Internal use only	
Reference Number	/

Nomination to change the conservation class of a species under the Queensland *Nature Conservation Act 1992*

Complete this form to nominate a species for assessment of its conservation class under the *Nature Conservation Act 1992* (NC Act). Any subspecies, variety, race, hybrid, mutation or geographically separate population (hereafter 'species') can be nominated. The appropriate conservation class will be selected during an expert assessment process and, following approval processes, reflected in the next suitable update of the NC Act.

A species may be nominated to an appropriate conservation class from any other conservation class. The nomination assessment process may result in a species being recommended to the conservation class as nominated, or to a class better supported by scientific data and expert opinion. Assessments and nominations will be shared with the Commonwealth and other Australian jurisdictions within the species' distribution.

All plant and vertebrate species native to Queensland are protected under the NC Act and classified as Least Concern unless found eligible for a different conservation class. Invertebrate species are only protected under the NC Act if specifically named under a conservation class. A species can be nominated for listing or reassignment from any conservation class to:

A national threat category:

- Extinct (EX), Extinct in the Wild (EW), Critically Endangered (CR), Endangered (E) or Vulnerable (V) if it meets at least one of the International Union for Conservation of Nature (IUCN) criteria for species at risk of extinction

A state threat class:

- Near Threatened (NT) if the species meets at least one of the criteria for species at risk of becoming threatened in the future based on concerns relating to population dynamics or threats
- Least Concern (LC) if evidence is provided that no criteria for a higher class have been met, and the species won't become eligible for a higher class in the foreseeable future should conservation actions cease due to reclassification.

The assessment of species against the national threat categories reflected in this form complies with the Memorandum of Understanding for the Common Assessment Method (CAM) between the Commonwealth and Australian states and territories. The objective of the CAM is for partner jurisdictions to adopt each other's national assessments as appropriate. Information about the CAM can be found at https://www.qld.gov.au/environment/plants-animals/wildlife-permits/common-assessment.

To nominate a species with an Australian distribution that is not restricted to Queensland, use the nomination form and guidelines at http://www.environment.gov.au/biodiversity/threatened/nominations/forms-and-guidelines and email the completed form to the Australian Government at EPBC.nominations@environment.gov.au.

Important notes for completing this form

- **To enable a species eligibility for listing to be assessed against the criteria, please complete the form as comprehensively as possible by providing a response in each box with an orange border.**
- Completing a nomination is a demanding task. Nominators are encouraged to seek advice from experts where appropriate to assist in completing the nomination form.
- The opinion of scientific experts may be cited as personal communication with their approval. Please provide the experts names, qualifications and contact details (including employment in a government agency if relevant) in the reference list at the end of the form.
- Include any available information and analysis or state when the required information is not available.
- Figures, tables and maps can be included at the end of the form or provided as separate electronic files or hardcopy documents (referenced as appendices or attachments in your nomination).
- Cross-reference relevant areas of the nomination form where needed.
- **Reference all information sources**, both in the text and in a reference list at the end of the form.
- Identify confidential material and the reason it is sensitive. With the exception of information you have identified as confidential, nominations under the CAM process may be made available by a state, territory or the Commonwealth Government to experts or the public for comment.
- If the species is listed nationally, the Australian Government will publish nomination information on its website. Your details as nominator will not be released and will be treated as confidential information.
- Guidance on interpreting this nomination form can be found in the "*Guidelines for Assessing the Conservation Status of Native Species*" developed by the Australian Government under the EPBC Act here http://www.environment.gov.au/biodiversity/threatened/nominations/forms-and-guidelines. Although not fully relevant under the NC Act, the guidelines provide assistance on several aspects of this form. Please email SpeciesTechnical.Committee@des.qld.gov for further advice on completing the nomination.

Further information on selected questions

INTRODUCTION

Species native to Queensland may be nominated to any conservation class under the NC Act, including to transfer between classes. If the taxon at risk is a population or hybrid, or if you wish to know if it has been unsuccessfully nominated under the NC Act in the past, please contact the Queensland Department of Environment and Science for advice at SpeciesTechnical.Committee@des.qld.gov.au.

To search for a species' conservation class under the NC Act please refer to the *Nature Conservation (Wildlife) Regulation 2006*: https://www.legislation.qld.gov.au/view/html/inforce/current/sl-2006-0206.

You can also search the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) list of threatened species in the Species Profile and Threats Database (SPRAT) at www.environment.gov.au/cgi-bin/sprat/public/sprat.pl.

The full lists of threatened fauna and flora under the EPBC Act are available here:
www.environment.gov.au/cgi-bin/sprat/public/publicthreatenedlist.pl?wanted=fauna
www.environment.gov.au/cgi-bin/sprat/public/publicthreatenedlist.pl?wanted=flora.

You can find a list of nominated species that did not meet the assessment criteria for listing under the EPBC Act at www.environment.gov.au/biodiversity/threatened/unsuccessful-species.html.

A nomination to transfer a species from a threatened conservation class to Least Concern or Near Threatened under the NC Act need not address sections marked with an asterisk (*).

