

# Waterbirds and aquatic invertebrates of swamps on the Victoria-Bonaparte mudflat, northern Western Australia

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## Abstract

The aquatic invertebrate and waterbird faunas of the western part of the Victoria-Bonaparte mudflat, located in the Victoria-Bonaparte biogeographic region of the Kimberley, Western Australia, were surveyed in early 1993. Sixty-two species of waterbird and at least 131 species of aquatic invertebrate were recorded. The mudflat has national significance for some shorebird species, especially Redshanks, and has a significant Asian element in the invertebrate fauna. The survey contributes to growing evidence that the micro-invertebrate fauna of Western Australia is distinctive, but the conservation significance of the area for invertebrates cannot be assessed properly without more information concerning other areas of northern Australia.

## Introduction

Australia has been divided into 80 biogeographic regions, based on climate, geology, landform, flora, fauna and land use, to provide a framework for assessing the adequacy of Australia's system of conservation reserves (Thackway & Cresswell 1995). The Victoria-Bonaparte mudflat, an extensive area that is occasionally inundated by fresh or saline water, is within the Victoria-Bonaparte biogeographic region in the extreme north-eastern Kimberley area of Western Australia.

Approximately 1,000,000 palaeartic shorebirds occur annually in coastal habitats of northern Australia, with major concentrations at Eighty-Mile Beach and Roebuck Bay, in Western Australia, and the Gulf of Carpentaria, in Queensland (Lane 1987). These areas are staging points for shorebirds as they migrate to and from Australia. Many shorebirds remain in northern Australia over the austral winter, rather than returning to the Northern Hemisphere to breed, but Minton & Martindale (1982) recorded only 7120 shorebirds along the coast between Darwin and Kununurra, including the Victoria-Bonaparte mudflat, during an aerial survey in late August 1981. As a result, subsequent shorebird studies in north-western Australia have been concentrated further south in the Kimberley and in the Pilbara, where more shorebirds had been recorded (*e.g.* Minton & Jessop 1994).

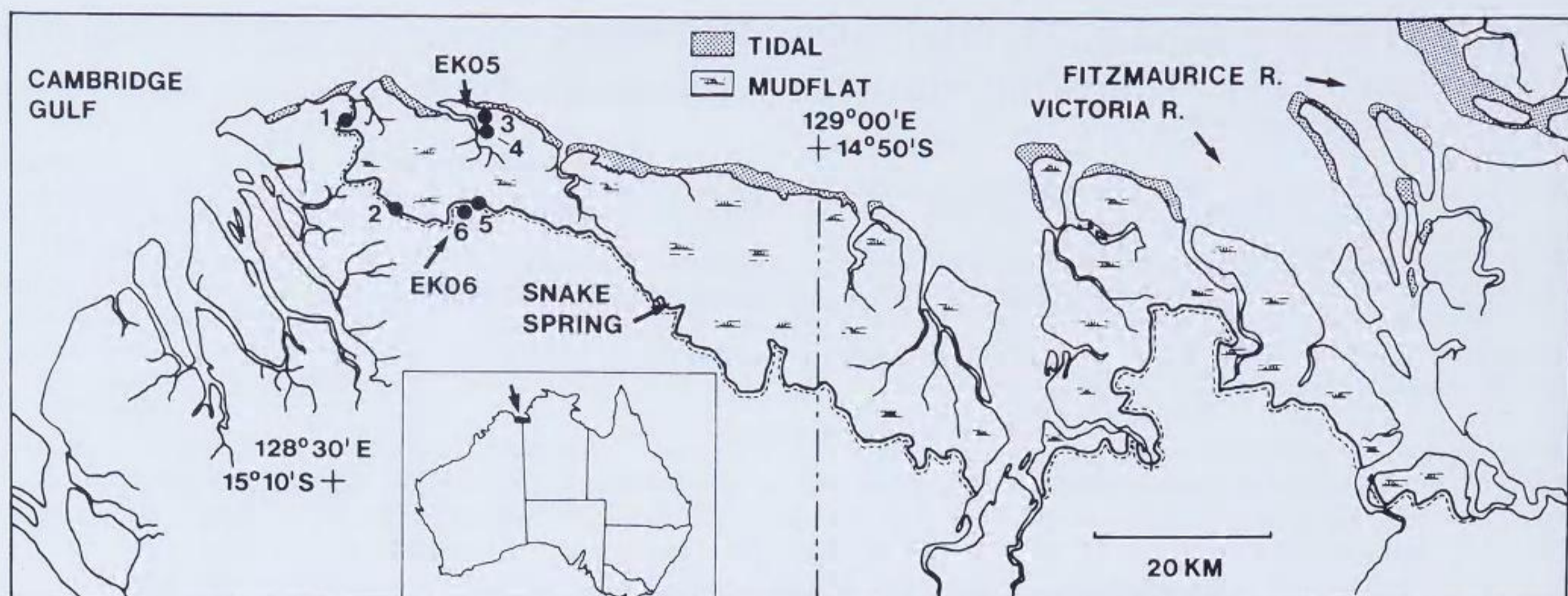
Most information about aquatic invertebrates in lentic waters of northern Australia comes from studies in the Alligator Rivers region of the Northern Territory (*e.g.* Tait *et al.* 1984; Julli 1986; Hawking 1992) and extensive collecting by B V Timms (Timms 1988; Timms & Morton 1988). Information for the Kimberley is virtually restricted to the work of Timms, and what can be extracted from taxonomic and biogeographic papers that are mostly based on the collections of Williams (1979) and Timms (*e.g.* McKenzie 1966; Watts 1987). Recent work

