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The distribution, ecology and conservation status of *Euastacus urospinosus* Riek, 1956 (Crustacea: Decapoda: Parastacidae), a dwarf freshwater crayfish from the Mary and Brisbane River drainages, south-eastern Queensland

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ABSTRACT

The Maleny Crayfish *Euastacus urospinosus* has previously only been recorded from Booloumba and Obi Obi Creeks, Mary River, Queensland. Recent biological surveys of the region have extended its known distribution to include rainforested streams draining both sides of the Conondale Range into the Mary and Brisbane Rivers. In the Brisbane River drainage *E. urospinosus* was found from 415 to 613 m elevation at 15 sites in 5 creek systems, and was abundant at each site. New observations on burrowing and ecological preferences are presented. *E. urospinosus* appears to be dependant on the presence of bangalow palm trees (*Archontophoenix cunninghamiana*). The newly extended distribution, along with an assessment of current threats, suggests that the current IUCN listing of 'Endangered' could potentially be downgraded to 'near threatened', but only after a genetic analysis to assess the possible isolation of populations between catchments. ❑ *conservation, crayfish, distribution, ecology, Conondale Range, Mary River, Brisbane River,* Euastacus urospinosus.

As part of the ongoing Australian Crayfish Project (ACP), research was conducted in the upper Brisbane River catchment between Nanango, Kilcoy and Jimna in late July 2011. That survey was centred on *Cherax* crayfish in the Brisbane River drainage, however as part of the investigation, several specimens of a *Euastacus* species were observed that were clearly not *E. hystricosus* Riek, 1951, the species that would normally be expected. One specimen was collected and later identified as *Euastacus urospinosus* Riek, 1956 (Fig. 1). *E. urospinosus* was originally described from one small male specimen collected from a cleared section of Obi Obi Creek, Maleny, Queensland. Morgan (1988) redescribed the species in detail with additional specimens from a tributary of Obi Obi Creek above Mapleton Falls. Borsboom (1998) conducted a detailed study on the species ecology and biology based on specimens from North Booloumba and Bundaroo creeks, both tributaries of Booloumba Creek. Then Shull *et al.* (2005) collected specimens from two sites north of Maleny in tributaries of Obi Obi Creek. Until now all species records have been in the Mary River drainage. To confirm the extension of its distribution into the Brisbane River catchment system, another limited survey was conducted in January 2012, and its presence was confirmed in another two nearby creek systems. Finally, in May 2012 we undertook a more extensive survey, using our new found

FIG. 1. *Euastacus urospinosus* in life. West Kilcoy Creek, Brisbane River drainage.

knowledge of the species' habitat preferences, to effectively find the limits of distribution in the new catchment.

METHODS

The upper part of the Brisbane River catchment was surveyed from Beerwah westwards to Jimna, Johnstown, Nanango, and to the mountains behind Yarraman. The coordinates of collection sites were recorded using a Global Positioning System. The presence of crayfish was assessed by physically lifting rocks and logs, by excavating burrows, both by hand and with the assistance of spades, and by visually finding the entrances to active burrows. Large deep burrows were carefully excavated so as to document the direction and shape of the burrow, and the presence of branch tunnels. Specimens were preserved in 70% ethanol.

Voucher numbers refer to the collection currently maintained by Robert McCormack as part of the Australian Crayfish Project (ACP). Abbreviations: AM, Australian Museum, Sydney; Ck, Creek; OCL, Occipital Carapace Length, the oblique distance from the posterior radius of the eye socket to the posterior mid-dorsal carapace (see Morgan 1997); QM, Queensland Museum, Brisbane; R., River; Trib., Tributary.

