Technical Memorandum 18

The taxonomy and seasonal population dynamics of some Magela Creek flood plain microcrustaceans (Cladocera and Copepoda)

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CONTENTS

ABSTRACT

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Six Magela Creek floodplain billabongs were sampled between September 1981 and January 1983 to determine the seasonal population dynamics of littoral and limnetic microcrustaceans. Thirty-seven cladoceran and four copepod species were identified amongst littoral weedbeds and several unidentified harpacticoid copepods and ostracods were also found. By comparison only 6 cladoceran and 4 copepod species were found in limnetic areas.

Littoral species generally attained their highest densities during the mid-Wet to Early-dry seasons. The number of open water species present in samples generally increased with the progression of the Dry season. Towards the end of the Dry season, a simplification of the limnetic species assemblage occurred in some billabongs, perhaps in response to adverse changes in water quality.

A guide to the cladoceran and copepod species found so far in the area is provided.

1 INTRODUCTION

The Magela Creek system lies within the area known as the Alligator Rivers Region in the Northern Territory. It is a seasonally flooded tributary of the East Alligator River, approximately 250 km east of Darwin (Fig.1).

Microcrustacean zooplankton are an important component of the aquatic ecosystem in Magela Creek, as they feed upon detritus, bacteria and phytoplankton, and in turn form a sizeable portion of the diet of numerous fish species (Bishop et al. 1980; Morley 1981). As they have few intrinsic regulatory mechanisms with which to counter environmental changes they are likely to be affected by habitat disturbance.

The only previous studies in the area are those of Morley (1981) and Tait (1982), these were qualitative studies of planktonic forms of microcrustaceans and rotifera. Little information dealing with the littoral or epiphytic microcrustacean fauna is presented in these studies.

This study provides information on the seasonal population dynamics of both planktonic and epiphytic microcrustacean fauna (specifically Cladocera and Copepoda) encountered in Magela floodplain billabongs and nearby inundated floodplain areas. A guide to these species is included to facilitate further studies (Appendix A).

2 STUDY AREA

Three broad topographic areas exist in the Magela Creek catchment: sandstone plateaux, lowlands and flood plains (Fig. 1).

The onset of the monsoonal Wet season in November/December causes the inundation of the Magela Creek flood plain. After one to two months the monsoons cease and are followed by a lengthy Dry season, during which water on the flood plain is reduced to a series of discrete billabongs. Six of these billabongs, Jabiluka, Leichhardt, Mine Valley, Ja Ja, Island and Winmurra (Fig. 1), were used as the focal points for this study. Island and Leichhardt are main-channel billabongs and are relatively deep and narrow. Ja Ja, Jabiluka and Mine Valley billabongs are more broad and shallow, Mine Valley being particularly shallow. Winmurra is a small shallow backflow billabong, distanced somewhat from the flood plain, and fed by Sevenjay Creek, a tributary of Magela Creek. It was included in the study because of its proximity to the proposed Jabiluka Project milling operations.

The monsoonal regime causes marked fluctuations in physical (turbidity, temperature, depth, flow rate) and chemical parameters (pH, conductivity, and concentrations of metals and dissolved oxygen)in the billabongs (Hart & McGregor 1982; Morley 1981).

Turbidity and conductivity are low during the Wet season but increase during the Dry season, especially in the shallower billabongs such as Mine Valley and Winmurra. The pH was usually between 4 and 6 throughout the study period (Pancontinental Mining Ltd, unpub. data), with the lower pH values generally recorded towards the end of the Dry season.

During the Wet season, prolific macrophyte growth occurs on the flood plain and in the shallow sections of billabongs. Common species include *Najas tenuifolia* R.Br. and *Utricularia* sp. (fully submerged macrophytes), *Eleocharis* sp. (reeds) and *Nymphaea* spp. (water lilies). Winmurra and Mine Valley billabongs become choked by these macrophytes during the Wet - Early-dry season. The majority of the macrophytes die down as water levels fall during the Dry season.

3 METHODS

3.1 Sampling program

Initially, sampling was carried out at approximately monthly intervals concurrently with the Pancontinental Mining Ltd Water Quality Sampling Program (Morley 1981; Pancontinental Mining Ltd, unpub. data). Pancontinental Environmental Studies should be consulted, as they become available, for water quality results. With the onset of the 1981/82 Wet season the Pancontinental Mining Ltd Environmental Program was rationalised and it was not possible to maintain this systematic approach to all of the billabongs. Appendix B details sampling dates and species counts.

Ideally a more intensive sampling program than the one carried out here would be desirable, particularly amongst the beds of macrophytes. Cladocerans and copepods in tropical waters are likely to have short life spans (Hutchinson 1967) and perhaps weekly or fortnightly sampling would more accurately describe the population dynamics of microcrustaceans amongst these weedbeds. Hence results of this study should be considered to be broad outlines only of the population dynamics.

3.2 Sampling methods

Background

As zooplankton populations generally are neither evenly nor randomly distributed (Hutchinson 1967), difficulties may arise in obtaining representative samples from a body of water: clumping may occur in the horizontal plane, while the well documented phenomenon of vertical migration may cause zooplankton to accumulate at particular depths.

Some copepods may enter diapause and 'drop out' of the water column during adverse environmental conditions (Elgmork 1980), thereby escaping detection if benthic sediments are not sampled (though this, along with cladoceran production of ephippial eggs may be a good indication of adverse conditions).

To achieve even a modest level of statistical precision may require a considerable number of samples to be collected from any one waterbody on a given date (Cassie 1971; Heyman et al. 1982; Shiel et al. 1982).

Little, if any, information is available regarding spatial distribution of microcrustaceans amongst aquatic macrophytes and Cassie (1971) and Heyman et al. (1982) should be consulted when devising a sampling program.

Field materials and methods

A variety of sampling methods, reflecting the seasonal variation in aquatic habitats which occur in the floodplain billabongs, was used in this study. Tow nets, tube samplers, Birge cones and a light trap were utilised at various times.

Sampling was usually carried out from a small boat, a canoe or occasionally, an airboat. Winmurra and Mine Valley billabongs became very shallow (< 0.8 m) towards the end of the Dry season and sampling was carried out, at that time, by wading through these billabongs.

Open water sampling consisted of multiple vertical hauls, using a simple plankton net. The 'mouth' sizes of the nets used were 50 cm by 25 cm, 30 cm diameter and 25 cm diameter and all nets were of 53 μm mesh. The smaller nets were used in shallow water. Diagonal hauls were used initially in the study but were replaced by vertical hauls to reduce possible errors in sampling due to the vertical stratification of zooplankton in the waterbody. An 'American Oceanographic' flowmeter was fitted into the mouth of the plankton nets midway through the study in order to increase the accuracy of sample volume estimation. The flowmeter consists of a rotor coupled directly to a digital counter which records each revolution of the rotor. The number of revolutions is then used to calculate the distance of the haul, using the formula and calibration curve provided by the manufacturer.

After each haul, the walls of the filtering cone were rinsed with water to flush any clinging animals into the collecting bucket at the base of the net. The animals collected were removed from the bucket via a stopcock and placed in a 60 mL plastic screw-top jar, making sure that all the animals in the bucket were rinsed out into the jar. Multiple hauls were combined into a single mixed sample. Samples were preserved in 4% formaldehyde buffered with 1% (final concentration) borax.

Aquatic macrophytes were quantitatively sampled for microcrustaceans using a 5 cm internal diameter perspex tube (see Pennak 1962). The 2 m long tube was hand driven vertically through macrophyte beds into the sediment. The depth to which the tube was immersed was recorded (for sample volume calculations), and an upper seal was then fitted to the tube. The tube was withdrawn from the water (placing a hand on the bottom of the tube to prevent any sample loss), and the sample was allowed to drain through a plankton net (53 μm mesh). This procedure was carried out at least ten times in any particular macrophyte bed to provide a single mixed sample. Removal, storage and preservation were as detailed above. Apart from its simplicity, this method also had the advantage of not unduly disrupting the more delicate species of macrophytes. This is important when frequent repetitive sampling (e.g. weekly) is carried out in a relatively small area such as Winmurra Billabong over an extended period, such as through the life cycle (initial growth to decay) of an aquatic macrophyte. If too much damage is done to the macrophyte bed while sampling, changes to the microcrustacean fauna over time may not reflect 'natural' changes.

A Birge cone (30 cm mouth diameter, 53 μm wall mesh) was used for qualitative sampling of microcrustaceans amongst aquatic macrophytes. There were some problems in using the Birge cone among finely structured macrophytes such as *Najas tenuifolia* and *Utricularia* spp. These macrophytes tended to cling to the Birge cone surface forming a dense mat around the cone. This impeded flow of water (and microcrustaceans) into the net. It also considerably slowed the speed of retrieval of the Birge cone possibly allowing some animals, such as copepods, to avoid the advancing net. On those occasions when Birge cone and tube samples were collected simultaneously from a site, the Birge cone consistently returned considerably lower microcrustacean density results. Thus, any population density figure obtained from a Birge cone sample, already very approximate, is probably an underestimate.

A tube light trap was also used for sampling among aquatic macrophytes. The unit consisted of a downwardly directed light source (a water proof torch) attached to the top of a cylindrical collection chamber of approximately 2 L capacity. The entrance to the collection chamber consisted of an inward pointing transparent funnel, allowing the light beam to penetrate downwards into the water. Flotation was provided by a polystyrene foam collar around the torch stem. The unit was placed in a selected weedbed area after sunset and left for three hours, after which it was removed from the water and sufficient formalin was injected into the collection chamber to kill the entrapped animals. The animals were allowed to settle to the bottom of the chamber and siphoned out into a 60 mL plastic jar. The animals were allowed to settle to the bottom of the jar, the supernatant was siphoned off and the jar was then filled with 4% formaldehyde (borax buffered) solution. The advantage of a light trap is that, unlike samples taken by a Birge cone or tube sampler, the sample is free from plant fragments and detritus. This markedly simplifies the counting and identification of species. Possible disadvantages are that if species are not attracted by light they will not be captured, and that if different species have different mobilities, the more mobile species may reach the light trap more easily, resulting in selective sampling. Further research on the use of light traps is recommended. Results from light trap samplings are listed in Appendix B, to allow comparisons with other sampling methods.

3.3 Laboratory methods

Samples in storage jars were lightly stained with lignin pink to facilitate sorting of specimens. Specimens were removed from jars using a wide-mouth pasteur pipette, placed in a channeled dish and then counted with the aid of a stereoscopic microscope. At least 300 microcrustaceans were usually counted per sample. If it was obvious that considerably more than 300 specimens had been collected in a sample (which was usually the case), subsampling was carried out. The subsampler consisted of a perspex cylinder (250 mL capacity) divided longitudinally into four equal internal divisions, with a space above the compartments to allow mixing of the sample. The whole sample was funnelled into the subsampler and gently agitated in the open space to obtain a homogeneous mixture of microcrustaceans. The cylinder was then turned so that four subsamples of equal volume were obtained. Rubber stoppers allowed individual draining of each section. If necessary, this procedure was repeated: i.e. the one quarter subsample was diluted to a suitable volume using 4% formaldehyde, and then funnelled into the cleaned subsampler and further divided until an appropriate dilution was obtained. Counting was then carried out as above. The remaining sample was quickly scanned for any species not present in the counted subsample.

Where the identity of a species required confirmation, it was removed from the counting dish using a fine looped needle and placed (after dissection in the case of copepods), on a microscope slide using lactophenol mountant. Illustrations were made using a Leitz phase-contrast microscope (Model M6) fitted with a drawing attachment.

4 FACTORS AFFECTING MICROCRUSTACEAN POPULATIONS

Some discussion of the factors affecting the distribution and number of cladocera and copepods is desirable to assist in the explanation of the findings. These factors include instrinsic aspects such as reproductive methods, feeding mechanisms and body size, as well as extrinsic factors such as the availability of suitable habitat, food supply, fish predation and water quality.

4.1 Reproduction

The life history of cladocerans, and to a certain extent copepods, is shaped by their existence in shallow freshwaters which may dry up (Hutchinson 1967). Cladocerans cope with the seasonal drying of their environment by producing resting eggs (following sexual fertilisation) which are surrounded by a thickened brood chamber called an ephippium. These resting eggs are able to resist desiccation and lie dormant until favourable conditions return. When their habitat is next inundated the resting eggs hatch, producing females which then reproduce parthenogenetically (i.e. without fertilisation of the eggs). As almost the entire population is composed of females that have the ability to produce relatively mature offspring, there is a great potential for rapid population growth during the relatively short periods when conditions are favourable. In Magela Creek, short generation times are induced by the high water temperatures. When conditions deteriorate, males are usually produced and these fertilise eggs within the female, which are then deposited in the ephippium.

The open water cladoceran species form resting eggs at the end of the Dry season, possibly to avoid unfavourable water quality conditions. In so doing they also avoid the high rates of water flow which occur through most of the billabongs during the Wet season.

Copepods rely on sexual reproduction which leads to slower population increase than parthenogenetic reproduction, because only half of the population can produce progeny. Eggs are carried in egg sacs attached to the urosome of the female, and hatch into small larvae known as nauplii. There are five to six naupliar stages and six copepodite stages before the adult form is assumed, the adult being the sixth copepodite stage (Hutchinson 1967). Population growth in copepods is more dependant on the survival rates of the various immature stages than on egg production. Although copepods have considerably slower generation times than cladocerans, copepods have an advantage in that the naupliar stages generally don't compete with their adult stages for food as they consume different-sized particles (Le Cren & Lowe-McConnell 1980).

Copepods have evolved several methods of avoiding unfavourable conditions. In some cyclopoids, late stage copepods avoid unfavourable conditions by going into diapause, a process in which development ceases and the animal forms a desiccation-resistant cyst which becomes buried in the mud (Hutchinson 1967). Diapause has evolved to respond to predictable cyclic changes in the environment (Elgmork 1980).

It has been demonstrated by Elgmork (1980) that *Mesocyclops leuckarti* goes into 'active diapause': growth and development, but not activity, are arrested and the individual exists close to, but not in the sediments. Additionally, copepod species have been shown to become quiescent when environmental conditions become unfavourable. Because quiescence is not restricted to a particular instar, is short-termed, irregular, and repeatable by an individual, it can be considered as a flexible 'back-up' to diapause. Thus quiescence can enable a species to survive when abnormal conditions (conditions not of a seasonal nature) occur (Elgmork 1980).

The calanoid copepod, *Diaptomus*, has been observed to 'drop' eggs which form into resting eggs (Hutchinson 1967), though their resistance to desiccation is not known.

Although no direct evidence was provided by this study to confirm the presence of the above-mentioned resistant or resting forms, it seems likely from the results obtained that various copepod species occurring in Magela Creek do have such forms. This is discussed further in Section 5.

4.2 Food supply, feeding mechanisms and habitats

The availability of suitable food and habitat is of major importance in determining the presence and population densities of microcrustaceans. Tait (1982) states that particulate organic matter is the major food source for microcrustaceans in the open water areas of billabongs in Magela Creek. Phytoplankton also appears to be an important component in the diet of open water species in Magela Creek (pers. obs.).

Total organic carbon and phytoplankton levels are lowest in the Wet to Early-dry season and build up with the progression of the Dry season (Morley 1981). Food may be a limiting factor for open water microcrustaceans in the early part of the Dry season even after water flow has ceased, though further study would be required to determine this definitely.

Various open water species have been noted to have optimal food particle size preferences. For example, the filter feeders *Moina micrura* and *Bosminopsis deitersi* prefer smaller sized food particles than does *Diaphanosoma excisum* or the raptorial feeding *Diaptomus lumholtzi* (Hutchinson 1967; Smirnov & Timms 1983).

It is likely that the diversity of microhabitats and food sources occurring within weed bed habitats contributes to the species richness of microcrustacean communities in the study area. Shiel (1976) discusses the concept of spatial microhabitat separation, where microcrustacean species are restricted to localised areas of a weedbed habitat or to particular weedbeds because of their differing food requirements, or because of their ability to move over or through a particular substrate. This is reflected in the highly variable morphology of cladocerans (compared with copepods) which can be considered to be adaptations to a particular life mode. Thus, Fryer (cited in Shiel 1976) has observed that *Graptoleberis testudinaria* has the ability to glide over the smooth and slippery surfaces of various macrophytes, consuming small particles and bacteria, while *Biapertura kendallensis* ingests large inorganic particles, diatoms and algae predominantly from the bottom layers, climbing up through the vegetation only occasionally. *Ilyocryptus* and *Leydigia* are detritus feeders inhabiting the surface layers of mud (Shiel 1976; Hutchinson 1967). *Macrothrix* is also a detritus feeder (Shiel 1976). Considerably more research would be required before detailed accounts could be given for the majority of species occurring in Magela Creek.

4.3 Fish predation

Although the effects of invertebrate predation (e.g. by *Chaoborus* larvae, *Mesocyclops leuckarti* and *Mesocyclops* sp. nov.) upon microcrustaceans should not be discounted, many authors consider predation by fish to be the significant regulator of microcrustacean size distribution and biomass, particularly in tropical ecosystems (Kalk et al. 1979; Le Cren & Lowe-McConnell 1980). Tait (1982) and Bishop et al. (1980) have found that numerous fish species occurring in Magela Creek prey heavily on microcrustacean species in various seasons, both in open water and in littoral areas. Macan (cited in Kalk et al. 1979), considers that good evidence exists that larger species of Cladocera and Copepoda (> 1.5 mm) may be selected out by intensive fish predation. This may be one of the reasons for the relatively smaller sizes of Magela Creek microcrustaceans, compared with those of temperate waters, and the absence of *Daphnia* species (Fernando 1980).

4.4 Water quality

The waters of Magela Creek floodplain billabongs remain below pH 7 throughout the year (Morley 1981; Pancontinental Mining Ltd, unpub. data), and occasionally fall dramatically in the Late-dry - Early-wet season (Hart & McGregor 1982; Morley 1981; Brown et al. 1983; Pancontinental Mining Ltd, unpub. data). Numerous researchers have discussed the effects of acidification upon zooplankton communities and have found that decreased pH reduces zooplankton diversity and biomass (Yan & Strus 1980; Confer et al. 1983; Fryer 1980). It should be stressed though, that pH should not be considered in an isolated manner. For example, acidification affects the concentrations of chemical substances, including potential toxicants. Changes in aquatic communities such as fish, phytoplankton and aquatic invertebrates may also occur, affecting zooplankton food availability and predation pressure (Confer et al. 1983). A particular species may appear to be sensitive to a lowering of pH whereas, in fact, it is responding to a lowering in the availability of its particular food source. Thus changes in microcrustacean communities which are linked to changes in pH may be quite complex in nature.

Most published studies on the toxicity of various metals to microcrustaceans relate to temperate northern hemisphere species assemblages. Baudouin & Scoppa (cited in Yan & Strus 1980) report that various zooplankton species show great variability in susceptibility to metals. This point may be important if microcrustaceans are to be used as monitoring organisms in Magela Creek.

The effect of turbidity upon microcrustacean communities has been noted by Shiel et al. (1982) and Timms (1970). It has been suggested that increased turbidity allows predator avoidance by microcrustaceans (Timms 1970). *Diaphanosoma excisum* has been noted to occur predominantly in turbid waters (Kalk et al. 1979), though this may be due to a combination of reduced predation pressures and increased food supply.

5 RESULTS AND DISCUSSION

5.1 Introductory remarks

The microcrustacean zooplankton communities of Magela Creek exhibit marked seasonal fluctuations in both population densities and species richness, in keeping with the seasonal variation of the aquatic environment.

Fewer species of microcrustaceans, and generally lower densities (though not necessarily lower biomass), were found in the open water areas of billabongs compared with the littoral (i.e. macrophyte) habitats. This is contrary to the findings of Morley (1981).

Forty-three cladoceran and nine copepod species were identified in this study. As well, at least three unidentified ostracod species were recorded.

As shown in Table 1, the common microcrustacean assemblage of the open water areas, apart from littoral 'strays', contains two calanoid copepods, three cyclopoid copepods and a total of six cladoceran species (though the actual number was usually less at any given time).

With the onset of the Wet season, microcrustacean densities in the open water area of Ja Ja Billabong became very low, probably owing to the considerable volume of water flowing through it. It is likely that this also occurred in other billabongs. Although Winmurra, a backflow billabong, does not experience high flow rates, the open water species were largely excluded during the Wet season due to the extensive growth of macrophytes which occupied the entire waterbody. The number of open water species builds up to a peak through the Dry season, and then falls late in the Dry season.

Thirty-seven cladoceran species (from 25 genera), five copepod species and at least three ostracod species were found in weedbed habitats. It is possible that additional species exist within the study area, either at low densities or in habitats not sufficiently sampled in this study.

Shiel (1976) has shown that different species of microcrustaceans prefer different macrophyte structures, with some species being dominant within one particular macrophyte habitat and relatively insignificant within others. Therefore, the weedbed microcrustacean dynamics discussed in the following sections (and Figs 2-7) relate to populations in specific macrophytes, generally the more common species such as *Najas tenuifolia* and *Utricularia* sp. Other macrophyte species were sampled after the *Najas tenuifolia* and *Eleocharis* sp. had died down in the mid- to Late-dry season and these are included in Figs 2-7. Information about the population dynamics of microcrustaceans from a wide variety of specific macrophyte weedbeds would have been ideal, but would have required a far more extensive sampling program than was possible in this study.

5.2 Island Billabong

Figure 2 shows the seasonal population dynamics and densities of microcrustaceans recorded in Island Billabong during the study. Table 2 lists the species code numbers. When sampling commenced in September 1981 (mid-Dry season), *Bosminopsis deitersi* was the numerically dominant species in the open water area. This dominance was maintained at most times during the study (periods of high water flow aside). Island Billabong, being relatively large and deep with a predominately sandy bottom (Hart & McGregor 1982), maintains low turbidity levels throughout the Dry season (Morley 1981; Pancontinental Mining Ltd, unpub. data), thereby maintaining a greater euphotic zone compared to other floodplain billabongs. Food supply for limnetic filter feeding zooplankton could therefore be expected to compris mainly phytoplankton and relatively fine detritus particles, which may be utilised more effectively by *B. deitersi* compared to other limnetic species.

Other species occurring in the open water area included the calanoid copepods *Diaptomus lumholtzi* and *Calamoecia ultima*, the cyclopoid copepods *Mesocyclops decipiens* and *M. leuckarti*, and the cladocerans *Ceriodaphnia cornuta*, *Bosmina meridionalis*, *Moina micrura* and *Diaphanosoma excisum*. *D. excisum* and *M. leuckarti* made up a greater proportion of the total microcrustacean population towards the end of the 1982 Dry season. Several additional species were found in low numbers in the open water area (e.g. *Ephemeroporus barroisi*, *Kurzia longirostris* and *Ilyocryptus spinifer*). These species had probably strayed or been flushed from weedbeds or benthic habitats.

Najas tenuifolia was sampled, using a Birge cone, on three occasions between January and May 1982: sampling times corresponded to the initial growth, maturation and decline of this weedbed. Sampling was confined to an inundated bank of the billabong where flow was minimal.

Species richness was found to be greater in the weedbed habitat than in the open water area. Of the 24 cladoceran species found amongst the *Najas tenuifolia* weedbed, the chydorid *Ephemeroporus barroisi* was numerically dominant in all three samples. *Biapertura kendallensis*, *B. macrocopa*, *B. karua* and *Echinisca triserialis* made up an increased percentage of the population during the decline of the weedbed. Other common species included *Chydorus eurynotus*, *Moinodaphnia macleayi*, *Streblocerus serricaudatus* and *Euryalona orientalis*. A carnivorous cyclopoid copepod, *Mesocyclops* sp. nov., and the herbivorous *Microcyclops varicans* were also common in this weedbed habitat. They were also the dominant species occurring within an isolated *Utricularia* sp. weedbed which was sampled in October 1982 (Late-dry season). *Calamoecia ultima* was prevalent both among the developing *N. tenuifolia* weedbeds (perhaps being flushed from the open water area during inundation) as well as the above-mentioned *Utricularia* sp. sample. (Ostracod spp. were numerically dominant in the mature *N. tenuifolia* weedbed in March 1982.)

5.3 Wirmurra Billabong

This small backflow billabong possesses a rich microcrustacean community, at relatively high densities. Thirty-one cladoceran and six copepod species were identified from the billabong with 29 cladocerans being associated with weedbed habitats (20 of these being chydorids). Figure 3 shows the changes in numbers over the study period. Open water microcrustaceans exhibited considerable variation both in relative species composition and in population densities between the successive Dry seasons sampled in this study. The number of microcrustaceans in the open water peaked at 240 ind./L in November 1981, while the highest density obtained during the 1982 Dry season was 13 ind./L in October 1982. No distinct difference in physical or chemical water quality variables was discernible between the two seasons (Pancontinental Mining Ltd, unpub. data). It would seem unlikely that such a large difference in densities between seasons is due to errors in sampling, but the above figures should be treated with caution. The sampling technique used (multiple net hauls combined into one sample) gives no indication of the variability in microcrustacean distribution, and thus of whether the samples can be considered representative.

An average microcrustacean population density of 541 ind./L was found amongst *Najas tenuifolia* weedbeds in early July 1982, when the weedbeds were mature and had considerable epiphytic growth on the stems and leaves. The variability in species and population densities evident between the sampled *N. tenuifolia* weedbeds is discussed in Section 5.8.

Representative open water species were *Calamoecia ultima, Mesocyclops decipiens, M. leuckarti, Mesocyclops* sp. nov., *Diaphanosoma excisum, Moina micrura, Ceriodaphnia cornuta,* and *Bosminopsis deitersi*. The reason for the absence of *Diaptomus lumholtzi* is not known but may have been due to intensive fish predation or because Winmurra Billabong occasionally dries up in the late Dry season. If *D. lumholtzi* does not have desiccation-resistant stages it would be excluded from Winmurra, as there is little possibility of immigration from the fast flowing source of 7J Creek.

Open water species are excluded from Winmurra during the Wet season not because of high flow rates, but because of the extensive growth of macrophytes which effectively choke the billabong at this time.

Mesocyclops sp. nov. was the dominant predator in both the weedbed and open water area, appearing to compete more successfully than the smaller *M. leuckarti*. *M. leuckarti* is a well-documented predator on zooplankton species (including its own immature stages), though it will also feed on phytoplankton if other sources are scarce (Jamieson 1980; Le Cren & Lowe-McConnell 1980). In preserved samples, *M. leuckarti* specimens were occasionally observed to be attached to partially eaten copepodites or cladocerans, indicating a carnivorous life habit. *Mesocyclops* sp. nov. is assumed to have a similar life mode, as it was also observed to be grasping partially eaten copepod nauplii and cladocerans. The high densities of possible prey species was probably responsible for the high numbers of *Mesocylops* sp. nov. amongst the weedbeds.

Calamoecia ultima dominated the open water area in the mid-Dry season of 1982, declining in importance as the Dry season progressed. *Diaphanosoma excisum* persisted to the end of the 1981 Dry season and appeared again soon after open water areas appeared in Winmurra (i.e. after the macrophytes began to decline). The relative proportion of *D. excisum* increased towards the end of the Dry season while *Moina micrura* numbers peaked in mid-Dry season and fell towards the end of the Dry season. *Bosminopsis deitersi* was found on one occasion in Winmurra (mid-December 1981), at which time it was the dominant species (at very low densities). This was after the initial rains of the Wet season and the turbidity was low (Pancontinental Mining Ltd, unpub. data).

Of the 29 cladoceran species identified from weedbed habitats, only a few were present at greater than 5% of the population at any one time. *Ephemeroporus barroisi* was the numerically dominant cladoceran amongst *Najas tenuifolia* in the Wet to mid-Dry seasons. *Alona monacantha* became dominant when *N. tenuifolia* weedbeds were very mature, with high amounts of epiphytic growth on the leaves (July 1982).

Other common species included *Echinisca triserialis, Ilyocryptus spinifer, Macrothrix spinosa, Biapertura rigidicaudis, Alona davidi* and *Chydorus eurynotus*. *Mesocyclops* sp. nov. and *Microcyclops varicans* were common amongst the weedbeds, with *Mesocylops* sp. nov. becoming the dominant microcrustacean as the weedbeds began to decay in the mid-Dry season (August 1982). Ostracods were well represented amongst weedbeds, being particularly prevalent amongst *Najas tenuifolia* and *Eleocharis* sp. weedbeds in May 1982 (Late-wet - Early-dry) and in *Eleocharis* sp. weedbeds in February 1983 (early Wet).

5.4 Ja Ja Billabong

The open water species in this floodplain billabong exhibited a marked seasonal succession. The first open water species to appear after the high flow rates of the Wet season were *Mesocyclops decipiens*, *M. leuckarti* and *Moina micrura*, followed slightly later by *Calamoecia ultima* (Fig. 4). The rapid appearance of copepods is possibly related to the aestivating ability of their late stage copepodites, allowing quick development of adults after high water flow rates cease. *Moina micrura* has been observed by Rzoska (cited in Kalk et al. 1979) to form resting eggs containing large late-stage embryos, which can rapidly hatch when conditions become favourable. *M. micrura* also has a faster feeding rate upon smaller particles than larger cladocerans (Kalk et al. 1979), perhaps allowing it to more efficiently exploit the conditions existing in the billabong during the Wet and Early-dry seasons, i.e. turbidity and low suspended solids, (Pancontinental Mining Ltd, unpub. data) and low phytoplankton numbers (Morley 1981).