has shown that the stream fauna of the Kimberley is comparatively rich (M J Smith, W R Kay & S A Halse, unpublished observations) in contrast to the tentative suggestion of Williams (1979) that it was depauperate. The only comprehensively studied lentic site in the Kimberley, Lake Gregory on the edge of the Great Sandy Desert, also supported a rich fauna (Halse *et al.* in press). McKenzie (1966) commented on the apparent affinities of the ostracod faunas of the Kimberley and Indonesian islands. Lansbury (1984) suggested that the hemipteran fauna of coastal Kimberley waterbodies has similar Indonesian links, unlike the remainder of Australia.

The biology of the Victoria-Bonaparte biogeographic region, like much of the Kimberley area, is poorly known, and less than 10 per cent of the Western Australian portion is reserved. In a review of the conservation reserve system of the Kimberley, Burbidge *et al.* (1991) recommended that the conservation value of the Victoria-Bonaparte mudflat be investigated, and McKenzie *et al.* (1991) examined two rainforest patches (EK05, EK06). The aim of the present study was to gather information on waterbirds and aquatic invertebrates using the mudflat. The conservation value of the mudflat and the biogeographic affinities of some invertebrate taxa are discussed.

## Study area

The Victoria-Bonaparte mudflat is a band approximately 10-20 km wide along the coast of Joseph Bonaparte Gulf, between Cambridge Gulf in Western Australia and the mouth of the Victoria River in the Northern Territory (Fig 1). Tidal flats up to 2 km wide and a narrow sandy beach occur on the northern side of the mudflat, south of which is an elevated narrow band of low dunes between the beach and a hinterland of extensive bare mudflat. Several creeks, lined by mangroves, drain the mudflat. Along the landward boundary there are many small freshwater pools and some larger areas of freshwater marsh.



**Figure 1.** Victoria-Bonaparte mudflat, showing the sampling sites for aquatic invertebrates and other features mentioned in text (the boundary of the mudflat in the Northern Territory is drawn approximately). 1, Grassed Pool; 2, Brolga Spring; 3, Samphire Pool; 4, Mudflat Pool; 5, Rainforest Swamp; 6, Edge Swamp

Several shallow, seasonally inundated freshwater pools covered with emergent grass *Vetiveria pauciflora* and sedges *Cyperus conicus* and *C. javanicus* occur at the north-western end of the mudflat (Fig 1). The northernmost of the pools is referred to as Grassed Pool. At the south-western end is a small permanent swamp, Brolga Spring, which contains *Melaleuca viridiflora* trees and *Sesbania cannabina* on the southern side. There are two shallow pools east of the mouth of the second largest creek on the mudflat, near the coastal rainforest site, EK05 (McKenzie *et al.* 1991). The freshwater, seasonal Samphire Pool is located in an interdunal swale and supports emergent samphire *Halosarcia halocnemoides tenuis* and sedge *Cyperus aquatilis*, while the brackish, tidally filled Mudflat Pool lies in a depression on the southern side of the dune area with a shallow drainage line connecting it to bare mudflat; it has some emergent grass. Rainforest Swamp, a small semi-permanent freshwater swamp, containing tall *Melaleuca argentea* and *Nauclea orientalis* trees and small herbaceous ferns such as *Cyclosorus interruptus* and *Blechnum orientale*, was adjacent to the rainforest site, EK06, near Long Spring (McKenzie *et al.* 1991). There is also a small seasonal freshwater swamp at Long Spring between the fringing woodland and open mudflat, referred to herein as Edge Swamp. Around Snake Spring, on the southern edge of the central part of the mudflat, extensive areas are ephemerally flooded with fresh water via small creeks from the south and covered with dense stands of grass and sedge.