RESULTS

DISTRIBUTION

Euastacus urospinosus was recorded from 15 sites across five streams in the headwaters of the Brisbane River catchment: West Kilcoy, East Kilcoy, Mary Smokes, Sandy and Stony Creeks (Fig. 2, Table 1). In streams further to the east we were unable to locate *E. urospinosus*, even though suitable habitat seemed to be present, so future surveying in this direction may well increase the distribution eastwards. In Monsildale Creek catchment, further to the west, we were also unable to locate *E. urospinosus*, but the preferred rainforest conditions do not seem to occur around Monsildale Creek, or further west, so this lack of suitable habitat is likely to be the limiting factor. Two other similar species also occur in the Brisbane River catchment, *E. setosus* (Riek, 1956) replaces *E. urospinosus* in the

Table 1. Locality details for records of *Euastacus urospinosus* collected as part of the Australian Crayfish Project. Latitudes and longitudes are provided as decimal degrees. All specimens were collected by Robert B. McCormack & Paul Van der Werf.

Voucher Record #	Sex	Weight (g)	OCL (mm)	LOCALITY	LATI-TUDE	LONGI-TUDE	ALT (m)	COLL. DATE
ACP-3783	♂	22	35.1	West Kilcoy Ck, Conondale National Park (Brisbane R.)	26.75637	152.54637	552	29.07.2011
AM-P89667	♂	6	25.1	Trib. Mary Smokes Ck, Bellthorpe State Forest (Stanley–Brisbane R.)	26.85342	152.67299	514	13.01.2012
ACP-3855	♂	4	20.5	Trib. Mary Smokes Ck, Bellthorpe State Forest (Stanley–Brisbane R.)	26.85342	152.67299	514	13.01.2012
QM-W52160	♀	6	22.4	Trib. Mary Smokes Ck, Bellthorpe State Forest (Stanley–Brisbane R.)	26.85342	152.67299	514	13.01.2012
QM-W52161	♂	7	23.9	Trib. of east Kilcoy Ck, Conondale National Park (Brisbane R.)	26.74352	152.56852	613	13.01.2012
AM- P89668	♀	13	30.3	Trib. of east Kilcoy Ck, Conondale National Park (Brisbane R.)	26.74320	152.57012	594	14.01.2012
ACP-3903	♂	2	16.0	East Kilcoy Ck, Conondale National Park (Brisbane R.)	26.74103	152.57092	600	14.01.2012
ACP-3904	♀	7	23.5	East Kilcoy Ck, Conondale National Park (Brisbane R.)	26.74593	152.57165	580	14.01.2012
ACP-4003	♂	2	15.5	Branch Ck, Bellthorpe State Forest (Stoney Ck–Stanley–Brisbane R.)	26.85773	152.67763	524	20.05. 2012
ACP-4004	♂	6	24.7	Trib. of Mary Smokes Ck, Bellthorpe State Forest (Mary Smokes–Brisbane R.)	26.85247	152.67386	522	20.05.2012
ACP-4005	♂	2	16.2	Trib. of Flagstone Ck, Bellthorpe State Forest (Kilcoy Ck–Mary R.)	26.81774	152.67783	528	20.05.2012
ACP-4006	♂	0.71	11.6	Trib. West Kilcoy Creek, Bellthorpe National Park (Kilcoy–Brisbane R.)	26.76307	152.55459	515	20.05.2012
QM-W52162	♂	3	17.0	Stoney Ck (Stanley–Brisbane R.)	26.85790	152.72030	468	21.05.2012
ACP-4028	♀	3	20.8	Stoney Ck (Stanley– Brisbane R.)	26.85790	152.72030	468	21.05.2012
ACP-4029	♂	3	17.6	Branch Ck (Stoney Ck–Stanley–Brisbane R.)	26.86087	152.70772	415	21.05.2012
QM-W52163	♂	5	21.2	Branch Ck, (Stoney Ck–Stanley–Brisbane R.)	26.86087	152.70772	415	21.05.2012
ACP-4031	Juv.	1	13.8	Branch Ck (Stoney Ck–Stanley–Brisbane R.)	26.85818	152.70112	466	21.05.2012
QM-W52164	♂	12	28.7	Branch Ck (Stoney Ck–Stanley–Brisbane R.)	26.85818	152.70112	466	21.05.2012

Table 1. Continued ..

