Australian Marine Zooplankton: Taxonomic sheets

Version 1: July 2013

CSIRO UTAS IMOS Integrated Marine Observing System

Australian Marine Zooplankton: Taxonomic sheets

Contents

Citation

If you use these taxonomic sheets, please cite:

Richardson AJ, Davies C, Slotwinski A, Coman F, Tonks M, Rochester W, Murphy N, Beard J, McKinnon D, Conway D, Swadling K (2013) Australian Marine Zooplankton: Taxonomic Sheets. 294 pp.

Introduction

Rationale

This guide has developed over the years, predominantly at the CSIRO Marine and Atmospheric Research laboratory in Brisbane. We have focused on species descriptions that are possible for a plankton monitoring survey that requires relatively rapid identification to as higher taxonomic resolution as possible. We are para-taxonomists rather than true taxonomists describing species, although we work closely with taxonomists whenever possible. Descriptions include features that are identifiable using a good dissecting microscope but not a compound microscope. For example, we dissect 5th legs off copepods but not their mouthparts. This necessarily means that species descriptions are most relevant for the Australian region, and should be applied in other regions with caution.

Not all zooplankton groups are represented. We have focused on the holoplankton, as the meroplankton can not routinely be identified to species. Of the holoplankton, we have focused on the most abundant and well-described species, particularly copepods that have the additional attributes of being robust with diagnostic features.

This guide is a work in progress and we welcome feedback. The sheets here do not represent all the species in Australian waters or even all the species we have identified. We will continue to update existing sheets and expand the number of species covered. Please email us at IMOS-Plankton@csiro.au with feedback and any suggested changes or additions.

Anatomy of sheets

For comparability, we have ensured as far as possible that taxonomic sheets are consistent, particularly within taxonomic groups (e.g. the calanoid copepods), but also among taxonomic groups (e.g. copepods vs siphonophores). Each species is described on two pages, although for species with little information the back page is blank. For species with separate sexes (e.g. copepods, cladocerans), we have placed the female identification on the front page and male identification on the back page. For salps, we have placed information on the aggregate form on the front and on the solitary form on the back. This guide is thus designed to be printed double-sided so each species is on a single page.

The validity of the species is according to WoRMS (World Register of Marine Species, http://www.marinespecies.org/; Appeltans et al., 2012) and Boxshall & Halsey (2004) for copepods, with guidance from experts. Under the species name header, we have listed the authority, a species taxonomic affiliation, and synonyms as given in WoRMS. Note that synonyms in WoRMS are only given where a species is correctly named and not when people have incorrectly spelt or used a species name (compare Razouls website for copepods).

Anatomic nomenclature for copepods is as per Huys & Boxshall (1991) and depicted in Boltovskoy (1999) (Figure 1, 2). For other groups, the relevant references and expert opinion are given. We have included information on Size, Genus Notes, Species Notes, and Ecology, with references at the end of the sheet. The source of all figures is given under the figures. All images are from CSIRO and University of Tasmania (Anita Slotwinski and Claire Davies).

At the bottom of each sheet are the two people who had the largest contribution to each sheet (under Compiled by:), although all authors have contributed to the sheets. Where sheets have been verified by taxonomic experts, their names are also recorded.