## Methods

Waterbirds were counted from 17-19 February by SAH and from 4-6 April by SAH and GBP in 1993 to document the numbers and species of waterbirds using the area in late summer, during the middle of the wet season, and in autumn when migratory shorebirds are concentrated in northern Australia prior to leaving for the Northern Hemisphere. A partial count of the Western Australian

portion of the Victoria-Bonaparte mudflat was made from a Cessna 182 flying at a height of 30-40 m and speed of 100 knots on 17 February. On 18-19 February, several marine and freshwater sections of the mudflat were counted from a Robinson helicopter flying at a height of 15 m and speed of 50 knots. In addition, ground counts were made at Snake Spring, Grassed Pool and on 4 km of tidal flat north of EK05. On 4 April, ground counts were made among mangroves and on tidal flat west of the creek mouth at EK05, and at the second-most north-western grassed pool (Fig 1). On 5-6 April, a complete count of the Western Australian portion of the mudflat was made from a Cessna 182 flying at a height of 20 m and speed of 60 knots.

Two samples of aquatic invertebrates were collected from Grassed Pool, Samphire Pool, Mudflat Pool, Rainforest Swamp and Edge Swamp by SAH on 18-19 February by sweeping approximately 50 m of water, and as many microhabitats as possible, using FBA-type pondnets with 50 and 110  $\mu\text{m}$  mesh. The 50  $\mu\text{m}$  mesh sample was preserved in 5 per cent buffered formalin, the 110  $\mu\text{m}$  mesh sample was preserved in 70 per cent alcohol for sorting and identification in the laboratory. Water samples were taken from four of the sites for measurement of conductivity ( $\text{mS cm}^{-1}$ ; TPS LC81), which was converted to parts per thousand total dissolved solids (ppt TDS) as  $\text{TDS} = 0.6 \text{ mS cm}^{-1}$ .

## Results

Altogether, 62 species of waterbird were recorded on the Western Australian portion of the Victoria-Bonaparte mudflat, including 28 species of shorebird (Table 1). More than 4,000 birds were counted in both February and April, with almost 2000 shorebirds present each occasion. Notable records in February were 1701 Magpie Geese, mostly near Snake Spring, 126 Marsh Sandpipers near Snake Spring and Grassed Pool, and 5 Redshanks on the creek near EK05. Notable records in April were