SCIENTIFIC AND COMMON NAMES OF NOMINATED SPECIES

- Provide the currently accepted scientific and common name(s) for the species (including Indigenous names, where known). Note any other scientific names that have been used recently such as superseded names.

TAXONOMY

- Record the species' authority and the taxonomic group to which it belongs (Family name is sufficient for plants; both Order and Family name are required for fauna).
- Is the species known to hybridise with other species? Describe any cross-breeding with other species in the wild, indicating where and how frequently this occurs.

DISTRIBUTION

- In accordance with the CAM, the Commonwealth is the default assessment 'lead' for species occurring across multiple Australian jurisdictions, and the nomination will be subject to the prioritisation and assessment process under the EPBC Act. Download the nomination form here http://www.environment.gov.au/system/files/pages/d72dfd1a-f0d8-4699-8d43-5d95bbb02428/files/nomination-form-species.pdf, and email it to epbc.nominations@environment.gov.au. Further information on the EPBC Act nomination, prioritisation and assessment process is available at http://www.environment.gov.au/biodiversity/threatened/nominations.
  Note: where the relevant jurisdictions agree, a State or Territory (rather than the Commonwealth) may take the lead on assessing a cross-jurisdictional species, in consultation with the Commonwealth and other jurisdictions.
- A nomination for a species endemic to Queensland or with its only Australian distribution in Queensland, for example a species only occurring in Queensland and Papua New Guinea, can be assessed under the NC Act. Please submit your completed nomination form to SpeciesTechnical.Committee@des.qld.gov.au.
- Describe the species' current geographic distribution within Queensland, and where applicable, outside Australia.
- Provide a map, if available, indicating latitude, longitude, map datum and location names
  - Indicate the percentage of the global population that occurs in Queensland, and what is its significance?
  - Is the Queensland population distinct, geographically isolated, or does part or all of the population migrate into/out of the Queensland jurisdiction?
  - Explain the relationship between the Queensland population and the global population.
  - Do global threats affect the Queensland population?
- Give locations of other existing or proposed populations such as populations that are captive, propagated, naturalised outside their range, recently re-introduced to the wild, and planned to be re-introduced. Note if these sites have been identified in recovery plans. Provide latitude, longitude, map datum and location name, where available, in an attached table.
- Give details of fauna species' home ranges/territories including any relevant daily and seasonal or irregular movement patterns, such as arrival/departure dates if migratory.
- Does the species occur within an EPBC Act listed ecological community? You will find a list of EPBC Act listed ecological communities here: www.environment.gov.au/cgi-bin/sprat/public/publiclookupcommunities.pl.

BIOLOGY/ECOLOGY

- **Life cycle**: Provide detail on the age at sexual maturity, average life expectancy, natural mortality rates, and generation length
  - "*Generation length*" is defined as the average age of parents of the current cohort (i.e. newborn individuals in the population), and reflects the turnover rate of breeding individuals in a population. Generation length is greater than the age at first breeding and less than the age of the oldest breeding individual, except in species that breed only once. Where generation length varies under threat, use the more natural pre-disturbance generation length. It is often calculated as = (longevity + age at maturity)/2. Provide details of the method(s) used to calculate the generation length.
- **Reproduction**: Provide detail on the reproductive requirements of this species.
  - **Flora**: When does the species flower and set fruit? What conditions are needed for this? What are the pollinating and seed dispersal mechanisms? If the species reproduces vegetatively, describe when, how and what conditions are needed. Does the species require a disturbance regime (e.g. fire, cleared ground) to reproduce?
  - **Fauna**: provide an overview of the species' breeding system and breeding success, including: when it breeds; what conditions are needed for breeding; whether there are any breeding behaviours that may make it vulnerable to a threatening process.
- **Habitat**
  - Provide information on aspect, topography, substrate, climate, forest type, associated species, sympatric species and anything else that is relevant to the species' habitat.
  - Explain how habitats are used (e.g. breeding, feeding, roosting, dispersing, basking, etc.).
  - Does the species use refuge habitat (e.g. in times of fire, drought or flood)? Describe this habitat.
- **Feeding (fauna):**

- Summarise the feeding behaviours, diet, and the timing/seasonality associated with these. Include any behaviour that may make the species vulnerable to a threatening process.

- **Movement (fauna)**: provide information on daily and seasonal movement patterns.

IDENTIFICATION OF KNOWN THREATS AND IMPACTS OF THE THREATS

- For each threat, describe:
  a. whether it is actual or potential
  b. how and where it impacts on this species
  c. what its effect has been so far (is the threat known or suspected?, does it only affect certain populations?) Present supporting information/research).
  d. its expected effect in the future (is the threat known or suspected?, does it only affect certain populations?, is there supporting research/information?) Present supporting information/research).
  e. its relative importance or the magnitude of the impact on the species.

- Identify and explain any additional biological characteristics particular to the species that are threatening to its survival (e.g. low genetic diversity).
- If subject to natural catastrophic events, i.e. events with a low predictability that are likely to severely affect the species, identify the type of event, its likely impact, and its likelihood of occurrence (e.g. a drought/cyclone in the area every 100 years). If **climate change** is an important threat to the species, provide referenced information on how climate change might significantly increase the species' vulnerability to extinction. Please refer to the *Guidelines for Assessing the Conservation Status of Native Species*: http://www.environment.gov.au/system/files/pages/d72dfd1a-f0d8-4699-8d43-5d95bbb02428/files/tssc-guidelines-assessing-species-2018.pdf.

