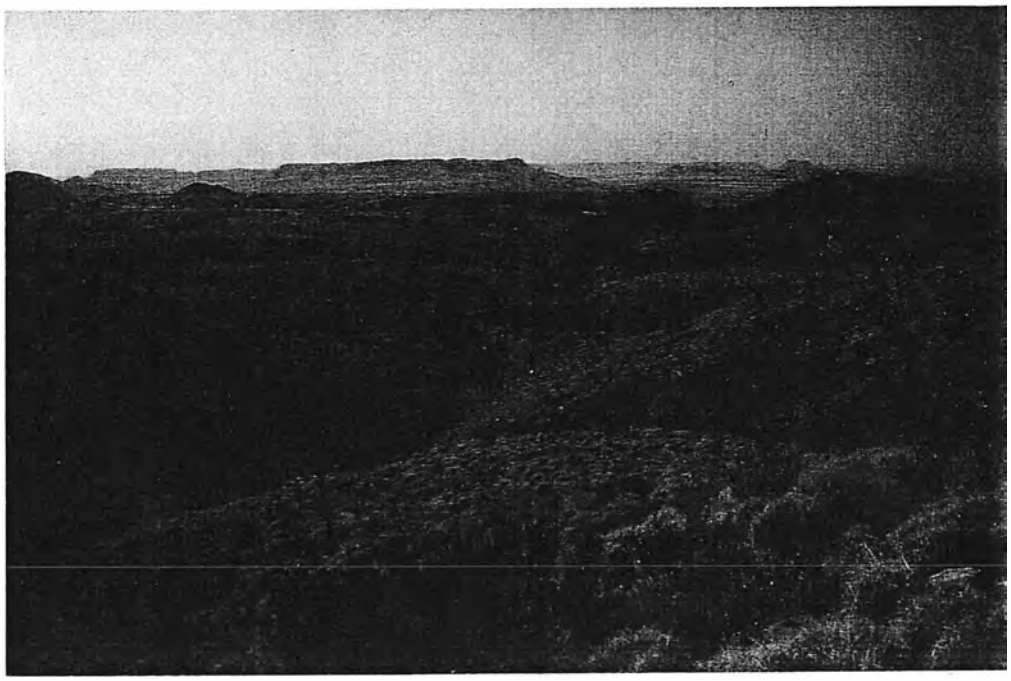
A FAUNAL ANALYSIS OF THE HYDRADEPHAGAN WATER BEETLES OF THE PILBARA IN WESTERN AUSTRALIA

(Coleoptera: Haliplidae, Dytiscidae and Gyrinidae)



Report prepared for

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by

Lars Hendrich

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A FAUNAL ANALYSIS OF THE HYDRADEPHAGAN WATER BEETLES OF THE PILBARA IN WESTERN AUSTRALIA

A PRELIMINARY REPORT

(Coleoptera: Haliplidae, Dytiscidae and Gyrinidae)

by

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INTRODUCTION

Australia has a rich and diverse hydradephagan beetle fauna. For many groups suitable identification keys exist. The revisions of the Australian Dytiscidae (WATTS, 1978), Gyrinidae (OCHS, 1949), Haliplidae (WATTS, 1988; VAN VONDEL, 1995), Hygrobiidae (BRITTON, 1981), and several additional contributions to various genera (e.g. OCHS, 1956, WEWALKA, 1975 & 1979, BRANCUCCI, 1983, BISTRÖM, 1982 & 1996, WATTS, 1997) have made it possible to identify most adults to species level. In spite of this work, there are very few references to the ecology and faunistics of Australian species. In 1993 and 1995 Larson published the first comprehensive papers, analyzing habitat and community patterns, natural history and distribution of northern Queensland species.

Water beetles are an important animal group in Australian freshwaters. They inhabit virtually every kind of fresh- and brackish water habitat, from the smallest puddles up to large lakes and swamps and from streams to irrigation ditches and reservoirs. Due to their diversity in terms of species numbers, variation in size and ecological niche they represent an ideal group for environmental impact assessments (EIAs), conservation assessments and biodiversity studies in a wider sense (e.g. DAVIS & CHRISTIDIS, 1997).