Table 1

Waterbirds recorded on the Victoria-Bonaparte mudflat in February and April 1993

Species	Feb	April
Magpie Goose <i>Anseranas semipalmata</i>	1701	10
Plumed Whistling-Duck <i>Dendrocygna eytoni</i>	20	6
Wandering Whistling-Duck <i>Dendrocygna arcuata</i>	12	
Radjah Shelduck <i>Tadorna radjah</i>	11	5
Green Pigmy-Goose <i>Nettapus pulchellus</i>	11	1
Pacific Black Duck <i>Anas superciliosa</i>	39	37
Grey Teal <i>Anas gracilis</i>	32	
Hardhead <i>Aythya australis</i>	1	
Darter <i>Anhinga melanogaster</i>	3	
Little Pied Cormorant <i>Phalacrocorax melanoleucos</i>	30	
Little Black Cormorant <i>Phalacrocorax sulcirostris</i>	11	
Australian Pelican <i>Pelecanus conspicillatus</i>	23	17
Little Egret <i>Egretta garzetta</i>	42	54
Eastern Reef Egret <i>Egretta sacra</i>	6	1
Pied Heron <i>Ardea pictata</i>		4
Great Egret <i>Egretta alba</i>	5	6
Intermediate Egret <i>Egretta intermedia</i>	2	2
Unidentified egret	48	99
Striated Heron <i>Butorides striatus</i>		2
Nankeen Night Heron <i>Nycticorax caledonicus</i>	18	1
Glossy Ibis <i>Plegadis falcinellus</i>		59
Australian White Ibis <i>Threskionis aethiopica</i>	183	281
Straw-necked Ibis <i>Threskionis spinicollis</i>		30
Black-necked Stork <i>Xenorhynchus asiaticus</i>	14	6
Sarus Crane <i>Grus antigone</i>		2
Brolga <i>Grus rubicundis</i>	18	81
Black-tailed Godwit <i>Limosa limosa</i>	2	2
Bar-tailed Godwit <i>Limosa lapponica</i>	30	171
Whimbrel <i>Numenius phaeopus</i>	21	53
Eastern Curlew <i>Numenius madagascariensis</i>	6	5
Little Curlew <i>Numenius minutus</i>		1
Common Redshank <i>Tringa totanus</i>	5	
Marsh Sandpiper <i>Tringa stagnatilis</i>	126	83
Common Greenshank <i>Tringa nebularia</i>	13	65
Wood Sandpiper <i>Tringa glareola</i>		3
Terek Sandpiper <i>Tringa terek</i>		29
Common Sandpiper <i>Tringa hypoleucos</i>		1
Grey-tailed Tattler <i>Tringa brevipes</i>		15
Ruddy Turnstone <i>Arenaria interpres</i>		5
Great Knot <i>Calidris tenuirostris</i>	10	74
Red Knot <i>Calidris canutus</i>	5	
Red-necked Stint <i>Calidris ruficollis</i>		34
Sharp-tailed Sandpiper <i>Calidris acuminata</i>	1	
Curlew Sandpiper <i>Calidris ferruginea</i>	2	2
Comb-crested Jacana <i>Irediparra gallinacea</i>	2	
Beach Stone-Curlew <i>Burhinus neglectus</i>	2	1
Pied Oystercatcher <i>Haematopus longirostris</i>	36	21
Black-winged Stilt <i>Himantopus himantopus</i>	101	261
Red-necked Avocet <i>Recurvirostra novaehollandiae</i>	1	
Pacific Golden Plover <i>Pluvialis dominica</i>	1	1
Grey Plover <i>Pluvialis squatarola</i>	1	14
Red-capped Plover <i>Charadrius ruficapillus</i>	11	2
Greater Sand Plover <i>Charadrius leschenaultii</i>	3	43
Red-kneed Dotterel <i>Erythronyx cinctus</i>		1
Masked Lapwing <i>Vanellus miles</i>	37	120
Unidentified wader	1559	903
Silver Gull <i>Larus novaehollandiae</i>	5	3
Gull-billed Tern <i>Gelochelidon nilotica</i>	7	133
Caspian Tern <i>Hydroprogne caspia</i>	3	6
Crested Tern <i>Sterna bergii</i>	1	
Little Tern <i>Sterna albifrons</i>	1	32
Whiskered Tern <i>Chlidonias hydrida</i>		37
White-winged Black Tern <i>Chlidonias leucoptera</i>		1123
Unidentified tern	162	354
Clamorous Reed-Warbler <i>Acrocephalus stentoreus</i>		2
<b>Total</b>	<b>4384</b>	<b>4304</b>

1123 White-winged Black Terns and 53 Whimbrels. Counts for some species, especially shorebirds and terns, were under-estimates because not all birds could not be identified to species level during the aerial surveys and categories such as 'unidentified tern' were used. Estimates of total waterbird numbers were probably reasonably accurate, however (see Halse *et al.* 1996).

All sites sampled for invertebrates on the Victoria-Bonaparte mudflat, except Mudflat Pool (11.8 ppt TDS), were fresh. The salinity of Samphire Pool was 0.84 ppt, Brolga Spring was 0.51 ppt and Edge Swamp was 0.20 ppt. At least 131 species of invertebrate were collected, with the number of species per site ranging from 13 at the brackish Mudflat Pool to 60 at Edge Swamp (Appendix). Species-rich orders were Cladocera (27 species), Ploimida (24), Coleoptera (20), Copepoda (10) and Ostracoda (10).

A significant number of species were undescribed. Apart from *Metacyclops* sp. EK1, these included the ostracods *Bennelongia* sp. 363, *Cyprinotus* sp. 362 and *Ilyodromus* sp. 365, cladocerans *Macrothrix* sp. A and *Macrothrix* sp. B and rotifers *Lecane* sp. A and *Lecane* sp. B (Appendix). The ostracod, *Strandesia/Chamydotheca* sp., appeared to be an undescribed genus (P De Deckker, pers. comm.). Many of the insect larvae, especially dipterans, could not be identified to species because the taxonomy of the larvae is poorly known.

## Discussion

Fewer waterbird species (62) occurred on the Western Australian portion of the Victoria Bonaparte mudflat during the two surveys than have been recorded on the long-term list for Parry Lagoons (77), which is the best known site for waterbirds in the Victoria-Bonaparte biogeographic region (Jaensch & Lane 1993). Total numbers were substantially lower than the highest counts at Parry Lagoons and 4304 birds of 50 species were recorded on the mudflat in April, compared with 8145 birds of 33 species at Parry Lagoons on the same day (aerial survey, S A Halse & G B Pearson, unpublished observations). Nevertheless, the mudflat is more important for waterbirds, especially shorebirds, than previously thought. Because of the greater range of habitat for shorebirds, especially tidal flats, the two surveys of the mudflat yielded 28 species of shorebird compared with the long-term list of 24 for Parry Lagoons.