The percentage of *C. ultima* and *M. decipiens* in the microcrustacean population fell through the Dry season, while that of *Diaptomus lumholtzi*, *Diaphanosoma excisum* and *Moina micrura* rose. *D. excisum* was the numerically dominant species in the mid to late Dry season, when water turbidity was relatively high.

Twenty-nine cladoceran species were identified from littoral weedbeds. As in other billabongs, few species were dominant through the study. *Ephemeroporus barroisi* quickly established itself amongst the growing *Najas tenuifolia* weedbeds at the beginning of the Wet season, being numerically dominant in January 1982. Other cladoceran species present at this time included *Ilyocryptus spinifer*, *Echinisca triserialis*, *Moinodaphnia macleayi* and *Biapertura karua*. The water flow rate at this time was considerable. *Streblocerus serricaudatus* was dominant amongst the *Najas tenuifolia* weedbeds in March 1982, when water flows had eased but before the weedbeds had reached maturity.

Mesocyclops sp. nov. and *Microcyclops varicans* appeared soon after the weedbeds had commenced growth after inundation, increasing in relative abundance as the weedbeds reached maturity (May 1982).

5.5 Mine Valley Billabong

Like Winmurra, Mine Valley Billabong is relatively small and shallow, and has been known to dry up late in the Dry season. Macrophytes grow prolifically within the billabong in the Wet season, occupying the total waterbody.

Microcrustacean densities within the open water remained very low throughout the study period: the highest value of 3 individuals per litre occurred in November 1982 (Late-dry season). By comparison, an approximated figure of 220 individuals per litre was obtained from a mature bed of *Najas tenuifolia*, using a Birge cone sampler. It is likely that the actual littoral microcrustacean density was considerably higher, because using a Birge cone overestimates filtering rate (compare density figures obtained for tube and Birge cone samplings in Appendix B).

Figure 5 shows the seasonal microcrustacean population dynamics in Mine Valley Billabong during the study period. Of the open water species, *Calamoecia ultima* and *Moina micrura* peaked in numbers in the mid-Dry season and fell as the dry season progressed, while *Diaptomus lumholtzi* and *Diaphanosoma excisum* peaked later in the Dry season. *Mesocyclops leuckarti* and *M. decipiens* were the dominant cyclopoid copepods in the 1981 late Dry season but were insignificant during the 1982 Dry season.

No microcrustaceans were found in either late February 1982 (Late-dry

- Early-wet season), or in mid-November 1982 (Late-dry season). *Diaptomus lumholtzi* and *Diaphanosoma excisum* were the only species present at low densities in mid-December 1982, when the pH was around 4 (Pancontinental Mining Ltd, unpub. data).

Twenty-seven cladoceran species were found either amongst weedbeds (*Najas tenuifolia* and *Eleocharis* sp.) or amongst decomposing weedbed remnants. *Ephemeroporus barroisi* was dominant amongst growing weedbeds and *Echinisca triserialis*, *Moinodaphnia macleayi*, *Alonella clathratula* and *Kurzia longirostris* were common. *Chydorus eurynotus*, *E. barroisi*, *Euryalona orientalis*, *Ilyoryptus spinifer* and *Camptocercus australis* were present (in low densities) in open water samples in the 1982 mid-Dry season. They were probably associated with the abundant amounts of decomposing macrophyte material. *Mesocyclops* sp. nov. and *Microcyclops varicans* were common amongst weedbeds and were also found in the open water (mid-Dry season) after the weedbeds declined. Ostracod numbers peaked in the mature weedbeds (April/May 1982).

5.6 Jabiluka Billabong

Figure 6 shows the microcrustacean population dynamics in Jabiluka Billabong during the study period.

Open water species found within Jabiluka are similar (and show similar trends) to those found in Ja Ja Billabong, which is not surprising as the two billabongs are very similar. The exception was *Moina micrura* which was poorly represented in Jabiluka Billabong.

Microcrustacean community densities in weedbed habitats were again considerably higher than in the open water area, with 129 ind./L being recorded amongst *N. tenuifolia* and *Eleocharis* sp. weedbeds in March 1982. Tube samplings were not collected in Jabiluka Billabong after this period and it is possible (in light of results from other billabongs) that the densities were higher later in the season.

Several littoral species were found in the open water at the beginning of the 1982 Wet season,: they were probably flushed from developing weedbeds by high water flow. Examples included *Kurzia longirostris*, *Ephemeroporus barroisi*, *Echinisca triserialis* and *Ilyocryptus spinifer*.

E. barroisi dominated the weedbed cladoceran assemblage but 25 other species were identified, 18 of these were chydorids. A bed of *Utricularia* sp. and *Ludwidgia* sp. sampled later in the 1982 Dry season (late October), was dominated by ostracods but contained markedly fewer cladoceran species than mid-Wet to Early-dry season samples. Notably absent at this time were most of the chydorid species, the exceptions being *Ephemeroporus barroisi*, *Euryalona orientalis* and *Dunhevedia crassa*, along with *Echinisca triserialis*, *Moinodaphnia macleayi*, *Mesocyclops* sp. nov., *Microcyclops varicans* and *Diaptomus australis*. *Ceriodaphnia cornuta* was also present in this sample but it is likely that it infiltrated the weedbed from the open water area where it was common at that time.

5.7 Leichhardt Billabong

Leichhardt is a main channel billabong, similar to Island Billabong, being relatively deep and narrow, with turbidity levels not increasing greatly through the Dry season (Pancontinental Mining Ltd, unpub. data).

There was a comparatively high microcrustacean density in the open water areas during the Dry season with a peak value of 162 ind./L recorded in October 1982.

Typical open water species were present during the Dry season and, as in other billabongs, species dominance varied temporally (Fig. 7). In the 1981 Late-dry season the open water habitat was dominated by *Diaphanosoma excisum* and *Bosminopsis deitersi*, following an earlier peak by *Diaptomus lumholtzi*. *Mesocyclops decipiens*, *M. leuckarti* and the littoral species *Macrothrix spinosa* were the only species found at low densities in the open water area as particularly acid floodplain water (pH < 4; Pancontinental Mining Ltd, unpub. data) flowed into the billabong at the commencement of the Wet season (December 1981).

Mesocyclops decipiens was the first species to appear in the open water after the high water flow rates which occurred through the billabong during the 1982 Wet season. As the Dry season progressed other open water species reappeared, with *Diaptomus lumholtzi* dominating the mid- to late Dry season population. As in the previous year, the relative abundance of *D. lumholtzi* and *Moina micrura* fell in the late Dry season, while that of *Diaphanosoma excisum*, *Bosminopsis deitersi*, *Mesocyclops decipiens* and *M. leuckarti* rose.

Population densities among the weedbed habitats could be expected to peak at levels higher than those recorded, as quantitative results are only available from weedbeds exposed to considerable water flow rates. Higher densities would be expected when water flow ceased and the weedbeds matured in the Early- to mid-Dry season (unfortunately the quantitative samples were destroyed in transit to Sydney).

Echinisca triserialis and *Ephemeroporus barroisi* were dominant amongst developing *Najas tenuifolia* weedbeds early in the Wet season (20.i.82). These species continued to be common in the weedbeds in March 1982, along with *Moinodaphnia macleayi*, *Alona clathratula*, *Chydorus* sp. near *flaviformis*, *Kurzia longirostris*, *Alona davidi*, *Ilyocryptus spinifer* and *Macrothrix hystrix*. *E. barroisi* was dominant amongst *Najas tenuifolia*/*Utricularia* spp. weedbeds in May 1982.

5.8 Discussion

The microcrustacean species (especially cladocera) occurring on the Magela Creek flood plain form a rich assemblage in comparison to other studied areas in Australia. This may, in part, be due to the relatively few detailed studies carried out on littoral Entomostraca in Australia. For example, Smirnov & Timms (1983) recorded up to 10 cladoceran species per lagoon from the Goulburn lagoons, while Shiel (1976), in a more detailed study of one of the lagoons, recorded 31 cladoceran species. Nevertheless, the 43 cladoceran and 9 copepod species identified from the Magela Creek floodplain billabongs constitute a rich assemblage of species, the cladocerans in particular forming one of the richest so far investigated in Australia (B.V. Timms, pers. comm.).

The majority of microcrustacean species found in this study occurred among aquatic macrophyte weedbeds. Thirty-seven cladoceran species (from 25 genera), 4 copepod species and a number of unidentified ostracod and harpacticoid copepod species were found in weedbeds. This species richness may be aided by the marked seasonal variation in the aquatic environment brought about by the monsoonal climate. The expansion of the aquatic environment in the Wet season, with the associated proliferation of aquatic macrophytes, creates an extensive range of physical sites that can be exploited by littoral microcrustaceans. The wide variation in the morphology of various macrophyte species (compare *Eleocharis* spp. or *Leersia* sp. with *Najas tenuifolia* or *Hydrilla* sp.), along with differences in physical factors (e.g. exposure to different water flow rates, different water depth, etc.), provides a variety of sites and microhabitats to suit different microcrustacean species (see Section 4.2).

Deficiencies in the sampling program among aquatic macrophytes, i.e. the lack of short interval (weekly or fortnightly) sampling, create limitations in the description of littoral microcrustacean population dynamics. For example, in Winmurra Billabong two *Najas tenuifolia* weedbeds were sampled (tube method) in early July 1982. One weedbed was in the centre of the billabong (water depth 1.8 m), the other was near the billabong edge (depth 0.5 m). In the former sample, 14 species were identified (excluding ostracods) with a calculated density of 360 ind./L, while in the latter, 7 species were identified at a density of 720 ind./L. Only 4 species were common to both samples. Obviously, with this amount of variation between weedbeds that were similar except in water depth, questions regarding the variability of results obtained from other weedbed samples must be raised. Further study is therefore required before littoral microcrustacean population dynamics can be said to be adequately described.

Of the 37 cladoceran and 5 copepod species identified from weedbed habits, only a few species were consistently present at relatively high abundances in samples. The most common species found amongst the sampled weedbeds were *Ephemeroporus barroisi*, *Mesocyclops* sp. nov., *Microcyclops varicans*, *Echinisca triserialis* and *Ilyocryptus spinifer*.

Ephemeroporus barroisi, a small chydorid, was often the dominant species amongst weedbed habitats and was present in virtually all weedbed samples. Whether this prevalence was due more to the inherent capabilities of this animal (i.e. rapid reproduction rate and flexibility in habitat preference) or to the lack of predation pressures (because of its small size and/or life mode), is open to speculation: other species may reproduce as quickly as, or more quickly than, *E. barroisi*, but their numbers are kept in check by predation pressures.

The two cyclopoid copepods *Mesocyclops* sp. nov. and *Microcyclops varicans* were present in most weedbed samples, often in high relative proportions. There was a trend for these proportions to be higher later in the season compared to cladocerans. This may be related to their reproduction cycle which involves various naupliar and copepodite stages and it takes a longer time for adult forms to be assumed (and hence identified) compared to cladocerans.

The macrothricid species *Echinisca triserialis* and *Ilyocryptus spinifer* were also present in most weedbed samplings. *Ilyocryptus spinifer* was also present (at low relative abundances) in numerous open water samples. This is in keeping with the observations of Fryer (1980), who considered it to be a benthic species.

The remaining species tended to occur irregularly at low relative abundances. These were *Diaptomus australis*, *Diaphanosoma sarsi*, *Latonopsis* (3 species), *Pseudosida*, *Moinodaphnia*, *Alonella*, *Australochydorus*, *Chydorus* (2 species), *Dadaya*, *Dunhevedia*, *Alona* (4 species), *Biapertura* (5 species), *Camptocercus*, *Euryalona*, *Graptolebris*, *Indialona*, *Kurzia*, *Leydigia*, *Oxyurella*, *Simocephalus* (2 species), *Echinisca williamsi*, *Macro-*

thrix (2 species) and *Streblocerus*. The trend for littoral microcrustacean assemblages of Magela Creek to be usually dominated (to a considerable degree) by one or a few species is similar to that found by Shiel (1976) in a Victorian billabong.

Species endemic to Australia were restricted to *Latonopsis brehmi*, *Australochydorus aporus*, *Biapertura rigidicaudis*, *B. macrocopa*, *Echinisca williamsi*, and *Macrothrix hystrix* (its collection in this study being the first since the original description by Gurney in 1927). *Alona monacantha* was previously unrecorded in Australia.

As the Dry season progresses and water levels fall, many weedbeds die down, and hence there is a reduction in suitable habitats for littoral microcrustaceans.

Discrete billabongs are formed on the flood plain and the open water species assemblages reform after the cessation of the high water flow rates of the Wet and Early-dry seasons.

The open water areas of the Magela Creek floodplain billabongs were generally inhabited by the same limnetic microcrustacean species, though there were variations in the relative species composition and population densities both within and between billabongs. The common limnetic species found were the calanoid copepods *Diaptomus lumholtzi* and *Calamoecia ultima*, the cyclopoid copepods *Mesocyclops decipiens* and *Mesocyclops leuckarti*, and the cladocerans *Diaphanosoma excisum*, *Ceriodaphnia cornuta*, *Moina micrura* and *Bosminopsis deitersi*. The four cladoceran species are the most common limnetic cladocerans found in tropical waters (Fernando 1980).

Although there were marked differences between billabongs in microcrustacean species composition, some general similarities were apparent. The cyclopoid copepods were normally the first microcrustaceans to reappear after the billabongs were flushed by Wet season floods. This may have been due to diapause, which allows adults to reappear relatively quickly. Although *Mesocyclops leuckarti* and *M. decipiens* reappeared quickly, their densities were low (< 10 ind./L) and did not increase until well into the Dry season. In the case of *M. leuckarti*, a predator on other microcrustaceans, the obvious lack of prey species early in the Dry season would keep its population density low. Though if *M. leuckarti* adults could reproduce at this time (given that, compared to cladocerans, copepod egg production is less dependant on the food supply prevailing at the adult stage [Le Cren & Lowe-McConnell 1980]), it would give its immature stages time to develop, as they utilise a different (smaller) particle size food source (Le Cren & Lowe-McConnell 1980). By the time they are adults, later in the Dry season, a greater food supply would be available.

Mesocyclops sp. nov. and *Microcyclops varicans* were found in open water areas in two billabongs (Winmurra and Mine Valley) in the 1982 Dry season, apparently at the expense of *M. leuckarti* and *M. decipiens*. The two billabongs are similar in that they are both small and shallow, with the entire waterbody becoming choked with aquatic macrophytes in the Wet and Early-dry seasons. *Microcyclops varicans* and *Mesocyclops* sp. nov. apparently continue to occupy the open water areas, though at greatly decreased densities, after their 'preferred' habitat amongst weedbeds dies down.

The calanoid copepods *Calamoecia ultima* and *Diaptomus lumholtzi* generally appeared in open water areas after the cyclopoid copepods (though *D. lumholtzi* was absent from Winmurra Billabong). *C. ultima* tended to be relatively more abundant earlier in the Dry season than *D. lumholtzi*. A variety of factors may be involved in this temporal succession. For example, although both species are filter feeders, they may have a preference for differently sized food particles: *D. lumholtzi*, being a larger, more robust species, may be better able to utilise larger particles. Any changes to the available food supply (be it size or type) through the Dry season may therefore be advantageous to one species and not the other. *C. ultima* may also be less tolerant than *D. lumholtzi* of certain physical or chemical water quality parameters (e.g. low DO or pH), therefore limiting its population in the Late-dry season.

The limnetic cladoceran fauna reappeared in samples at about the same time as the calanoid copepods. In Ja Ja and Mine Valley billabongs *Moina micrura* formed a greater percentage of the population earlier in the Dry season than other cladocerans (possibly due to the reason given in Section 5.4). *Diaphanosoma excisum* tended to form a greater percentage of the open water population late in the Dry season when, in most billabongs (e.g. Winmurra, Mine Valley, Jabiluka and Ja Ja), there is greatly increased turbidity (Pancontinental Mining Ltd, unpub. data). Increased turbidity may result in reduced predation pressures (Timms 1970). The same phenomenon occurs in Island and Leichhardt billabongs, where turbidity did not increase markedly (Pancontinental Mining Ltd, unpub. data). Therefore other factors besides turbidity may be involved in allowing *D. excisum* to better exploit the open water areas in the late Dry season, compared to other species.

Bosminopsis deitersi was prevalent in the structurally similar billabongs, Island and Leichhardt, but relatively unimportant in the other billabongs. Obviously conditions existed in these billabongs which were favourable to *B. deitersi* (see Section 5.2).

Daphnia spp. were absent in this study and are almost totally absent in tropical waters, apart from some smaller species such as *Daphnia lumholtzi* (Fernando 1980). The smaller size of limnetic microcrustaceans in Magela floodplain billabongs (and tropical waters generally - Fernando 1980) compared to temperate regions, may be due to a variety of factors including intensive fish predation (Section 4.3). High water temperature has been found by Lynch to reduce the feeding efficiency of larger *Daphnia* species, and Lesur has found it to reduce fecundity (Fernando 1980). It is therefore considered by Fernando (1980) to be a major reason for the reduced size of limnetic microcrustaceans in tropical regions.

The microcrustacean population densities recorded in this study should be treated with caution. The variation in population densities between samples from different weedbeds and the lack of truly quantitative sampling of limnetic microcrustaceans, limit the value of the figures obtained. They do seem to indicate though, that littoral microcrustaceans attain higher densities than do limnetic microcrustaceans. The abundant epiphytic growth in the weedbeds is likely to be a significant source of food for littoral microcrustaceans.

In some billabongs a reduction in the number of limnetic species occurred in the Late-dry season, usually coinciding with a noticeable reduction in water quality. For example, *Diaphanosoma excisum* and *Moina micrura* were the only species present in Winmurra Billabong in mid-November 1982, when dissolved oxygen was only 1.8 mg/L, pH was 5.6 and surface water temperature was 34.2°C (Pancontinental Mining Ltd, unpub. data). *D. excisum*, *Mesocyclops decipiens* and *M. leuckarti* were the only species present, at low densities, in Leichhardt Billabong in mid-December 1981, when pH was

3.8, DO was 3.8 mg/L and the surface water temperature was 32.8°C (Pancontinental Mining Ltd. unpub. data). Similarly only *D. excisum* and *Diaptomus lumholtzi* were present in Mine Valley Billabong in mid-December, 1982 when pH was 4.4 and DO was 1.5 mg/L (Pancontinental Mining Ltd, unpub. data). Further study would be required to determine if the species mentioned above are any more resistant to adverse water quality conditions than other limnetic species, and whether other factors (such as food supply), are involved.

6 CONCLUSIONS

The microcrustacean species (especially Cladocera) occurring within the Magela Creek flood plain form a very rich assemblage in comparison with those of other areas of Australia. This is probably due to the marked seasonal variation in the aquatic environment of Magela Creek brought about by the monsoonal climate. The expansion of the aquatic environment in the Wet season, with the associated proliferation of aquatic macrophytes, creates a wide range of physical habitats for littoral microcrustaceans. Of the 43 cladoceran species identified in this study, 37 cladocerans (and 4 copepod species) were from littoral habitats. Common littoral species included *Ephemeroporus barroisi*, *Echinisca triserialis*, *Ilyocryptus spinifer*, *Mesocyclops* sp. nov. and *Microcyclops varicans*.

As the water level falls with the progression of the Dry season, weedbeds decline and discrete billabongs are formed on the flood plain. Littoral species assemblages decline because of lack of suitable habitats, and open water species assemblages reform after cessation of the high water flow rates of the Wet season. A reduction in limnetic species numbers was evident towards the end of the Dry season, particularly in smaller billabongs, where deterioration in water quality was more marked.

In view of their likely importance to the aquatic system of Magela Creek, further investigation of both limnetic and littoral microcrustaceans is required to provide more detailed information of seasonal population dynamics and statistically verifiable population density estimates. Investigation of differences in the littoral microcrustacean species assemblages between different macrophyte species weedbeds is also required to provide an overall view of littoral microcrustacean populations in billabongs and in floodplain areas.

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Table 1. Littoral and limnetic microcrustacean species occurring on the Magela Creek flood plain

PLANKTONIC SPECIES

(a) Common in open water	(b) Less common in open water
Calanoid copepods	
Diaptomus lumholtzi	
Calamoecia ultima[1]	
Cyclopoid copepods	
Mesocyclops decipiens	*Mesocyclops aspericornis*
Mesocyclops leuckarti[1]	
Cladocera	
Diaphanosoma excisum	*Scapholeberis kingi*
Ceriodaphnia cornuta[1]	*Bosmina meridionalis*
Moina micrura[1]	
Bosminopsis deitersi[1]	

LITTORAL/BENTHIC SPECIES

(a) Common in weedbeds	(b) Less common in weedbeds
Calanoid copepods	
	Diaptomus australis
Cyclopoid copepods	
Mesocyclops sp. nov.[2]	*Ectocyclops* sp.
Microcyclops varicans[2]	harpacticoid spp.
Cladocera	
Latonopsis australis	*Diaphanosoma sarsi*[2]
Pseudosida bidentata	*Latonopsis fasciculata*
Moinodaphnia macleayi	*Latonopsis brehmi*
Alonella clathratula	*Australochydorus aporus*
Ephemeroporus barroisi[2]	*Dunhevedia crassa*
Chydorus eurynotus[2]	*Biapertura kendallensis*
Chydorus sp. near *flaviformis*[2]	*Camptocercus australis*
Dadaya macrops	*Indialona globulosa*
Alona davidi[2]	*Leydigia acanthocercoides*[2]
Alona sp. near *costata*	*Oxyurella singalensis*
Alona sp. near *cambouei*	*Simocephalus serrulatus*
Alona monacantha	*Echinisca williamsi*
Biapertura karua[2]	*Macrothrix hystrix*[2]
Biapertura verrucosa	
Biapertura macrocopa[2]	
Biapertura rigidicaudis[2]	
Euryalona orientalis[2]	
Graptoleberis testudinaria	
Kurzia longirostris	
Simocephalus latirostris	
Echinisca triserialis[2]	
Ilyocryptus spinifer	
Macrothrix spinosa[2]	
Streblocerus serricaudatus	
Ostracod spp.	

[1]occasionally occur in weedbeds; [2]occasionally occur in open water.

Table 2. Key to species code numbers for Figs 2-7

1. *Diaptomus lumholtzi* Sars
2. *Calamoecia ultima* (Brehm, 1960)
3. *Mesocyclops dicipiens* Kiefer
4. *Mesocyclops leuckarti* (Claus)
5. *Mesocyclops* sp. nov.
6. *Mesocyclops aspericornis* Daday, 1901
7. *Microcyclops varicans* (Sars 1862)
8. *Diaptomus australis* (Kiefer, 1936)
9. Copepod nauplii
10. Harpacticoida
11. *Diaphanosoma excisum* Sars, 1885
12. *Diaphanosoma sarsi* Richard, 1894
13. *Latonopsis australis* Sars, 1888
14. *Latonopsis brehmi* Petkovski, 1973
15. *Latonopsis fasciculata* Daday
16. *Pseudosida bidentata* Herrick, 1884
17. *Bosminopsis deitersi* Richard, 1897
18. *Bosmina meridionalis* Sars, 1904
19. *Ceriodaphnia cornuta* Sars, 1885
20. *Moina micrura* Kurz, 1874
21. *Moinodaphnia macleayi* (King, 1853)
22. *Alonella clathratula* Sars, 1896
23. *Australochydorus aporus* Smirnov & Timms, 1983
24. *Chydorus eurynotus* Sars, 1901
25. *Chydorus* sp. near *flaviformis* Birge, 1893
26. *Dadaya macrops* (Daday, 1898)
27. *Dunhevedia crassa* King, 1853
28. *Ephemeroporus barroisi* (Richard, 1894)
29. *Alona monacantha* Sars, 1901
30. *Alona davidi* Richard, 1895
31. *Alona* sp. near *costata* Sars, 1862
32. *Alona* sp. near *cambouei* Guerne & Richard, 1893
33. *Biapertura kendallensis* (Henry, 1919)
34. *Biapertura karua* (Sars, 1888)
35. *Biapertura verrucosa* Sars, 1901
36. *Biapertura macrocopa* (Sars, 1895
37. *Biapertura rigidicaudis* Smirnov, 1971
38. *Camptocercus australis* Sars, 1896
39. *Euryalona orientalis* (Daday, 1898)
40. *Graptoleberis testudinaria* (Fischer, 1851)
41. *Indialona globulosa* (Daday, 1898)
42. *Kurzia longirostris* (Daday, 1898)
43. *Leydigia acanthocercoides* (Fischer, 1854)
44. *Oxyurella singalensis* (Daday, 1898)
45. *Simocephalus latirostris* Stingelin, 1906
46. *Simocephalus serrulatus* (Koch)
47. *Scapholeberis kingi* Sars, 1903
48. *Echinisca triserialis* (Brady, 1886)
49. *Echinisca williamsi* Smirnov & Timms, 1983
50. *Ilyocryptus spinifer* Herrick, 1882
51. *Macrothrix spinosa* King, 1853
52. *Macrothrix hystrix* Gurney, 1927
53. *Streblocerus serricaudatus* (Fischer, 1849)
54. Ostracoda

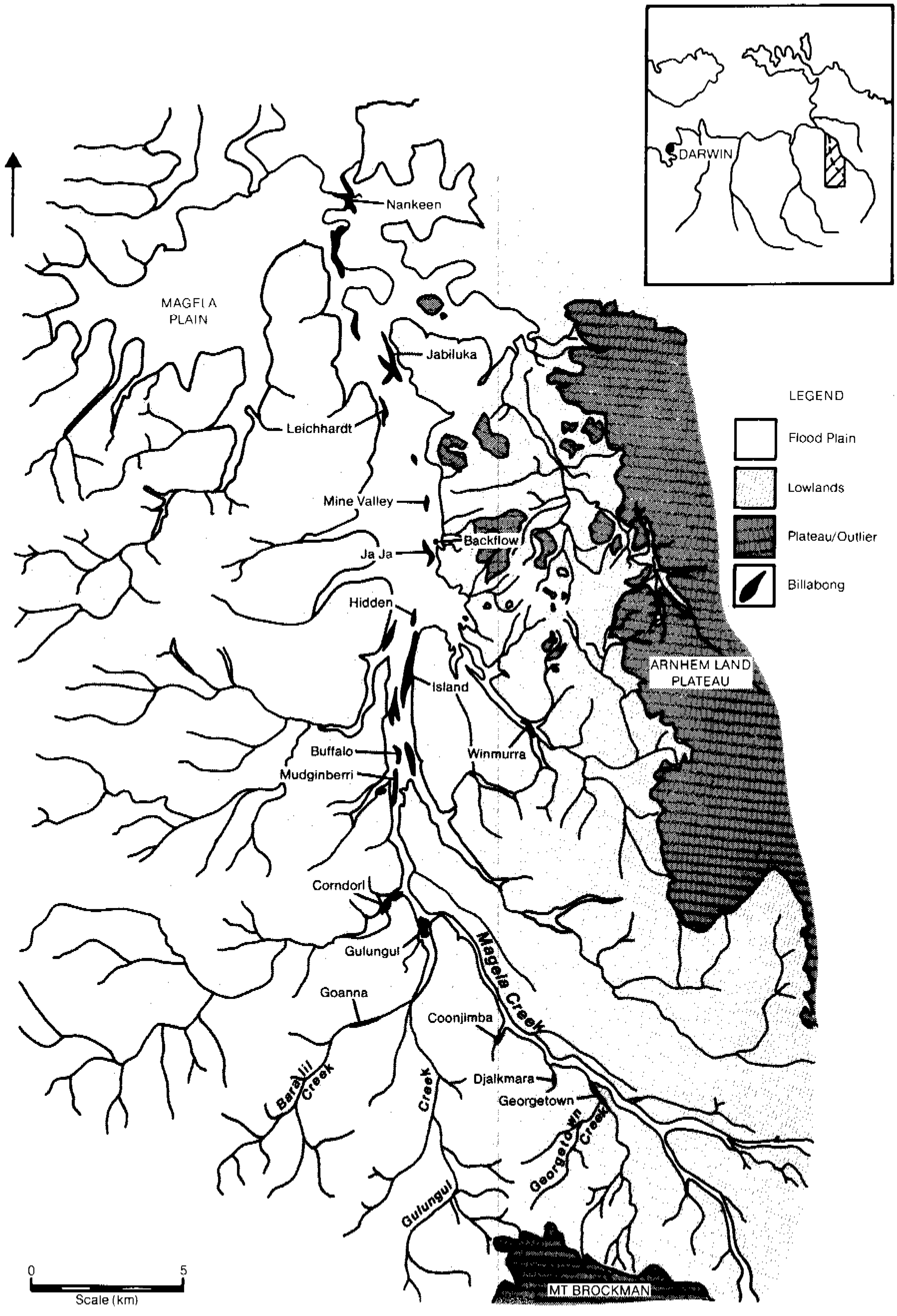

Figure 1. Magela Creek system

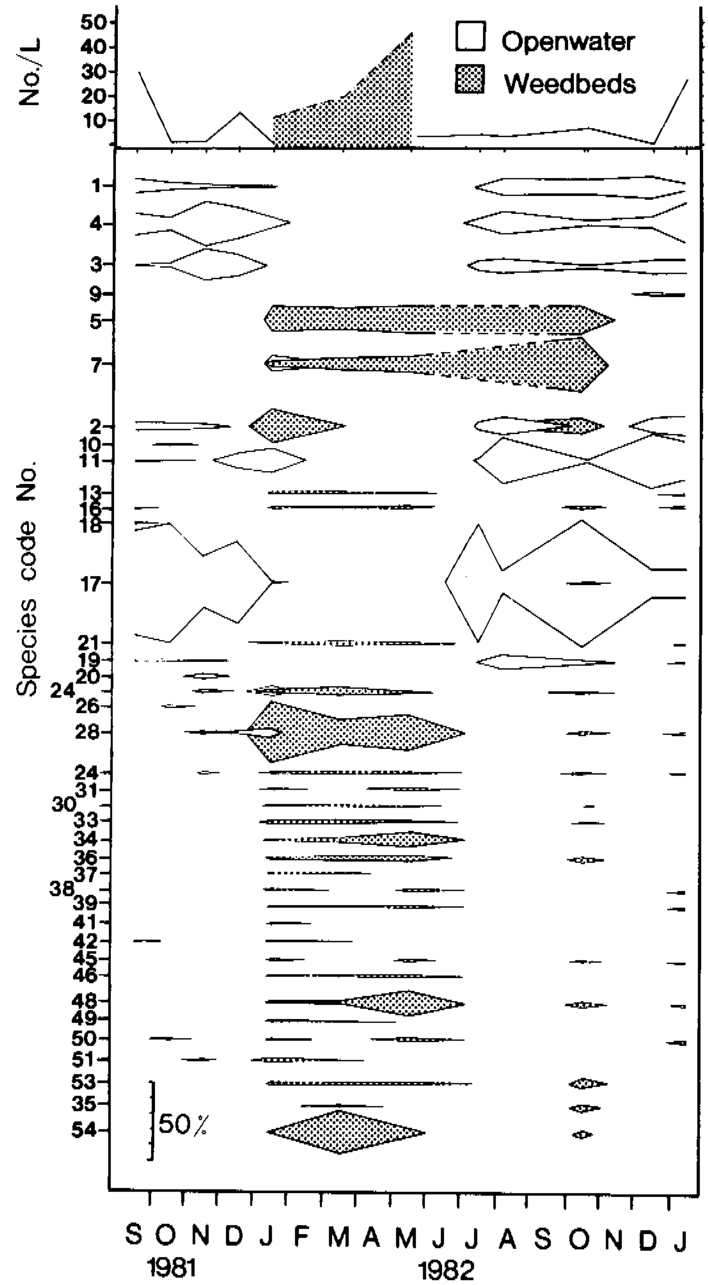

Figure 2. Seasonal population dynamics of microcrustacean species occurring in Island Billabong

