifying the family can be difficult, even for specialists.

When identifying invertebrates you can use the information in this guide in conjunction with the keys above. For example, if you identify an invertebrate that is not listed in the *Critter Catalogue* as occurring in South Australia, check your ID carefully – you have probably mis-identified your specimen.

One final comment on identification – adults and final instar larvae are usually easier to identify than juveniles. Not only are they larger but they will have developed the characteristics that scientists use to tell them apart. Also, aquatic invertebrates are easily damaged when they are being collected. The bits that get knocked off, like gills, legs, heads and antennae, are often important diagnostic features. Handle your bugs carefully and try not to damage them.

Scientific names, biological classification and taxonomy

A great abundance and variety of life exists on earth. Organising and describing all these living things is a long and difficult process. Scientists have described over one million species of plants and metazoan (multicellular) animals; however, many organisms are yet to be discovered.

Biologists have developed systems and concepts to help us understand and organise our knowledge of living organisms. Most biologists believe that life has developed through a process of evolution by natural selection, first described in 1859 by Charles Darwin in his book *The Origin of Species*. The idea that all organisms on earth have evolved from a common ancestor over time means that they are related. Scientists organise living things into groups based on how closely they are related to each other.

Unfortunately, scientists often give organisms complicated scientific names that are hard to remember and often even harder to spell. However, this means that each species has its own unique name which cannot be confused with any other species. Common names are often simpler and easier to remember than scientific names, but their use creates some major problems. For example, different species can be given the same common name: the freshwater crayfish *Cherax albidus* and *Cherax destructor* are both commonly called ‘yabbies’. In some cases, one species can be known by different common names in different places, such as the fish *Macquaria ambigua*, which is known by at least three common names: ‘yellowbelly’, ‘callop’ and ‘Murray perch’.

There is a standard hierarchical method of classifying and naming animals. All animals belong to the Kingdom Animalia. Within this kingdom there are at least 35 Phyla. The animals which are most familiar to us – mammals, birds, reptiles, amphibians and fish – belong to the Chordata, a phylum not covered in this guide.

Within each Phylum there are classes, within classes there are orders and so on, down to species. The classification of the yabbie is presented below:

Classification level	Scientific name	Common name
KINGDOM:	Animalia	animals
PHYLUM:	Arthropoda	
CLASS:	Crustacea	crustaceans
ORDER:	Decapoda	
FAMILY:	Parastacidae	crayfish
GENUS:	<i>Cherax</i>	
SPECIES:	<i>destructor</i>	yabbie

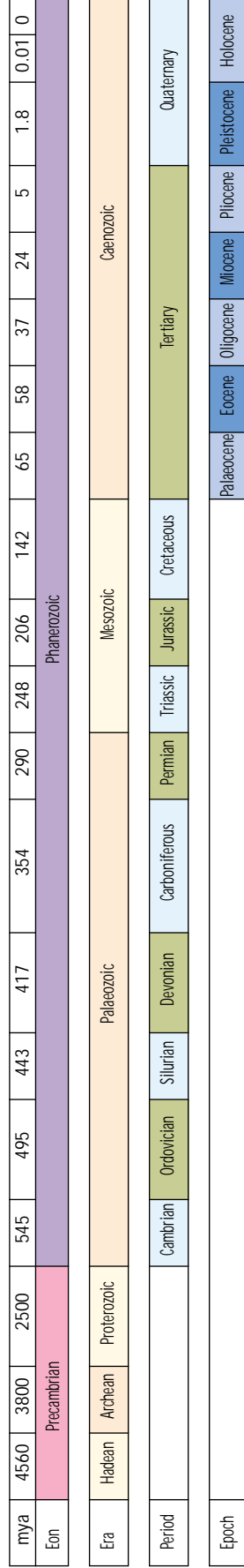
Unfortunately, not all scientists agree on the same taxonomic structure. For example, in this guide phylum Arthropoda contains the classes Collembola (springtails), Insecta (insects), Crustacea (crustaceans) and Arachnida (spiders and mites). Some authors believe that Arthropoda should be a super-phylum and Collembola, Insecta, Crustacea and Arachnida should each be a phylum.

Discussion of the scientific debate over classification is beyond the scope of this guide, but readers should be aware that different authors might use different classifications. There is an excellent discussion of the idiosyncrasies of scientific classification on page 17 of *The Waterbug Book*. In the Critter Catalogue, taxonomic structure, scientific names and common names follow those in Hawking and Smith (1997). This book is a useful reference for users of the Critter Catalogue, and consistency will make things easier for people using these books together.

Geological time scale

In the Critter Catalogue, the age of a species, family, order or phylum is referred to in terms of the geological time scale. Figure 1 displays graphically the different geological ages in terms of millions of years from the present. For example, the current Holocene period is the most recent stage in the geological time scale and started 0.01 million years ago (mya) or 10,000 years before the present.

Figure 1: A summary of the geological time scale



Reference: Sibly, J. 2001. Dragonflies of the world. CSIRO Publishing, Australia

Key to layout of the Critter Catalogue

The invertebrates in the *Critter Catalogue* are organised within taxonomic groups, and information is provided within each group under the headings below. As some groups are more diverse than others, better known or perhaps even more interesting, the amount of information within each section does vary between groups.

Background

The number of species, geographical range and diversity of the group worldwide, in Australia and in South Australia; the proportion of members of the group that are aquatic and the life stages that are aquatic. Comments are provided on group relationships, age of species, and fossil record.

Size

Length in millimetres.

Features

Physical features.

Diet and feeding

What and how they eat.

Locomotion

How they move.

Gas exchange (breathing)

How they obtain oxygen.

Lifecycle and reproduction

Life stages, how long each stage lasts, how the mature animals mate, and how they lay eggs or otherwise produce young.

Habitat

Macro- and microhabitat.

Critter facts

Interesting and exciting facts about the group.

Identification

Easily identifiable features, how hard it is to identify, and what taxa you could mistake it for.

Classification and sensitivity

Classification of the aquatic taxon within the group and their sensitivity rating (from 1-10, NR for not rated; presented in brackets) based on Australian SIGNAL2 scores.

References

Where the species is referred to in Hawking and Smith (1997), Williams (1980) and Gooderham and Tsyrlin (2002).