In April, 1910 shorebirds were counted on the Western Australian portion of the Victoria-Bonaparte mudflat, with a further 6642 counted between the Northern Territory border and the Fitzmaurice River, an overall distance of approximately 250 km (Fig 1). In February, 1973 shorebirds were counted on the mudflat. These counts represent higher densities than observed by Minton & Martindale (1982), who recorded 7120 shorebirds on the 630 km between Darwin and Kununurra. The mudflat also has national significance for several shorebird species (see Watkins 1993). The 5 Redshanks seen in February comprised as large a flock as has been recorded in Australia, equalled only by 5 birds at Broome in April 1985 (Lane & Jessop 1985; Hewish 1987). It is possible that other Redshanks were present on the creek near EK05, or on other parts of the mudflat. Australian

records are mostly restricted to north-western Australia and the Victoria-Bonaparte mudflat must be regarded as one of the more important Australian sites for the species. Although the count of 53 Whimbrels at the mouth of the creek near EK05 in April under-estimated the number on the whole mudflat, when combined with 235 Whimbrels seen on the same day in the Northern Territory between the Fitzmaurice River and Western Australian border (S A Halse & G B Pearson, unpublished observations), the total count for the 250 km length of coast was the seventh highest for the species in Australia (Watkins 1993). The count of 126 Marsh Sandpipers in February, although an under-estimate of the number on the whole mudflat, was the fifteenth highest count in Australia (Watkins 1993).

The conservation value of the Victoria-Bonaparte mudflat for aquatic invertebrates is difficult to evaluate because there have been few studies in similar areas. The floodplains of the Alligator Rivers region appear to support more species; Shiel & Koste (1983) recorded an average of 34 rotifer species per sample and Julli (1986) recorded approximately 20-30 species of cladocerans compared with 2-15 rotifers and 2-13 cladocerans at sites on the mudflat. On the other hand, with 28-60 species at freshwater sites the mudflat compared well with Lake Gregory, in the southern Kimberley which, when fresh, averaged 35 species per site (Halse *et al.* in press; S A Halse, unpublished observations).

The distributions of most species of aquatic invertebrates in northern Australia are poorly known and, therefore, the significance of unusual records on the mudflat is difficult to assess. For example, the only previous record of the harpacticoid copepod *Cletocamptus confluens* in Australia was from Peron Peninsula, Shark Bay, 2000 km south-west of the mudflat (Lang 1948), so its occurrence at Mudflat Pool has conservation implications, except there have been so few invertebrate surveys that the species may well be widespread. Likewise, at present many aquatic habitats in the Kimberley support significant numbers of undescribed species and this, by itself, cannot be used as evidence of special conservation value. A recent study of land snails in rainforest patches of the Kimberley found that at least 36 per cent, and perhaps as many as 50 per cent, of species collected were undescribed (Solem 1991). All 26 pseudoscorpion species collected in the same study were undescribed (Harvey 1991), as were the 11 indigenous earthworm species (McKenzie & Dyne 1991).

It is worth noting that, in addition to obviously undescribed taxa, several taxa collected on the mudflat differed only slightly from descriptions of known species. Without collections from other localities and detailed analyses, it is impossible to determine whether the small differences represented geographic variation or new species. We have listed these taxa as having affinity to known species, including the rotifer *Scaridium elegans* and the cladoceran *Moina weismanni*, both of which have not been recorded in Australia previously.

The rotifers of northern Australia have strong Indo-Malaysian affinities (Shiel & Williams 1990) and this seems to be the case for much of the crustacean fauna on the Victoria-Bonaparte mudflat. The cladoceran fauna of northern Australia has a strong circumtropical element

(Timms 1988) and several genera with Indo-Malaysian affinities, such as *Pseudosida*, *Grimaldina* and *Moinadaphnia*, occurred on the mudflat. The undescribed cyclopoid copepod, *Metacyclops* sp EK1, is unlike other Australian *Metacyclops* and has affinities with species from north of Australia (D W Morton, personal communication). Similarly the ostracod, *Cypris subglogosa*, which was recorded in Australia for the first time, is widespread in ricefields of equatorial regions, Asia and eastern Europe (Okubo 1972a). *Cyprinotus kimberleyensis*, which appears to be widespread in the Kimberley, is also found in Asian ricefields (Okubo 1974) and the ostracod genus, *Strandesia*, which was well represented in the mudflat samples, is common throughout Asia (*e.g.* Okubo 1972b; Victor *et al.* 1980).