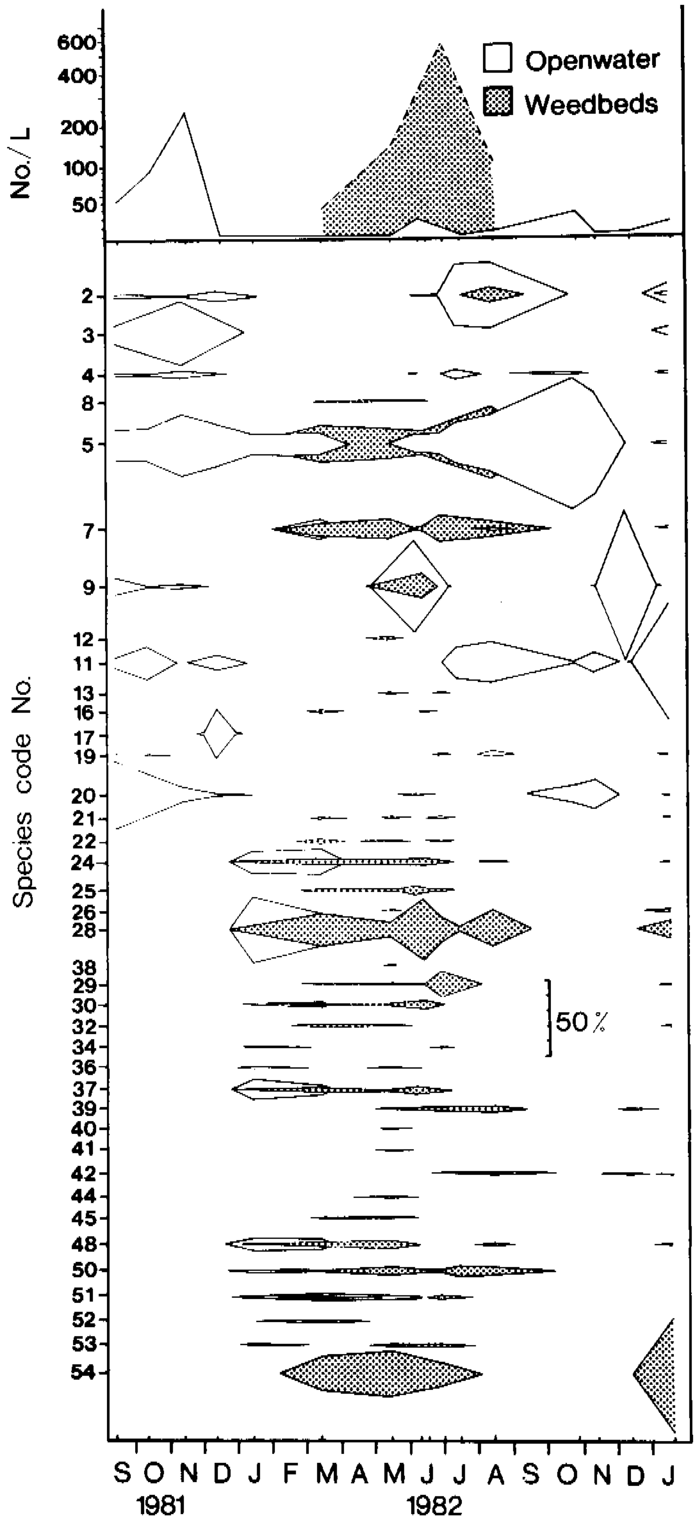

Figure 3. Seasonal population dynamics of microcrustacean species occurring in Winmurra Billabong

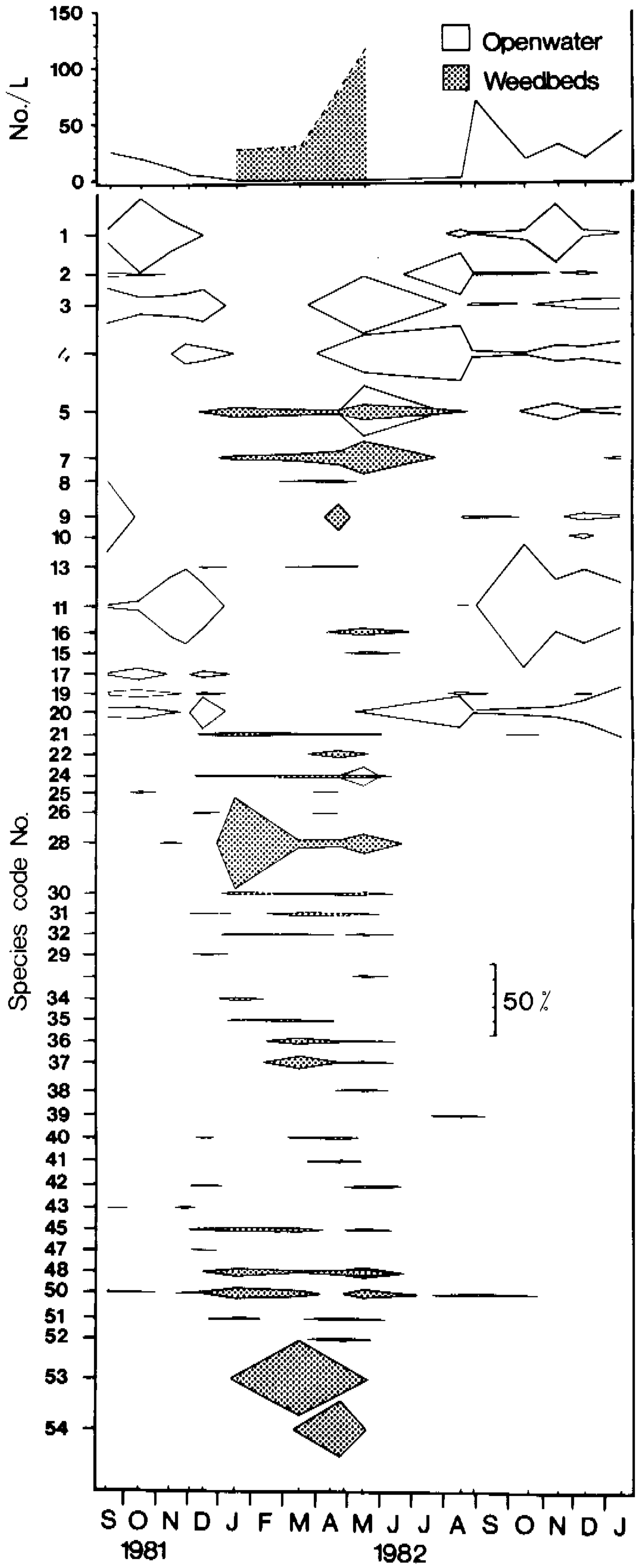

Figure 4. Seasonal population dynamics of microcrustacean species occurring in Ja Ja Billabong

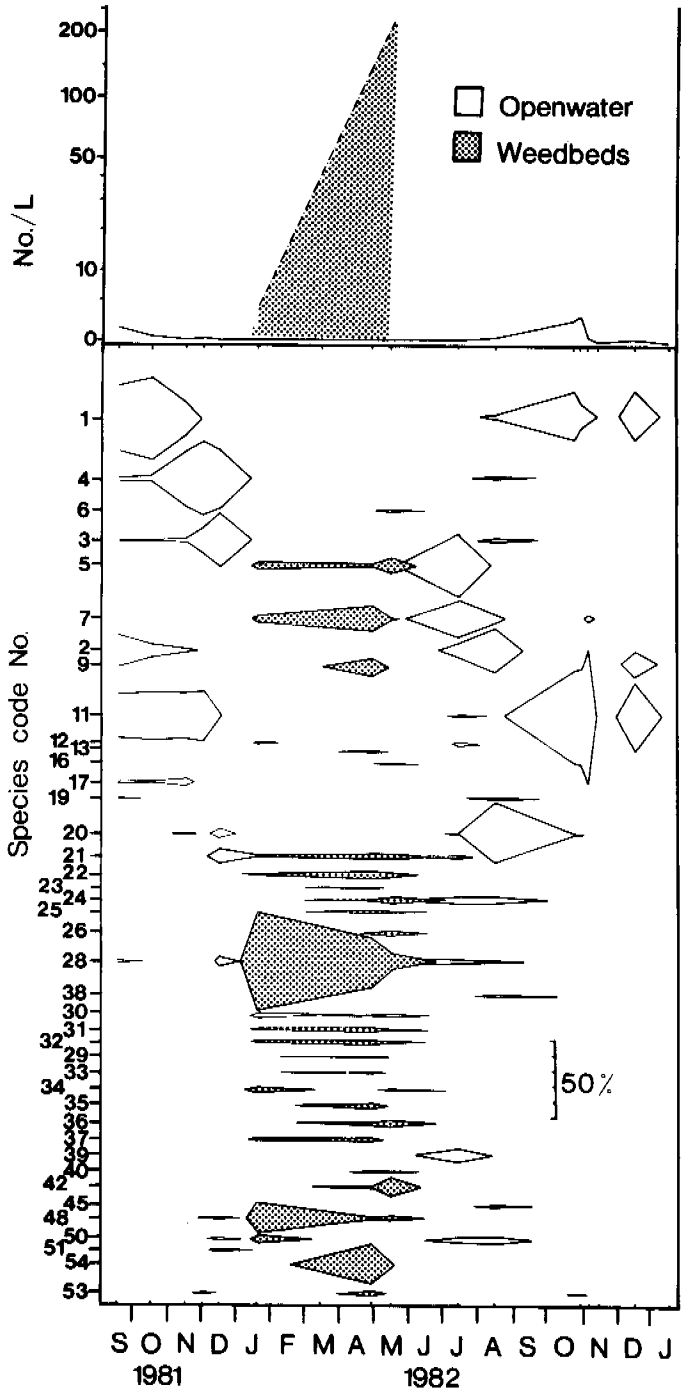

Figure 5. Seasonal population dynamics of microcrustacean species occurring in Mine Valley Billabong

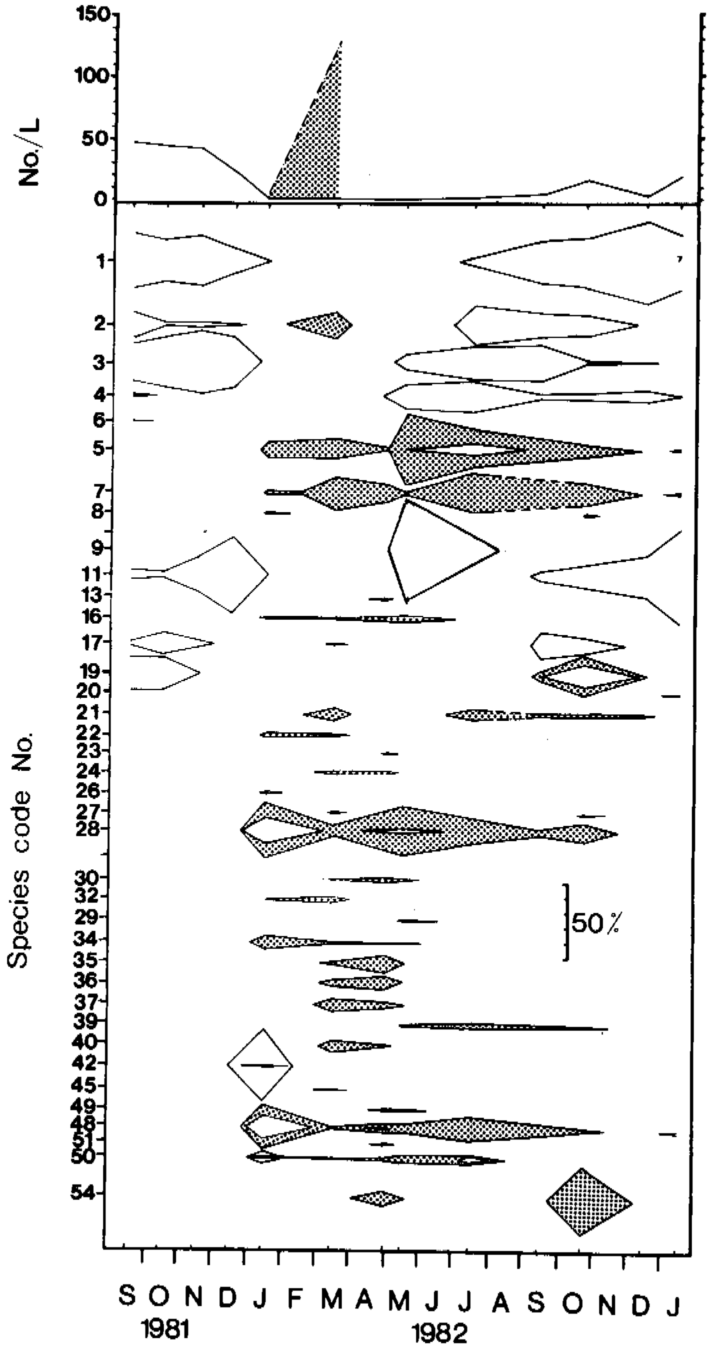

Figure 6. Seasonal population dynamics of microcrustacean species occurring in Jabiluka Billabong

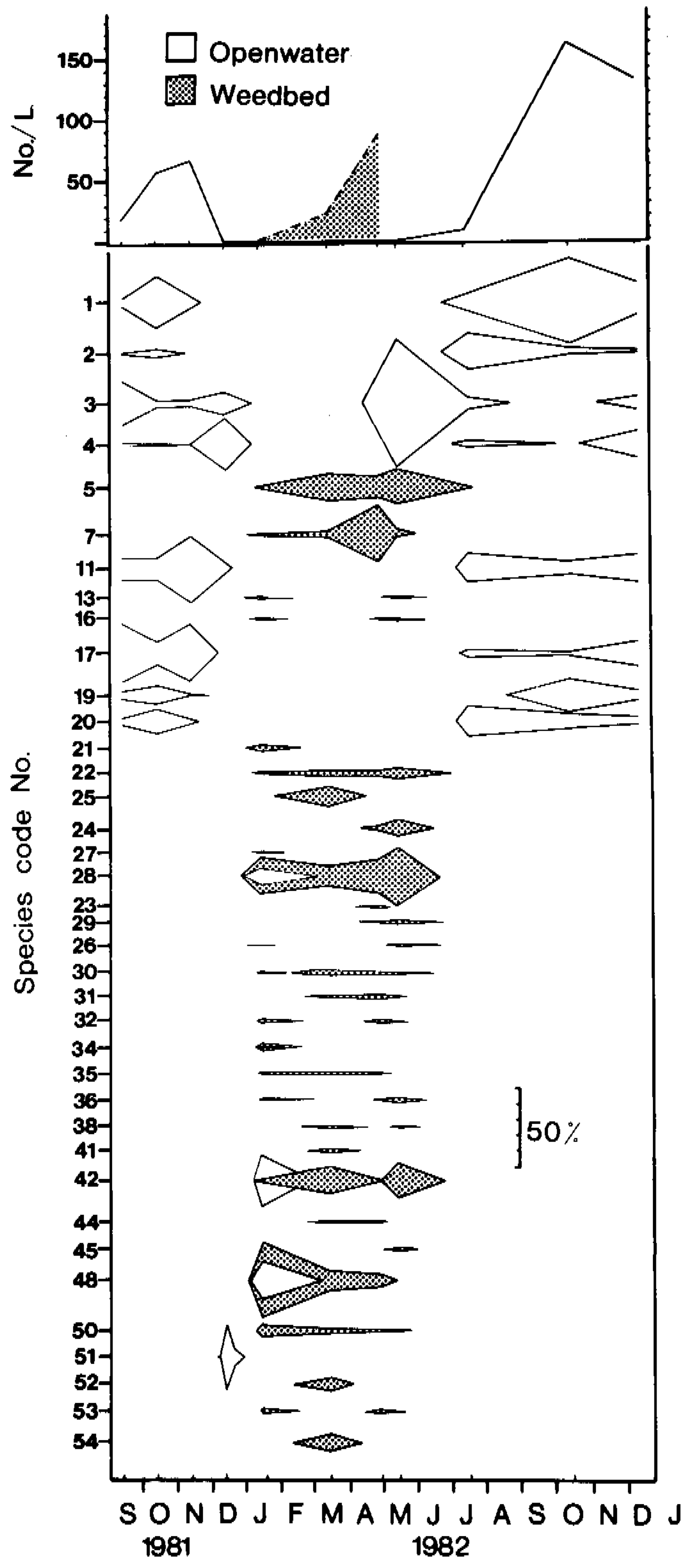

Figure 7. Seasonal population dynamics of microcrustacean species occurring in Leichhardt Billabong

APPENDIX A: GUIDE TO MICROCRUSTACEAN SPECIES (CLADOCERA AND COPEPODA) OCCURRING IN THE MAGELA CREEK FLOOD PLAIN

Keys and illustrations are provided for most of the cladoceran and copepod species recorded in this report.

The keys are modified from Smirnov & Timms (1983) and Mamaril & Fernando (1978) (for Cladocera); Morton (1977) (for Cyclopoidae); and Bayly et al. (1967) and Williams (1980) (for Calanoida). Other useful taxonomic references include Smirnov (1971), Korovchinsky (1981), and Bayly (1961, 1962, 1964, 1966, 1979).

Details of cladoceran morphology and terminology are as given by Smirnov & Timms (1983), while copepod morpology and terminology follow Morton (1977). Unless otherwise stated keys and illustrations are of female specimens.

GUIDE TO THE CLADOCERA

Key to families of CLADOCERA so far found in the Magela Creek flood plain

1. Six pairs of thoracic limbs, all similar; (in the genera so far found in Magela Creek, one branch of antenna 2-segmented, the other 3-segmented)..........................SIDIDAE Baird, 1850
   Five or six pairs of thoracic limbs, dissimilar.................2

2(1). Antennule fused with rostrum................BOSMINIDAE Sars, 1865
   Antennule not fused with rostrum.................................3

3(2). Both branches of antenna 3-segmented.....CHYDORIDAE Stebbing, 1902
   One branch of antenna 3-segmented, the other 4-segmented.........4

4(3). Antennule immovable and short (in females).......................
   ....DAPHNIIDAE Straus, 1820
   Antennule movable, mostly long..................................5

5(4). Antennule on anterior side of head...............................
   ....................................MACROTHRICIDAE Baird, 1843
   Antennule on posterior side of head.........MOINIDAE Goulden, 1968

Key to genera of SIDIDAE so far found in the Magela Creek flood plain

1. Body and head elongated, narrow; long setulated setae present only along ventral margin of valve.....*Diaphanosoma* Fischer, 1850
   Body and head massive; long setulated setae along whole edge of valve...2

2(1). Antennule bearing sensory papillae and setae distally.............
   ....*Latonopsis* Sars, 1888
   Antennule bearing sensory papillae laterally and sensory setae distally..............................*Pseudosida* Herrick, 1884

Genus *Pseudosida* Herrick, 1884
***Pseudosida bidentata* Herrick, 1884**
Fig. A1

3 claws on postabdomen, the first small, the second and third larger in size and subequal in length. Anal teeth of postabdomen arranged in 11 groups with 2-4 teeth per group. Sensory papilac laterally positioned.

Key to the species of **Diaphanosoma** *so far found in the Magela Creek flood plain*

(A key to all the known Australian species of *Diaphanosoma* is given by Korovchinsky 1981.)

1. Eight setae on distal segment of biarticulate branch of antenna. Postabdomen without anal denticles. Valve has a ventral inflexion forming a broad free flap, which tapers distally joining its ventral margin almost at right angles. Less than 17 denticles on lower part of posterior margin of valve, followed by a row of setules of diminishing size ....*D. excisum* Sars, 1885 (Fig. A1A,B)
   Eight setae on distal segment of biarticulate branch of antenna. Postabdomen without anal denticles. Free flap of valve extending beyond its junction with the ventral margin. 18-22 denticles on lower part of posterior margin of valve..*D. sarsi* Richard, 1894

Key to species of **Latonopsis** *so far found in the Magela Creek flood plain*

1. Anal teeth of postabdomen conical and arranged singly............2
   12-14 anal teeth in groups of 2-3. 3 subequal terminal claws ....*L. fasciculata* Daday (Fig. A2A-F)

2. Biarticulate branch of antenna with < 12 setae; claw with two basal spines................*L. australis* Sars, 1888 (Fig. A2A-C)
   Biarticulate branch of antenna with > 20 setae; claw with three basal spines..........................*L. brehmi* Petkovski, 1973[1]

[1]one specimen found in this study

Key to the genera of BOSMINIDAE Sars 1865

1. Antennules fused at their bases; postabdomen tapers distally...... ....*Bosminopsis* Richard, 1895
   Antennules not fused at their bases; distal end of postabdomen truncated...................................*Bosmina* Baird, 1845

Genus *Bosminopsis* Richard, 1895
One species known from Australia:

***Bosminopsis deitersi*: Richard, 1895**
Fig. A3-C

Genus *Bosmina* Baird, 1945
***Bosmina meridionalis* Sar, 1904**

This species is described fully by Smirnov & Timms (1983). It was recorded by Morley (1981) and an unconfirmed identification was made in this study.

Key to genera of CHYDORIDAE Stebbing, 1902 so far found in the Magela Creek flood plain

Keys to many of the species of the genera of Chydoridae mentioned in the following sections are given by Smirnov & Timms (1983).

1. Expodites of limbs III and IV with 7 setae. Major and minor head pores on longitudinal axis of head shield; major head pores separate, or only single major head, or rarely none......2
   Expodites of limb IV with 6 setae. Major head pores on longitudinal axis of head shield and connected, separate or single; minor head pores laterally positioned..........................6

2(1). Setae on posterior half of ventral margin of valve on its edge.... ....*Alonella* Sars, 1862
   Setae on posterior half of ventral margin of valve inserted on its inner surface..3

3(2). Head shield with two major head pores...........................4
   Head shield with one major hear pore or none....................5

4(3). Body spherical in outline. Postabdomen not oval; anal opening on its functionally ventral side............................... ....*Chydorus Leach*, 1816; *Ephemeroporus* Frey, 1982
   Oval in outline. Postabdomen oval; anal opening on its functionally posterior side........................*Dunhevedia* King, 1853

5(3). Head shield without head pores, ventral margin of valve with a serrated infolded lobe anteriorly, claw with two basal spines.... ....*Australochydorus* Smirnov & Timms, 1983
   Head shield with one major head pore. Eye and ocellus very large ....*Dadaya* Sars, 1901

6(1). Head shield with three major head pores.........................7
   Head shield with one or two major head pores...................11

7(6). Lateral setae of postabdomen very large, anal teeth of postabdomen very small.......................*Leydigia* Kurz, 1875
   Lateral setae of postabdomen not very large.....................8

8(7). Anterior margin of head shield broadly rounded in lateral view; ventral margin of valve straight.........*Graptoleberis* Sars, 1862
   Anterior margin of head shield not broadly rounded in lateral view..9

9(8). Postabdomen long and narrow....................................10
   Postabdomen not long and narrow.................*Alona* Baird, 1843

10(9). Rostrum elongated..............*Kurzia* Dybowski & Grochowski, 1894
   Rostrum not elongated....................*Camptocercus* Baird, 1843

11(6). Head shield with one major head pore...........................12
   Head shield with two major head pores...........................13

12(11). Body considerably longer than high............*Euryalona* Sars, 1901
Body only slightly longer than high....................*Indialona*

13(11). Major head pores linked by a narrow connection...................
.....................................*Biapertura* Smirnov, 1977
Major head pores separate....*Oxyurella* Dybowski & Grochowski, 1894

Genus *Alonella* Sars, 1862

Posterior margin of body high in comparison with body height. Head pores located near posterior margin of head shield. All setae of ventral border of valve originate from its edge.

***Alonella clathratula* Sars, 1896**
Fig. A6A

Polygons of valve reticulation with fine longitudinal striations. Some doubt exists to the validity of the species separation of *A. excisa* and *A. clathratula* (B.V. Timms, pers. comm.), and they are therefore not differentiated in this report.

Genus *Chydorus* Leach, 1816

Expodites of limbs III and IV with 7 setae. Setae on posterior half of ventral margin of valve inserted on its inner surface. Body spherical in outline. Postabdomen not oval.

***Chydorus eurynotus* Sars, 1901**
Fig. A7F-H

Labrum blunt with no serrations (indentations) on anterior side.

Chydorus* sp. near *flaviformis
Fig. A7D,E

Pronounced reticulation which rises above the valve surface. The taxonomic status of this species is not clear, and it is possible that a number of species are included (B.V. Timms, pers. comm.).

Genus *Ephemeroporus* Frey, 1982
***Ephemeroporus* (form. *Chydorus*) *barroisi* (Richard, 1894)**
Fig. A7A-C

The ventro-posterior corner of the valve usually has a denticle. The labrum has serrations. Postabdomen is not oval, with 2-4 anal teeth near the anal perture being especially long.

Genus *Dunhevedia* King, 1853
***Dunhevedia crassa* King, 1853**
Fig. A6E-G

Postabdomen oval in outline, with the anal aperture on its functionally posterior side. A denticle is present below the ventro-posterior corner of the valve, and the labrum does not have serrations.

Genus *Australochydorus* Smirnov & Timms, 1983
***Australochydorus aporus* Smirnov & Timms, 1983**
Fig. A8

The ventral margin of the valve has a serrated infolded lobe anteriorly. The ventro-posterior corner of the valve is widely rounded, without denticles. The claw has two long basal spines.

Genus *Dadaya* Sars, 1901
***Dadaya macrops* (Daday, 1898)**
Fig. A6C,D

Eye and ocellus very large. The antennule protrudes well beyond the tip of the rostrum.

Genus *Leydigia* Kurz, 1875

As this genus lives in the surface layer of mud (Smirnov & Timms 1983) and as this habitat was not intensively sampled, it is possible that species additional to the one described below exist in the study area. *L. leydigi* was recorded by Morley (1983), though it was not possible to confirm this identification.