Adult water beetles were collected during a three-week faunal survey of the Pilbara of Western Australia in August and September 2002. For these insects the aquatic habitats of that region have only been investigated previously in June 2001 by Chris Watts (Adelaide). As a consequence the results of this fieldwork provided a number of new and remarkable regional records.

Furthermore, the planned publication form much needed contributions to the taxonomy, ecology and distribution of some highly endemic Western Australian species, and will prove useful for technicians monitoring the biological health of rivers and wetlands.

THE STUDY AREA

With uplands and associated drainage systems of the Ashburton, Fortescue and DeGrey Rivers, the Pilbara has the highest mountains in the western part of the continent (Hamersley Range) with Mt. Meharry (1,250 m) the highest point. To the east the ranges grade into low ridges, surrounded increasingly by sandy plains. The most characteristic type of aquatic habitat is that provided by intermittently flowing streams or rivers. The hills are incised by deep gorges, often carrying permanent water holes (e.g. Kalamina, Knox, Hancock, Weano Gorge). To the northwest, gently rolling hills end in a flat coastal plain of varying width. Waters, for the most part, are fresh, but some rivers draining of the Western Australian Plateau may be saline.

The climate is generally arid and subtropical, though a more Mediterranean-like climate prevails in the southern part of the Pilbara. Rainfall is low and unreliable; nowhere is the median annual value in excess of 400 mm. In the north, rain usually associated with summer cyclones or monsoons, whereas the south it is usually associated with winter low pressure systems.

A complex vegetation pattern of *Triodia* grassland, *Acacia aneura* woodland occur on the flood plains and *Triodia* grassland with open tree layer of *Eucalyptus leucophloia* on the stony hills is typical of this region. Fringing forests of the river and creek-lines are dominated by *E. camaldulensis* and *E. coolabah*. Despite a very low, uncertain rainfall and nutrient-poor soils, the landscape texture is varied and there is a high species richness of both perennial shrubs and ephemeral grasses and forbs (BRIDGEWATER 1987, WILLIAMS & ALLEN 1987).

COLLECTING PROCEEDURES

Most of the specimens were collected using different kinds of aquatic dip nets and metal kitchen strainers. Diameters of meshes varied from 500 to 1000 µm. Leaf litter and aquatic vegetation were swept heavily; the material obtained was then placed on a white 1m x 1m nylon sheet. Specimens were sorted with forceps and/ or an aspirator.

Less active species or individuals are traced by carefully sorting the substrate. Beetles from springs, small puddles and streams can frequently be directly sampled with an aspirator or a pair of forceps. The beetles, which usually cling to the substrate, are thus released and float on the water surface, where they can then easily be picked up with an aspirator.

Specimens collected were fixed in 70-90% alcohol, and brought to the South Australian Museum, Adelaide (South Australia) and the Free University of Berlin (Germany) for further processing and setting. Reference specimens will be deposited in the Museum of Perth.

LOCALITIES SAMPLED

Field work was carried out from 24rd August to 15th September 2002. The survey area of this study includes most aquatic habitat types of the Pilbara. Those sites appearing to be of particular interest for the likelihood of finding new and undescribed species were most intensively sampled (e.g. springs and pools of intermittent creeks).