QM-W52165	♀	22	35.1	Trib of Branch Ck (Stoney Ck–Stanley–Brisbane R.)	26.65668	152.69635	470	21.05.2012
ACP-4034	♀	18	31.1	Trib. of Branch Ck (Stoney Ck–Stanley–Brisbane R.)	26.65668	152.69635	470	21.05.2012
ACP-4035	♂	2	16.4	Trib. of Branch Ck (Stoney Ck–Stanley–Brisbane R.)	26.86317	152.68970	467	21.05.2012
QM-W52166	♂	8	24.4	Trib. of Goodla Ck (Sandy Ck–Stanley–Brisbane R.)	26.82267	152.67718	584	22.05.2012
ACP-4037	♀	36	43.5	Trib. of Goodla Ck (Sandy Ck–Stanley–Brisbane R.)	26.82267	152.67718	584	22.05.2012

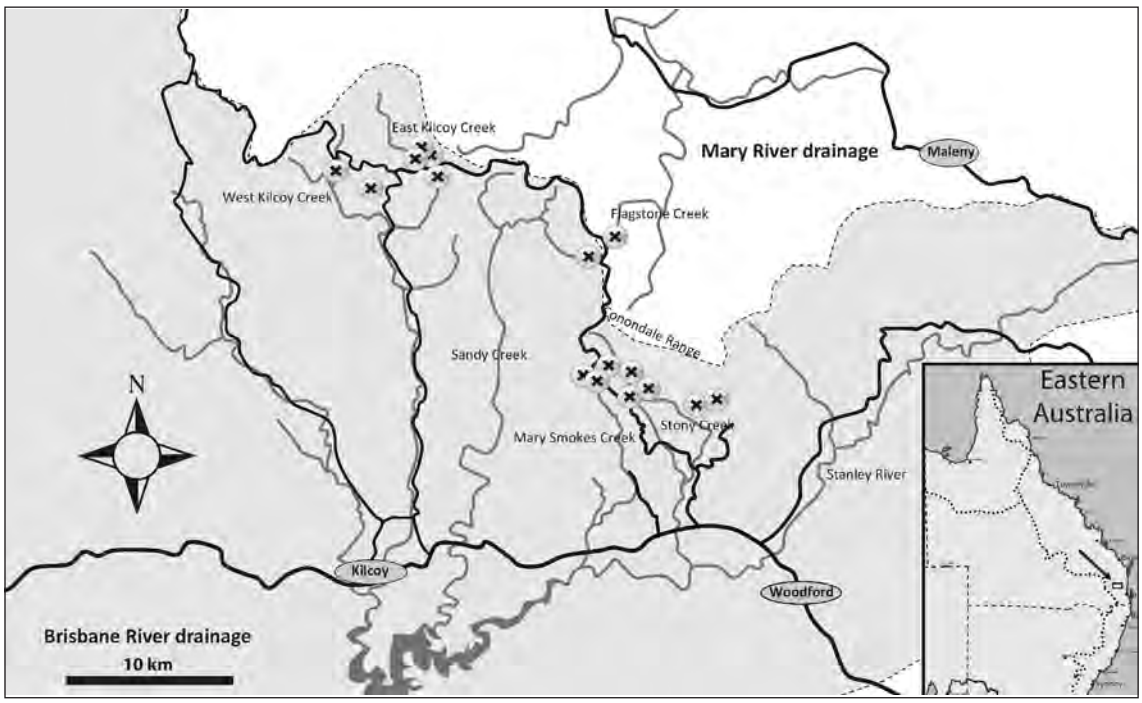

FIG. 2. Distribution of *Euastacus urospinosus* in the Brisbane River Catchment. *E. urospinosus* was newly recorded from 15 sites in the Brisbane River catchment and one site in the Mary River drainage. All sites were above 415 m, and the species was abundant at all sites.

southeast, and *E. jigara* Morgan, 1988, is found further to the south-west.

This survey did not target the Mary River drainage, however, we did observe large numbers of burrows, and vouchered one specimen for laboratory analysis, from a tributary of Flagstone Creek a tributary of the Mary River. This also greatly increases the known distribution of the species in the Mary River drainage.