***Leydigia acanthocercoides* (Fisher, 1854)**
Fig. A16

Claw without a basal spine. Postabdomen widest distally. The eye is slightly smaller than the ocellus. Most of the groups of lateral setae appear to be composed of two setae, though some have three. This raises some difficulties in positive identification when the key in Smirnov & Timms (1983) is used. Identification of this species should therefore be considered tentative, until further work on this genus is carried out.

Genus *Graptoleberis* Sars, 1862
***Graptoleberis testudinaria* (Fischer, 1851)**
Fig. A17A-C

Postabdomen narrows distally. Claw with one basal spine.

Genus *Alona* Baird, 1843

This genus at present consists of species having three major head pores (Smirnov & Timms 1983). Several species found in this study require further taxonomic investigation to confirm their identity, (i.e. *Alona* sp. near *costata* and *Alona* sp. near *cambouei*). It is quite possible that additional species of *Alona* to the ones described below exist in the study area.

***Alona* sp. near *costata* Sars, 1862**
Fig. A9

This species is externally very similar to *A. costata*.

***Alona* sp. near *cambouei* Guerne & Richard, 1893**
Fig. A10

This species is similar to *A. cambouei*, but the valve is not marked with distinctly granulated polygons.

Alona monacantha
Fig. A11

Denticles present in the ventro-posterior corner of the valve. Labrum has serrations. Basal spine nearly half as long as claw.

***Alona davidi* Richard, 1895**
Fig. A12

The rostrum is blunt. The body is comparatively high with both dorsal and ventral sides convex. Three main head pores connected.

Genus *Kurzia* Dybowski & Grochowski, 1894
***Kurzia longirostris* (Daday, 1898)**
Fig. A18A

Antennule reaches to middle of rostrum. Distal angle of postabdomen protruding.

Genus *Camptocercus* Baird, 1843
***Camptocercus australis* Sars, 1896**
Fig. A18B

Body and postabdomen elongated. Ventro-posterior corner of valve without denticles.

Genus *Euryalona* Sars, 1901
***Euryalona orientalis* (Daday, 1898)**
Fig. A19B

Distal end of postabdomen with a rounded process separated by an incision from the base of the claws. Single main head pore. An indentation is usually present in the ventral margin (anterior to the centre) of the valve.

Genus *Indialona*
***Indialona globulosa* (Daday, 1898)**
Fig. A17D,E

Anterior margin of labrum usually with serrations. Inner margin of posterior margin of valve with a row of spinules. Anal denticles very small.

Genus *Biapertura* Smirnov, 1977

This genus is composed of those species of Aloninae possessing two narrowly connected major head pores. The status of this genus is uncertain (see Smirnov & Timms 1983, p. 56).

***Biapertura macrocopa* (Sars, 1895)**
Fig. A13A,B

Labrum with notches (serrations). Spine on the proximal joint of the antennal branches (exopodite), exceeding the length of the second joint. The second joint also has a long spine which far exceeds the length of the terminal joint. Ventro-posterior corner of the valve without denticles.

***Biapertura karua* (King, 1853)**
Fig. A13C,D

The postabdomen is rounded, with small anal teeth. Denticles are present on the ventroposterior corner of the valve (the number sometimes varying).

***Biapertura rigidicaudis* Smirnov, 1971**
Fig. A14A,B

Length of preanal margin of the postabdomen equals the distance from the preanal angle to the base of the claw.

Biapertura verrucosa
Fig. A14C-F

The labrum has a denticle on its anterior margin. Claw and basal spine with setae on their concave margins. Two main pores connected by a narrow margin, with conspicuous lateral pores.

Biapertura kendallensis **(Henry, 1919)**
Fig. 15A-C

The anal teeth of the postabdomen are large and have setulations along their functionally posterior side. The size of the setulations appears to vary, so care has to be taken when determining this feature. Contrary to the species description given by Smirnov & Timms (1983) there are usually spinules present on the border of the first and second joints of the distal swimming setae of the antennae.

Genus *Oxyurella* Dybowski & Grochowski, 1894
Oxyurella singalensis **(Daday, 1898)**
Fig. A19A

Claw with one large basal spine and a few small spines proximally. Anal teeth large and gradually increasing in size distally.

Key to the genera of MOINIDAE *Goulden, 1968 so far found in the Magela Creek flood plain*

1. Distal segment of four-segmented branch of antenna with four setae; ocellus present ....*Moinodaphnia* Herrick, 1887
   Distal segment of four-segmented branch of antenna with three setae; ocellus absent..........................*Moina* Baird, 1850

Key to species of Moina *Baird, 1850 so far found in the Magela Creek flood plain*

1. Antennule less than ten times as long as wide. One seta present on the anterior side of the penultimate segment of thoracic limb I. Ventral edge of the valve evenly arched. Ephippium with one egg..........................*M. micrura* Kurz, 1874 (Fig. A5A-B)
   As above, except ephippium with two eggs..........................
   ....*M. australiensis* Sars, 1986[1]

[1]Recorded in a study by Morley (1981).

Genus *Moinodaphnia*, Herrick, 1887

One species is described from this genus, being *Moinodaphnia macleayi* (King, 1853), (Fig. A5C,D).

Key to genera of MACROTHRICIDAE Baird, 1843 so far found in the Magela Creek flood plain

1. Antennule one-segmented; dorsal side of postabdomen straight or convex...2
   Antennule two segmented; dorsal side of postabdomen widely convex....................................*Ilyocryptus* Sars, 1862

2(1). Intestine convoluted; postabdomen clawed..........................
....*Strebloceru*s Sars, 1862
Intestine not convoluted; postabdomen clawed....................3

3. Antennule dilated distally, claw lacks a basal spine..............
....*Macrothrix* Baird, 1843
Antennule not dilated distally, claw lacks a basal spine..........
....*Echinisca* Lievin, 1848

Key to species of **Ilyocryptus** *Sars, 1862 so far found in the Magela Creek flood plain*

1. Antennule fairly short, its length less than 8 times its width; lateral setae of postabdomen long...............................
..................................*I. sordidus* (Liévin, 1848)[1]
Antennule thin, its length 8-10 times its width; lateral setae of postabdomen long, though not more than 8 in number (usually 3 or 5..........................*I. spinifer* Herrick, 1882. Fig. A20A

[1]Identified in a study by Morley (1981).

Genus *Strebloceru*s Sars, 1862
***Strebloceru*s *serricaudatus* (Fischer, 1849)**
Fig. A21

Antennules bent with several short, thick bristles. Preanal edge of postabdomen has a serrated appearance. Distal segment of the setae natatoriae long.

Key to species of **Macrothrix** *Baird, 1843 so far found in the Magela Creek flood plain*

1. Dorsal edge of head and valves finely serrated in places..........
..............................*M. spinosa* King, 1853 (Fig A22B-D)
Dorsal edge of head and valves not serrated.....................2

2(1). Head and valves with short closely spaced hairs..................
..................................*M. hystrix* Gurney, 1977[1]
Head and valve glabrous; Distal segment of setae natatoriae short, its length being several times than that of proximal joint..............................*M. breviseta* Smirnov, 1976[2]

[1]Several subspecies of *M. hystrix* may exist (B.V. Timms pers. comm.).
[2]Identified in a study by Morley (1981).

Key to species of **Echinisca** *Liévin, 1848 so far found in the Magela Creek flood plain*

1. Second and third segments of four-segmented branch of antenna with no groups of large spines; teeth of preanal edge of postabdomen, if present, ungrouped; lateral view of dorsal side of head shield smoothly convex; blunt unserrated prominence on ventral side of head.....................*E. capensis* Sars, 1916[1]
As above, but no unserrated prominence on ventral side of head...2

2. Distal segment of setae natatoriae very short; carapace slightly keeled; largest seta of antenna with short spines.......................................*E. triserialis* (Brady, 1886) (Fig. A22A)
Distal segment of setae natatoriae very short; carapace not keeled; largest seta of antenna with short spines.................................*E. williamsi* Smirnov & Timms, 1983 (Fig. A22B)

[1]*E. capensis* (or a very similar species) has been found in the Kakadu area (B.V. Timms pers. comm.).

Key to genera of DAPHNIIDAE *Straus 1850 so far found in the Magela Creek flood plain*

1. Ventral side of valve convex.....................................2
Ventral side of valve straight........*Scapholeberis* Schoedler 1858

2(1). Ventral side of head with a small rostrum...*Simocephalus* Schoedler 1858
Ventral side of head without a rostrum......*Ceriodaphnia* Dana 1852

Genus *Scapholeberis* Schoedler 1858
***Scapholeberis kingi* Sars 1903**
Fig. A3A

The straight ventral side of the valve and the mucro in the ventro-posterior corner of the valve are diagnostic for this genus. Rostrum trilobate, postabdomen with 4-6 spines.

Key to species of Ceriodaphnia *Dana, 1853 so far found on the Magela Creek flood plain*

1. Head with an acute beak on the ventral side...*C. cornuta* Sars, 1885 (Fig. A3B)
Head without a beak..2

2. Central region of postabdomen the widest; frontal and lower margin of head without denticles......*C. laticaudata* P.E. Mueller, 1867[1]
Postabdomen not widest centrally; very small denticles on proximal half of concave side of claw.....*C. dubia* Richard, 1894[2]

[1]Recorded from Magela Creek area by B.V. Timms (unpub. data).
[2]Recorded from Magela Creek flood plain by Morley (1981).

Key to species of Simocephalus *Schoedler, 1858 so far found in the Magela Creek flood plain*

1. Postabdominal claw with an outward basal pecten of enlarged spines (visible at moderate magnification)............................4
Spines on outward basal pecten of postabdominal claw not enlarged (not visible under moderate magnification).....................2

2. Rostrum developed into a prominent 'nose' (Fig. A4B); anal spines 6 or less in number, the most proximal spines small (Fig. A4C).........................*S. longirostris* Stingelin, 1906 (Fig. A4A-C)
Rostrum short; 7 or more anal spines..........................3

3. Ocellus elongated, its length equal to or greater than the diameter of the eye..............*S. vetulus* (O.F. Muller, 1776)[1]
Ocellus oval or rhomboidal; head with setules present anteriorly ....*S. serrulatus* (Koch) (Fig. A4D)

4. Anterior tip of head produced into a sharp point; valve with a strong posterior prominence situated above the longitudinal body axis...........................*S. acutirostratus* (King, 1853)[2]

[1]Possibly present in Magela Creek (B.V. Timms, pers. comm.).
[2]Recorded from Magela Creek by Morley (1981).

GUIDE TO THE COPEPODA

Key to orders of COPEDODA

1. Body with wide metasome and narrow urosome portions..............2
Metasome and urosome not markedly different in width, antennules very short.. ....Harpacticoida (not dealt with further in this report)

2(1). Antennules reaching well beyond end of metasome; antennae biramous; egg sac single...............................CALANOIDA
Antennules not reaching beyond metasome; antennae uniramous; egg sacs paired.......................................CYCLOPOIDA

Key to genera of CALANOIDA so far found in the Magela Creek flood plain

1. Males: right antennule 22-segmented; hinged between segments 18 and 19...2
Females: fifth leg biramous; urosome 3-segmented...............3

2(1). Endopodite of first leg 1-segmented; endopodite of second to fourth legs 2-segmented...............................*Calamoecia*
Endopodite of first leg 2-segmented; endopodite of second to fourth legs 3-segmented...............................*Diaptomus*

3(1). Exopodite of fifth leg essentially 2-segmented; endopodite of fifth leg without setae on the inner edge..............*Diaptomus*
Exopodite of fifth leg 3-segmented, endopodite of fifth leg with setae on inner edge; endopodite of first leg 1-segmented........ ....*Calamoecia*

Genus *Diaptomus*
Fig. A23

Two species of *Diaptomus* were recorded in this study, *Diaptomus lumholtzi* Sars (Fig. A23A-D) and *D. australis* (Kiefer) (Fig. A23E-F) found in open water and weedbed habitats respectively. They are the only species of *Diaptomus* known to occur in Australia.

Genus *Calamoecia*
Fig. 31

Calamoecia ultima (Brehm) (Fig. A24) were recorded in this study usually from open water areas, occasionally from weedbed habitats.

Key to genera of CYCLOPOIDAE *so far found on the Magela Creek flood plain*

1. First to fourth legs (P1-4) with both rami 2-segmented, P5 1-segmented.................................*Microcyclops* Claus
P1-4 with both rami 3-segmented. Antenna (A2) 4-segmented.......2

2(1). P5 completely reduced and represented only by 3 setae arising from first urosomal somite....................*Ectocyclops* Brady[1]
P5 1- or 2-segmented...3

3(2). P5 1-segmented, outer spines of the expodite of leg 4 (P4Re), small in comparison with corresponding spines of P1-3...*Tropocyclops* Kiefer[2]
P5 2-segmented with its distal segment bearing 2 subequal elements....................................*Mesocyclops* Sars

[1]*Ectocyclops medius* was recorded by Morley (1981).
[2]*Tropocyclops alincius* was recorded by Morley (1981).

Key to species of Mesocyclops *so far found on the Magela Creek flood plain*

Considerable changes to the genus *Mesocyclops* (both to the species included in the genus, and to the nomenclature of some species) are envisaged in the near future (D.W. Morton, pers. comm.). It is recommended that researchers make themselves aware of these changes.

1. Adaxial lobe of basis of first leg (P1) bearing a seta (Fig. A25F)..2
Adaxial lobe of basis of P1 without seta..........................4

2. Inner terminal spine of third endopodite segment of fourth leg (P4Ri3) about twice as long as outer terminal spine (Fig. A26B); intercoxal plate of P4 with two rounded, toothed prominences (Fig. A26B)..3
Terminal spines of P4Ri3 subequal in length; intercoxal plate of P4 with two elongated, pointed prominences...*M.* sp. nov[1] (Fig. A25F,G)

3. Innermost terminal setae of caudal rami (CR) less than three times length of CR.............*M. decipiens* Kiefer (Fig. A26A-C)
Innermost terminal setae of CR of more than 3.4 times length of CR..................................*M. hyalinus* (Rehberg)[2]

4. CR with hairs along inner edges; penultimate segment of A2 bearing 8 setae.......................*M. aspericornis* Daday 1901
CR with inner edges bare; penultimate segment of A2 bearing 7 setae......................*M. leuckarti* (Claus) (Fig. A25A-E)

[1]Two distinct species may exist in this separation (D.W. Morton, pers. comm.); see introductory note above.
[2]*M. hyalinus* was recorded in a study by Morley (1981).

Key to the species of Microcyclops *so far found in the Magela Creek flood plain*

1. P2Re2 and P3Re2 with 4 spines; terminal armature of P4Ri2 with an outer spine and inner setae; P5 wider than long..*M. dengizicus* (Lepeschkin)[1]
   P2Re2 and P3Re2 with 4 spines; terminal armature of P4Ri2 consisting of 2 spines; P5 longer than wide, usually bearing a tiny spinule; setae of P4Ri2 not reaching past end of inner apical spine..............*M. varicans* (Sars) (Fig. A26D-G)

[1]*M. dengizicus* was recorded by Morley (1981).

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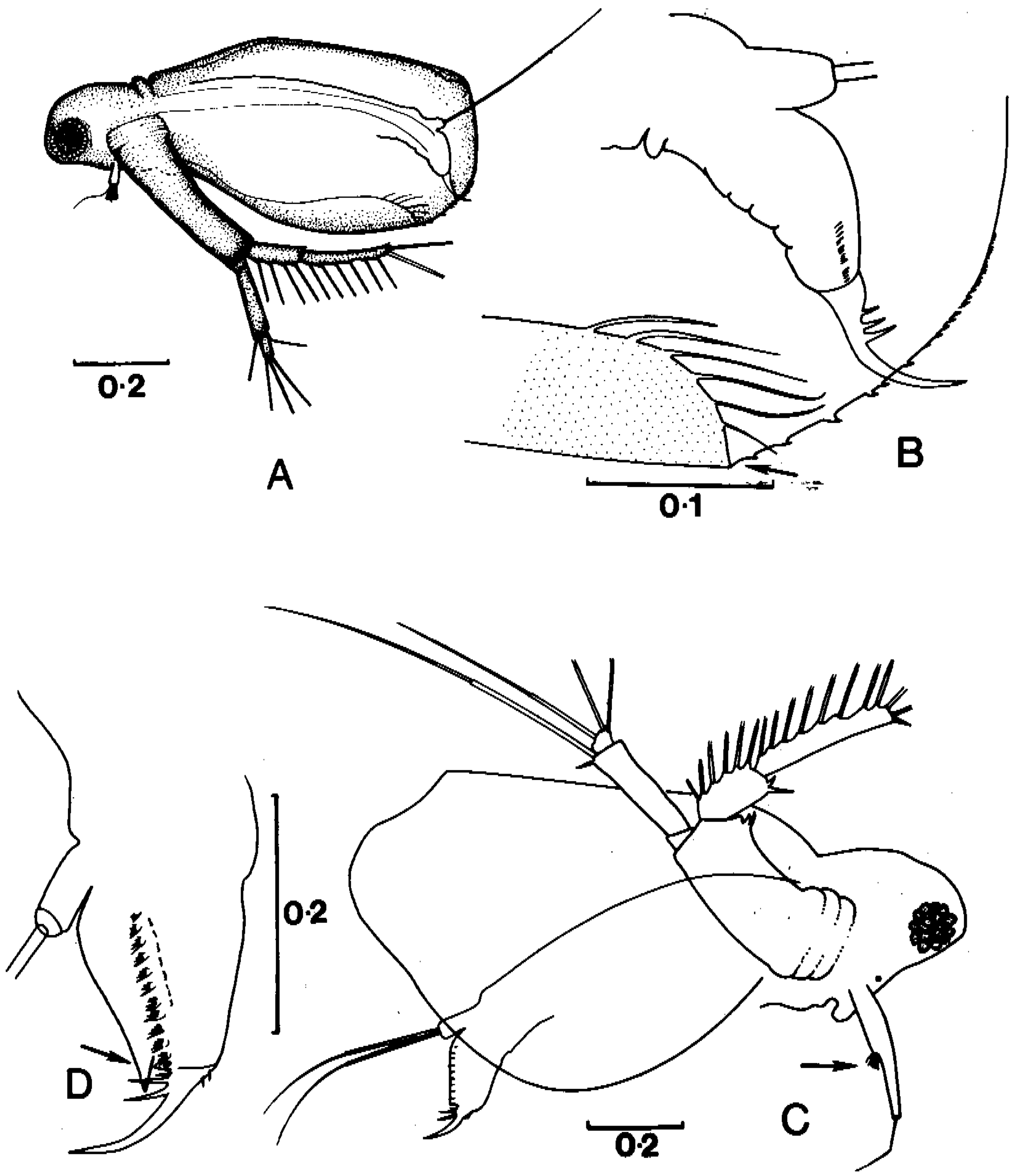

Figure A1. SIDIDAE: A, Diaphanosoma excisum, *whole animal; B, detail of postabdomen, free flap and denticles on ventro-posterior margin of valve; C.* Pseudosida bidentata, *whole animal, setae on ventral margin of valve not shown; D, postabdomen. All measurements in mm.*

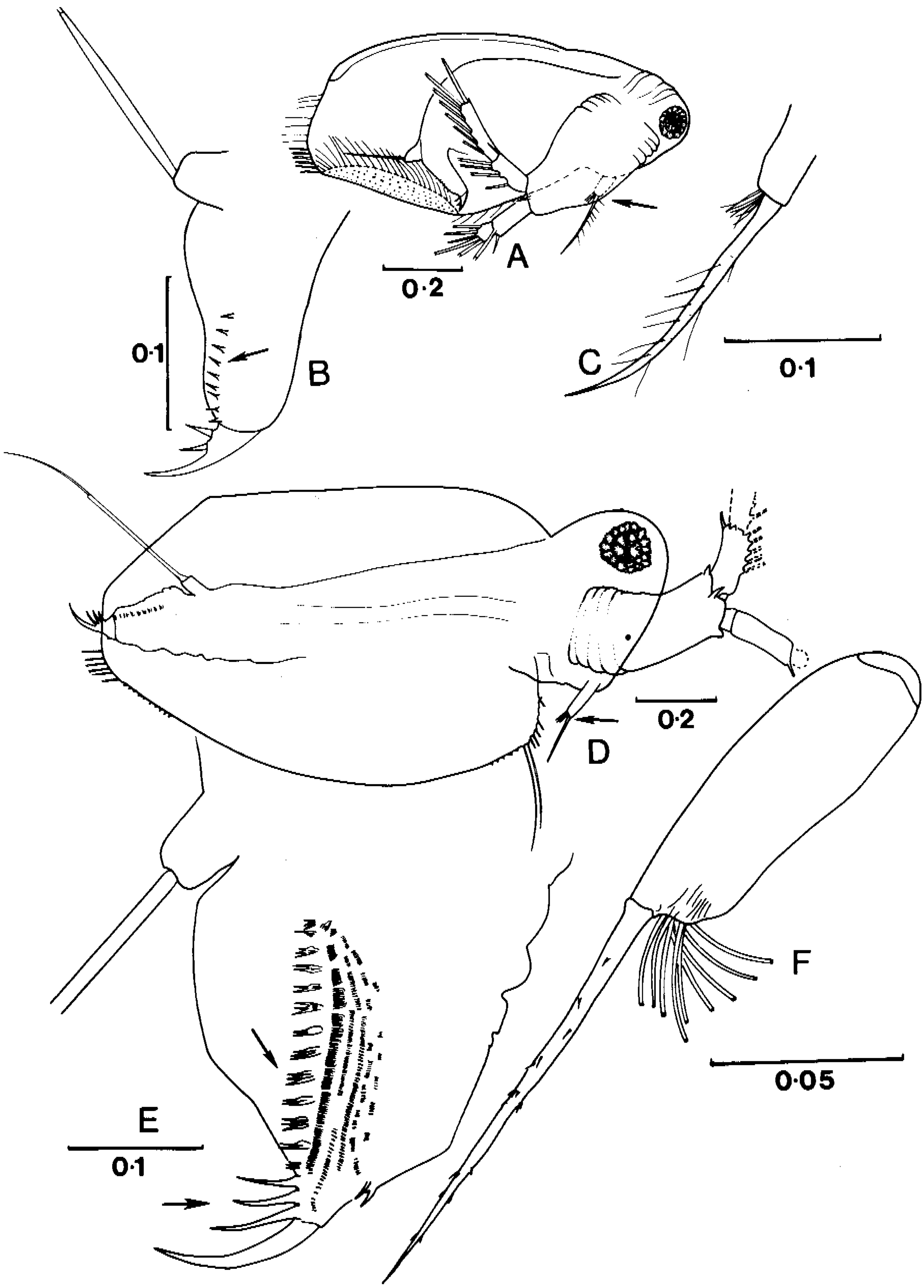

Figure A2. *SIDIDAE:* *A,* Latonopsis australis, *whole animal;* *B, postabdomen;* *C, antennule;* *D,* Latonopsis fasciculata, *incomplete specimen;* *E, postabdomen;* *F, antennule. All measurements in mm.*

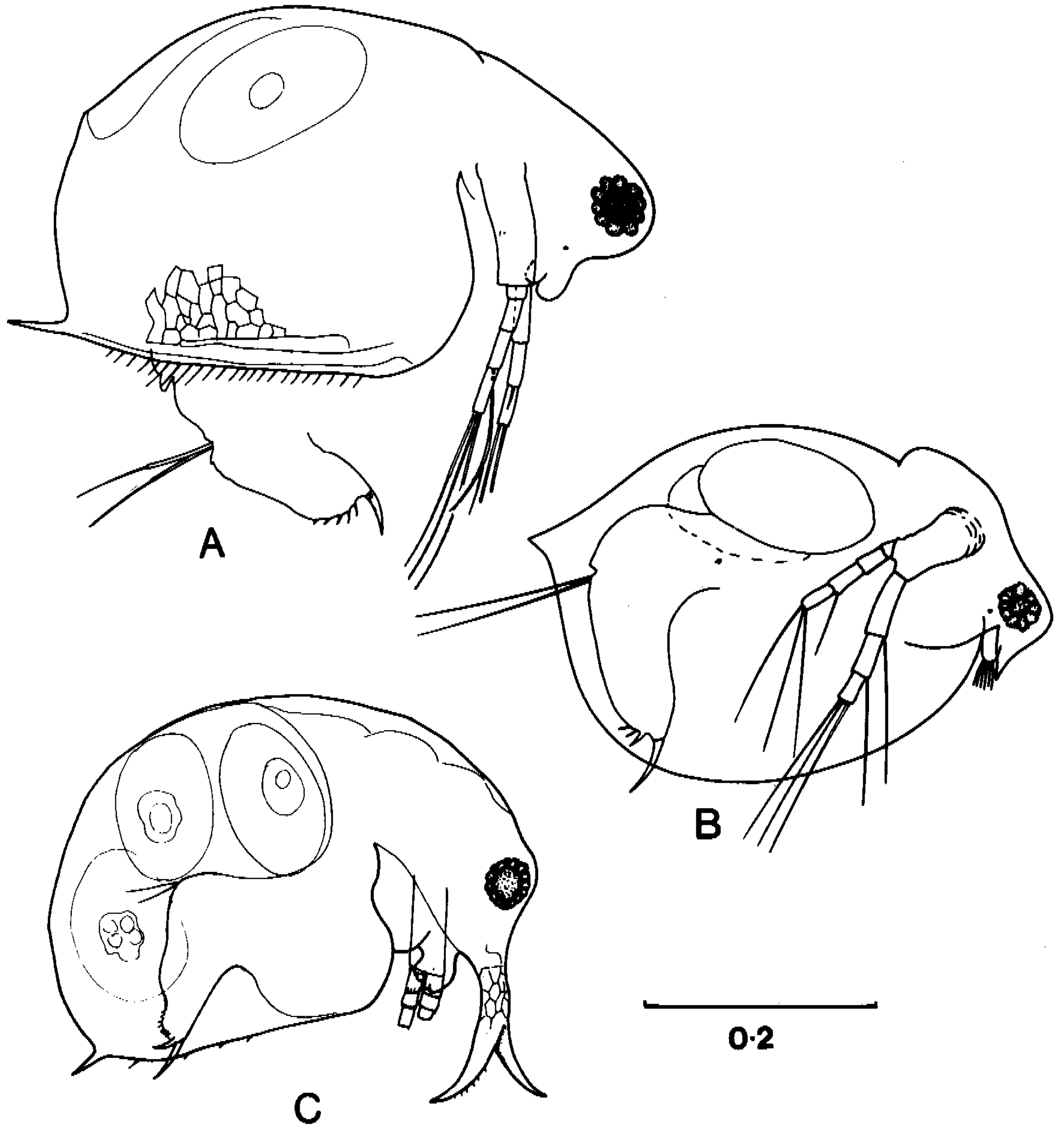

Figure A3. *DAPHNIIDAE:* *A*, Scapholeberis kingi; *B*, Ceriodaphnia cornuta. *BOSMINIDAE:* *C*, Bosminopsis deitersi. *All measurements in mm.*

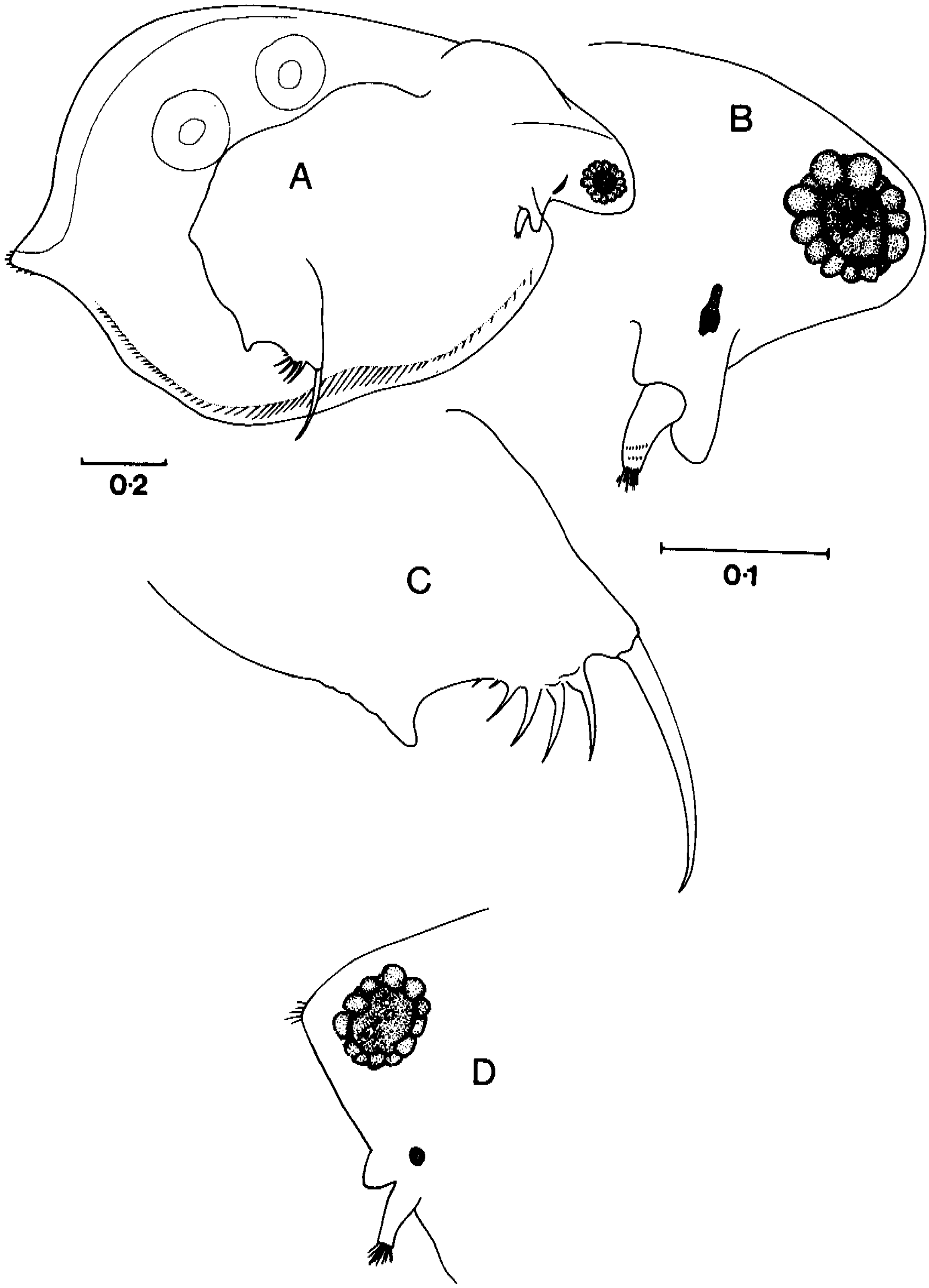

Figure A4. DAPHNIIDAE: A, Simocephalus latirostris, *whole animal (antennae not shown); B, detail of head (note antennule structure); C, postabdomen; D,* Simocephalus serrulatus, *detail of head (note antennule structure). All measurements in mm.*