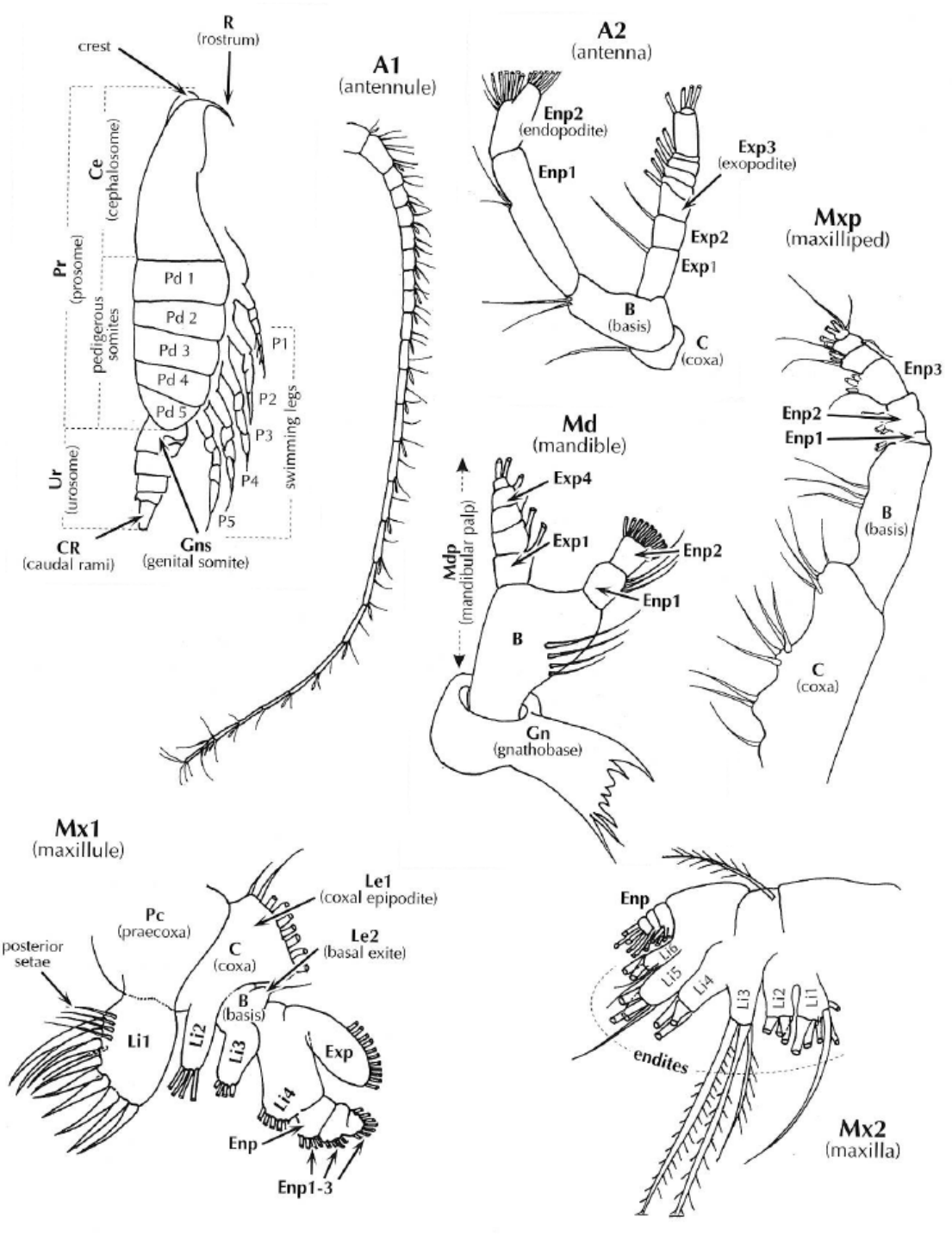

Fig. 1. Copepod body parts used in the sheets (from Boltovskoy 1999).

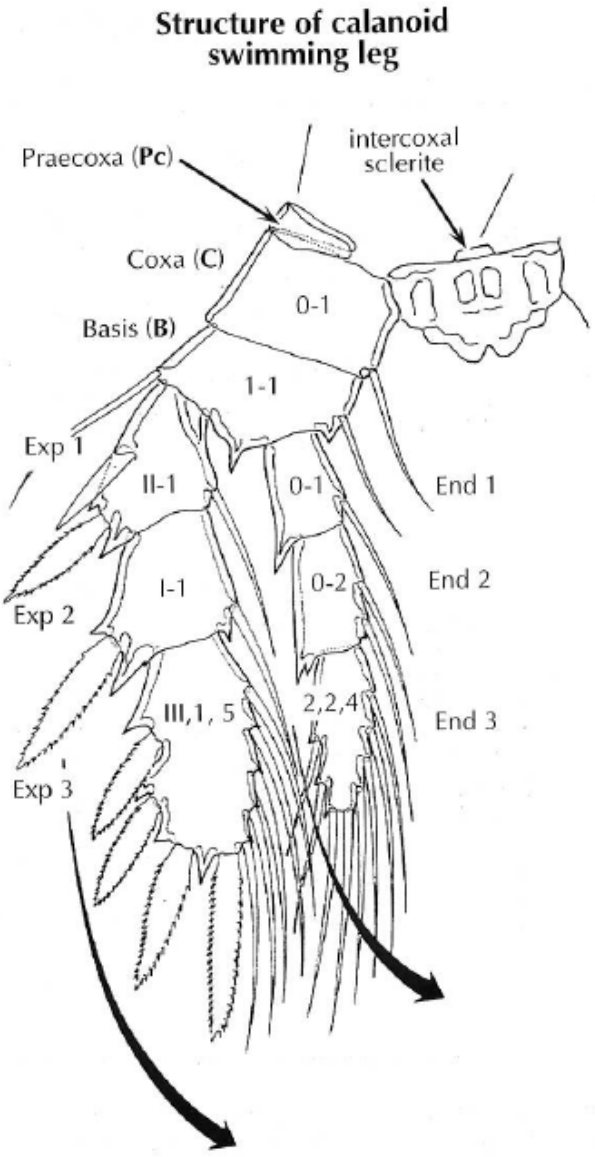

Fig. 2. Calanoid copepod swimming leg (from Boltovskoy 1999).