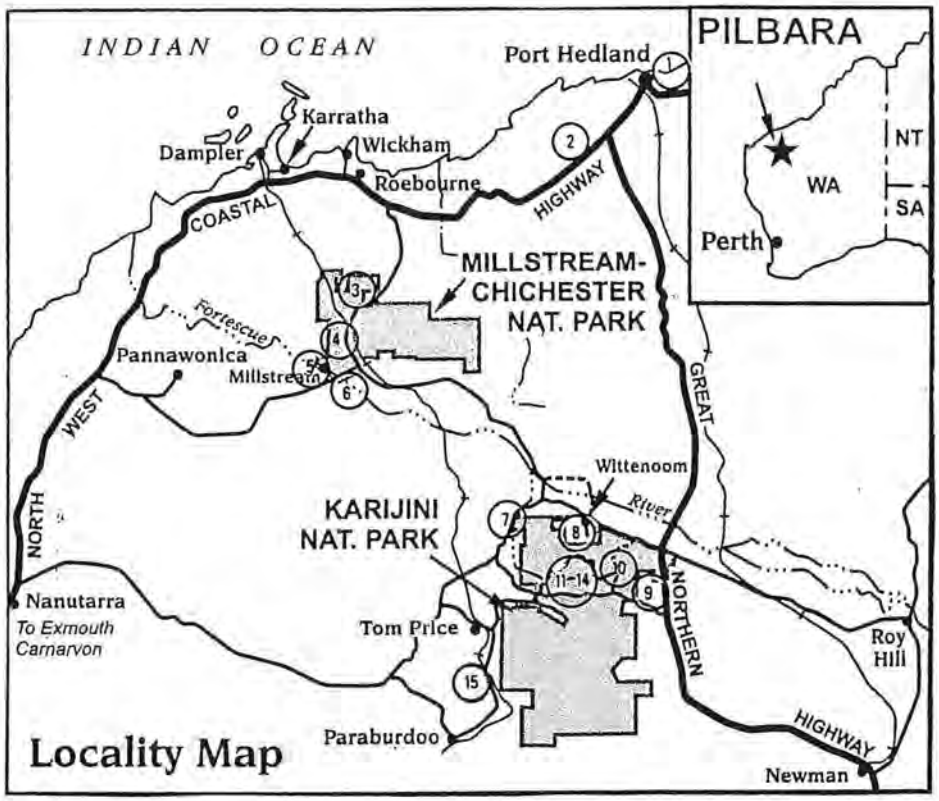

Fig. 1: Localities sampled in the Pilbara.

Loc. WA 1/165: Pilbara, De Grey River, River Crossing Hwy. No. 1, 72 km E of Port Hedland, 20m, 24.8.2002, 20°10'S 119°11'E, Hendrich leg. Riverside with dense mats of floating vegetation and shaded by old River Gums. Bottom consisted of sand and a thin layer of rotten plant debris (Fig. 6).

Loc. WA 2/166: Pilbara, Yule River, River Crossing Camping Area at Hwy. No. 1, 53 km SW of Port Hedland, 20m, 24.8.2002, 20°41'S 118°17'E, Hendrich leg. Isolated and mainly exposed pools in almost dry river bed. Rich in submers vegetation (e.g. *Chara*). Bottom consisted of sand, larger stones and a thin layer of rotten plant debris.

Loc. WA 3/167: Pilbara, Millstream Chichester N.P., McKenzie Springs, 200m, 25.8.2002, 21°18'S 117°12'E, Hendrich leg. Isolated and halfshaded spring fed pool (6 sqm, upt to 1.5 m depth) rich in aquatic vegetation (*Typha orientalis*, sedges and mats of *Chara*). Bottom consisted of rocks, stones and sand, with a layer of rotten plant debris (Fig. 2).

Loc. WA 4/168: Pilbara, Millstream Chichester N.P., Portland River, Roeburne-Wittenoom Road, 25.8.2002, 21°29'S 117°10'E, Hendrich leg. Isolated, eutrophic and shallow pool

(cattle hole, 10 sqm) in a temporary and partly shaded creek (River Gums). Without any aquatic vegetation. Bottom in some parts with a layer of rotten leaves and twigs.

Loc. WA 5/169: Pilbara, Millstream Chichester N.P., Gregory Gorge, Palm Pool at Fortescue River Crossing, 26.8.2002, 21°33´S 117°03´E, Hendrich leg. Slow flowing stream with seasonally inundated old *Melaleuca* woodland on fringe. Numerous isolated, shallow, shaded and pools (up to 20 cm depth) in the river bed. Aquatic vegetation: Different sedges, *Potamogeton* and mats of other floating vegetation. Bottom consisted of sand and in some pools rotten plant debris.

Loc. WA 5a/169a: Pilbara, Millstream Chichester N.P., Gregory Gorge, irrigation channels at Visitor Centre, 26.8.2002, 21°34´S 117°03´E, Hendrich leg. Perennial, slow flowing ditches rich in aquatic vegetation (Indian Water Fern, *Nymphaea*), shaded by introduced African palms and native old River Gums. Bottom consisted of sand and a thin layer of rotten leaves (Fig. 7).