*CONSERVATION ADVICE: THREAT ABATEMENT AND RECOVERY ACTIONS

- Describe how threats are or could be abated and/or species recovered.
- Identify who is undertaking these activities and how successful the activities have been to date.
- Describe any mitigation measures or approaches that have been developed specifically for the species at identified locations. Identify who is undertaking these activities and how successful the activities have been to date.
- For species nominated as Extinct in the Wild, provide location details for any naturalised or captive populations and the level of human intervention required to sustain the species.

IMPACT OF TRANSFERRING A THREATENED SPECIES TO NEAR THREATENED OR LEAST CONCERN

- Only complete this section if you are nominating a species for transfer to Near Threatened or Least Concern from a class of nationally threatened wildlife (Extinct, Extinct in the Wild, Critically Endangered, Endangered or Vulnerable).
- Provide details of the expected impact on the species if conservation actions ceased following its transfer out of a threatened wildlife class.

CURRENT LISTING CLASS AND CATEGORY

- Note: The term 'class' under the NC Act is equivalent to the term 'category' under the EPBC Act.
- Select the species' current class under the NC Act where applicable. Search the species' NC Act class here: https://www.legislation.qld.gov.au/view/html/inforce/current/sl-2006-0206.
- Select the species' current category under the EPBC Act where applicable. Search the Australian Government SPRAT Database here: www.environment.gov.au/cgi-bin/sprat/public/sprat.pl.

NOMINATED LISTING CLASS

- **After completing the section 'Eligibility against the criteria'** sufficient evidence should be available to determine your response to this section. Please select the NC Act class to which the species is being nominated.

REASONS FOR A NOMINATION TO TRANSFER TO ANOTHER CLASS

Please describe why the species is being nominated to transfer to another conservation class in Queensland:

- *Genuine.* The change in class is the result of a genuine status change that has taken place since the previous assessment. For example, the change is due to an increase in the rate of decline, a decrease in population or range size or habitat, or declines in these for the first time (owing to increasing/new threats).
- *Knowledge.* The change in class is the result of new knowledge, e.g. owing to new or newly synthesised information about the status of the taxon (e.g. better estimates for population size, range size or rate of decline).
- *Taxonomy.* The change in class is due to a taxonomic change adopted during the period since the previous assessment. Such changes include:

- *newly split* (the taxon is newly elevated to species level)
- *newly described* (the taxon is newly described as a species)
- *newly lumped* (the taxon is recognised following lumping of two previously recognised taxa)
- *no longer valid/recognised* (either the taxon is no longer valid, e.g. because it is now considered to be a hybrid, variant form or subspecies of another species, or the previously recognised taxon differs from a currently recognised one as a result of a split or lump).

- *Mistake*. The previous class was applied in error.
- *Other.* The change in class is the result of other reasons not easily covered by the above, and/or requires further explanation. Examples include change in assessor's attitude to risk and uncertainty.

INITIAL LISTING

- The reasons for the initial NC Act listing may be available in the original nomination for the species. This can be obtained by emailing the Department of Environment and Science's Species Technical Committee at SpeciesTechnical.Committee@des.qld.gov.au.
- The reasons for EPBC Act listing may also be available. Search for the species' EPBC Act listing and conservation advice for threatened species in the SPRAT Database www.environment.gov.au/cgi-bin/sprat/public/sprat.pl.
- If there is insufficient information to provide details of the reasons for the original listing, please state this.

CHANGES IN SITUATION LEADING TO THE NOMINATION TO TRANSFER TO ANOTHER CLASS

- Describe the changes that have occurred or are likely to occur to the species' population, range or habitat that influence the nomination to change the species' conservation class.

ELIGIBILITY AGAINST CRITERIA

- For a species to be eligible as Near Threatened or a class of threatened wildlife, it must be assessed as meeting **at least one** of the five 'criteria' on this nomination form. For example, for a species listed as Vulnerable to be transferred to the Endangered class, it must meet the threshold/s for at least one of the five criteria for Endangered.
- A species does not have to be found eligible for the same class under all criteria; however, all questions must be answered. If information is not available for a particular criterion, a statement to this effect is required.
- If you hold unpublished data that support assessment of a criterion, you must provide them with the nomination.
- Standards for assessing a species' conservation status in Australia align with the IUCN Red List Criteria and Categories. Please refer to the IUCN guidelines for explanations of how to address the criteria http://s3.amazonaws.com/iucnredlist-newcms/staging/public/attachments/3151/redlistguidelines.pdf.

DECLARATION

In signing this nomination form, you agree to grant the Queensland Government (as represented by the Department of Environment and Science) a perpetual, non-exclusive, worldwide, royalty-free licence to use, reproduce, publish, communicate and distribute information that you have provided in the nomination form that is not referenced to other sources with the exception of information specifically identified by you as confidential, in websites and publications and to promote those websites and publications in any medium.