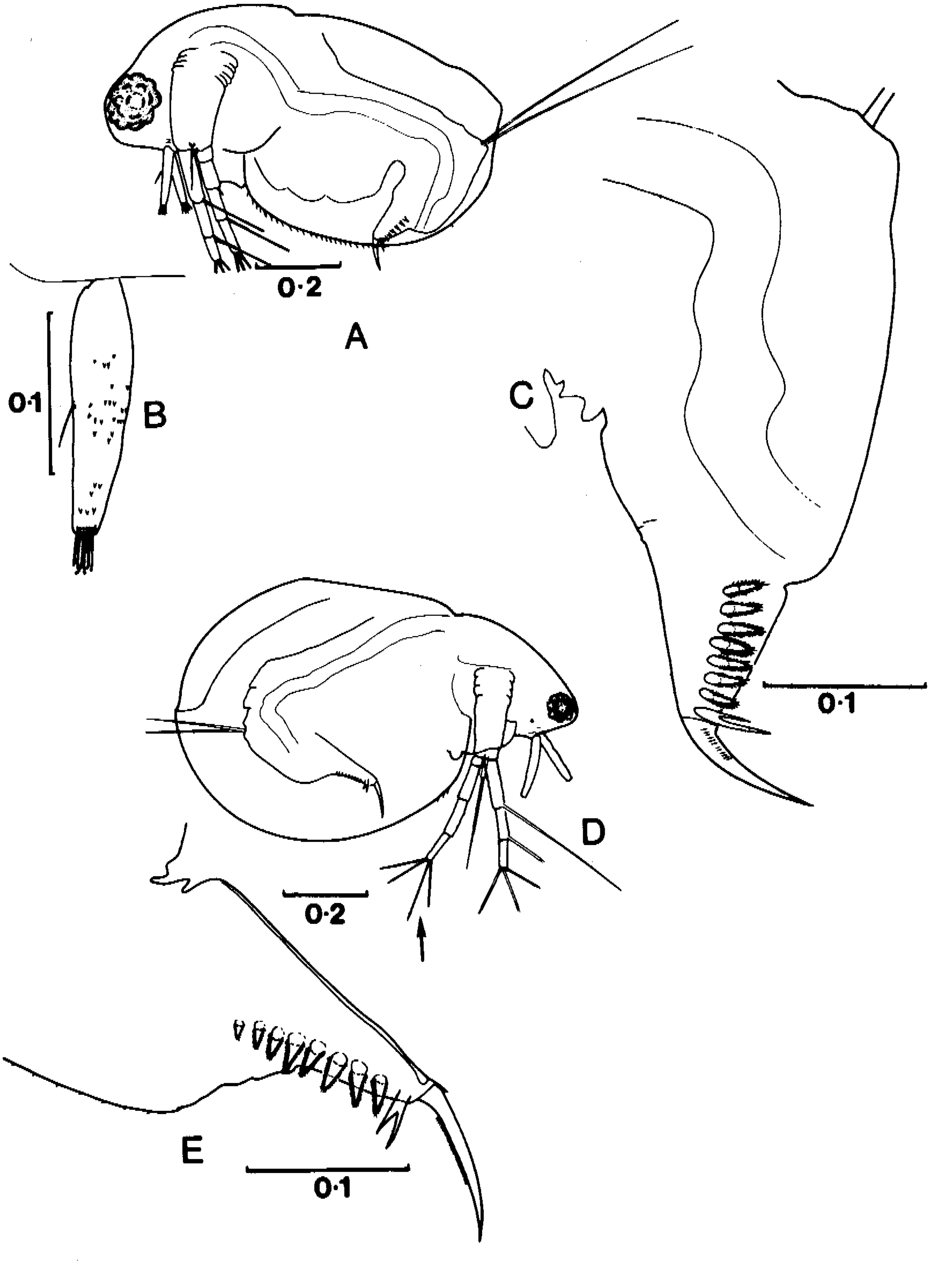

Figure A5. MOINIDAE: A, Moina micrura, *whole animal; B, antennule; C, postabdomen; D,* Moinodaphnia macleayi, *whole animal; E, postabdomen. All measurements in mm.*

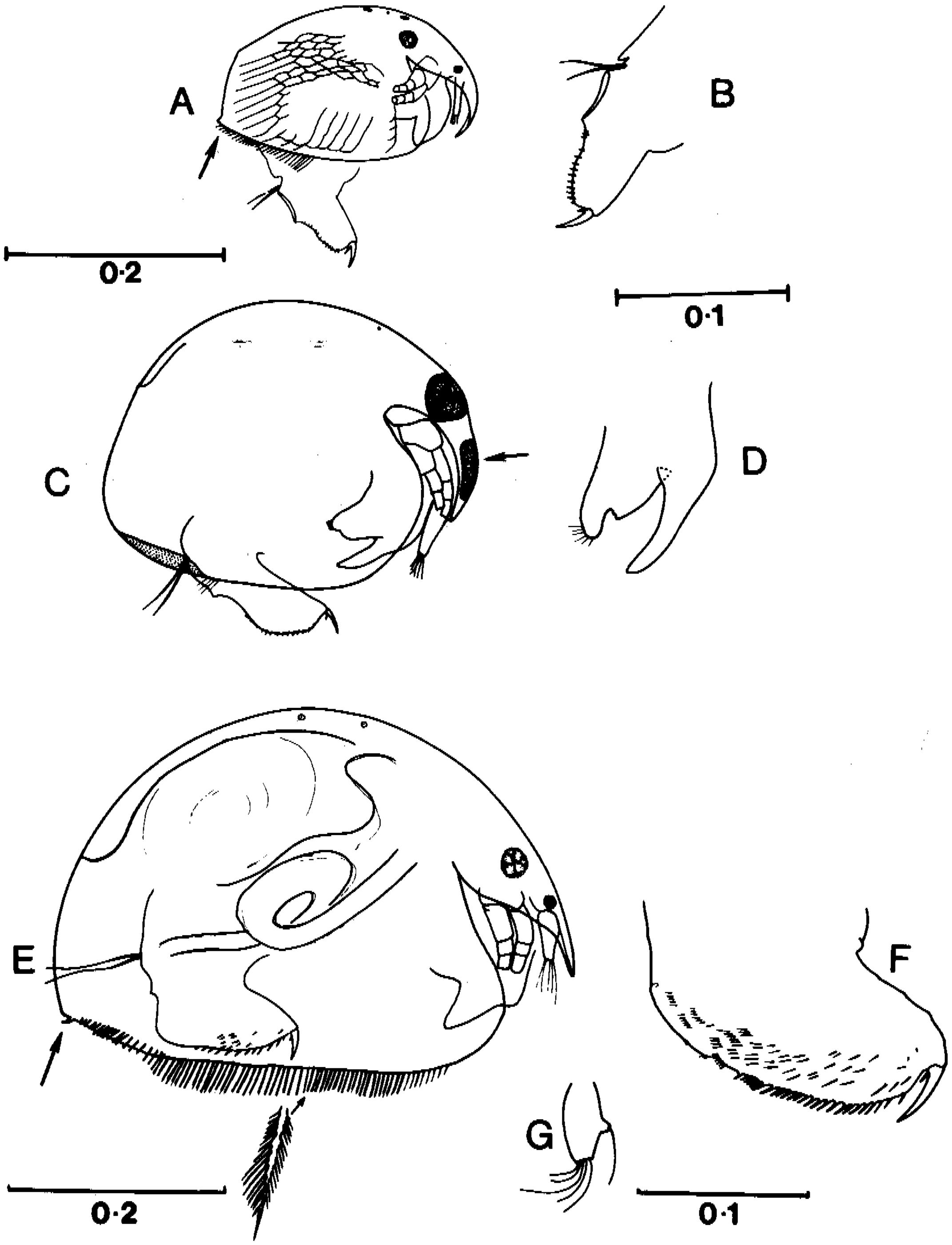

Figure A6. CHYDORIDAE: A, Alonella clathratula, *whole animal; B, postabdomen; C,* Dadaya macrops, *whole animal; D, labrum; E,* Dunhevedia crassa, *whole animal; F, postabdomen; G, antennule. All measurements in mm.*

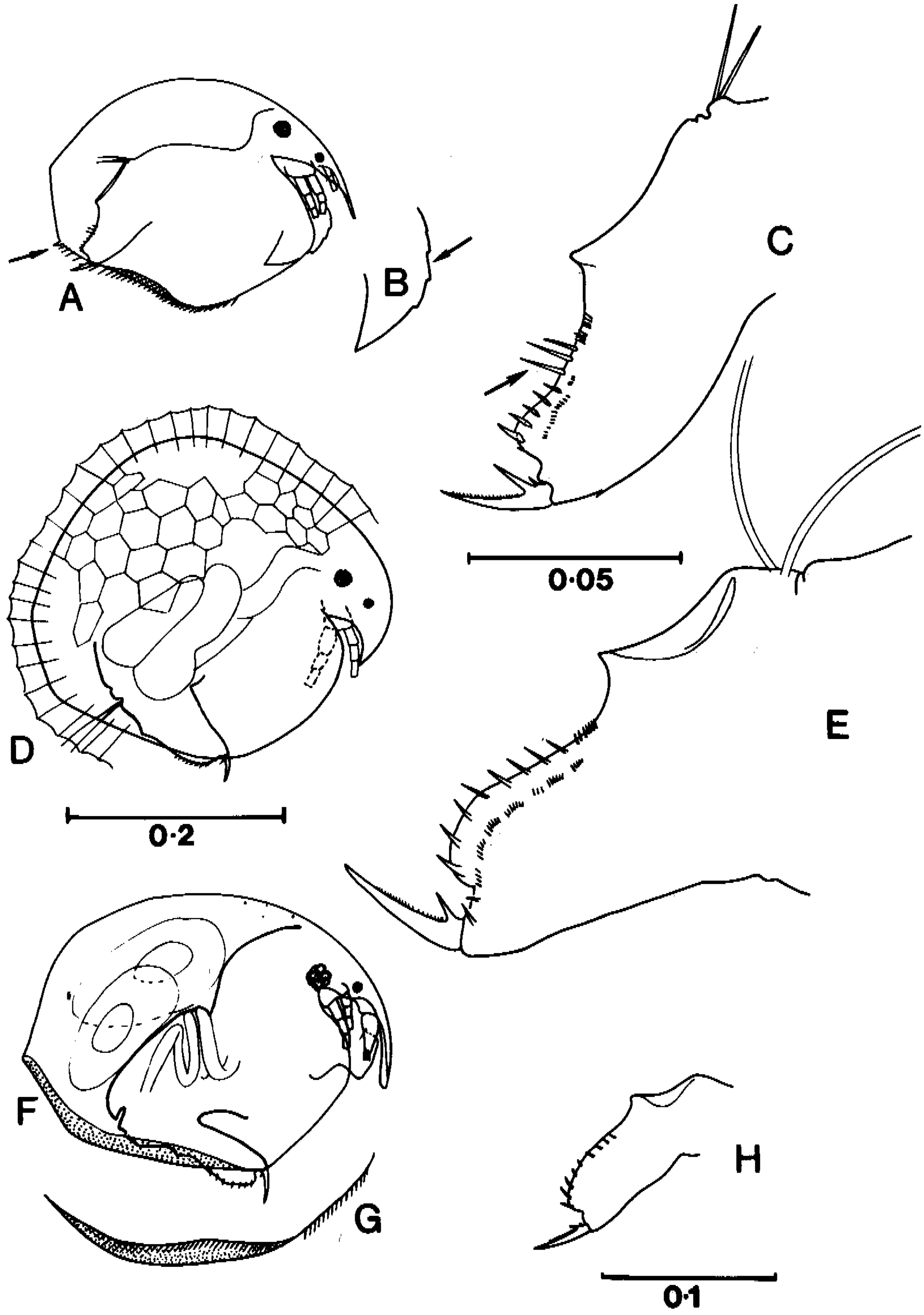

Figure A7. *CHYDORIDAE:* *A,* Ephemeroporus barroisi, *whole animal;* *B, labrum;* *C, postabdomen;* *D,* Chydorus *sp. near* flaviformis, *whole animal;* *E, postabdomen;* *F,* Chydorus eurynotus, *whole animal;* *G, detail of ventral margin of valve;* *H, postabdomen.* *All measurements in mm.*

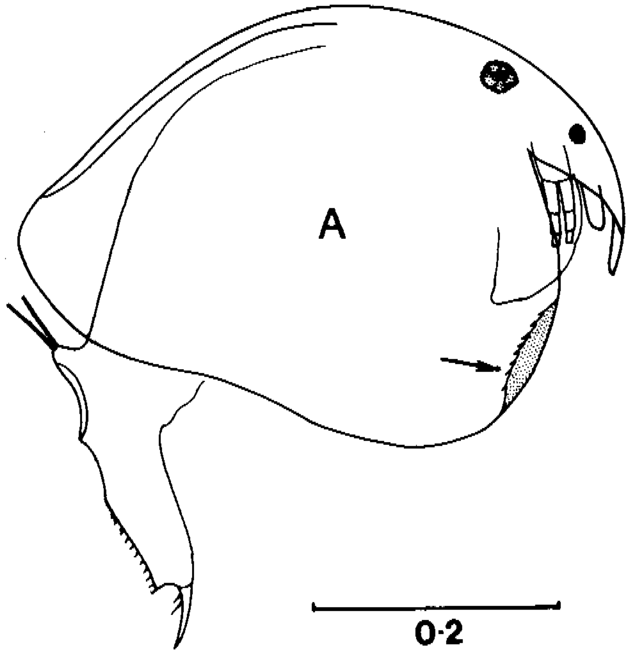

Figure A8. CHYDORIDAE: A, Australochydorus aporus, *whole animal (setae on ventral margin of valve not shown). All measurements in mm.*

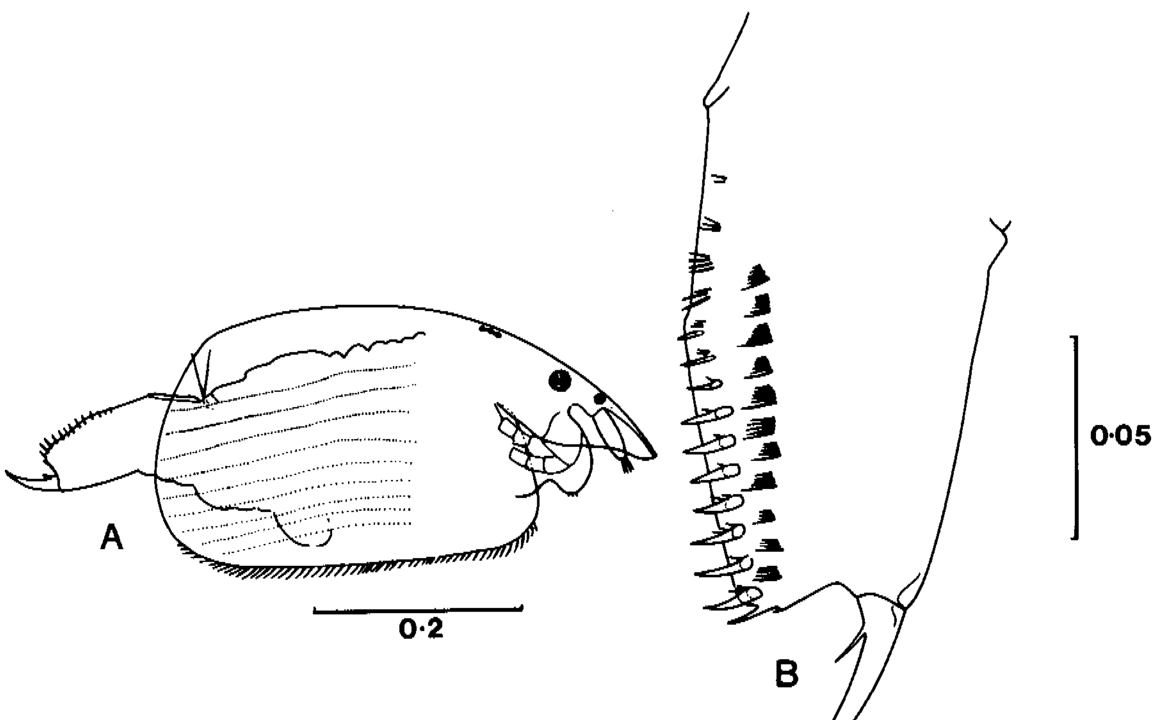

Figure A9. CHYDORIDAE: A, Alona *sp. near* costata, *whole animal; B, postabdomen. All measurements in mm.*

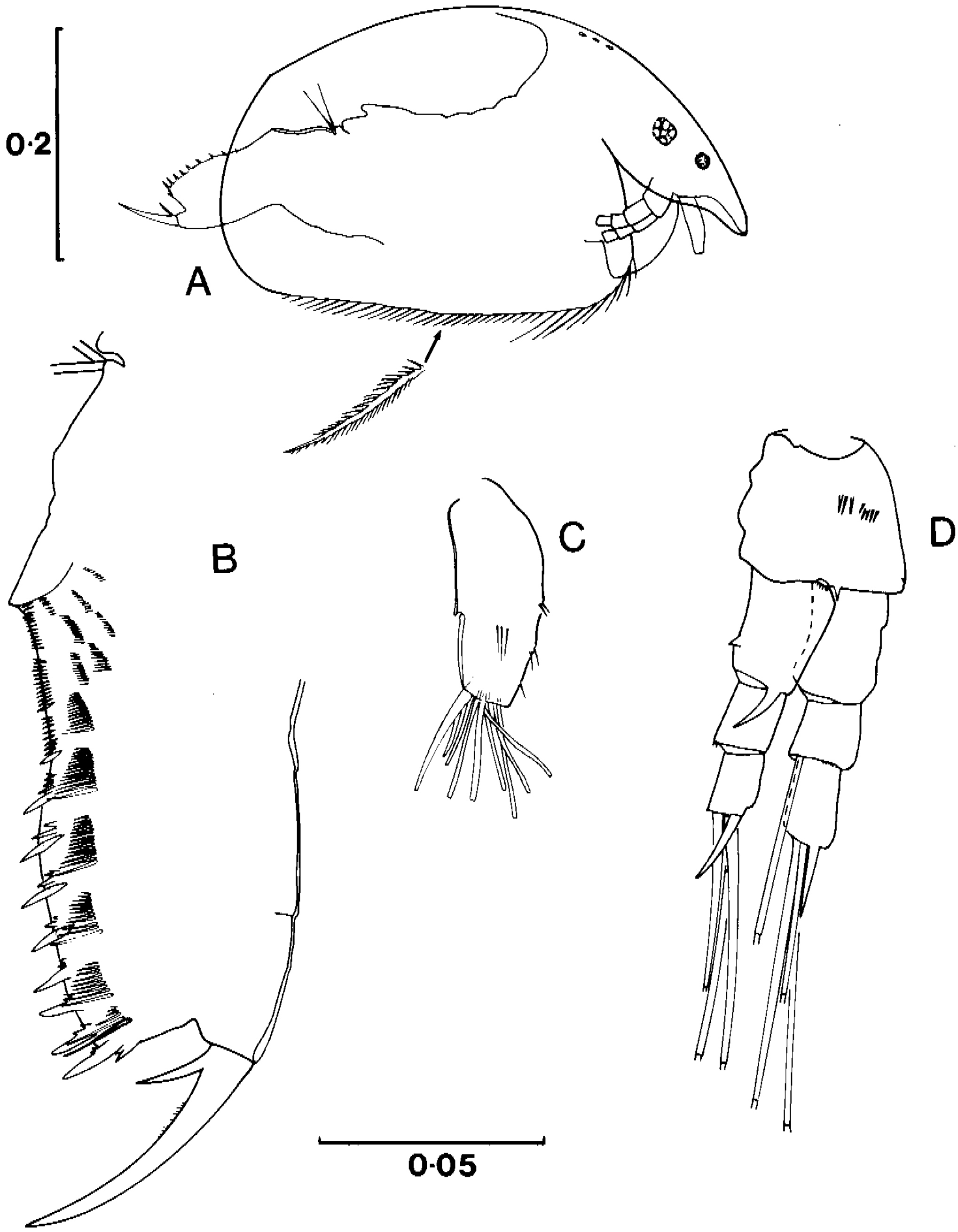

Figure A10. CHYDORIDAE: A, Alona *sp. near* cambouei, *whole animal; B, postabdomen; C, antennule; D, antenna. All measurements in mm.*

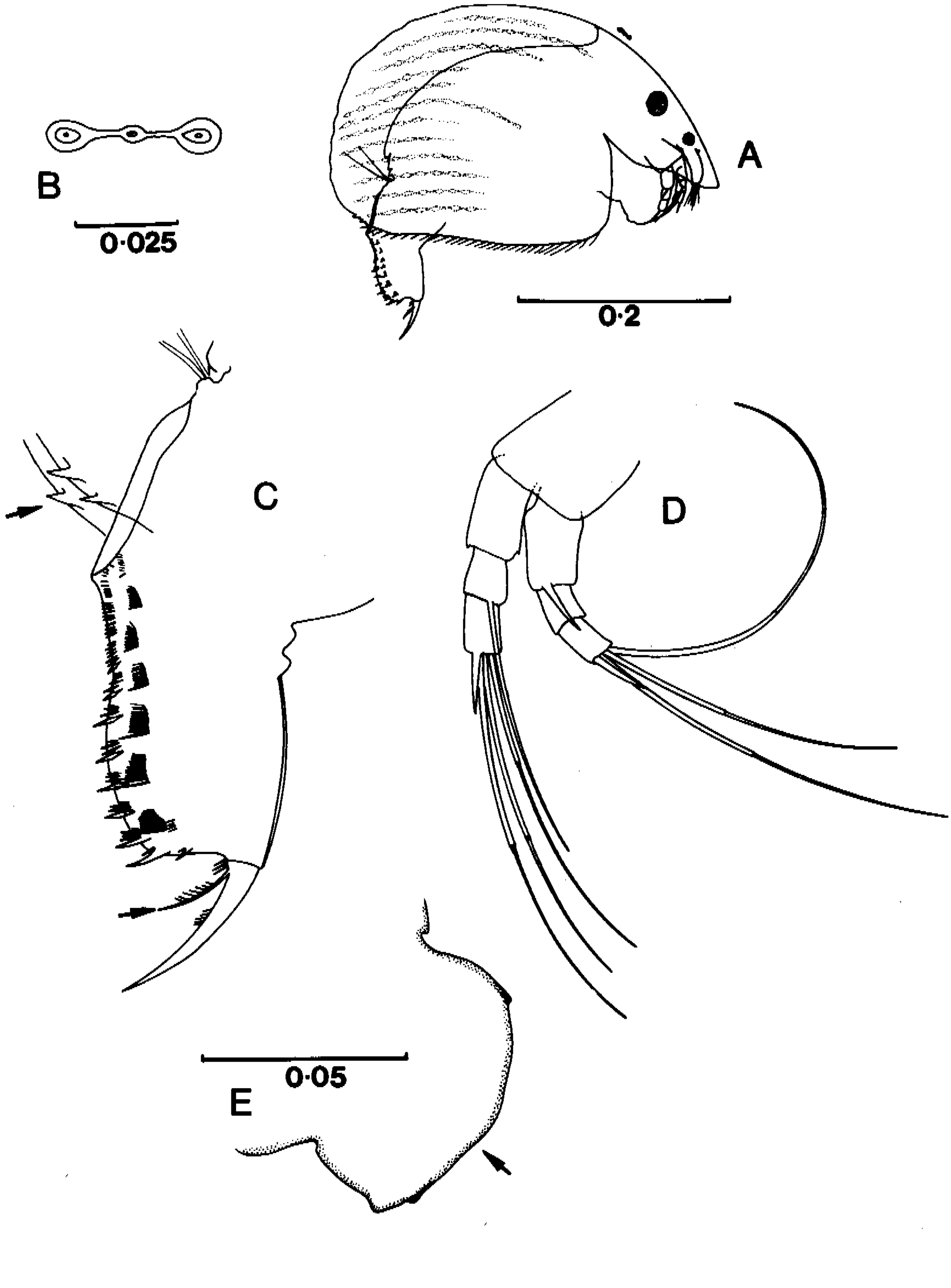

Figure A11. CHYDORIDAE: A, Alona monacantha, *whole animal; B, head pores; C, postabdomen and denticles on ventro-posterior corner of valve; D, antenna; E, labrum. All measurements in mm.*

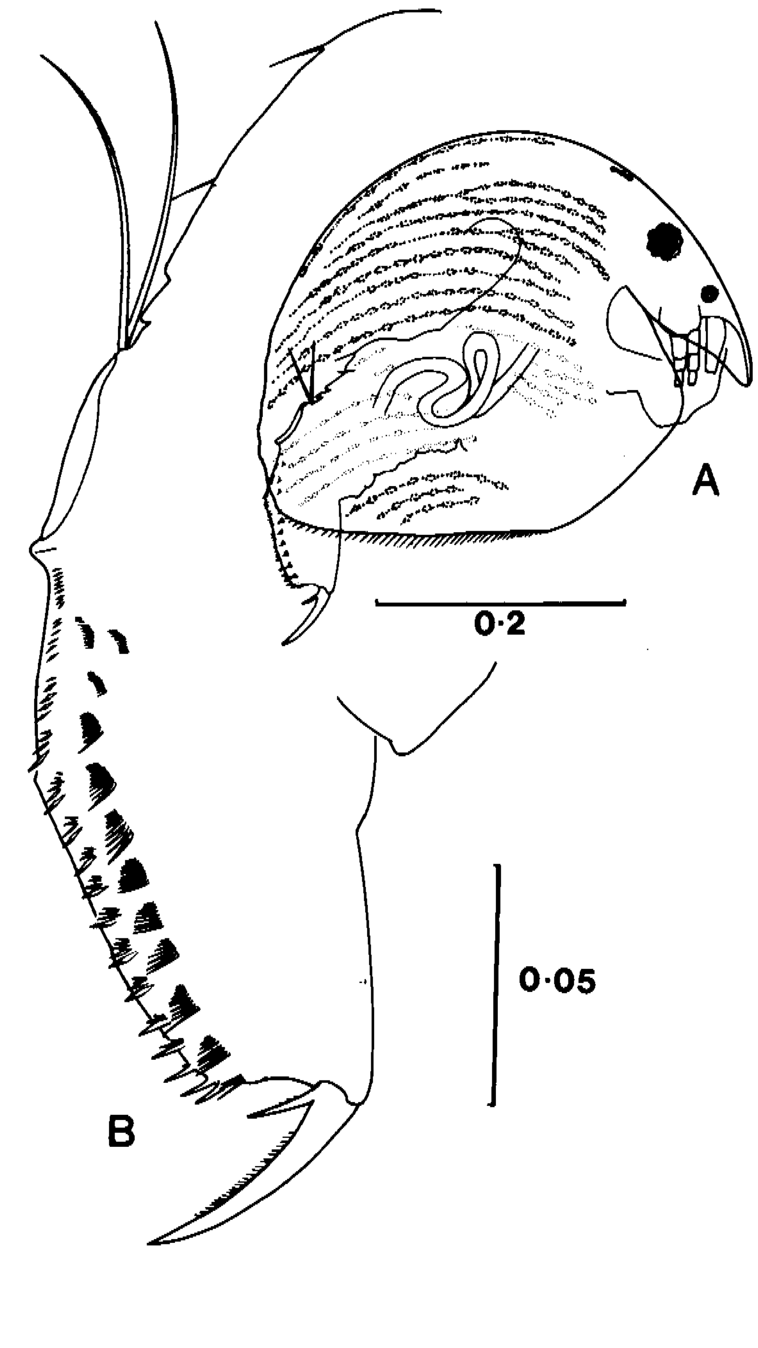

Figure A12. CHYDORIDAE: A, Alona davidi, *whole animal; B, postabdomen. All measurements in mm.*