Loc. WA 6/170: Pilbara, Millstream Chichester N.P., Fortescue River side branch, SE Visitor Centre, 26.8.2002, 21°37´S 117°07´E, Hendrich leg. Isolated, eutrophic and shallow pool (cattle hole, 10 sqm) in a temporary and partly shaded creek (River Gums). Without any aquatic vegetation. Bottom in some parts with a layer of rotten leaves and twigs.

Loc. WA 7/171: Pilbara, Hamersley Range, Hamersley Gorge, 400m, 27.8.2002, 22°15´S 117°59´E, Hendrich leg. Different rocky pools (2 - 20 sqm) in the main stream bed (up to 1 m depth). Aquatic vegetation: *Potamogeton* sp., dense mats of *Chara*, in smaller pools green and red algae (Fig. 9).

Loc. WA 8/172: Pilbara, Hamersley Range, Wittenoom Gorge, Wittenoom „Town Pool", 400m, 27.8.2002, 22°15´S 118°19´E, Hendrich leg. Different halfshaded pools (10 - 20 sqm, up to 1 m depth) surrounded by River Gums. Aquatic vegetation: Sedges and mats of floating vegetation (e.g. *Chara* and *Potamogeton* sp.). Bottom consisted sand with a thin layer of mud and plant debris.

Loc. WA 9/173: Pilbara, Hamersley Range, 17 km S Auski Roadhouse, Fig Tree Crossing, 400m, 28.8.2002, 22°32´S 118°44´E, Hendrich leg. Different isolated and halfshaded pools (10 - 20 sqm, up to 1.5 m depth) of an intermittent stream. Aquatic vegetation: Sedges and mats of floating vegetation (e.g. *Chara* and *Potamogeton* sp.). Bottom consisted sand and stones, with a thin layer of mud and plant debris.

Loc. WA 10/174: Pilbara, Hamersley Range, Karijini N.P., Dales Gorge [Fortescue Falls and Circular Pool], 400m, 28.8.2002, 22°29´S 118°35´E, Hendrich leg. Slow flowing stream and halfshaded rocky pools (10 - 20 sqm, up to 1.5 m depth). Aquatic vegetation: Sedges, *Typha orientalis* and mats of floating vegetation (e.g. *Chara*, *Nymphaea* and *Potamogeton* sp.). Bottom consisted of rocks, sand and larger stones, with a thin layer of mud and plant debris.

Loc. WA 11/175: Pilbara, Hamersley Range, Karijini N.P., Kalamina Gorge, 450m, 29.8.2002, 22°25´S 118°23´E, Hendrich leg. Slow flowing stream and exposed and shallow rocky pools (10 - 20 sqm, up to 0.5 m depth). Aquatic vegetation: Sedges, *Typha orientalis* and mats of floating vegetation (e.g. *Chara*). Bottom consisted of rock, sand and larger stones, with a thin layer of mud and plant debris (Fig. 10).

Loc. WA 12/176: Pilbara, Hamersley Range, Karijini N.P., Knox Gorge, 450m, 29.8.2002, 22°21'S 118°18'E, Hendrich leg. Exposed and deep rocky pool (100 sqm, up to 1.5 m depth). Aquatic vegetation: Sedges and green algae. Bottom consisted of rock, sand and larger stones, with a thin layer of mud and plant debris (Fig. 3).

Loc. WA 13/177: Pilbara, Hamersley Range, Karijini N.P., Weano Gorge, 450m, 29.8.2002, 22°21'S 118°17'E, Hendrich leg. Shaded, cold and deep rocky pools (20 sqm, up to 0.6 m depth) without any vegetation. Bottom consisted of rocks, sand and larger stones.

Loc. WA 14/178: Pilbara, Hamersley Range, Karijini N.P., Hancock Gorge, 450m, 30.8.2002, 22°21'S 118°16'E, Hendrich leg. Shaded, cold and deep rocky pools (20 sqm, up to 0.6 m depth) without any vegetation. Bottom consisted of rocks, sand and larger stones (Figs. 4 & 5).