As nominator, your details are automatically subject to the provisions of the *Privacy Act 1988* and will not be divulged to third parties. The Commonwealth, State and Territory governments have agreed to collaborate on national threatened species assessments using the CAM. As part of this collaboration, your nomination, including your details as nominator, may be provided to other government jurisdictions, who will also observe these privacy and confidentiality arrangements.

If you subsequently agree to be cited as the author of specific, cited information, you will be acknowledged in all publications and websites in which that information appears, in a manner consistent with the *Style Manual for Authors, Editors and Printers* (latest edition).

Nomination form to change the conservation class of a species in Queensland

Details of the nominated species

SCIENTIFIC NAME OF SPECIES (SUBSPECIES, VARIETY, ETC. TO BE SPECIFIED WHERE RELEVANT)

Euastacus robertsi Monroe, 1977

COMMON NAME(S)

Robert's crayfish

TAXONOMY

Provide any relevant detail on the species' taxonomy (e.g. authors of taxon or naming authority, year and reference; synonyms; Family and Order).

Crayfish in the Order Decapoda, Family Parastacidae. Formally described by Monroe (1977).

*CONVENTIONAL ACCEPTANCE OF TAXONOMY

Is the species' taxonomy conventionally accepted?

☒Yes
☐No

If the species is not conventionally accepted, please provide the following information:

- a taxonomic description of the species in a form suitable for publication in conventional scientific literature

OR

- evidence that a scientific institution has a specimen of the species, and a written statement signed by a person who is a taxonomist and has relevant expertise (has worked with, or is a published author on, the group of species nominated) that the species is considered to be a new species.

Euastacus robertsi and its closely related sister taxon from Far Northern Queensland, *E. fleckeri* (Watson, 1935) (red and blue spiny crayfish), are together morphologically distinct from all other *Euastacus* species (Coughran 2008). They are potentially different enough to warrant the erection of a new genus (Morgan 1988). This level of differentiation is reflected in genetic results, which find these two taxa to be sister to all other *Euastacus* species, possibly representing 80-100 million years of distinct evolutionary divergence (Shull 2005; Owen et al. 2015). Within *E. robertsi* itself, there is a deep genetic split which largely accords with geography, and may suggest the presence of an undescribed species (Shull et al. 2005; Ponniah & Hughes 2006; Hurry et al. 2014). See "Distribution" below for more details.

*DESCRIPTION

Provide a description of the species. Include where relevant its distinguishing features, size and social structure.
How distinct is this species in its appearance from other species? How likely is it to be misidentified?

Euastacus robertsi's maximum weight is about 65 g, with a maximum recorded occipital carapace length (OCL) of 50.8 mm (Coughran 2008; McCormack 2012), making it a mid-sized member of the genus. Its back is a dull rusty red-brown, with an underlying blue colour that blends to purple on the sides, and with a bright purple to blue underside, and bright red antennae (McCormack 2012). *Euastacus robertsi* and *E. fleckeri* together are morphologically distinct from other species of the genus due to their shallow dorsolongitudinal carpal groove, lack of mesal dactylar spination, development of a large mesoventral carpal spine offset from the ventromesal spines, and unclear distinction between thoracic spines and general tubercles (Morgan 1988). *Euastacus robertsi* can be distinguished from *E. fleckeri* by the shape of its rostrum (acute triangular in *E. robertsi*, round U-shaped in *E. fleckeri;* Monroe 1977) and propodal spine development and number (Morgan 1997). *Euastacus robertsi* has not been found sympatrically with other crayfish (McCormack 2012), with *E. fleckeri* being the nearest species geographically, about 30 km to the southwest.

DISTRIBUTION

Provide a succinct overview of the species' known or estimated current and past distribution, including international/national distribution. Provide a map if available.

Is the species' habitat protected within the reserve system (e.g. national parks, Indigenous Protected Areas, or other conservation estates, private land covenants, etc.)? If so, which populations? Which reserves are actively managed for this species? To your knowledge, which reserves are being actively managed in way that provides incidental benefits for this species? Give details.

Among the *Euastacus* species, *E. robertsi* is the species at the northernmost extent of the genera's Australian distribution, and is restricted to upland tropical rainforest (above 650 m ASL, usually nearer 850 m up to ~1100 m) on a few mountains in northern Queensland, south of Cooktown (McCormack 2012). It is known from three mountain tops (see Fig. 1): Mt. Finnigan (including the type location of Horan's Creek), Mt. Pieter Bott (~30 kms to the southeast of Mt. Finnigan) and Thornton Peak (~10 km to the southwest of Mt. Pieter Bott) (Monroe 1977; Morgan 1988; Ponniah & Hughes 2004; Shull et al. 2005; McCormack 2012; R. McCormack pers comm 2020; J. Coughran pers comm 2020). *Euastacus robertsi*'s area of occupancy (AOO) is 20 km^2, and extent of occurrence (EOO) is 215 km^2 (calculated with GeoCat, available at: geocat.kew.org; Bachman et al. 2011). *Euastacus robertsi* is considered to inhabit three locations, which are the upland tropical rainforest communities of Mt. Finnigan (Ngalba Bulal National Park), Mt. Pieter Bott, and Thornton Peak (last two Daintree National Park) as defined by the IUCN (IUCN Standards and Petitions Subcommittee 2019), based on common threats (see Criterion B below for more information).