Distribution maps

Distribution maps were based on 89,327 positive occurrence records for zooplankton species. Much of the data for zooplankton distribution maps are from two Integrated Marine Observing System (IMOS) projects: the Australian Continuous Plankton Recorder survey and the zooplankton component of the Australian National Reference Station program. The Integrated Marine Observing System is an integrated, regional observing system covering physical, chemical and biological variables. These data were supplemented from the Australian Zooplankton Database containing historical published and unpublished data collected (Appendix 1). This database was collated by CSIRO. For more information about this database or if you would like to contribute species-level zooplankton data in the Australia region, contact anthony.richardson@csiro.au. In the Australian Zooplankton Database, we have updated taxonomic names based on WoRMS and corrected or removed locations that were incorrect (e.g. on land).

Acknowledgements

We would like to thank Tim Lynch (CSIRO) for his enthusiasm for the Taxonomic Guide and Atlas, and for providing some funding. We would also like to thank several taxonomic experts who have worked with us on the sheets to verify them. Thank you also for your time over the years to help train us: Dave Conway (Marine Biological Association of the UK) and Dave McKinnon (Australian Institute of Marine Science) for calanoid copepods, Ruth Boettger-Schnack (Germany) for the cyclopoid copepods *Oncaea*, Lisa Gershwin (CSIRO) for jellyfish, and Mark Gibbons (University of the Western Cape, South Africa) for jellyfish, appendicularians, chaetognaths, tunicates. Finally, we would like to take this opportunity to acknowledge the generosity of researchers who have provided raw data to the Australian Zooplankton Database: Peter Rothlisberg (CSIRO), Dave McKinnon (AIMS), Daniel Gaughan (WA Fisheries), Anita Slotwinski (CSIRO), Joanna Strzelecki (CSIRO), Felipe Gusmao (CSIRO), and Jason Everett. We would also like to thank Amelia Armstrong (UQ) for help with the digital images. Finally, We would like to highlight that the website Diversity and Geographic Distribution of Marine Planktonic Copepods (Razouls et al., 2005-2012) has been indispensible for developing the taxonomic sheets for copepod species and is a valuable resource for copepod identification (http://copepodes.obs-banyuls.fr/en/index.php).

References

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Boxshall, G., Halsey, S. H., 2004. An introduction to copepod diversity, The Ray Society 1-940

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Appendix 1. Summary of the datasets used in drawing species maps.

Dataset name	Institution	Region	Custodian	Taxa	Number of occurrences
AusCPR	CSIRO/ AAD	Australia	Anthony Richardson anthony.richardson@csiro.au	Zooplankton	21,588
NRS	CSIRO	Australia	Anthony Richardson anthony.richardson@csiro.au	Zooplankton	14,277
Albatross Bay	CSIRO	Gulf of Carpentaria	Peter Rothlisberg Peter Rothlisberg@csiro.au	Copepods	11,859
Bathurst Island	AIMS	North coast of Australia (minus GoC)	David Mckinnon D.Mckinnon@aims.gov.au	Copepods	146
Brisbane River	Published literature	East coast of Australia (minus GBR)	Bayly, I. A. E.	Copepods	1
Carleton Lagoon	Published literature	GBR	Carleton, J. H., Hamner, W. M.	Copepods	1
Cazasuss dataset	IMAS	Tasmania	Kerrie Swadling K.swadling@utas.edu.au	Copepods	75
Darwin Harbour	AIMS	North coast of Australia (minus GoC)	David Mckinnon D.Mckinnon@aims.gov.au	Copepods	1,341
GBR	AIMS	GBR	David Mckinnon D.Mckinnon@aims.gov.au	Copepods	772
Gaughan estuary	WA Fisheries	West coast of Australia	Daniel Gaughan Daniel.Gaughan@fish.wa.gov.au	Cnidaria, Chaetognaths	3
Hillarys	WA Fisheries	West coast of Australia	Daniel Gaughan Daniel.Gaughan@fish.wa.gov.au	Cnidaria, Chaetognaths	431
Kimberley (100 micron)	AIMS	West coast of Australia	David Mckinnon D.Mckinnon@aims.gov.au	Copepods	173
Kimberley (150 micron)	AIMS	West coast of Australia	David Mckinnon D.Mckinnon@aims.gov.au	Copepods	1,257
Lihir	CSIRO	PNG	Anthony Richardson anthony.richardson@csiro.au	Copepods	1,054
North West Cape	AIMS	West coast of Australia	David Mckinnon D.Mckinnon@aims.gov.au	Copepods	1,529
Nyan Taw PhD	IMAS	Tasmania	Kerrie Swadling K.swadling@utas.edu.au	Zooplankton	4,984
Othman	CSIRO	Gulf of Carpentaria	Anthony Richardson anthony.richardson@csiro.au	Copepods	7,765
Peter Wallace Liston	AIMS	GBR	David Mckinnon D.Mckinnon@aims.gov.au	Copepods	9,318
Ramu	CSIRO	PNG	Anthony Richardson anthony.richardson@csiro.au	Copepods	658
Robertson	AIMS	GBR	Robertson, A. I., Dixon, P., Daniel P. A.	zooplankton	14
Scott Reef (100 micron)	AIMS	North coast of Australia (minus GoC)	David Mckinnon D.Mckinnon@aims.gov.au	Copepods	5,453
Scott Reef (500 micron)	AIMS	North coast of Australia (minus GoC)	David Mckinnon D.Mckinnon@aims.gov.au	Copepods	62
Slotwinski	TAFI	Tasmania	Anita Slotwinski	Copepods	1,793
South Coast	WA Fisheries	West coast of Australia	Daniel Gaughan Daniel.Gaughan@fish.wa.gov.au	Cnidaria, Chaetognaths	693
Terauds	IMAS	Southern Ocean	Kerrie Swadling K.swadling@utas.edu.au	Copepods	52
WA Eddies	CSIRO	West coast of Australia	Joanna Strzelecki Joanna.Strzelecki@csiro.au	Zooplankton	549
Wessels	AIMS	North coast of Australia (minus GoC)	David Mckinnon D.Mckinnon@aims.gov.au	Copepods	461
Whitsundays	AIMS	GBR	Felipe Gusmao felipeoceano@gmail.com	Zooplankton	636
Acartia pseudodiaptomus	UQ	East coast of Australia (minus GBR)	Greenwood, J.	Copepod	3
Bass strait Western Vic	AIMS	East coast of Australia (minus GBR)	David Mckinnon D.Mckinnon@aims.gov.au	Copepod	34
Brisbane River	Published	East coast of Australia	Bayly, I. A. E.	Copepod	39