ECOLOGY

This study did not target the larger giant spiny crayfish, *Euastacus hystricosus*, that also lives in the area, though they were plentiful, especially juveniles under rocks in the creeks. *E. hystricosus* is a species best sampled with baited traps which we did not use. The focus of our study was *E. urospinosus* and *Cherax* crayfish. Our *Euastacus urospinosus* specimens ranged in size from 11.6–43.5 mm OCL, and were found

at elevations of 415–613 m. Berried females were observed only in May, and a female of 36 grams, and 43.5 mm OCL, had 67 eggs. *Cherax* crayfish specimens sampled ranged from 10.0–31.9 mm OCL, and occurred from the lowest of our sites at 256 m above sea level up to 566 m (*Cherax* species occurs down to the coastal plain). Many specimens of *E. urospinosus* had abundant colonies of small white commensal temnocephalans (Platyhelminthes: Turbellaria) covering their bodies, and ectocommensal worms (Phreodrilid oligochaetes) were also observed on specimens from the Brisbane River drainage.

Euastacus urospinosus is a burrowing crayfish preferring cryptic habitat. It typically makes two types of burrows. Smaller crayfish less than 28 mm OCL make relatively rudimentary burrows with only one or two entrances under rocks or other structures, and which usually extend no more than 300 mm into creek banks. They were always in wet areas, but burrows did not always reach water and many were just in wet sandy/rock areas along the stream edges or gravel bars. Larger adults, conversely, make deep burrows that are not connected to the creek and range deep into the rainforest adjacent to the creeks, or along ephemeral drainage gullies. Small drainage gullies through the rainforest that were dry on the surface during our survey, but would hold flowing water during rain events, were favoured areas. Burrows were also found in riparian rainforest that would only have water coverage during major flood events, and in such cases, burrows typically went down to the water table. These could be as deep as 1m or more, but where the water table was at as little as 300 mm depth, the burrows would still be long. Most of the smaller adult burrows we managed to excavate were generally 0.85–1.2 m in total depth with an average of three (occasionally 2–5) surface entrances, several blind tunnels, and a chamber at the bottom. The lower tunnels and chamber were usually flooded. Most adult burrows were in the rainforest floor adjacent to small flowing streams, with a particular concentration of burrows around palm tree roots (Fig. 3). It was common for the whole forest floor in palm valleys to be riddled with burrows (McCormack 2012).

Two important factors governing the presence of *Euastacus urospinosus* became apparent during our work: 1) bangalow palm trees (*Archontophoenix cunninghamiana*) must be present; and 2) *Cherax* crayfish must be absent. Streams without palms scattered along the banks did not seem to support *E. urospinosus*, and even at over 500 m elevation invariably contained a *Cherax* species. Additionally, when we encountered *Cherax* crayfish in a stream with palms, only *E. hystricosus* was co-occurred. Conversely, when *Cherax* was absent but *E. hystricosus* present, the two *Euastacus* species cohabited, with *E. hystricosus* in the large main streams, while *E. urospinosus* preferred the stream margins and banks as well as the smaller feeder streams that penetrate deep into the rainforest. Only *E. urospinosus* is found at the top of the catchment in the smaller feeder streams flowing through the rainforest, but then as the streams widen and deepen, both species begin to be found together. Lower down the stream again, *E. urospinosus* disappears, and *Cherax* species begin to co-occur with *E. hystricosus*, and then lower down still, a species of *Cherax* becomes the only crayfish present. From our observations there are some grounds to speculate that the dominance of *E. urospinosus* over *Cherax* spp. is directly linked to the prosperity of *E. hystricosus*. It seems possible that if *E. hystricosus* disappeared from a stream then there would be no obstacle to the upstream dispersal of *Cherax*, and if that occurred then *E. urospinosus* may be ultimately displaced from the area.

Euastacus urospinosus, like many species of its genus, are aggressive and will whip around to face any threat, raising their claws and snapping whilst rapidly retreating backwards, seeking to retreat under shelter or down their burrow. No crayfish were observed wandering the creeks or forest floor during the day, however, occasionally the tips of crayfish claws could be seen at the entrance to the burrow in the late afternoon. Our limited surveys did not include any night time field work.