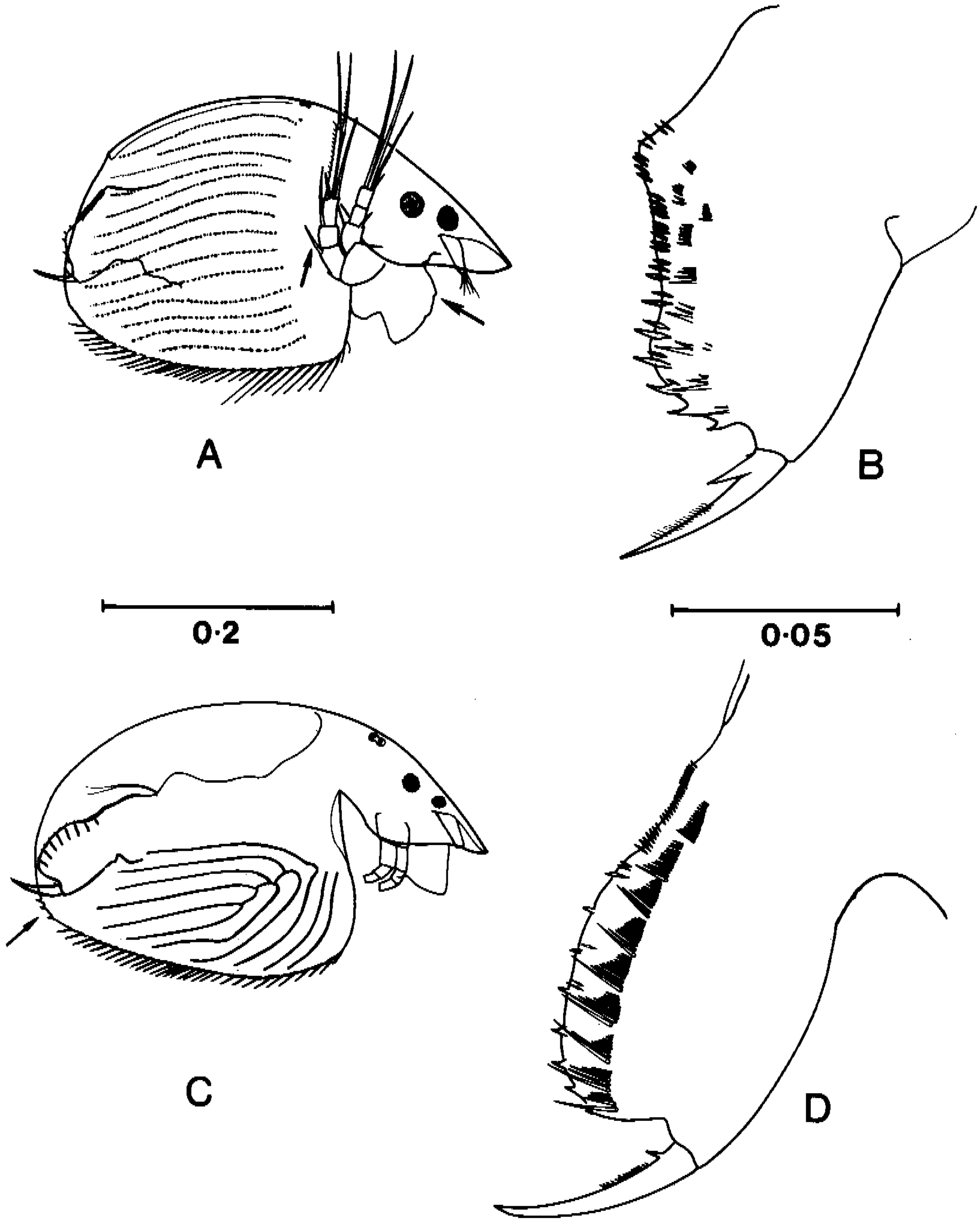

Figure A13. CHYDORIDAE: A, Biapertura macrocopa, *whole animal; B, postabdomen; C,* Biapertura karua, *whole animal; D, postabdomen. All measurements in mm.*

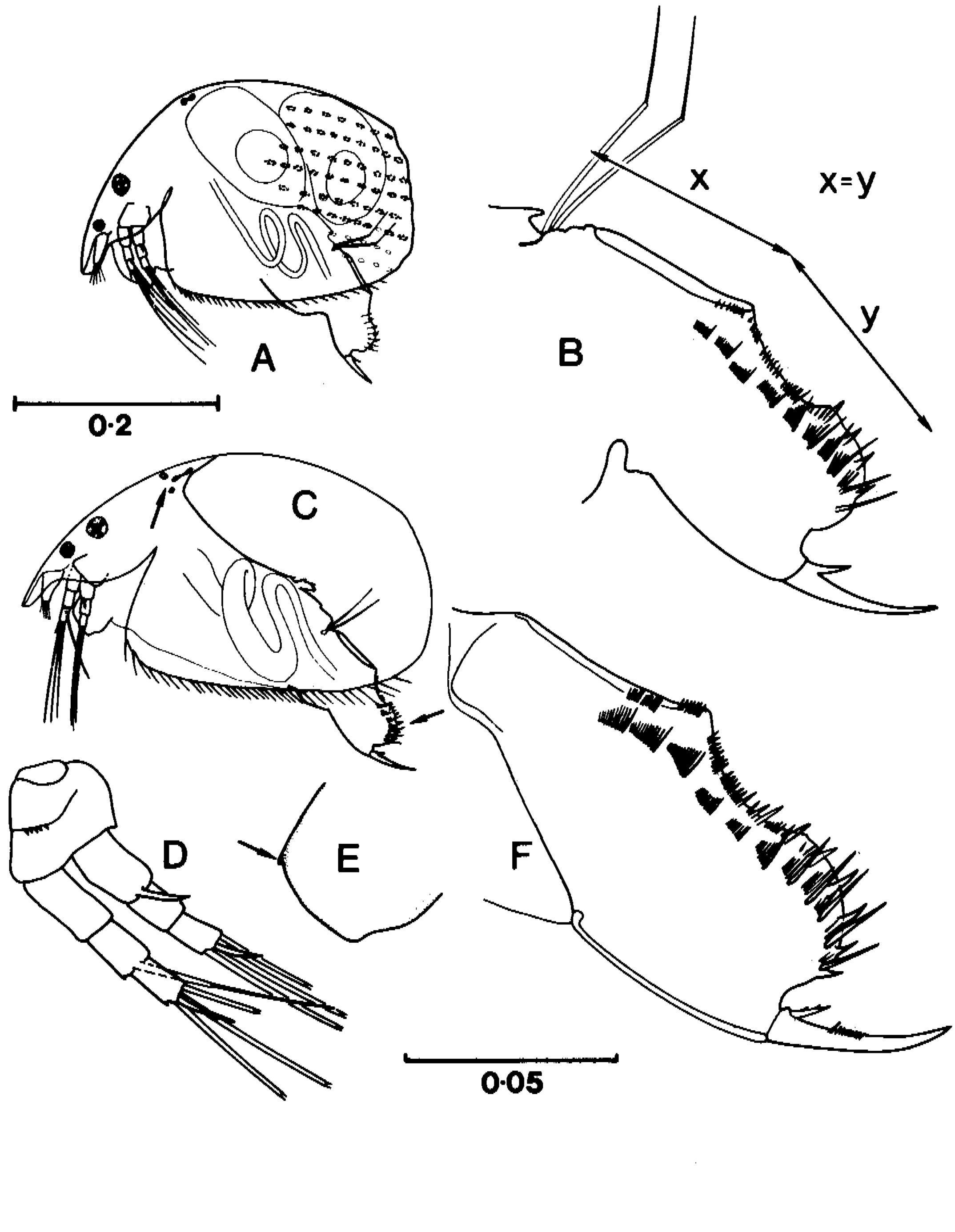

Figure A14. CHYDORIDAE: A, Biapertura rigidicaudis, *whole animal; B, postabdomen; C,* Biapertura verrucosa, *whole animal; D, antenna; E, labrum; F, postabdomen. All measurements in mm.*

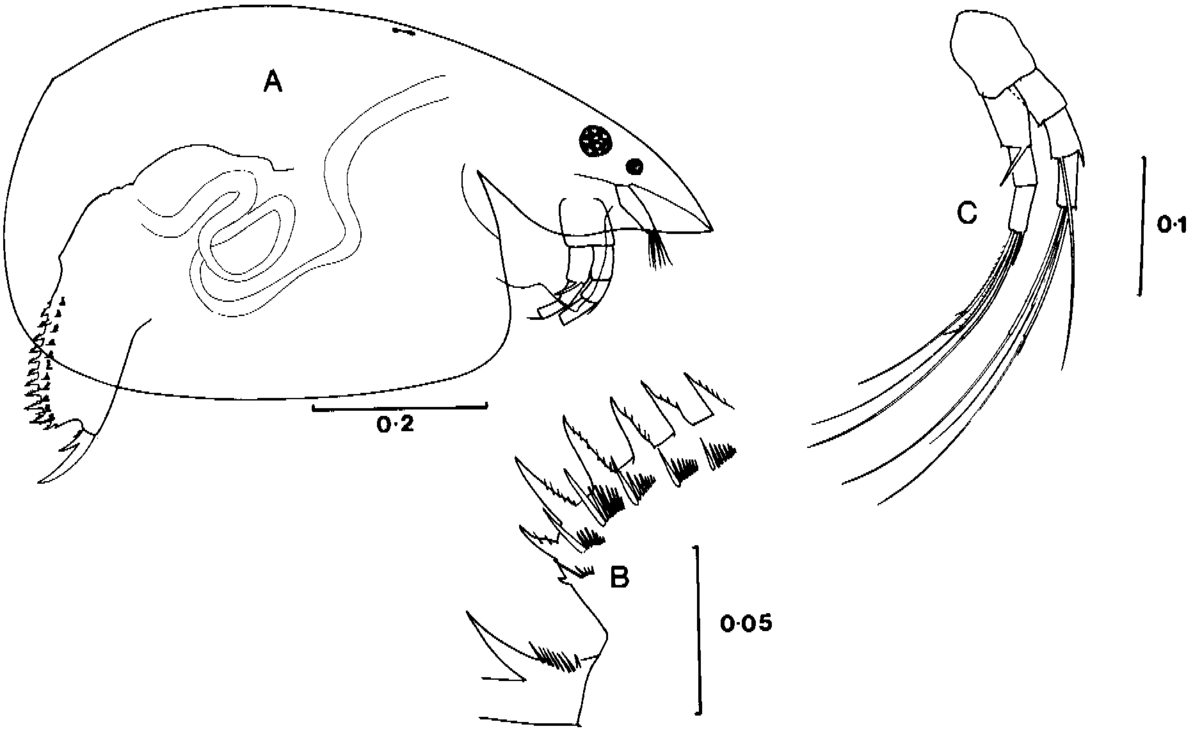

Figure A15. CHYDORIDAE: A, Biapertura kendallensis, *whole animal; B, detail of postabdomen; C, antenna. All measurements in mm.*

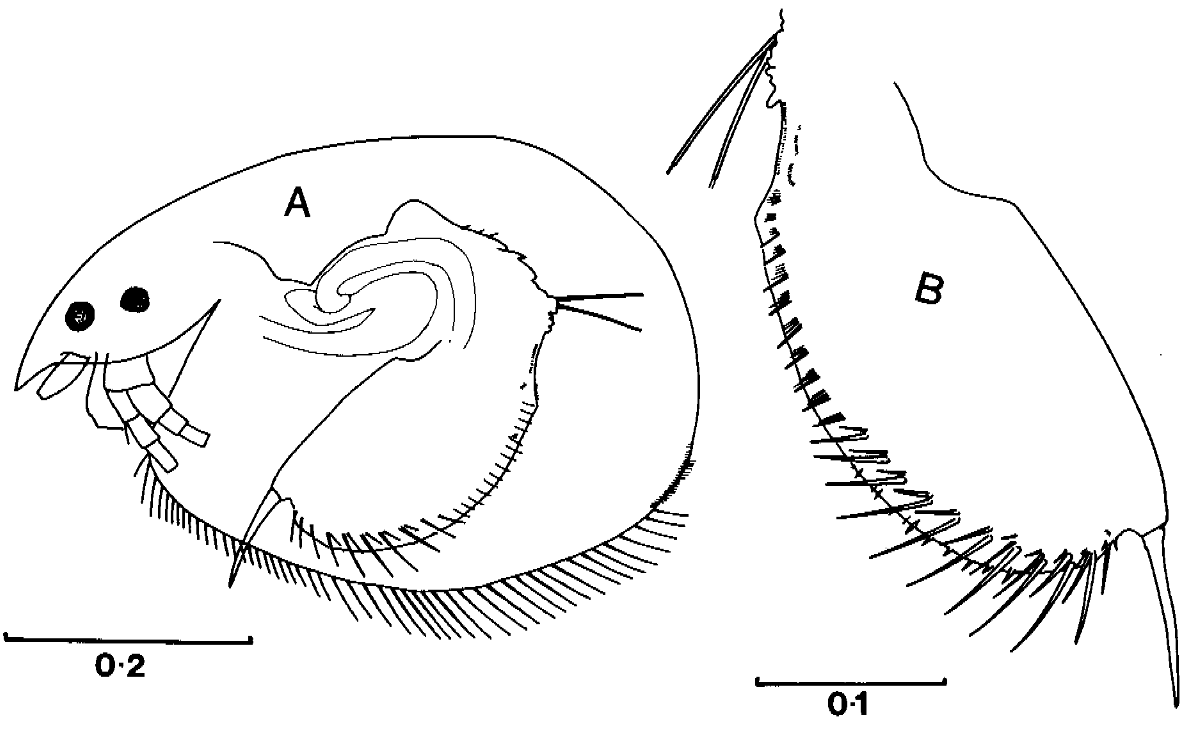

Figure A16. CHYDORIDAE: A, Leydigia acanthocercoides, *whole animal; B, postabdomen. All measurements in mm.*

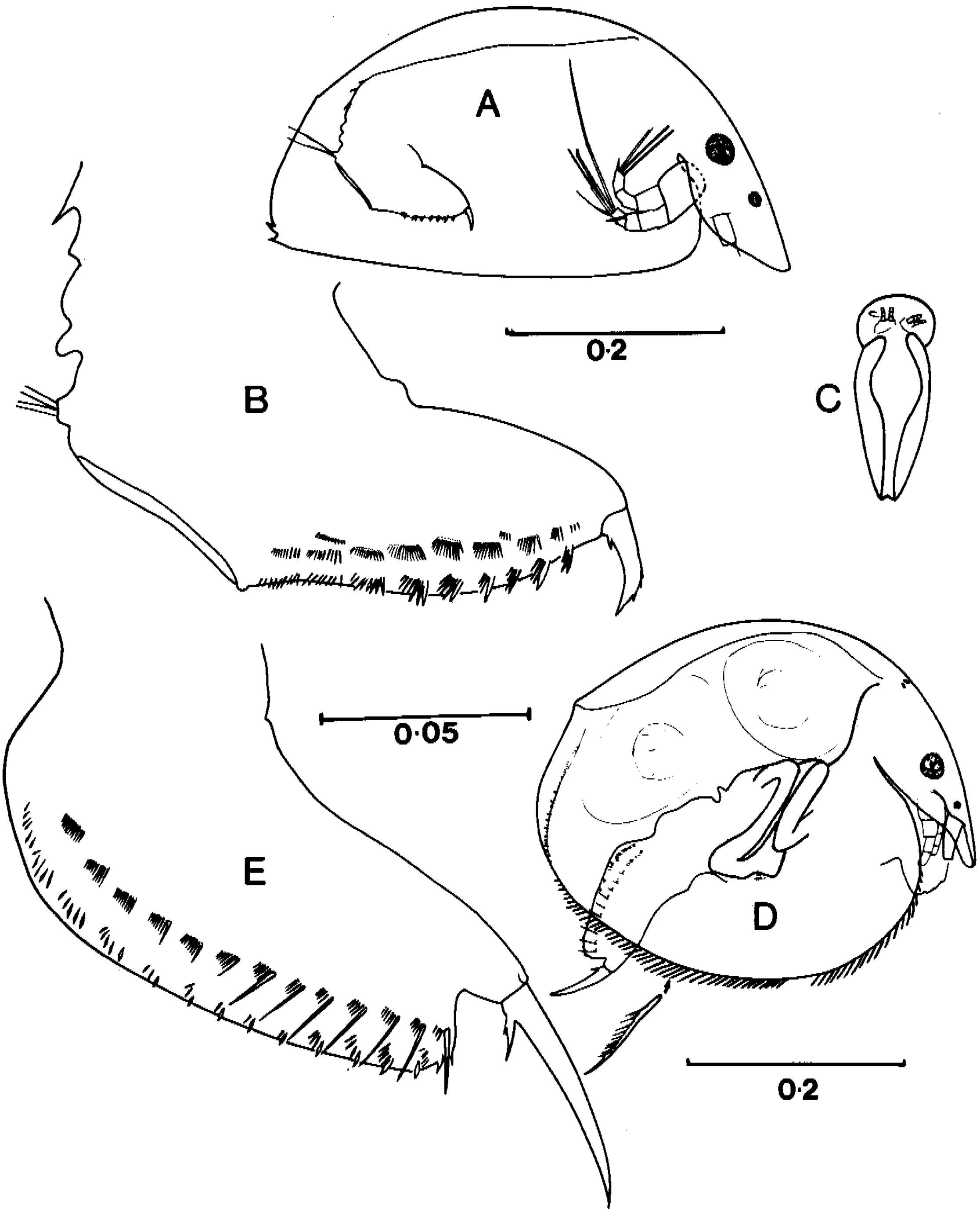

Figure A17. CHYDORIDAE: A, Graptoleberis testudinaria, *whole animal; B, postabdomen; C, whole animal, ventral view; D,* Indialona globulosa, *whole animal; E, postabdomen. All measurements in mm.*

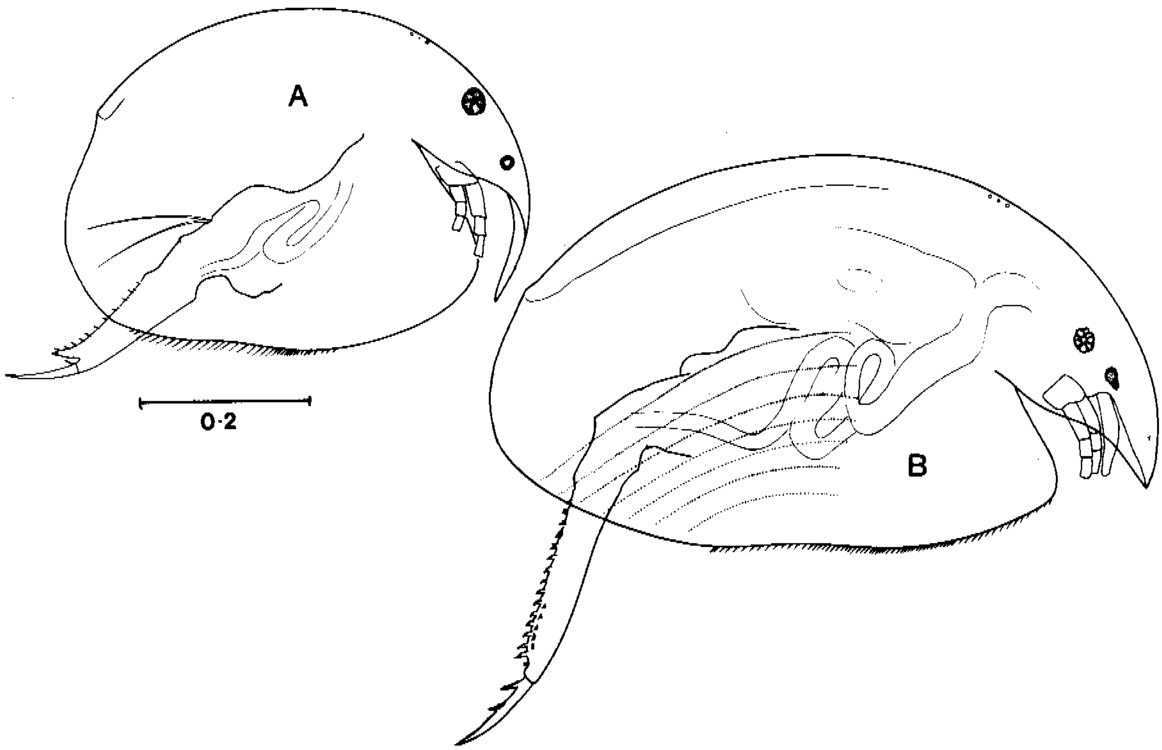

Figure A18. CHYDORIDAE: A, Kurzia longirostris, *whole animal; B,* Camptocercus australis, *whole animal. All measurements in mm.*

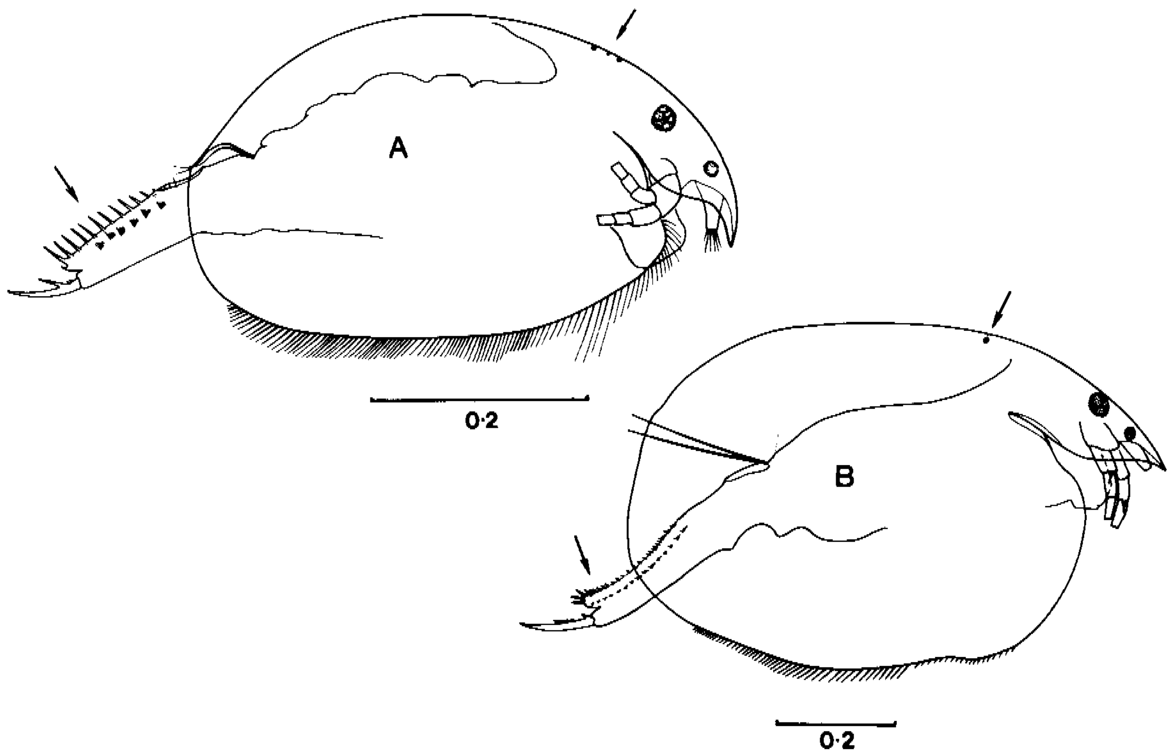

Figure A19. CHYDORIDAE: A, Oxyurella singalensis, *whole animal; B,* Euryalona orientalis, *whole animal. All measurements in mm.*

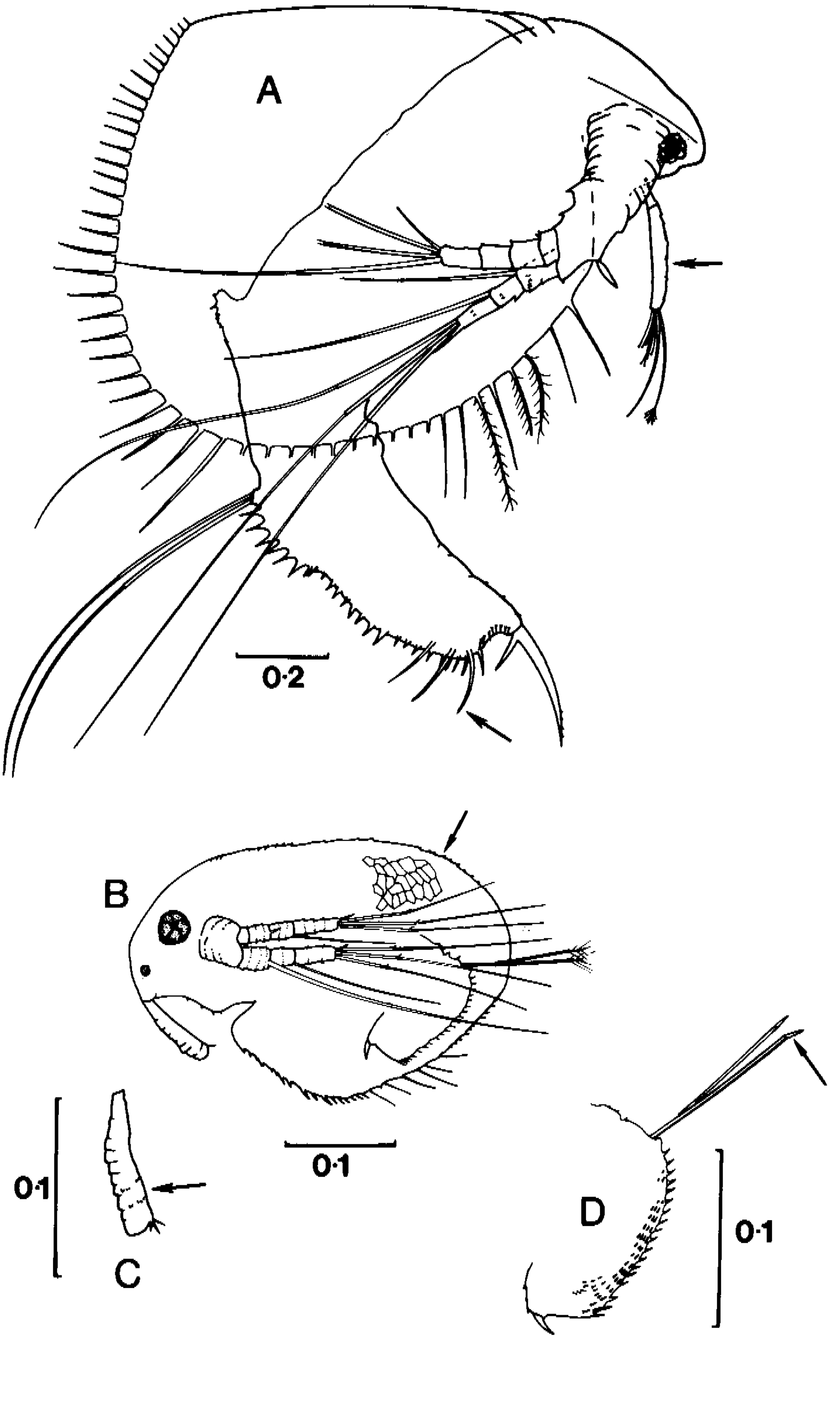

Figure A20. MACROTHRICIDAE: A, Ilyocryptus spinifer, *whole animal; B,* Macrothrix spinosa, *whole animal; C, antennule; D, postabdomen. All measurements in mm.*