Loc. WA 14a/178a: Pilbara, Hamersley Range, Karijini N.P., Hancock Creek Crossing, Weano Road, 5 km S Weano Campsite, 450m, 30.8.2002, 22°27'S 118°10'E, Hendrich leg. Exposed, eutrophic and deep sandy pools (100 sqm, up to 1.5 m depth). Aquatic vegetation: Sedges, *Typha orientalis* and green algae. Bottom consisted of sand and larger stones, with a thin layer of mud and plant debris (Fig. 11).

Loc. WA 15/179: Pilbara, Hamersley Range, Karijini N.P., 30 km S Tom Price, Bellary Creek 1st Crossing on Tom Price Road, 30.8.2002, 22°57'S 117°51'E, Hendrich leg. Exposed, eutrophic and deep sandy pools (20 sqm, up to 0.5 m depth). Aquatic vegetation: Sedges (*Baumea* sp. ?) and *Typha orientalis*. Bottom consisted of sand and larger stones, with a thin layer of mud and plant debris.

RESULTS AND DISCUSSION

In the present study a total of 33 species of predacious water beetles were collected from the the Pilbara in Western Australia (**table, fig. 12**). They belong to the following families (species numbers in parantheses): Haliplidae (1), Gyrinidae (3) and Dytiscidae (29). In the present study at least 1 species is new to science and will be described shortly (HENDRICH in prep.).

The water beetle fauna of the Pilbara is dominated by Torresian faunal elements. Altogether 13 species, 39 % of the total fauna recorded, are mainly distributed in the tropical parts of northwestern and northern Australia.

Just five species are endemics (*Australodytes* sp. nov., *Hydroglyphus orthogrammus*, *Sternopriscus pilbaraensis*, *Tiporus lachlani* and *Tiporus tambreyi*), restricted to permanent, mainly lotic habitats in the Pilbara. Only two species are widespread in Northern and Central Australia (*Copelatus nigrolineatus* and *Necterosoma regulare*), and five species (*Allodessus bistrigatus*, *Dineutes australis*, *Eretes australis*, *Hyphydrus elegans* and *Platynectes decempunctatus*) occur in most parts of Australia. At least five species are widespread in the Palaeartic and/or Oriental and Australasian realms (*Hydaticus consanguineus*, *Hyphydrus lyratus lyratus*, *Laccophilus sharpi*, *Rhantaticus congestus* and *Rhantus suturalis*).

The greatest diversity was met in the Palm Pool at Fortescue River Crossing (Gregory Gorge, loc. 5: 22 species/ 66 %) and McKenzie Springs (loc. 3: 20 species/ 60 %). Both localties, situated within the Millstream Chichester National Park, housed all endemic species of the Pilbara.

A small sensation is the discovery of a new large *Austrodytes* species. *Austrodytes* is a monotypic genus, with one representative in Northern Australia - *Austrodytes insularis* HOPE. The ecology of both species is unusual for Cybistrini (Genera *Cybister*, *Onychohydrus*, *Homoeodytes*). Known so far all related Oriental and Australasian species are more or less lentic, occuring in well vegetated permanent lakes, swamps or larger forest pools. In contrary the genus *Austrodytes* inhabit permanent streams in the tropical north of Australia. *Austrodytes insularis* is recorded from the Kimberleys, Kakadu and Litchfield National Parks and various localities in Northern Queensland (LARSON, 1993 & 1997). The undescribed species, a bit larger than *insularis*, is endemic for the Pilabara (HENDRICH, in prep.).

According to VAN VONDEL (1995), the finding of the rarely collected and recently described *Haliplus wattsi* is the first record of the family Haliplidae for the Pilbara. The species was known before from the Kimberleys and Northern Territories only.

The other interesting and remarkable beetles are *Hydroglyphus orthogrammus*, a rather small (3 mm) but colorfull species (yellowish with blackish stripes on elytra), extremely rarely collected, and of which only the type material and two additional specimens are known (see WATTS, 1978); and the blackish *Tiporus alastairi*, a rare species, distributed in the Southern Kimberleys.

Results of the survey have permitted the detection of some tendencies reflecting habitat selection for most of the species. Of the 33 species recorded here, 13 species (40 %) are restricted to lentic sites, while 10 species (30 %) are found in lotic situations only.