In conclusion, the Victoria-Bonaparte mudflat is a nationally significant area for waterbirds, especially shorebirds, although the numbers of birds found there is not as high as in some other areas of the Kimberley. The use of the area by Redshanks, a species that mostly stops in southern Asia during the austral summer, is consistent with the occurrence of invertebrates on the mudflat that have Asian affinities. A more comprehensive inventory of invertebrate species and their distributions is required before the relative significance of the Victoria-Bonaparte mudflat for the conservation of invertebrates can be assessed. However, the survey supported Lansbury's (1984) suggestion that there is a strong Asian element in the invertebrate fauna of the coastal Kimberley and added to the growing evidence that Western Australia has a distinctive micro-invertebrate fauna (Frey 1991; Maly & Bayly 1991; Storey *et al.* 1993).

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## Appendix

Taxa of aquatic invertebrates collected at six sites on the Victoria-Bonaparte mudflat in February 1993. 1, present; 1a, adult beetles; 1b, larval beetles only

Taxon	Mudflat Pool	Samphire Pool	Edge Swamp	Rainforest Swamp	Grassed Pool	Brolga Spring
<b>PROTISTA</b>						
<b>LOBOSEA</b>						
<b>ARCELLINIDA</b>						
<b>Arcellidae</b>						
<i>Centropyxis aculeata</i> (Ehrenberg)					1	
<b>ROTIFERA</b>						
<b>DIGONONTA</b>						
<b>BDELLOIDEA</b>						
<i>Bdelloidea</i> sp.		1				1
<b>MONOGONONTA</b>						
<b>FLOSCULARIACEA</b>						
<b>Hexarthridae</b>						
<i>Hexarthra intermedia</i> Wiszniewski			1			
<b>Filinidae</b>						
<i>Filinia longiseta</i> (Ehrenburg)			1			1
<b>Testudinellidae</b>						
<i>Testudinella patina</i> (Hermann)			1		1	1
<b>PLOIMIDA</b>						
<b>Asplanchnidae</b>						
<i>Asplanchna brightwelli</i> (Gosse)			1			
<b>Brachionidae</b>						
<i>Anuraeopsis fissa</i> (Gosse)			1	1		
<i>Brachionus angularis</i> Gosse						1
<i>Brachionus quadridentatus</i> Hermann			1			1
<i>Brachionus</i> sp. C			1			
<i>Platyias quadricornis</i> Ehrenberg			1	1		1
<b>Notommatidae</b>						
<i>Cephalodella</i> sp.					1	
<i>Scaridium</i> aff. <i>elegans</i> Segers & De Meester			1			
<b>Synchaetidae</b>						
<i>Polyarthra dolichoptera</i> Nelson			1			
<b>Lecanidae</b>						
<i>Lecane (Monostyla) bulla</i> Gosse				1	1	1
<i>Lecane (Monostyla) hamata</i> Stokes			1			
<i>Lecane</i> (s. str.) <i>curvicornis</i> (Murray)			1	1		
<i>Lecane</i> (s. str.) <i>luna</i> (Muller)		1	1		1	1
<i>Lecane</i> (s. str.) <i>leontina</i> (Turner)			1		1	1
<i>Lecane</i> (s. str.) <i>ludwigi</i> (Eckstein)						1
<i>Lecane</i> (s. str.) <i>ungulata</i> (Gosse)			1		1	
<i>Lecane</i> (s. str.) sp. nov. A					1	
<i>Lecane</i> (s. str.) sp. nov. B				1		
<i>Lecane</i> (s. str.) sp.	1					
<b>Euchlanidae</b>						
<i>Dipleuchlanis propatula</i> (Hudson & Gosse)					1	
<i>Dipleuchlanis</i> sp. B			1			
<i>Euchlanis dilatata</i> Ehrenberg			1			
<i>Euchlanis</i> sp. B			1		1	1
<b>Mytilinidae</b>						
<i>Mytilina acanthophora</i> Hauer				1		
<b>Trichotriidae</b>						
<i>Trichotria</i> sp.			1			
<b>MOLLUSCA</b>						
<b>GASTROPODA</b>						
<b>BASOMMATOPHORA</b>						
<b>Planorbidae</b>						
<i>Physastra</i> sp.				1		
<i>Gyraulus</i> sp.				1		
<b>Lymnaeidae</b>						
<i>Lymnaea</i> sp.				1		
<b>ARTHROPODA</b>						
<b>ARACHNIDA</b>						
<b>HYDRACARINA</b>						
<b>Pionidae</b>						
<i>Piona australica</i> K O Viets					1	
<b>Hydrachnidae</b>						
<i>Hydrachna</i> sp.						1
<b>CRUSTACEA</b>						
<b>NOTOSTRACA</b>						
<b>Triopsidae</b>						
<i>Triops australiensis</i> Spencer & Hall					1	
<b>CLADOCERA</b>						
<b>Sididae</b>						