All of the recorded sites on Mt. Finnigan for this species are within the Ngalba Bulal National Park, and all of the sites on Mt. Pieter Bott and Thornton Peak are within the Daintree National Park. These areas are part of The Wet Tropics of Queensland World Heritage Area. The species receives the umbrella protection of being found entirely within national parks, however it is not actively managed. Montane and upland areas are a focus of management actions within both national parks (QPWS 2019) and the high levels of endemicity of their montane biota is recognised. However, crayfish are not specifically mentioned in the *Daintree National Park Management Plan* (QPWS 2019) or *Ngalba Bulal National Park Management Statement* (QDES 2013).

The above distributional calculations are based on the currently accepted taxonomy of a single unitary species of *E. robertsi*. However, there is significant genetic divergence evident within the mitochondrial and nuclear DNA of *E. robertsi* (Ponniah & Hughes 2004, 2006; Shull et al. 2005; Hurry et al. 2014) and its associated ectocommensal temnocephalan flatworm (*Temnosewellia albata* Sewell, Cannon & Blair 2006) (Hurry et al. 2014). This largely equates to a deep split between the northern part of *E. robertsi*'s distributional range (Mt. Finnigan) and the southern part (Mt. Pieter Bott/Thornton Peak), either side of the lowlands of the Bloomfield River Valley. This split probably dates to the Pliocene, about 2-3 million years ago (Hurry et al. 2014). There has apparently been a low level of secondary contact across the divide, with some "northern"-genotypes found at Thornton Peak (Hurry et al. 2014). This may be because Mt Finnigan and Thornton Peak once shared a ridge, but neither did with Mt Pieter Bott (Hurry et al. 2014). Morgan (1988) also noted some differences in chelae and rostra between specimens from north and south.

Hurry (2015) has shown that some specimens of *E. robertsi* from Thornton Peak have a nuclear haplotype (28S) associated with populations south of the divide, and a mitochondrial haplotype from the north. This could imply that the two lineages freely interbreed (and so are one species), or might represent a hybridisation event between closely related, but distinct, species that have come back into contact secondarily (*sensu* Hughes et al. 2003). It could however simply represent an ancestral polymorphism, since 28S does not mutate quickly, which would not provide evidence either way. Determining whether this is a "species level" divergence would require further genetic and taxonomic study. However, if the different lineages were to be treated as distinct taxa, the "northern" taxon (Mt. Finnigan, Thornton Peak; Clade E *sensu* Hurry et al. 2014) would have an AOO of 16 km^2 and an EOO of 59 km^2, and the "southern" taxon (Mt. Pieter Bott, Thornton Peak; Clade D) an AOO of 12 km^2 and EOO of 11 km^2 (considered same as AOO of 12 km^2 for assessment purposes).

BIOLOGY/ECOLOGY

Provide a summary of biological and ecological information.

Include information on:

- life cycle including age at sexual maturity, life expectancy and natural mortality rates
- specific biological characteristics
- the species' habitat requirements
- for fauna: feeding behaviour and food preference and daily/seasonal movement patterns
- for flora: pollination and seed dispersal patterns

Little is known about the life cycle of *E. robertsi*, however it is recognised that *Euastacus* species have a suite of common biological characteristics, and many of these characteristics apply to *E. robertsi* (Furse & Coughran 2011). The life-cycle of *E. robertsi* is likely similar to other upland *Euastacus* species, meaning slow growth,

late-maturing females, and a slow reproductive cycle (K-selection) (Furse & Coughran 2011). In particular the species is likely to be biologically similar to *E. fleckeri*, to which it is closely related (Shull et al. 2005).

Female sexual maturity probably starts when she reaches 30-50 mm OCL (Morgan 1988). A gravid female was collected in September (Monroe 1977) and so the breeding pattern is probably similar to other *Euastacus* species (McCormack 2012). The actual growth rates, population sizes and generation lengths of *E. robertsi* are not known.

Like many spiny crayfish species, *E. robertsi* is restricted to cooler upland habitats (Furse & Coughran 2011), but its precise thermal tolerance is not known. However, another montane rainforest species, *E. sulcatus* (Lamington spiny crayfish), becomes distressed at about 22ºC, and was effectively incapacitated at 27ºC, and all died (Bone et al. 2014). *Euastacus sulcatus* is much larger than *E. robertsi* and so it is possible that *E. sulcatus* could handle temperature variation better.

This species' habitat is in high-altitude pools and clear-flowing mountain streams, surrounded by tropical rainforest (Fig. 2) (Monroe 1977; Morgan 1988). Within areas of their inhabitation, they are further restricted to creeks that have flowing water and pools at ~850 m, with sources higher up the mountain. Streams only beginning at 750-850 m ASL were reportedly not found to host *E. robertsi* (McCormack 2012). Many other *Euastacus* species, such as *E. jagara* (Jagara hairy crayfish) and *E. urospinosus* (Maleny crayfish), are reportedly associated with certain vegetation types, or collected in association with particular species of vegetation (e.g. McCormack et al. 2010), and this may also be true for *E. robertsi* (R. McCormack pers. comm. 2020).