	literature	(minus GBR)			
Calanoids Moreton Bay	UQ	East coast of Australia (minus GBR)	Greenwood, J.	Copepod	51
Copepods GBR	Published literature	West coast of Australia	Farran, G. P.	Copepod	27
Cronulla	Published literature	East coast of Australia (minus GBR)	Sheard, K.	Zooplankton	14
Derwent Hunter 56	CSIRO	East coast of Australia (minus GBR)	William Dall	Copepod	92
East Australian slope	Published literature	East coast of Australia (minus GBR)	Sheard, K.	Zooplankton	305
Emergent zooplankton Moreton Bay	UQ	East coast of Australia (minus GBR)	Greenwood, J.	Zooplankton	7
Wilson inlet	WA Fisheries	West coast of Australia	Daniel Gaughan Daniel.Gaughan@fish.wa.gov.au	Cnidaria, Chaetognaths	7
Heron Island	UQ	West coast of Australia	Greenwood, J.	Zooplankton	38
Mangrove	AIMS	North coast of Australia (minus GoC)	David Mckinnon D.Mckinnon@aims.gov.au	Copepod	13
Myall Lakes	Published literature	East coast of Australia (minus GBR)	Muschal, M.	Zooplankton	2
Oithona	Published literature	Australia	Nishida, S.	Copepod	1
Paracalanid egg	AIMS	North coast of Australia (minus GoC)	David Mckinnon D.Mckinnon@aims.gov.au	Copepod	6
Raby bay	UQ	East coast of Australia (minus GBR)	King, C.R., Williamsom, I.	Zooplankton	19
SFRME	CSIRO	West coast of Australia	Joanna Strzelecki Joanna.strzelecki@csiro.au	Zooplankton	1,618
Terauds	IMAS	Southern Ocean	Kerrie Swadling K.swadling@utas.edu.au	Copepod	12
Thalaceans NSW	UNSW	East coast of Australia (minus GBR)	Jason Everett jason.everett@unsw.edu.au	Thalaceans	1
Zoop moreton bay	UQ	East coast of Australia (minus GBR)	Greenwood, J.	Zooplankton	18
Biotechnology Collection	OBIS	Australia	AIMS	Zooplankton	1
Tunicates	OBIS	Australia	US Museum of Natural History	Zooplankton	3
Invertebrates	OBIS	Australia	Marine Invertebrates provider OZCAM	Zooplankton	3
Ocean Genome Resource	OBIS	Australia	Oceam Genome Legacy	Zooplankton	3
World Ocean Database 2001	OBIS	Australia	US National Ocean Data Center	Zooplankton	65
TOTAL					**89, 327**