However, in some cases this division is difficult as different habitats often merge into one another, especially in the dry summer period when the study took place and many creeks and small streams started to drawn. A good example are the dytiscids *Bidessodes denticulatus* and *Sternopriscus pilbaraenis* which occur in stagnant rest pools of intermittent creeks as well as in slow flowing streams.

At least 10 species (30 %) were found in both lotic and lentic habitats.

All but three species (90 %) were collected in permanent water bodies only. Only three species occur in both permanent and temporary habitats.

In general, isolated, deep, shaded and well vegetated pools with clear water housed a species rich fauna, whereas sun exposed, warm and eutrophic water bodies are inhabited by fewer, often common and eurytopic species. The deep, cold and often connected pools in the gorges, without or with little emergent vegetation and plant debris housed a rich fish and dragonfly fauna while their water beetle fauna was rather poor. Predation by dragonfly nymphs, freshwater fishes and crayfish seems to have a significant effect on the distribution and abundance of Australian water beetles, especially their larval stages.

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The author warmly thanks Ingo Weckwerth (Berlin, Germany) for his assistance and enthusiatic encouragement in the field. The author thanks Park Rangers Mr. Maitland Parker and Mrs. Patricia Parker for valuable information concerning field studies in Karijini and Millstream Chichester National Parks. The Department of Conservation and Land Management is acknowledged for giving permission to conduct scientific research in the Pilbara [Permit numbers: SF 003017 and NE 002348].

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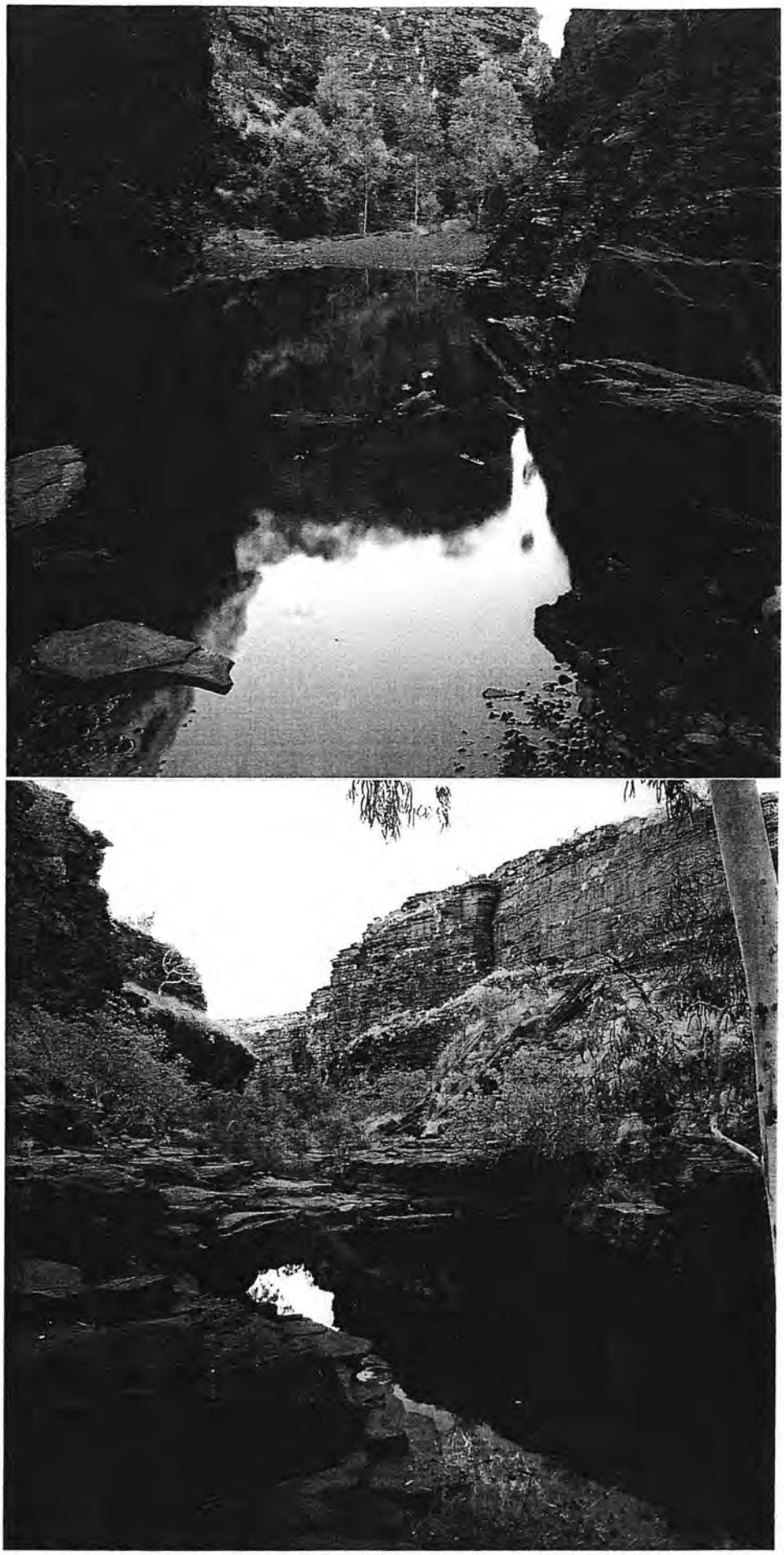
FIGURES