Euastacus robertsi build burrows into the bank, and these have one or two entrances, perhaps more (Monroe 1977). They also use natural crevices, rocks and leaf litter for shelter. Few burrows have been observed, suggesting a potentially low local population density (McCormack 2012).

Monroe (1977) caught specimens from under rocks or leaf litter during the day, but McCormack (2012) did not observe any crayfish in the water during the day. At night, Monroe (1977) observed crayfish at their burrow entrances. *E. robertsi*'s diet is unknown, but omnivory is possible, although they did not respond to traps baited with meat (McCormack 2012).

Fig. 2. Typical *Euastacus robertsi* habitat with burrows in-stream under rocks, Mt. Finnigan. Photo by Rob McCormack (Australian Aquatic Biological). Used with permission.

Threats

IDENTIFICATION OF KNOWN THREATS AND IMPACT OF THE THREATS

Identify any known threats to the species in the table below. Describe **past, current or future** threats, whether the threats are **actual or potential**, and the **type and level of impact** you believe each threat is having on the species.

Past threats	**Impact of threat**
Bushfire	Bushfire is a common feature of the general Australian environment, however fire is typically more prevalent in sclerophyll forests than rainforests (Murphy et al. 2012). *Euastacus robertsi* may have been buffered to some extent as dense rainforest burns much less often than open woodland. Nevertheless, the very small, restricted distribution of the species in a three locations places it at great risk in the event that fire does impact its very limited area. When bushfires do reach the rainforest, it can transform ecosystem structure and function and change the boundary between it and the sclerophyll forest (Hunter 2003). The effects of these fire regimes may be amplified by interactions with drought (see below). It is not clear what the direct impact of fire on crayfish populations may be, however another rainforest crayfish (Ellen Clark's Crayfish; *Euastacus clarkae*) suffered a mass kill directly after a fire (McCormack 2015). Similarly, *E. bispinosus* (Glenelg spiny crayfish) abundances declined after fire events, perhaps due to associated reduction of habitat quality (Johnston et al. 2014). Indirect impacts of fire are potentially long-lasting, and include serious habitat degradation and/or destruction, and ensuing water quality issues that highly impact freshwater species (Bryant et al. 2012). Sediment and ash run-off from fires can degrade water quality, leading to a change in the pH of the water and low dissolved oxygen (Silva et al. 2020). Level of past impact = low.
Feral pigs	"Predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*)" was listed by the Federal Government in 2001 as a key threatening process under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Commonwealth of Australia 2017). Negative impacts can be direct (predation, digging and rooting) and indirect (changing plant species composition, water quality) (Commonwealth of Australia 2017). Feral pigs are thought to consume crayfish and damage their habitat (Commonwealth of Australia 2017). They are considered a major threat for genera of burrowing crayfish, e.g. *Engaeus* (Tas, Vic), *Engaewa* (WA) (Commonwealth of Australia 2017). Feral pigs have been shown to adversely affect tropical Queensland lowland freshwater systems (through habitat destruction and impacts on water quality) (Mitchell et al. 2010). Little is currently known about the impact of feral pigs on upland tropical rainforest freshwater systems in general, and on *E. robertsi* in particular. They cause significant damage due to digging in Wet Tropics rainforests, in both the highlands and lowlands (Mitchell & Mayer 1997). Habitat destruction caused by feral pigs to stream beds and banks is evident and obvious (J. Coughran & J. Furse pers. comm. 2020). Level of past impact = low/moderate.
Unauthorised collecting	All spiny crayfishes (*Euastacus*) are "no take" species under the Queensland *Fisheries Act 1994* (Furse & Coughran 2011), however, it is unknown if *E. robertsi* has been the subject of illegal collecting for the aquarium trade (Coughran & Furse 2012). As *E. robertsi* is rare, it could be targeted for illegal collection as it may be valuable on the black market. For this reason, *E. robertsi* could be particularly at risk. Given the likely low population density and small, restricted distribution, any removal of specimens could be very harmful to the population as a whole. Level of past impact = unknown/low.
Current threats	**Impact of threat**
Bushfire	During the bushfire season of 2019-20,, *E. robertsi* sites are not known to have been directly impacted, the closest being approximately 4-5 km from Mt. Finnigan sites in lower altitude areas (Queensland Government 2020). Level of current impact = low.
Feral pigs	Feral pigs are reported from both national parks. They definitely impact the Daintree's montane and upland rainforest community (above 800 m elevation) through soil disturbance and erosion, and perhaps even direct predation (QPWS 2019). However, it is currently unknown to what extent this happens (QPWS 2019). Level of current impact = low/moderate
Unauthorised collecting	Australian crayfish are for sale in Australia and overseas (legally and illegally, including online), although it is not known if individuals of *E. robertsi* are among these. Level of current impact = unknown/low.
Future threats – actual	**Impact of threat**