We observed areas where creeks in both the Mary and Brisbane River drainages came within 100 m of each other, with *E. urospinosus* occurring in both, and only separated by low-lying ground that would be inundated during

FIG. 3. Flags signalling the entrances of adult *E. urospinosus* burrows in the rainforest floor on a tributary of Goodla Ck (Site ACP-4036; precise locality data in Table 1) at 584 m in the Brisbane River drainage. In this case there were as many as 25 in a 3×3 m quadrat. In the background are the authors, Rob McCormack (left) and Paul Van der Werf (right).

storms and prolonged wet periods. As *E. urospinosus* is known to construct burrows in the forest floor at least 20 m from the stream, and is also recorded to travel over 20 m to find a mate (Borsboom 1998), it seems feasible that there could be regular gene flow between the two catchment populations. Morphologically, specimens from both drainages show no obvious differences. We are not aware of any genetic studies having been conducted on this species, and studies into population genetics and gene flow would be desirable.

CONSERVATION STATUS

All *Euastacus* species are classed as 'no take' and protected in Queensland. Currently *E. urospinosus* is listed as Endangered on the IUCN Red List, but has no specific state conservation listing. The current IUCN (2012) listing is based on: IUCN Status: EN B1+2(a), (b)iii based on EOO <5,000 km2, severely fragmented distribution (two fragmented localities), and anticipated decline in area, extent and/or quality of habitat and EOO due to climate change (Coughran & Furse 2010). This assessment was based on a species' distribution of two geographically separate areas around 15 km apart and regarded as fragmented with an overall Extent of Occurrence (EOO) of approximately 200 km^2. Original listed threats included illegal or recreational fishing, localised impacts, climate change, cane toads and other exotic species (cats, foxes pigs, goats).

The new information presented here, increases the EOO for *E. urospinosus* to 600 km², and increases the number of known locations from two to eight, with new populations recorded at 16 new sites. Morgan (1988) listed the species distribution as above 240 m. The lower reaches of the independent creek systems in the Brisbane River drainage all connect to the main river at approximately 100 m altitude, and although this would be too low (and thus warm) to establish viable populations, perhaps migration up and down the creek systems during cold wet winter periods, by a few individuals at least, could be responsible for occasional dispersal into different creek systems.

Within the Brisbane River drainage *Euastacus urospinosus* occurs almost entirely within State Forests and National Parks, and often in remote inaccessible locations that offer excellent protection for this species. It is abundant at all sites. From our own research in the area, and after consultation with other researchers, we believe *E. urospinosus* is not generally susceptible to illegal or recreational fishing. The juveniles are rarely captured in traps, and the adults spend the majority of time away from the streams where illegal fishing occurs, so this is encouraging for the species long term survival.

Additionally, we did not identify any significant current threat by exotic species that normally impact on freshwater crayfish (pigs, goats, foxes, cats, cane toads, fish and invasive crayfish), within the Brisbane River drainage. In Queensland, feral pigs (*Sus scrofa*) are declared Class 2 animals under the Land Protection (Pest and Stock Route Management) Act 2002 (Queensland Government 2010), and are indeed a serious threat to similar crayfish species. *Euastacus yigara* Short & Davie, 1993, for example, is a similar dwarf crayfish from the Mistake Mountains area further north, that we consider is dramatically impacted by wild pigs that are devastating the juvenile population. However, *E. urospinosus* adults are secure in their deep forest burrows, and the juveniles that live within the creek and stream margins are also well protected by the nature of the very rocky geology of the area that provides protection from the pigs normal feeding activities. We found no evidence of widespread habitat degradation by pigs in the survey area. We found no evidence of threats from foxes, goats and cats, and we do not consider these a particular threat to this group of dwarf crayfish generally. We did not observe any cane toads in the area. No exotic fish species or invasive crayfish were found in the Brisbane River drainage during our surveys, however, we did record exotic *Cherax destructor* in the Mary River drainage (Tributary of Yabba Creek, Jimna State Forest 26.59854°S, 152.38082°E, 566 m). This species has the potential to out-compete the native species in a short period of time (Coughran *et al*. 2009), and must be considered a potential threat to *Euastacus urospinosus* in the Mary River drainage.