Taxon	Mudflat Pool	Samphire Pool	Edge Swamp	Rainforest Swamp	Grassed Pool	Brolga Spring
<i>Diaphanosoma</i> aff. <i>unguiculatum</i> Gurney			1	1	1	1
<i>Latonopsis</i> sp.						1
<i>Pseudosida szalay</i> Daday			1			
<i>Sarsilatona papuana</i> (Daday)			1	1		
<b>Chydoridae</b>						
<i>Alona</i> aff. <i>rectangula</i> Sars					1	
<i>Alona rectangula novaezealandiae</i> (Sars)				1	1	
<i>Alona</i> aff. <i>setuloides</i> Smirnov & Timms					1	
<i>Alona</i> aff. <i>costata</i> Sars		1	1		1	
<i>Alona</i> sp. A			1			
<i>Alona</i> ? sp. nov. B					1	
<i>Biapertura</i> aff. <i>karua</i> (King)			1			1
<i>Biapertura</i> aff. <i>setigera</i> (Brehm)			1			
<i>Dunhevedia crassa</i> King			1			1
<i>Kurzia longirostris</i> (Daday)				1		
<i>Leydigia acanthocercoides</i> (Fischer)					1	
<i>Leydigia</i> aff. <i>ciliata</i> Gauthier			1		1	
<b>Macrothricidae</b>						
<i>Grimaldina brazzai</i> Richard				1		
<i>Macrothrix</i> aff. <i>capensis</i> (Sars)					1	
<i>Macrothrix</i> aff. <i>timmsi</i> Smirnov					1	
<i>Macrothrix triserialis</i> Brady				1		
<i>Macrothrix</i> sp. nov. A			1	1		
<i>Macrothrix</i> sp. nov. B			1	1		
<b>Moinidae</b>						
<i>Moinadaphnia macleayi</i> (King)				1		
<i>Moina</i> aff. <i>micrura</i> Kurz			1		1	
<i>Moina</i> aff. <i>weismanni</i> Ishikawa		1	1		1	1
<b>Daphniidae</b>						
<i>Ceriodaphnia</i> sp.						1
<i>Simocephalus</i> sp.						1
<b>OSTRACODA</b>						
<b>Ilyocyprididae</b>						
<i>Ilyocypris australiensis</i> Sars			1			
<i>Bennelongia</i> sp. 363					1	
<i>Cyprinotus</i> sp. 362					1	
<i>Cyprretta baylyi</i> McKenzie			1	1		
<i>Cyprinotus kimberleyensi</i> McKenzie	1	1	1	1	1	1
<i>Cypris subglobosa</i> Sowerby			1			
<i>Ilyodromus</i> sp. 365			1			
<i>Strandesia</i> ? <i>camaguinensis</i> Tressler				1		1
<i>Strandesia</i> sp. 360				1		
<i>Strandesia/Chlamydotheca</i> gen nov. 357				1		
<b>CONCHOSTRACA</b>						
<b>Cyzicidae</b>						
<i>Cyzicus</i> sp. A					1	
<i>Cyzicus</i> sp. B		1				
<b>Cyclestheriidae</b>						
<i>Cyclestheria</i> sp.					1	
<b>COPEPODA</b>						
<b>Centropagidae</b>						
<i>Diaptomus</i> sp.				1		
<b>Cyclopoidae</b>						
<i>Apocyclops dengizicus</i> (Lepeschkin)	1	1				
<i>Mesocyclops</i> ? <i>australiensis</i> (Sars)					1	1
<i>Mesocyclops</i> sp. LS2				1		1
<i>Metacyclops</i> sp. EK1	1	1				
<i>Microcyclops varicans</i> (Sars)			1	1	1	
<i>Thermocyclops</i> sp. LS1			1	1		
<b>Canthocamptidae</b>						
<i>Cletocamptus confluens</i> Kiefer	1					
<i>Cletocamptus dietersi</i> (Richard)		1				
<i>Canthocamptidae</i> sp. 267				1		
<b>DECAPODA</b>						
<b>Hymenosomatidae</b>						
<i>Holthuisiana transversa</i> (von Martens)				1		
<b>INSECTA</b>						
<b>EPHEMEROPTERA</b>						
<b>Baetidae</b>						
<i>Cloeon</i> sp.		1		1		1
<b>ZYGOPTERA</b>						
<b>Coenagrionidae</b>						
<i>Coenagrionidae</i> sp.						1
<b>ANISOPTERA</b>						
<i>Anisoptera</i> sp.		1	1		1	
<b>Aeschnidae</b>						
<i>Hemianax papuensis</i> (Burmeister)				1		