Climate change	Global climate projections predict a greater than 99% probability that most of the years between 2019 and 2028 will be in the top 10 warmest years on record (Arguez et al. 2020). Climate modelling for the Wet Tropics predicts more frequent hot days, higher temperatures (average 1.3ºC by 2030), more frequent (by 10%) and more intense tropical cyclones, less rainfall (by 3.5%, especially in autumn), less water runoff to creeks, more frequent and intense El Niño droughts, and more intense bushfires (Australian National University 2009; DEHP 2016). The cool montane rainforests of the Wet Tropics of Far North Queensland as a whole are themselves at great risk from climate change, since they are refugia for many cool-adapted fauna and flora species, *E. robertsi* among them. For example, the buzzing nurseryfrog (*Cophixalus bombiens*) has an annual mean temperature range tolerance of only 1.8°C (Australian National University 2009). Available habitat will shrink as narrow, suitable "climatic envelopes" migrate up the mountains in the face of rising temperatures, and may eventually disappear completely (Krockenberger et al. 2003). A rise of only 1.0°C by 2030 could result in a 50% decrease in the area of upland rainforests (Hilbert et al. 2001). Many of these habitats may already be near a threshold of survival (Murphy et al. 2012), having progressively shrunk in the face of the natural warming and drying of the last few million years, and are now facing an accelerated warming due to human activities. Not only will the temperature rise, but rainfall may vary, and less moisture will be available to these high-altitude rainforests from cloud interception (Murphy et al. 2012; Wallace & McJanet 2013), which is a key driver of dry season perennial stream flow in the Wet Tropics. Climate change can act as an intensifier of other risk factors, with more frequent and more extreme cyclones, droughts, and bushfires, in particular as warm-adapted and more fire-prone tree and weed species move up the slope. Intense storm events can scour high-altitude streams and this can be deadly to juvenile *Euastacus* that seek refuge under leaves/fallen palm fronds, small loose rocks and logs (R. McCormack pers. comm. 2020). Mass mortality has been recorded in *E. valentulus* (strong crayfish) in southern Queensland when a very intense rain storm and flash flood killed hundreds, and probably thousands, of crayfish locally (Furse et al. 2012). Most of the crayfish killed in this event were about the same size as *E. robertsi* (30-40 mm OCL). As the rainforest habitat degrades with climate change, the pressure from invasive species is also predicted to increase, including from feral pigs and lantana. Climate change is a real threat to freshwater crayfish as *Euastacus* are very sensitive to changes in temperature and water availability, tend to be highly specialised, and often have distributions that are highly fragmented and very limited ("short-range endemics" *sensu* Harvey 2002) (Richman et al. 2015; Hossain et al. 2018). These factors combine to make them particularly vulnerable to the effects of intensifying climate change (Richman et al. 2015). Many *Euastacus* species in eastern Australia are already "climate refugees" (Bone et al. 2014), having been restricted to cool montane areas by the increase in Australia's temperature and aridity over the last few million years (Ponniah & Hughes 2006). This is certainly the case for *E. robertsi*, which is restricted to high montane rainforest, and is the most northerly species in the genus. Hossian et al. (2018) considered that *E. robertsi* was vulnerable to the modelled climate of 2050, which is only 30 years away. The precise thermal tolerance of *E. robertsi* is not known, but another montane rainforest species, *E. sulcatus,* becomes distressed at about 22ºC, and was effectively incapacitated at 27ºC, and all died (Bone et al. 2014). Thus, increased temperatures will likely severely impact *E. robertsi*. Higher temperatures and a changed bushfire regime could also cause a change in the species composition of riparian vegetation, which could influence the distribution of *E. robertsi* (R. McCormack pers. comm. 2020). Because of its highly restricted distribution, any impact on one part of the population is likely to influence the entire species distribution, and greatly increase extinction risk. Even a small adverse change could have a long-term impact, since a single event (fire, cyclone, heatwave etc.) could potentially wipe out an already reduced/weakened population as a result of climate change. The options for persistence of *E. robertsi* in the face of climate change are limited. *E. sulcatus* has shown some ability to adapt to higher temperatures, although this was a very small effect (Bone et al. 2014). Adaptation does not seem likely as *E. robertsi* is almost certainly cool-adapted, and has been for a long time. The rate of current climate change makes this unlikely. Another possibility is that *E. robertsi* could move to cooler, higher altitudes to retain its preferred climate envelope. This is not particularly likely as the species is already found at 1100 m, and its three mountains are not much higher (summits: Mt. Finnigan 1148 m, Thornton Peak 1374 m, Mt. Pieter Bott 1009 m). Further, it would also require there to be suitable freshwater habitats present at the summits. A third possibility is that *E. robertsi* could