The current IUCN listing of Endangered for *Euastacus urospinosus* is predicated on there being only two fragmented populations, and a continuing decline in extent and/or quality of habitat. However, given the present new data this is no longer valid, and a listing of 'near threatened' may be more appropriate. Based on the present survey work, we consider the species is unlikely to be facing a high risk of extinction in the wild within the next 20 years. Nevertheless, we currently have no genetic data on the populations of either catchment, and it is possible that they may be highly divergent with little or no gene-flow occurring. If this is the case, then a higher conservation category would still be applicable. Longer term population monitoring would also be appropriate, as the hotter and drier climate predicted to come is likely to have severe impacts on the viability of this and many other *Euastacus* species.

Large areas of the upper Brisbane River catchment have been cleared for agriculture, and this has clearly restricted the available habitat for *E. urospinosus*. Population numbers could be increased and reestablished by remediation of the small creeks that drain through the cleared agricultural areas. Fencing off riparian strips along the creeks and allowing native vegetation to regenerate would provide the shade, and coolness the species requires, and in particular, the replanting of palms would favour *E. urospinosus* and help deter *Cherax* crayfish invasions. Conservation measures

generally should be centred on retaining palm coverage around the smaller creeks as this appears pivotal to the survival of the species.

Future conservation or management initiatives for *E. urospinosus* will be greatly facilitated by further research. This should include: further distribution mapping (especially of the Mary River catchment that remains mostly unsurveyed); an assessment of population genetics; a better understanding of habitat requirements relating to palm trees; a better understanding of the potential interdependence with *E. hystricosus*; temperature monitoring of streams and investigations into thermal tolerance; and finally, investigations into the impacts of exotic species such as *Cherax destructor*.

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LITERATURE CITED

Borsboom, A. 1998. Aspects of the biology and ecology of the Australian freshwater crayfish, *Euastacus urospinosus* (Decapoda: Parastacidae). *Proceedings of The Linnean Society of New South Wales* **119**: 87–100.

Coughran, J. & Furse, J. 2010. *Euastacus urospinosus*. In: IUCN 2011. IUCN Red List of Threatened Species. Version 2011.2. <www.iucnredlist.org>. Downloaded 10 June 2012.

Coughran, J., McCormack, R.B. & Daly, G. 2009. Translocation of the Yabby, *Cherax destructor*, into eastern drainages of New South Wales, Australia. *Australian Zoologist* **35**(1): 100–103.

McCormack, R.B. 2012. *The spiny freshwater crayfish of Australia — A guide to the Euastacus freshwater crayfish of Australia.* (CSIRO Publishing: Melbourne).

Morgan, G.J. 1988. Freshwater crayfish of the genus *Euastacus* Clark (Decapoda: Parastacidae) from Queensland. *Memoirs of the Museum of Victoria* **49**(1): 1–49.

1997. Freshwater crayfish of the genus *Euastacus* Clark (Decapoda: Parastacidae) from New South Wales, with a key to all species of the genus. *Records of The Australian Museum Supplement* **23**: 1–110.

Queensland Government 2010. Fact Sheet — Declared class 2 pest animal. Control of feral pigs. The State of Queensland, Department of Employment, Economic Development and Innovation, 2010.

Riek, E.F. 1956. Additions to the Australian freshwater crayfish. *Records of the Australian Museum* **24**(1): 1–6, pl. 1.

Shull, H.C. Pérez-Losada, M., Blair, D., Sewell, K., Sinclair, E.A., Lawler, S., Ponniah, M. & Crandall. K.A. 2005. Phylogeny and biogeography of the freshwater crayfish Euastacus (Decapoda: Parastacidae) based on nuclear and mitochondrial DNA. *Molecular Phylogenetics and Evolution* **37**: 249–263.