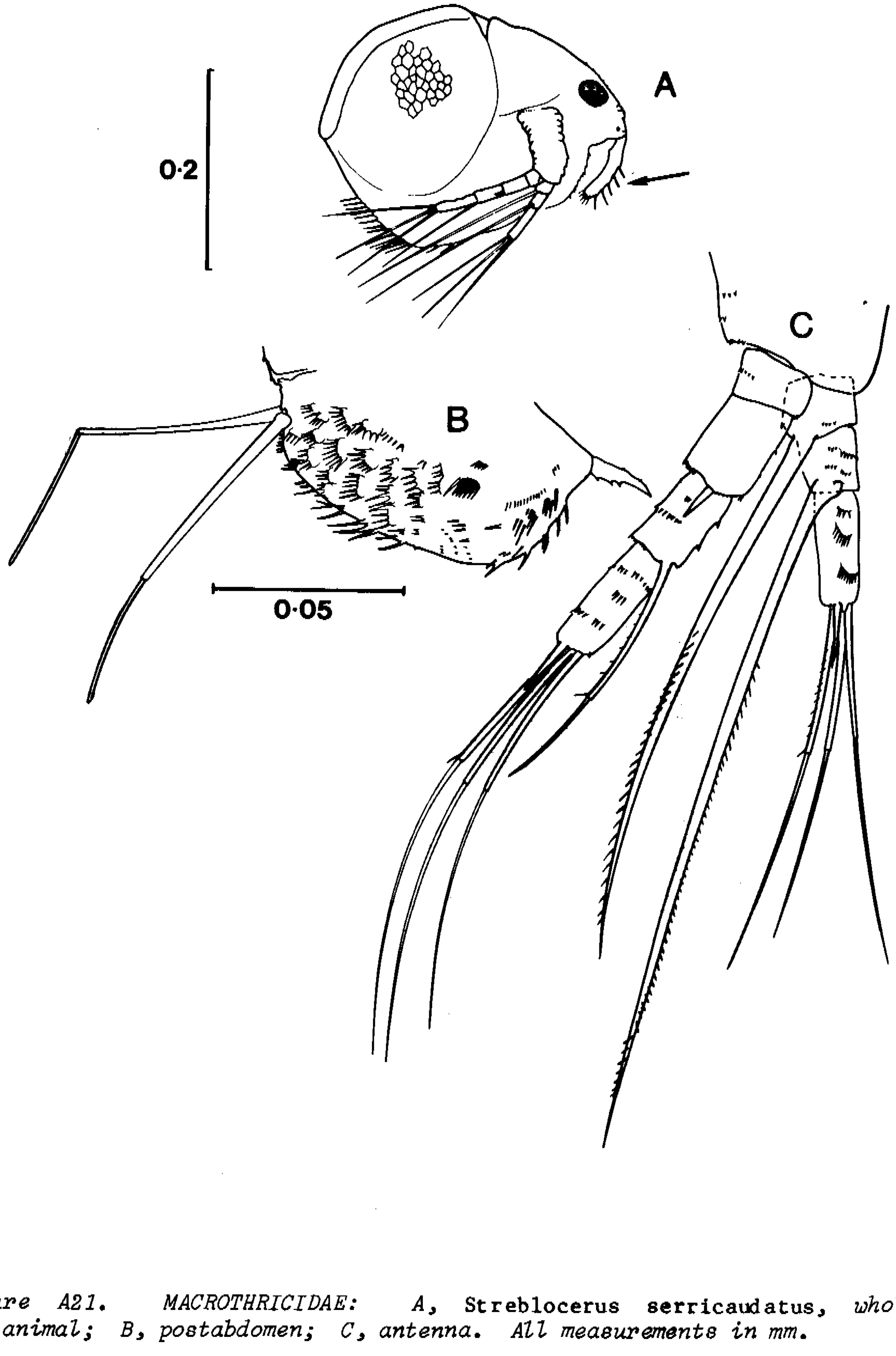

Figure A21. MACROTHRICIDAE: A, Streblocerus serricaudatus, *whole animal; B, postabdomen; C, antenna. All measurements in mm.*

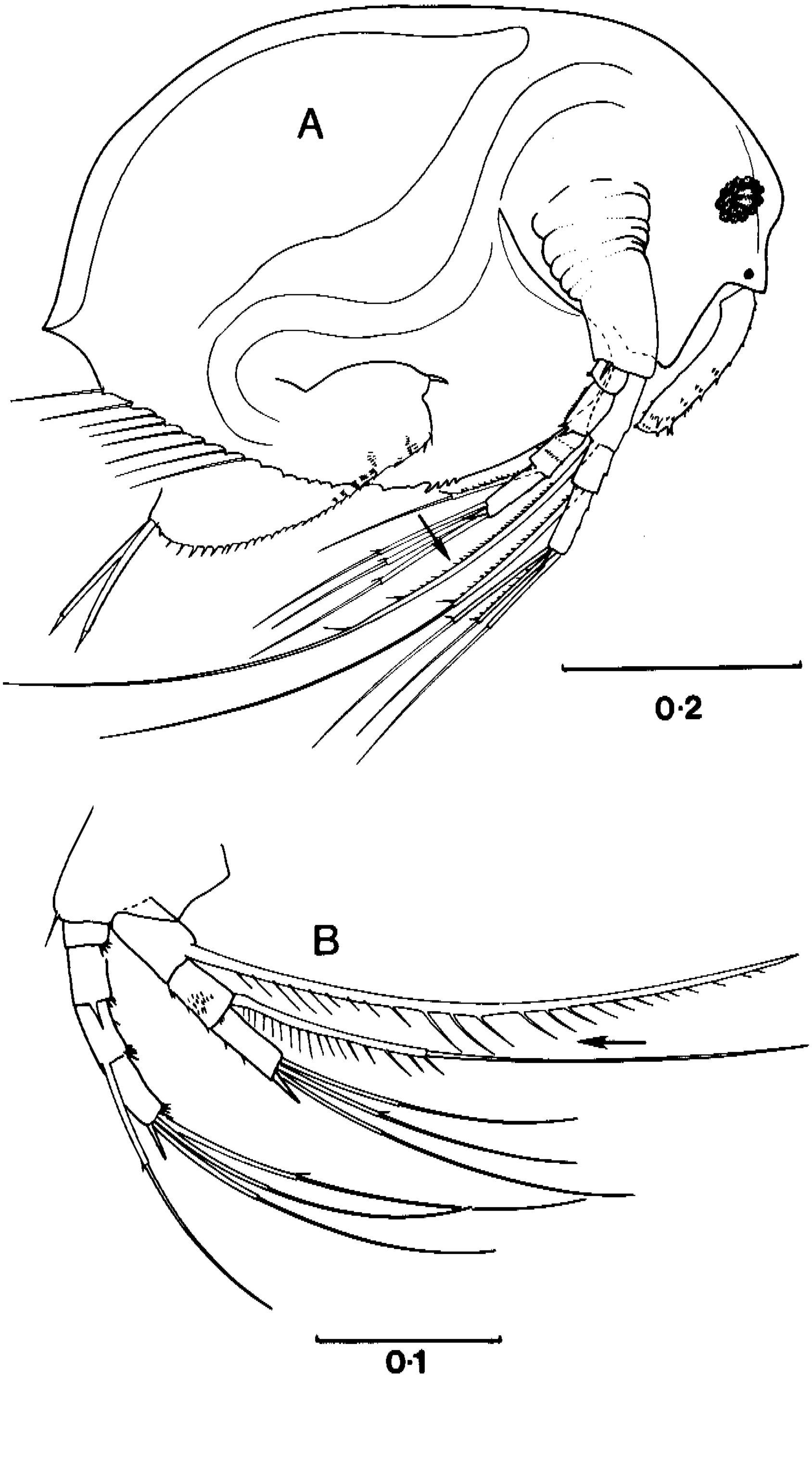

Figure A22. MACROTHRICIDAE: A, Echinisca triserialis, *whole animal; B,* Echinisca williamsi, *antenna. All measurements in mm.*

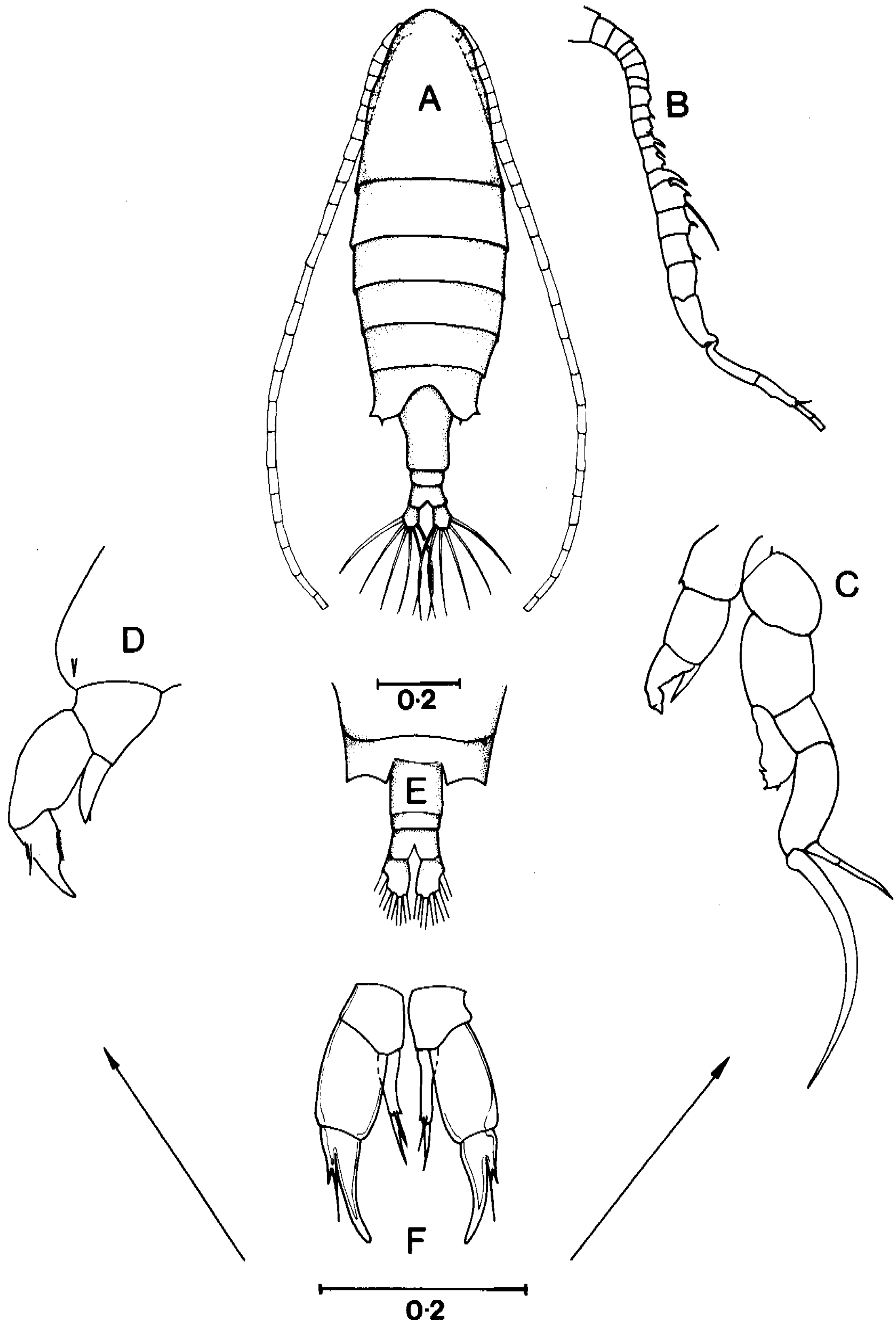

Figure A23. COPEPODA:CALANOIDA: A, Diaptomus lumholtzi, *female, whole animal, dorsal view (antennal and antennule setae not shown); B, male antennule; C, male fifth leg; D, female fifth leg; E,* Diaptomus australis, *dorsal view of last two metasomal segments and urosome of female; F, female fifth leg. All measurements in mm.*

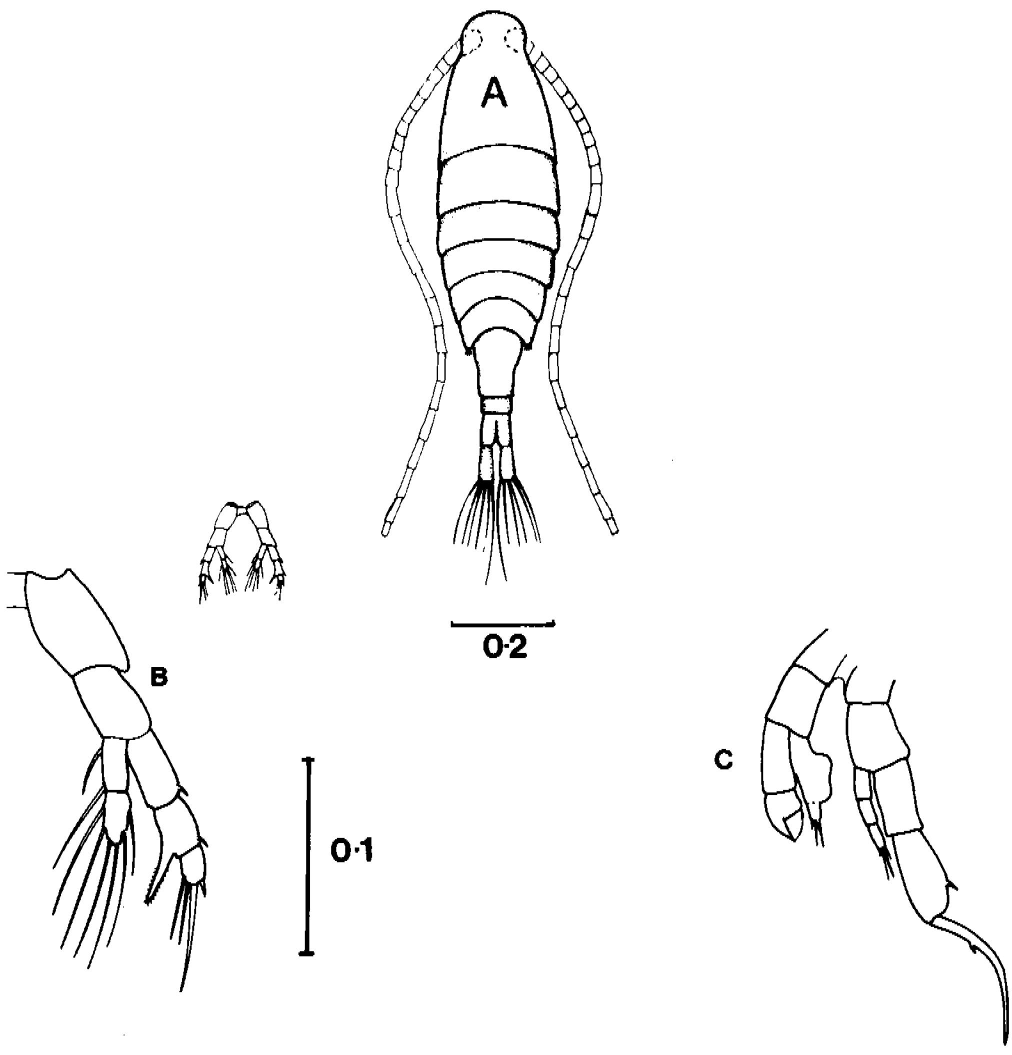

Figure A24. *COPEPODA:CALANOIDA:* *A,* Calamoecia ultima, *female, whole animal (antennule setae and antennae not shown);* *B, female fifth leg;* *C, male fifth leg.* *All measurements in mm.*

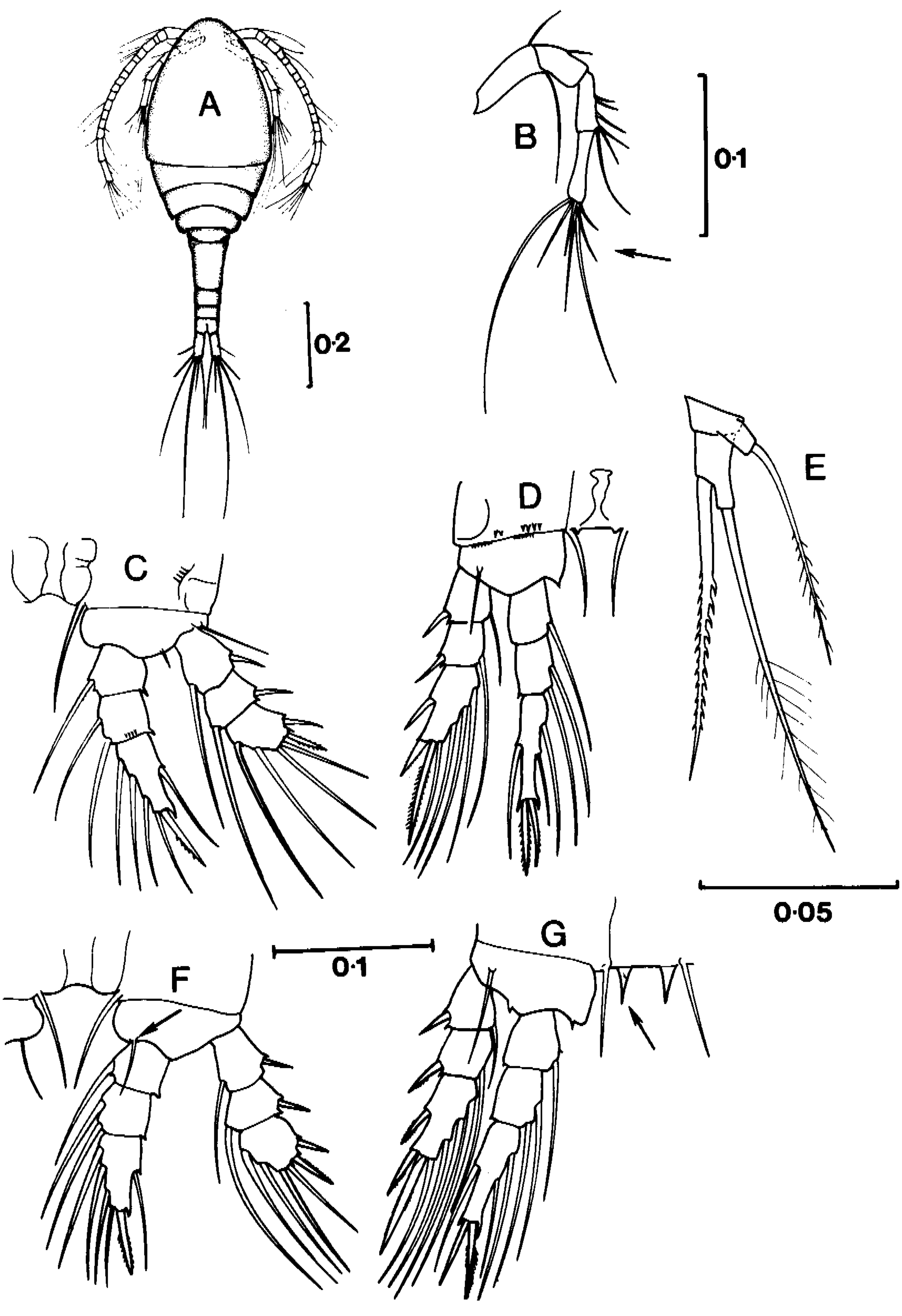

Figure A25. COPEPODA:CYCLOPOIDA: A, Mesocyclops leuckarti, *female dorsal view; B, female second antenna, note the 7 setae on terminal segment; C, female first leg (P1); D, female fourth leg (P4); E, female fifth leg (P5); F,* Mesocyclops *sp. nov., female P1; G, female P4. All measurements in mm.*

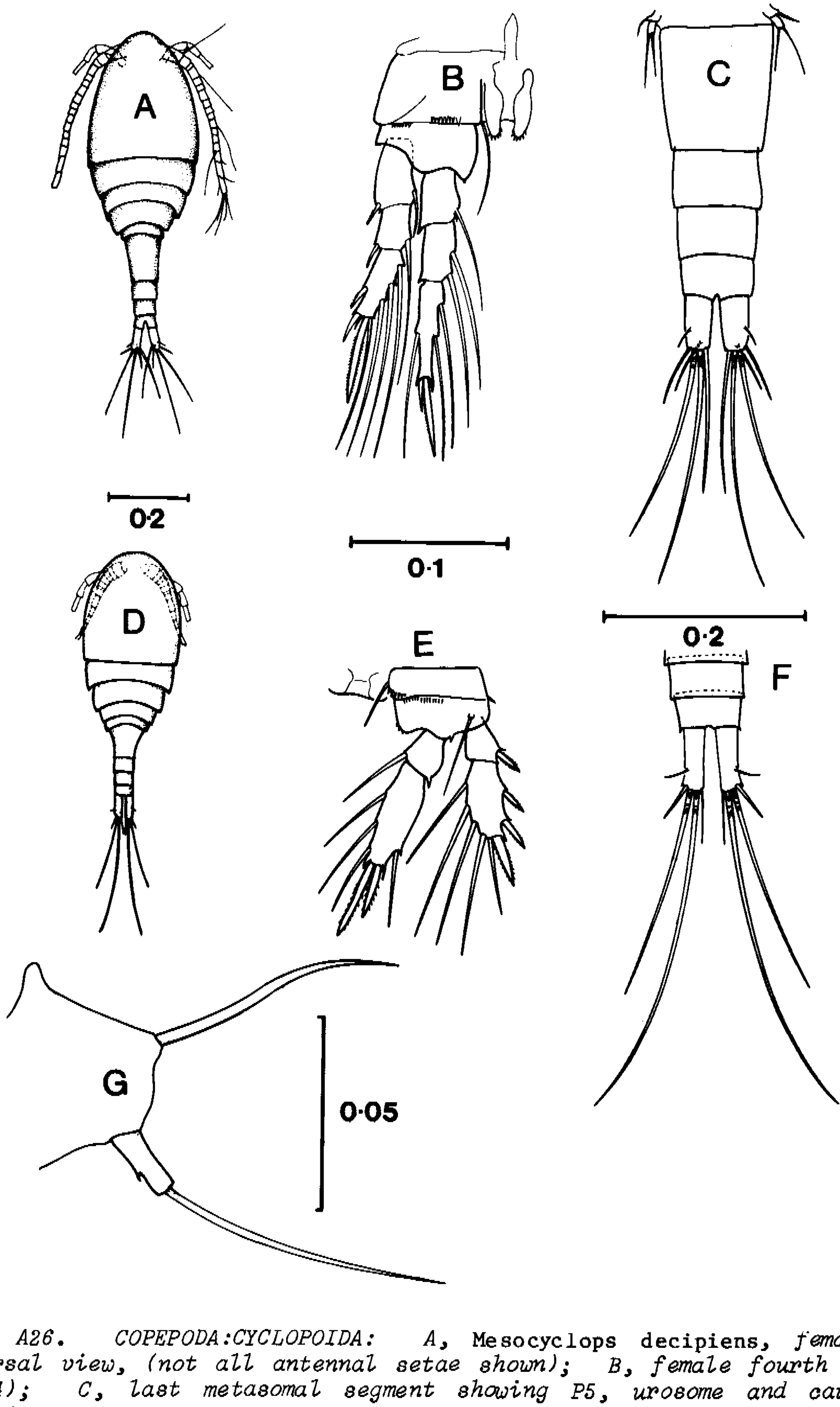

Figure A26. COPEPODA:CYCLOPOIDA: A, Mesocyclops decipiens, *female, dorsal view, (not all antennal setae shown); B, female fourth leg (P4); C, last metasomal segment showing P5, urosome and caudal rami; D,* Microcyclops varicans, *female dorsal view (not all antennal setae shown); E, female fourth leg (P4); F, last four urosomal segments and caudal rami; G, female fifth leg (P5). All measurements in mm.*

APPENDIX 2

Collection Information and Species Counts for the Billabongs

Table A1. Collection information and species counts for Island Billabong

B = Birge cone sample; N = net samples; O = open water; W = weed beds; Na = *Najas tenuifolia*; Ut = *Utricularia* sp.

Year	1981								1982					1983	
Month	09	10	11	12	01	01	03	05	07	08	10	10	12	01	01
Date	14	12	16	14	18	18	15	18	22	10	22	26	13	25	25
Collection method	N	N	N	N	N	B	B	B	N	N	B	N	N	N	N
Habitat	O	O	O	O	O	W	W	W	O	O	W	O	O	O	W
Macrophyte species	–	–	–	–	–	Na	Na	Na	–	–	Ut	–	–	–	Ut
Volume sampled (L)	1250	848	495	706	566	c.636	c.350	c.340	589	589	–	1014	455	342	–
Sub-sample counted	1/64	1/1	1/1	1/16	1/1	1/16	1/32	1/48	1/2	1/4	1/32	1/8	1/1	1/16	–
Total no. counted	573	705	489	466	308	442	217	326	1374	536	257	830	406	565	–
Total no. of species[a]	10	9	12	6	20	22	23	20	7	7	16	7	7	9	12
Diaptomus lumholtzi	57	33	15	4	1	–	–	–	25	50	–	83	60	25	–
Calamoecia ultima	30	28	15	–	–	101	1	–	55	62	25		40	72	P[b]
Mesocyclops decipiens	3	18	100	64	–	–	–	–	89	49	–	17	35	43	–
M. leuckarti	85	55	146	95	132	–	–	–	102	81	–	27	43	147	–
M. sp. nov.	–	–	–	–	–	70	29	54	–	–	48	–	–	–	–
M. aspericornis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Microcyclops varicans	–	–	–	–	30	16	16	32	–	–	93	–	12	11	–
Diaptomus australis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P
Copepod nauplii	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Harpacticoida	–	2	–	–	–	–	–	–	–	–	–	1	–	–	–
Diaphanosoma excisum	3	4	–	48	50	–	–	–	34	165	–	13	144	162	–
D. sarsi	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Latonopsis australis	–	–	–	–	–	–	1	3	–	–	–	–	–	–	P
L. brehmi	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
L. fasciculata	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Pseudosida bidentata	1	–	–	–	2	–	2	4	..	–	6	–	–	–	P
Bosminopsis deitersi	388	555	170	253	4	2	–	–	1060	83	2	684	72	103	–
Bosmina meridionalis	4	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Ceriodaphnia cornuta	2	8	5	–	–	–	–	–	5	45	2	4	–	1	–
Moina micrura	–	–	13	–	–	–	–	–	–	–	–	–	–	–	–
Moinodaphnia macleayi	–	–	–	–	–	2	5	6	–	–	–	–	–	–	P
Alonella clathratula	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–
Australochydorus aporus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Chydorus eurynotus	–	–	3	–	20	8	11	6	–	–	5	–	–	–	–
C. sp. near *flaviformis*	–	–	2	–	4	10	2	3	–	–	3	–	–	–	P
Dadaya macrops	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–
Dunhevedia crassa	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Ephemeroporus barroisi	–	–	9	2	22	174	33	70	–	–	5	–	–	–	P
Alona monacantha	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
A. davidi	–	–	–	–	–	4	2	2	–	–	–	1	–	–	–
A. sp. near *costata*	–	–	–	–	–	2	–	7	–	–	–	–	–	–	–
A. sp. near *guttata*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Biapertura kendallensis	–	–	–	–	8	3	6	1	–	–	1	–	–	–	–
B. karua	–	–	–	–	–	3	7	34	–	–	–	–	–	–	–
B. verrucosa	–	–	–	–	–	–	3	–	–	–	13	–	–	–	–
B. macrocopa	–	–	–	–	2	2	4	16	–	–	8	–	–	–	–
B. rigidicaudis	–	–	–	–	–	8	3	–	–	–	–	–	–	–	–
Camptocercus australis	–	–	–	–	6	–	–	6	–	–	–	–	–	–	P
Euryalona orientalis	–	–	–	–	2	1	1	7	–	–	–	–	–	1	P
Graptoleberis testudinaria	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Indialona globulosa	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–
Kurzia longirostris	1	–	–	–	2	–	4	–	–	–	–	–	–	–	–
Leydigia acanthocercoides	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Oxyurella singalensis	–	–	–	–	–	–	6	–	–	–	3	–	–	–	–
Simocephalus latirostris	–	–	–	–	2	1	–	4	–	–	3	–	–	–	P
S. serrulatus	–	–	–	–	–	1	1	5	–	–	–	–	–	–	–
Scapholeberis kingi	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Echinisca triserialis	–	–	–	–	4	10	5	48	–	–	11	–	–	–	P
E. williamsi	–	–	–	–	–	4	8	–	–	–	–	–	–	–	–
Ilyocryptus spinifer	–	1	–	–	2	3	–	3	–	–	–	–	–	–	P
Macrothrix spinosa	–	–	10	–	8	13	3	–	–	–	–	–	–	–	–
M. hystrix	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Streblocerus serricaudatus	–	–	–	–	5	2	4	5	–	–	16	–	–	–	–
Ostracoda	–	–	–	–	–	2	60	10	–	–	13	–	–	–	–

[a]excluding Ostracoda, copepod nauplii and Harpacticoida; [b]P = present, but number not recorded because sample leaked in transit

Table A2. Collection information and species counts for Winmurra Billabong

B = Birge cone sample; L = light trap sample; N = net samples; T = tube sample; O = open water; W = weed beds; El = *Eleocharis* sp.; Na = *Najas tenuifolia*; Ps = *Pseudoraphis* sp.