Fig. 2: Location WA 3/167: Pilbara, Millstream Chichester National Park, McKenzie Springs, 200m, 25.8.2002, 21°18′S 117°12′E. Isolated and halfshaded spring fed pool. The habitat of 20 species of carnivorous water beetles including all but one endemics of the Pilbara (e.g. *Hydroglyphus orthogrammus*, the new *Austrodytes*, *Tiporus lachlani* and *Sternopriscus pilbaranensis*), and *Tiporus alastairi* (Photo I. Weckwerth).

Fig. 3: Loc. WA 12/176: Pilbara, Hamersley Range, Karijini N.P., Knox Gorge, 450m, 29.8.2002, 22°21´S 118°18´E. Exposed and deep rocky pool. This is the habitat of 15 species, including the new *Austrodytes*, *Tiporus tambreyi*, *Laccophilus sharpi*, *Hydrovatus weiri* and all three whirligig beetles (Photo I. Weckwerth).



Figs. 4 & 5: Loc. WA 14/178: Pilbara, Hamersley Range, Karijini N.P., Hancock Gorge, 450m, 30.8.2002, 22°21′S 118°16′E. Shaded, cold and rocky pools without any aquatic vegetation. Habitat of *Platynectes decempunctatus* and *Austrodytes* nov. spec. (Photos I. Weckwerth).

Figs. 6 - 8: **6**) Loc. WA 1/165: De Grey River, River Crossing Hwy. No. 1, 72 km E of Port Hedland, 20m, 24.8.2002, 20°10´S 119°11´E; 7) Loc. WA 5a/169a: Pilbara, Millstream Chichester N.P., Gregory Gorge, irrigation channels at Visitor Centre, 26.8.2002, 21°34´S 117°03´E; **8**) Fortescue River in Millstream Chichester N.P., Cliff Lookout.

Figs. 9 - 11: **9**) Loc. WA 7/171: Hamersley Range, Hamersley Gorge, 400m, 27.8.2002, 22°15′S 117°59′E; **10**) Loc. WA 11/175: Hamersley Range, Karijini N.P., Kalamina Gorge, 450m, 29.8.2002, 22°25′S 118°23′E; **11**) Loc. WA 14a/178a: Hamersley Range, Karijini N.P., Hancock Creek Crossing, Weano Road, 5 km S Weano Campsite, 450m, 30.8.2002, 22°27′S 118°10′E.