Taxon	Mudflat Pool	Samphire Pool	Edge Swamp	Rainforest Swamp	Grassed Pool	Brolga Spring
<b>Gomphidae</b>						
<i>Hemigomphus</i> sp.		1				
<b>Libellulidae</b>						
<i>Diplacodes bipunctata</i> (Brauer)	1	1				
<i>Pantala flavescens</i> (Fabricius)	1	1				
HEMIPTERA						
<b>Gerridae</b>						
? <i>Limnogonus</i> sp.				1		
<b>Corixidae</b>						
<i>Micronecta</i> aff. <i>virgata</i> Hale		1	1			1
<b>Nepidae</b>						
<i>Austronepa angustata</i> (Hale)				1		
<b>Belostomatidae</b>						
<i>Lethocerus</i> sp.			1			
<b>Notonectidae</b>						
<i>Anisops malkini</i> Brooks		1				1
<i>Anisops nasuta</i> Fieber	1	1			1	1
<i>Anisops</i> sp.			1			
DIPTERA						
<b>Culicidae</b>						
<i>Culex annulirostris</i> Skuse		1	1	1	1	1
<b>Chironomidae</b>						
<i>Chironomus</i> sp.	1	1	1		1	1
<i>Cladotanytarsus</i> sp. K4						1
<i>Larsia albiceps</i> (Johannsen)						1
<i>Procladius paludicola</i> (Skuse)			1			1
<i>Tanytarsus</i> aff. K12					1	
<b>Stratiomyidae</b>						
Stratiomyidae sp.		1	1			
<b>Ephydriidae</b>						
Ephydriidae sp.						1
<b>Tabanidae</b>						
Tabanidae sp.	1					
LEPIDOPTERA						
<b>Pyralidae</b>						
Pyralidae sp. 1			1		1	
Pyralidae sp. 2			1			
TRICHOPTERA						
<b>Leptoceridae</b>						
Leptoceridae sp.			1			
COLEOPTERA						
<b>Gyrinidae</b>						
<i>Macrogyrus</i> sp.			1a			
<b>Noteridae</b>						
<i>Canthydrus bovillae</i> Blackburn			1a			
<b>Dytiscidae</b>						
<i>Eretes australis</i> (Erichson)		1b		1b		
<i>Homeodytes</i> sp.		1b	1b		1b	
<i>Hydroglyphus godeffroyi</i> (Sharp)	1a			1a		
<i>Hydroglyphus grammopterus</i> (Zimmerman)		1a				1a
<i>Hyphydrus</i> sp.				1b	1b	1b
<i>Laccophilus clarki</i> Sharp			1a	1a	1a	
<i>Laccophilus sharpi</i> Regimbart					1a	
<i>Laccophilus</i> spp		1b		1b		1b
Dytiscidae sp. A		1b	1b			
Dytiscidae sp. B				1b		
<b>Hydraenidae</b>						
<i>Paracymus</i> sp.			1a			
<b>Spercheidae</b>						
<i>Spercheus</i> sp.		1a	1a			
<b>Hydrophilidae</b>						
<i>Berosus debilipennis</i> Blackburn	1a					
<i>Berosus</i> aff. <i>ralphi</i> Watts	1a	1a				
<i>Berosus sadie/aquilo</i> complex					1a	
<i>Enochrus deserticola</i> Blackburn			1a	1a		1a
<i>Sternolophus immarginatus</i> d'Orchymont		1a				
Hydrophilidae sp.				1b		1b
<b>Helodidae</b>						
Helodidae sp.			1b			
<b>Scirtidae</b>						
Scirtidae sp.			1b			
<b>Total</b>	<b>13</b>	<b>28</b>	<b>60</b>	<b>42</b>	<b>42</b>	<b>39</b>