Year	1981				1982																				1983	
Month	09	10	11	12	01	03	05	05	05	05	05	06	06	06	07	07	07	07	08	08	08	10	11	12	01	01
Date	14	12	16	14	19	16	04	04	04	04	31	08	10	15	01	01	10	27	19	19	19	26	19	13	25	25
Collection method	N	N	N	N	N	T	B	B	T	T	L	L	N	B	T	T	N	L	T	N	T	N	N	N	B	N
Habitat	O	O	O	O	O	W	W	W	W	W	W	W	O	W	W	W	O	O	O	O	W	O	O	O	W	O
Macrophyte species	–	–	–	–	–	Na	El/Na	Na	Na	Ps	El/Na	Na	–	Na	Na	Na	–	–	–	–	Ps	–	–	–	Ps	–
Volume sampled (L)	1250	353	353	353	707	29	989	283	14	15	–	–	1250	353	5.2	11.2	4.9	–	13.2	282	7.6	736	751	1008	–	522
Sub-sample counted	1/128	1/128	1/256	1/1	1/2	1/4	1/212	1/32	1/8	1/16	1/1	1/8	1/64	1/153	1/16	1/16	1/1	1/32	1/1	1/1	1/2	1/16	1/1	1/1	–	1/16
Total no. counted	425	472	332	366	300	238	347	332	206	470	1193	406	372	270	235	250	31	529	116	800	411	583	37	3	198	492
Total no. of species[a]	8	7	4	7	14	19	21	14	12	8	15	14	15	12	7	14	6	8	5	4	9	4	2	1?	13	6
Diaptomus lumholtzi	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Calamoecia ultima	5	8	–	24	4	–	–	–	–	–	41	–	3	–	–	–	12	64	32	347	–	–	–	–	5	67
Mesocyclops decipiens	52	124	142	71	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	25
M. leuckarti	14	5	20	7	–	–	–	–	–	–	–	1	1	–	–	–	2	–	–	–	–	6	–	–	–	13
M. sp. nov.	86	96	136	104	40	57	42	20	46	87	21	13	45	40	32	82	8	–	47	1	196	507	–	–	2	–
M. aspericornis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Microcyclops varicans	48	–	–	–	–	20	27	32	41	31	24	20	5	10	36	65	–	10	4	–	44	–	–	–	4	–
Diaptomus australis	–	–	–	–	–	1	–	–	1	–	1	–	1	1	–	–	–	–	–	–	–	–	–	–	–	–
Copepod nauplii	–	–	–	–	–	–	–	–	29	–	–	–	250	46	–	–	–	–	–	–	–	–	25	3	–	–
Harpacticoida	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Diaphanosoma excisum	28	105	–	37	–	–	–	–	–	–	–	–	–	–	–	–	6	255	32	450	–	2	5	–	–	385
D. sarsi	–	–	–	–	–	–	–	1	8	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Latonopsis australis	–	–	–	–	–	–	4	8	2	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
L. brehmi	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
L. fasciculata	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Pseudosida bidentata	–	–	–	–	–	1	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–
Bosminopsis deitersi	–	–	–	119	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Bosmina meridionalis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Ceriodaphnia cornuta	1	6	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	29	1	–	23	–	–	–	1	–
Moina micrura	191	128	34	4	2	–	–	–	–	–	10	197	8	–	–	–	–	133	–	–	–	68	7	–	–	1
Moinodaphnia macleayi	–	–	–	–	1	2	3	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	1	–
Alonella clathratula	–	–	–	–		9	23	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Australochydorus aporus	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Chydorus eurynotus	–	–	–	–	43	9	15	4	6	17	26	56	1	15	–	21	–	2	–	–	2	–	–	–	1	–
C. sp. near *flaviformis*	–	–	–	–	–	1	13	20	11	–	42	12	1	4	8	–	–	–	–	–	–	–	–	–	6	–
Dadaya macrops	–	–	–	–	–	–	18	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Dunhevedia crassa	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Ephemeroporus barroisi	–	–	–	–	131	50	44	41	26	33	997	64	28	108	39	44	1	32	–	–	97	–	–	–	24	–
Alona monacantha	–	–	–	–	–	2	3	–	–	–	–	1	1	16	56	9	–	–	–	–	–	–	–	–	–	–
A. davidi	–	–	–	–	1	3	5	–	3	–	3	1	–	15	–	4	–	–	–	–	–	–	–	–	1	–
A. sp. near *costata*	–	–	–	–	–	1	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
A. sp. near *guttata*	–	–	–	–	–	3	3	1	–	–	10	25	–	–	–	–	–	–	–	–	–	–	–	–	1	–
Biapertura kendallensis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
B. karua	–	–	–	–	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
B. verrucosa	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

B. macrocopa	–	–	–	–	5	8	2	4	1	–	2	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–
B. rigidicaudis	–	–	–	–	41	–	2	–	–	–	–	13	22	–	–	2	–	4	–	–	–	–	–	–	–	–
Camptocercus australis	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–
Euryalona orientalis	–	–	–	–	–	–	6	–	–	–	–	–	–	4	–	1	–	–	–	2	15	–	–	–	–	–
Graptoleberis testudinaria	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Indialona globulosa	–	–	–	–	–	–	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Kurzia longirostris	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	–	–	–	–	10	–	–	–	1	1
Leydigia acanthocercoides	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Oxyurella singalensis	–	–	–	–	–	–	1	–	–	7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Simocephalus latirostris	–	–	–	–	–	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
S. serrulatus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Scapholeberis kingi	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Echinisca triserialis	–	–	–	–	26	13	24	41	18	6	13	1	–	–	–	–	–	–	–	–	4	–	–	–	1	–
E. williamsi	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Ilyocryptus spinifer	–	–	–	–	3	–	2	11	4	41	–	1	1	2	10	–	2	–	–	–	20	–	–	–	–	–
Macrothrix spinosa	–	–	–	–	1	1	–	–	–	–	–	–	1	–	4	–	–	–	–	–	–	–	–	–	–	–
M. hystrix	–	–	–	–	–	1	–	–	–	–	1	–	–	–	–	3	–	–	–	–	–	–	–	–	–	–
Streblocerus serricaudatus	–	–	–	–	1	–	–	–	–	16	1	–	1	–	–	2	–	–	–	–	–	–	–	–	–	–
Ostracoda	–	–	–	–	–	55	104	144	10	232	–	–	2	7	50	12	–	–	–	–	–	–	–	–	149	–

[a]excluding Ostracoda, copepod nauplii and Harpacticoida

Table A3. Collection information and species counts for Leichhardt Billabong

B = Birge cone sample; N = net samples; T = tube sample; O = open water; W = weed beds; Le = *Leersia* sp.; Na = *Najas tenuifolia*; Ut = *Utricularia* sp.

Year	1981				1982									
Month	09	10	11	12	01	01	03	04	05	05	07	10	10	12
Date	14	12	16	15	20	20	15	30	17	17	13	22	22	13
Collection method	N	N	N	N	N	B	T	T	N	B	N	B	N	N
Habitat	O	O	O	O	O	W	W	W	O	W	O	W	O	O
Macrophyte species	–	–	–	–	–	Na	Na/Ut	Le/Na	–	Ut	–	Le	–	–
Volume sampled (L)	1250	352	564	389	424	c.353	10.4	17.3	1273	c.353	294	–	260	250
Sub-sample counted	1/32	1/64	1/64	1/1	1/1	1/4	1/1	1/4	1/1	1/16	1/8	–	1/64	1/128
Total no. counted	656	311	584	14	49	370	196	266	46	543	323	–	624	258
Total no. of species[a]	7	8	7	4	13	17	15	17	5	18	8	7	6	8
Diaptomus lumholtzi	27	105	50	–	–	–	–	–	–	–	39	P[b]	351	56
Calamoecia ultima		15	–	–	–	–	–	–	–	–	77	P	20	5
Mesocyclops decipiens	192	13	23	2	–	–	–	–	40	–	26	–	–	26
M. leuckarti	10	2	5	5	–	–	–	–	–	–	13	P	–	47
M. sp. nov.	–	–	–	–	–	4	36	37	–	120	–	–	–	–
M. aspericornis	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Microcyclops varicans	–	–	–	–	1	3	10	98	–	29	–	–	–	–
Diaptomus australis	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Copepod nauplii	–	–	–	–	–	–	–	–	–	–	19	–	–	5
Harpacticoida	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Diaphanosoma excisum	102	45	255	1	–	–	–	–	–	–	65	–	50	48
D. sarsi	–	–	–	–	1	–	12	8	–	10	–	P	–	–
Latonopsis australis	–	–	–	–	1	2	–	–	–	2	–	–	–	–
L. brehmi	–	–	–	–	–	–	–	–	–	–	–	–	–	–
L. fasciculata	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Pseudosida bidentata	–	–	–	–	–	3	–	1	–	1	–	–	–	–
Bosminopsis deitersi	265	50	225	–	–	–	–	–	–	–	16	–	12	41
Bosmina meridionalis	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Ceriodaphnia cornuta	35	33	4	–	–	–	–	–	–	–	–	P	132	15
Moina micrura	25	48	22	–	–	–	–	–	–	–	65	–	61	15
Moinodaphnia macleayi	–	–	–	–	2	16	–	–	–	–	–	–	–	–
Alonella clathratula	–	–	–	–	–	1	9	8	–	49	–	–	–	–
Australochydorus aporus	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Chydorus eurynotus	–	–	–	–	–	–	–	10	–	60	–	–	–	–
C. sp. near *flaviformis*	–	–	–	–	–	–	21	–	–	–	–	–	–	–
Dadaya macrops	–	–	–	–	–	2	–	–	–	9	–	–	–	–
Dunhevedia crassa	–	–	–	–	1	2	–	–	–	–	–	–	–	–
Ephemeroporus barroisi	–	–	–	–	6	91	29	63	2	210	–	–	–	–
Alona monacantha	–	–	–	–	–	–	–	–	1	3	–	–	–	–
A. davidi	–	–	–	–	1	–	10	2	–	2	–	–	–	–
A. sp. near *costata*	–	–	–	–	–	–	3	8	–	1	–	–	–	–
A. sp. near *guttata*	–	–	–	–	–	10	–	3	–	2	–	–	–	–
Biapertura kendallensis	–	–	–	–	–	–	–	–	–	–	–	–	–	–
B. karua	–	–	–	–	3	7	–	–	–	–	–	–	–	–
B. verrucosa	–	–	–	–	1	2	4	3	–	–	–	–	–	–
B. macrocopa	–	–	–	–	1	4	–	1	1	18	–	–	–	–
B. rigidicaudis	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Camptocercus australis	–	–	–	–	–	–	2	–	–	3	–	–	–	–
Euryalona orientalis	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Graptoleberis testudinaria	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Indialona globulosa	–	–	–	–	–	–	5	–	–	–	–	–	–	–
Kurzia longirostris	–	–	–	–	16	3	–	1	2	–	–	–	–	–
Leydigia acanthocercoides	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Oxyurella singalensis	–	–	–	–	–	–	4	2	–	–	–	–	–	–
Simocephalus latirostris	–	–	–	–	–	–	–	–	–	13	–	–	–	–
S. serrulatus	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Scapholeberis kingi	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Echinisca triserialis	–	–	–	–	11	184	6	18	–	–	–	–	–	–
E. williamsi	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Ilyocryptus spinifer	–	–	–	–	4	27	1	1	–	1	3	P	–	–
Macrothrix spinosa	–	–	–	6	–	–	–	–	–	–	–	P	–	–
M. hystrix	–	–	–	–	–	–	17	–	–	–	–	–	–	–
Streblocerus serricaudatus	–	–	–	–	–	9	–	2	–	10	–	–	–	–
Ostracoda	–	–	–	–	–	–	–	–	–	–	–	–	–	–

[a]excluding Ostracoda, copepod nauplii and Harpacticoida; [b]P = present, but number not recorded because sample leaked in transit

Table A4. Collection information and species counts for Ja Ja Billabong

B = Birge cone sample; L = light trap sample; N = net samples; P = water pump sample; T = tube sample; O = open water; W = weed beds; Hy = *Hygrochloa* sp.; Le = *Leersia* sp; Na = *Najas tenuifolia*; Ps = *Pseudoraphis* sp.

Year		1981							1982					1983										
Month	09	10	11	12	12	01	01	03	03	03	03	04	04	05	05	08	08	08	08	10	10	11	12	01
Date	14	12	16	03	17	18	18	01	15	15	15	19	30	17	17	19	19	29	30	18	18	19	13	14
Collection method	N	N	N	N	N	P	P	L	T	B	N	L	B	N	B	N	N	N	N	B	N	N	N	N
Habitat	O	O	O	O	O	O	W	W	W	W	O	W	W	O	W	O	O	O	O	W	O	O	O	O
Macrophyte species	–	–	–	–	–	–	Na	Ps	Na	Na	–	Le	Hy	–	Na	–	–	–	–	Ps	–	–	–	–
Volume sampled (L)	1250	750	625	875	706	100	40	–	7.6	c.212	625	–	–	736	c.490	1250	500	2500	392	–	1124	1909	256	316
Sub-sample counted	3/64	1/32	1/16	1/8	1/4	1/1	1/8	1/1	1/1	1/1	1/1	1/1	–	1/1	1/128	1/8	1/2	1/48	1/8	–	1/16	1/128	1/16	1/32
Total no. counted	1466	445	455	557	759	0	537	3	230	335	0	233	273	75	448	555	540	1278	3389	–	1325	440	301	416
Total no. of species[a]	9	9	6	4	21	0	14	1	14	11	0	16	18	5	21	8	8	4	7	8	8	5	10	6
Diaptomus lumholtzi	147	254	107	78	1	–	–	–	–	–	–	11	–	–	–	49	15	–	2	P[b]	60	181	16	4
Calamoecia ultima	36	4	–	–	–	–	–	–	–	–	–	62	–	–	–	160	160	144	30	–	15	–	5	–
Mesocyclops decipiens	351	55	69	99	177	–	–	–	–	–	–	–	–	31	–	–	–	–	60	–	–	16	22	31
M. leuckarti	–	–	–	80	80	–	–	–	–	–	–	–	–	20	–	3	208	–	180	P	10	50	25	66
M. sp. nov.	–	–	–	–	1	–	34	3	8	–	–	4	9	9	164	–	1	–	–	P	8	–	2	19
M. aspericornis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Microcyclops varicans	–	–	–	–	–	–	10	–	12	49	–	12	24	–	107	–	–	–	–	P	–	–	15	–
Diaptomus australis	–	–	–	–	–	–	–	–	–	–	–	11	3	–	–	–	–	–	–	–	–	–	–	–
Copepod nauplii	761	–	–	–	–	–	–	–	–	–	–	–	52	–	–	–	–	1036	3000	–	–	–	–	8
Harpacticoida	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	10	–
Diaphanosoma excisum	35	33	165	300	263	–	–	–	–	–	–	–	–	–	–	10	–	–	–	P	1170	162	158	133
D. sarsi	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Latonopsis australis	–	–	–	–	1	–	–	–	–	–	–	–	4	–	–	–	–	–	–	–	–	–	–	–
L. brehmi	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–
L. fasciculata	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	–	–	–	–	–	–	–	–	–
Pseudosida bidentata	–	–	–	–	–	–	–	–	–	–	–	–	2	–	17	–	–	–	–	–	–	–	–	–
Bosminopsis deitersi	10	37	–	–	42	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Bosmina meridionalis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Ceriodaphnia cornuta	31	21	112	–	2	–	–	–	–	–	–	–	–	–	–	2	11	1	17	–	–	–	1	–
Moina micrura	89	39	1	–	167	–	–	–	–	–	–	2	–	–	1	329	142	96	85	P	60	31	47	155
Moinodaphnia macleayi	–	–	–	–	1	–	12	–	–	–	–	7	–	–	2	–	–	–	–	P	1	–	–	–
Alonella clathratula	–	–	–	–	–	–	–	–	–	–	–	1	11	–	4	–	–	–	–	–	–	–	–	–
Australochydorus aporus	–	–	–	–	–	–	–	–	5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Chydorus eurynotus	–	–	–	–	4	–	2	–	–	15	–	33	3	7	10	–	–	–	–	–	–	–	–	–
C. sp. near *flaviformis*	–	1	–	–	–	–	–	–	–	–	–	3	–	–	–	–	–	–	–	–	–	–	–	–
Dadaya macrops	–	–	–	–	1	–	–	–	–	–	–	8	–	–	–	–	–	–	–	–	–	–	–	–
Dunhevedia crassa	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Ephemeroporus barroisi	–	–	1	–	1	–	351	–	12	19	–	35	11	–	59	–	–	–	–	–	–	–	–	–
A. monacantha	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
A. davidi	–	–	–	–	–	–	6	–	1	10	–	–	4	–	9	–	–	–	–	–	–	–	–	–
A. sp. near *costata*	–	–	–	–	1	–	–	–	7	7	–	–	3	–	–	–	–	–	–	–	–	–	–	–
A. sp. near *guttata*	–	–	–	–	–	–	6	–	2	25	–	9	–	–	3	–	–	–	–	–	–	–	–	–
Biapertura kendallensis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–
B. apertura karua	–	–	–	–	–	–	14	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
B. verrucosa	–	–	–	–	–	–	4	–	2	–	–	4	–	–	–	–	–	–	–	–	–	–	–	–

B. macrocopa	-	-	-	-	-	-	-	-	6	13	-	1	2	-	2	-	-	-	-	-	-	-	-	-
B. rigidicaudis	-	-	-	-	-	-	-	-	17	2	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Camptocercus australis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-
Euryalona orientalis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2	-	-	-	-	-	-	-
Graptoleberis testudinaria	-	-	-	-	1	-	-	-	-	16	-	-	5	-	-	-	-	-	-	-	-	-	-	-
Indialona globulosa	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Kurzia longirostris	-	-	-	-	1	-	-	-	-	-	-	-	-	-	6	-	-	-	-	-	-	-	-	-
Leydigia acanthocercoides	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oxyurella singalensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Simocephalus latirostris	-	-	-	-	1	-	10	-	7	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-
S. serrulatus	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-
Scapholeberis kingi	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Echinisca triserialis	-	-	-	-	1	-	28	-	4	19	-	24	10	5	17	-	-	-	-	-	-	-	-	-
E. williamsi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ilyocryptus spinifer	5	1	-	-	12	-	36	-	11	-	-	-	-	-	25	1	1	1	15	P	1	-	-	-
Macrothrix spinosa	-	-	-	-	-	-	4	-	-	-	-	-	4	-	2	-	-	-	-	-	-	-	-	-
M. hystrix	-	-	-	-	-	-	-	-	-	-	-	-	6	-	-	-	-	-	-	-	-	-	-	-
Streblocerus serricaudatus	-	-	-	-	-	-	20	-	126	136	-	-	4	-	-	-	-	-	-	-	-	-	-	-
Ostracoda	-	-	-	-	-	-	-	-	10	24	-	-	112	3	10	-	-	-	-	-	-	-	-	-

[a]excluding Ostracoda, copepod nauplii and Harpacticoida; [b]P = present, but number not recorded because sample leaked in transit

Table A5. Collection information and species counts for Jabiluka Billabong

B = Birge cone sample; N = net samples; T = tube sample; O = open water; W = weed beds; El = *Eleocharis* sp.; Lu = *Ludwigia* sp.; Na = *Najas tenuifolia*.

Year	1981				1982												1983
Month	09	10	11	12	01	01	03	04	05	05	07	07	09	10	10	12	01
Date	14	12	16	14	20	20	15	30	17	17	14	14	15	21	21	13	18
Collection method	N	N	N	N	N	B	T	B	B	N	N	B	N	N	B	N	N
Habitat	O	O	O	O	O	W	W	W	W	O	O	W	O	O	W	O	O
Macrophyte species	-	-	-	-	-	Na	El/Na	Na	Na	-	-	Lu/El	-	-	Lu	-	-
Volume sampled (L)	1250	414	706	636	494	c.707	23.1	-	c.353	490	1890	-	1050	875	-	373	304
Sub-sample counted	1/128	1/64	1/64	1/32	1/1	1/4	1/8	-	1/32	1/1	1/4	-	1/16	1/64	-	1/2	1/16
Total no. counted	451	292	462	434	189	368	370	304	310	151	547	193	288	224	315	681	349
Total no. of species[a]	7	6	6	5	9	12	20	18	13	4	5	7	7	7	11	5	6
Diaptomus lumholtzi	170	80	153	70	1	-	-	-	-	-	30	-	85	73	-	368	125
Calamoecia ultima	25	5	25	7	-	-	67	-	-	-	142	-	47	29	1	-	-
Mesocyclops decipiens	107	94	190	137	-	-	-	-	-	15	121	-	66	4	-	1	-
M. leuckarti	10	-	-	-	-	-	-	-	-	25	106	-	7	9	-	118	2
M. sp. nov.	-	-	-	-	-	44	50	2	148	-	44	49	-	-	22	-	1
M. aspericornis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Microcyclops varicans	-	-	-	-	1	8	80	33	6	-	-	51	-	-	29	3	-
Diaptomus australis	-	-	-	-	-	4	-	-	-	-	-	-	-	-	2	-	-
Copepod nauplii	-	-	-	-	-	-	-	-	-	105	104	-	-	-	-	-	-
Harpacticoida	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-
Diaphanosoma excisum	29	11	66	219	5	-	-	-	-	-	-	-	17	33	1	193	215
D. sarsi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Latonopsis australis	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-
L. brehmi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. fasciculata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pseudosida bidentata	-	-	-	-	7	4	2	12	11	-	-	-	-	-	-	-	-
Bosminopsis deitersi	13	41	20	-	-	-	1	-	-	-	-	-	19	22	-	-	-
Bosmina meridionalis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ceriodaphnia cornuta	97	60	8	-	-	-	-	-	-	-	-	-	47	54	69	1	-
Moina micrura	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Moinodaphnia macleayi	-	-	-	-	-	-	30	-	-	-	-	14	-	-	7	-	-
Alonella clathratula	-	-	-	-	-	12	4	-	-	-	-	-	-	-	-	-	-
Australochydorus aporus	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Chydorus eurynotus	-	-	-	-	-	-	9	9	-	-	-	-	-	-	-	-	-
C. sp. near *flaviformis*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dadaya macrops	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Dunhevedia crassa	-	-	-	-	-	-	1	-	-	-	-	-	-	-	2	-	-
Ephemeroporus barroisi	-	-	-	-	33	142	25	85	92	5	-	35	-	-	38	-	-
Alona monacantha	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
A. davidi	-	-	-	-	-	-	3	12	4	-	-	-	-	-	-	-	-
A. sp. near *costata*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A. sp. near *guttata*	-	-	-	-	-	6	6	-	-	-	-	-	-	-	-	-	-
Biapertura kendallensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. karua	-	-	-	-	1	32	5	3	2	-	-	-	-	-	-	-	-
B. verrucosa	-	-	-	-	-	-	6	31	1	-	-	-	-	-	-	-	-
B. macrocopa	-	-	-	-	-	-	14	27	2	-	-	-	-	-	-	-	-
B. rigidicaudis	-	-	-	-	-	-	33	13	11	-	-	-	-	-	-	-	-
Camptocercus australis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Euryalona orientalis	-	-	-	-	-	-	-	-	1	-	-	5	-	-	3	-	-
Graptoleberis testudinaria	-	-	-	-	-	-	25	4	-	-	-	-	-	-	-	-	-
Indialona globulosa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kurzia longirostris	-	-	-	1	95	2	-	-	-	-	-	-	-	-	-	-	-
Leydigia acanthocercoides	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oxyurella singalensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Simocephalus latirostris	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-
S. serrulatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scapholeberis kingi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Echinisca triserialis	-	-	-	-	29	108	5	18	15	1	-	27	-	-	5	-	1
E. williamsi	-	-	-	-	-	-	-	7	-	-	-	-	-	-	-	-	-
Ilyocryptus spinifer	-	-	-	-	14	5	2	6	16	-	-	12	-	-	-	-	-
Macrothrix spinosa	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-
M. hystrix	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Streblocerus serricaudatus	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-
Ostracoda	-	-	-	-	3	-	-	32	-	-	-	-	-	-	136	-	-

[a]excluding Ostracoda, copepod nauplii and Harpacticoida

Table A6. Collection information and species counts for Mine Valley Billabong

B = Birge cone sample; N = net samples; O = open water; W = weed beds; El = *Eleocharis* sp.; Na = *Najas tenuifolia*.

Year			1981							1982							1983
Month	09	10	11	12	12	01	03	04	05	07	08	10	11	11	11	12	01
Date	14	12	16	2	16	20	15	30	17	17	19	28	04	09	19	13	25
Collection method	N	N	N	N	N	B	B	B	B	N	N	N	N	N	N	N	N
Habitat	O	O	O	O	O	W	W	W	W	O	O	O	O	O	O	O	O
Macrophyte species	–	–	–	–	–	Na	Na	El	Na	–	–	–	–	–	–	–	–
Volume sampled (L)	1250	706	1414	1718	353	c.176	–	–	c.530	490	369	2120	1423	1207	1230	490	540
Sub-sample counted	1/8	1/1	1/1	1/2	1/1	1/2	–	–	1/256	1/1	1/1	1/16	3/40	1/2	1/1	1/1	1/1
Total no. counted	209	430	42	301	51	369	–	293	468	112	199	323	344	442	0	176	0
Total no. of species[a]	8	6	7	6	8	13	14	22	15	10	12	5	5	4	0	2	0
Diaptomus lumholtzi	91	235	9	–	–	–	–	–	–	–	4	108	57	23	–	65	–
Calamoecia ultima	46	40	1	–	–	–	–	–	–	12	60	–	–	–	–	–	–
Mesocyclops decipiens	2	2	1	48	18	–	–	–	–	–	5	–	–	–	–	–	–
M. leuckarti	4	17	15	145	20	–	–	–	–	–	3	–	–	–	–	–	–
M. sp. nov.	–	–	–	–	–	18	–	4	45	47	–	16	58	–	–	–	–
M. aspericornis	–	–	–	–	–	–	–	–	7	–	–	–	–	–	–	–	–
Microcyclops varicans	–	–	–	–	–	4	–	52	6	28	10	–	–	21	–	–	–
Diaptomus australis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Copepod nauplii	–	–	–	–	–	–	–	35	–	–	–	–	–	–	–	32	–
Harpacticoida	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Diaphanosoma excisum	60	135	13	103	1	2	–	–	–	1	–	197	207	396	–	79	–
D. sarsi	–	–	–	–	–	–	–	–	–	3	–	–	–	–	–	–	–
Latonopsis australis	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–
L. brehmi	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
L. fasciculata	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Pseudosida bidentata	–	–	–	–	–	–	P[b]	–	1	–	–	–	–	–	–	–	–
Bosminopsis deitersi	1	1	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Bosmina meridionalis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Ceriodaphnia cornuta	1	–	–	–	–	–	–	–	–	–	5	–	1	–	–	–	–
Moina micrura	–	–	1	–	3	–	–	–	–	1	84	1	–	–	–	–	–
Moinodaphnia macleayi	–	–	–	–	5	4	–	10	–	3	–	–	–	–	–	–	–
Alonella clathratula	–	–	–	–	–	2	P	15	19	–	–	–	–	–	–	–	–
Australochydorus aporus	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–
Chydorus eurynotus	–	–	–	–	–	–	P	4	59	–	11	–	–	–	–	–	–
C. sp. near *flaviformis*	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–
Dadaya macrops	–	–	–	–	–	–	–	6	–	–	–	–	–	–	–	–	–
Dunhevedia crassa	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Ephemeroporus barroisi	4	–	–	–	2	243	P	5	196	3	1	–	–	–	–	–	–
Alona monacantha	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–
A. davidi	–	–	–	–	–	13	–	–	8	–	–	–	–	–	–	–	–
A. sp. near *costata*	–	–	–	–	–	1	P	10	9	–	–	–	–	–	–	–	–
A. sp. near *guttata*	–	–	–	–	–	7	P	7	2	–	–	–	–	–	–	–	–
Biapertura kendallensis	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–
B. karua	–	–	–	–	–	15	P	–	2	–	–	–	–	–	–	–	–
B. verrucosa	–	–	–	–	–	–	–	9	–	–	–	–	–	–	–	–	–
B. macrocopa	–	–	–	–	–	–	P	7	18	–	–	–	–	–	–	–	–
B. rigidicaudis	–	–	–	–	–	4	P	2	–	–	–	–	–	–	–	–	–
Camptocercus australis	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–
Euryalona orientalis	–	–	–	–	–	–	P	–	–	10	–	–	–	–	–	–	–
Graptoleberis testudinaria	–	–	–	–	–	–	P	6	2	–	–	–	–	–	–	–	–
Indialona globulosa	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Kurzia longirostris	–	–	–	–	–	–	–	2	63	–	–	–	–	–	–	–	–
Leydigia acanthocercoides	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Oxyurella singalensis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Simocephalus latirostris	–	–	–	–	–	–	–	–	–	–	4	–	–	–	–	–	–
S. serrulatus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Scapholeberis kingi	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Echinisca triserialis	–	–	–	3	1	39	P	1	14	–	–	–	–	–	–	–	–
E. williamsi	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Ilyocryptus spinifer	–	–	–	1	1	17	P	7	–	4	11	–	–	–	–	–	–
Macrothrix spinosa	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
M. hystrix	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–
Streblocerus serricaudatus	–	–	–	1	–	–	P	12	–	–	–	1	1	–	–	–	–
Ostracoda	–	–	–	–	–	–	–	–	17	–	–	–	–	–	–	–	–

[a]excluding Ostracoda, copepod nauplii and Harpacticoida; [b]P = present, but number not recorded because sample leaked in transit

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RESEARCH PUBLICATIONS

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