Carnivorous Water Beetles of the Pilbara	Loc. 1	Loc. 2	Loc. 3	Loc. 4	Loc. 5	Loc. 5a	Loc. 6	Loc. 7	Loc. 8	Loc. 9	Loc. 10	Loc. 11	Loc. 12	Loc. 13	Loc. 14a	Loc. 14	Loc. 15	Distribution	Ecology
HALIPLIDAE																			
Haliplus wattsi VAN VONDFEL, 1995					2													N-Australia	lentic, perm.
DYTISCIDAE																			
Allodessus bistrigatus (CLARK, 1862)	4	17	10		3								5			1		Australia	lentic (lotic)
Austrodytes spec. nov.			15					8		3	4		2					Pilbara, endemic !	lotic (lentic)
Bidessodes denticulatus (SHARP, 1882)					3		45											N-Australia	lotic (lentic)
Copelatus irregularis MACLEAY, 1871										1	2	2	1					N-Australia	lentic, temp.
Copelatus nigrolineatus SHARP, 1882	2	15	1		28		3			1	1	1	1					N- and C- Australia	lentic
Cybister tripunctatus (OLIVIER, 1795)	7		5		6	2		1			1				1			Orientalis, Australis	lentic, perm.
Eretes australis (ERICHSON, 1842)			1							5								Australia	lentic
Hydaticus consanguineus AUBÉ, 1838	6		5		2	2					5		1					Orientalis and N-Australia	lentic
Hydaticus daemeli SHARP, 1882			17					11		2	3							N-Australia	lentic/lotic
Hydaticus quadrivittatus BLANCHARD, 1853	1																	N-Australia	lentic, perm.
Hydroglyphus basalis (MACLEAY, 1871)	14				6		1		5								1	N-Australia	lentic
Hydroglyphus orthogrammus (SHARP, 1882)		12	20	10	2		4				1		14				1	Pilbara, endemic !	lotic (lentic)
Hydroglyphus grammopterus (ZIMMERMANN, 1928)	1	10		1	3													N-Australia	lentic
Hydroglyphus leai (GUIGNOT, 1939)							1											N-Australia	lentic
Hydrovatus rufoniger politus SHARP, 1882	10																	N-Australia	lentic
Hydrovatus weiri BISTRÖM, 1996					8	1	4			3	4	21	1					N-Australia	lentic/lotic
Hyphydrus elegans (MONTROUZIER, 1860)		2	10	1	2				1	3		1	5					Australia	lentic/lotic
Hyphydrus lyratus lyratus SWARTZ, 1808	8	12	2		11	2	4		1	4	3	2	5	1				Orientalis, N- and C- Australia	lentic
Laccophilus sharpi RÉGIMBART, 1889	24	37	8		2	3	4				4	9	10				3	Orientalis, N- and C- Australia	lentic/lotic
Limbodessus compactus (CLARK, 1862)			10		1		5		1				1		2		3	Orientalis and N-Australia	lentic/lotic
Necterosoma regulare (SHARP, 1882)		30		2	18		12		1								2	N- and C-Australia	lentic (lotic)
Onychohydrus atratus (FABRICIUS, 1801)			2		1			2										N-Australia	lentic, perm.
Platynectes decempunctatus (FABRICIUS, 1775) s.l.			2		3			3		3	1	34		4		1		Australia	lotic
Rhantaticus congestus (KLUG, 1833)			4		1													Aethiopis, Orientalis & Australis	lentic
Rhantus suturalis (MACLEAY, 1825)					1													Palaearctic, Oriental and Australian realms	lentic
Sternopriscus pilbaraensis HENDRICH & WATTS			6		2				11			1						Pilbara, endemic !	lotic (lentic)
Tiporus alastairi (WATTS, 1978)			12						1									S-Kimberleys, Pilbara	lotic (lentic)
Tiporus lachlani WATTS, 2001			4							19					1			Pilbara, endemic !	lotic (lentic)
Tiporus tambreyi (WATTS, 1978)		2	3		1				23				1		1			Pilbara, endemic !	lotic (lentic)
GYRINIDAE																			
Dineutes australis (FABRICIUS, 1775)		21	1			2		4		2		13	3	6		1		Australia	lotic
Macrogyrus darlingtoni OCHS, 1949					1						4		18					N-Australia	lotic
Macrogyrus finschi OCHS, 1925								14		33		1	6	2		1		N-Australia	lotic
Specimens: 979	77	158	138	14	107	12	83	43	44	79	33	85	74	13	5	4	10		
Species: 34	10	10	20	4	22	6	10	7	8	12	12	10	15	4	4	4	5		

Fig. 12: Checklist of carnivorous water beetles from the Pilbara, with data on their ecology and distribution [temp. - temporary habitats; perm. - permanent habitats]. Distribution after WATTS (1985) and LAWRENCE et al. (1987)