	migrate to cooler areas to the south. This is not likely because these mountains are surrounded by, presumably impassable, hot tropical, and sometimes dry, lowlands. A number of large-scale meta-analyses have considered the multiple interacting factors that influence extinction risk in freshwater crayfish. The single most important factor in extinction risk was range size, with dependence upon high-altitude habitat also contributing to a higher risk of extinction (Bland 2017). Another study considered freshwater crayfish species from around the world, and ranked them according to a combination of evolutionary distinctiveness and conservation status (EDGE); in effect which species are the most unique evolutionarily and are most at risk. *Euastacus robertsi* scored 3rd highest of 719 species in one analysis and 14th of 719 in the other (Owen et al. 2015). *Euastacus robertsi,* with its nearby sister species *E. fleckeri,* represent tens of millions of years of unique evolutionary history (Hoyal Cuthill et al. 2016). Level of future impact = high.
Bushfire	The widespread nature of the 2019-2020 fires has led to an inevitable discussion of the role of future climate change in increased fire risk. Climate projections for Far North Queensland indicate the likelihood of higher temperatures, and more intense bushfires (Australian National University 2009). The upland rainforest habitat of *E. robertsi* will be more inclined to burn if it dries out due to a projected lessening of the input of moisture from clouds, which previously was key for the montane area (Murphy et al. 2012; Wallace & McJannet 2013). This may be intensified by an encroachment of more fire-prone sclerophyll forest and weeds species (e.g. lantana [*Lantana camara]*) moving up the slope, and the prediction of more fuel being made available in future (Australian National University 2009; Murphy et al. 2012). The entire distribution of *E. robertsi* is in an area of proven fire risk, and because the species has such a small, restricted distribution (which will shrink further with climate change), there is a real possibility of future extinction in the wild given the predicted more intense and more frequent bushfires of the future. Level of future impact = high.
Feral pigs	Feral pigs will continue to provide a threat to *E. robertsi*, including to individuals, local populations and to the general quality of the species' habitat. Level of future impact = low/moderate.
Future threats – potential	**Impact of threat**
Unauthorised collecting	The level of future unauthorised collecting is difficult to estimate. However, *E. robertsi*'s rarity and small distribution places it at a great risk of depletion of numbers from any level of exploitation or collection (legal or otherwise) or an accidental introduction of a pathogen during this collecting (see Crayfish plague). Level of future impact = unknown/low.
Crayfish plague	*Aphanomyces astaci* (crayfish plague) is a highly contagious fungal disease that is uniformly fatal (100% mortality) to susceptible species (e.g., Panteleit et al. 2017), and it is considered one of the world's worst invasive species (Lowe et al. 2000). Many strains of the disease prefer cooler temperatures, which is also the preference of *E. robertsi*. Crayfish plague is not currently known in Australia, but is documented as fatal to Australian freshwater crayfish (Unestam 1975), and it poses an extremely high risk to native freshwater crayfish species (DAWE 2019). Illegally imported specimens of the North American crayfish species known to carry the disease have been seized in multiple Australian states (Department of Primary Industries & Regional Development 2021; Business Queensland 2021), but not known to be infected. A single, illegally-imported crayfish infected with crayfish plague has the capacity to devastate the entire Australian crayfish fauna. Increasing illegal wildlife/aquarium trade appreciably increases the risk and probability of the disease's introduction to Australia. Level of future impact = unknown.

*CONSERVATION ADVICE: THREAT ABATEMENT AND RECOVERY ACTIONS

Give an overview of recovery and threat abatement/mitigation actions that are underway, have been formally proposed or that you would like to recommend. Address all threats listed or state threats that lack conservation advice.

Current threats	**Abatement or recovery action underway**
Bushfire	To limit the risk of large bushfires, fuel-reduction burns and fuel monitoring in lowland areas are part of an active planned burning program undertaken by the managers of both Ngalba Bulal and Daintree National Parks, and both include a major component of cultural burning practices by Traditional Owners (QDES 2013, QPWS 2019). However, there are no fuel reduction burns in higher altitude rainforest habitat due to their sensitivity (K. Goodall pers. comm. 2020). In particular, there is a recognition of the need to mitigate the effects of bushfire on the fire-sensitive montane and upland areas (QPWS 2019).
Feral pigs	The QPWS and Traditional Owners manage and monitor feral pig impacts in key areas (QPWS 2019). In the Daintree NP, there is a joint program for feral pig control with the local council, and pig control is carried out at specific sites in Ngalba Bulal NP (K. Goodall pers. comm.

	2020). Poison baits for feral pigs were trialled in the Daintree, although the pigs rarely took the provided bait (Invasive Animals 2014). Feral pig management activities may need to increase, especially if the event *E. robertsi* populations suffer in bushfires. Even where *E. robertsi* habitat does not burn, predation pressure from feral pigs may increase as hungry pigs move out of adjacent burned areas. Feral pigs are known to adversely impact montane and upland forests of the Daintree, but the extent and severity is not known and will require further research (QPWS 2019).
	Abatement or recovery action proposed
Unauthorised collecting	Regular checks should be made of the internet to see if individuals of *E. robertsi* are offered for sale, and if so, the relevant parties prosecuted for illegal collecting, possession or sale. Further, information on correct hygiene protocols should be made available to those collecting legally to avoid introducing pathogens (for example: www.aabio.com.au/new/wp-content/uploads/2012/02/Hygiene-Protocol-2010.pdf). The Queensland Government is working on protocols at the moment (J. Furse pers. comm. 2020).
Future threats – actual	**Abatement or recovery action underway**
	Abatement or recovery action proposed
Bushfire	Surveys should be conducted to see if any *E. robertsi* sites were impacted by the 2019-2020 fires. This would greatly improve our knowledge of how vulnerable this species is to both direct and indirect effects of fire (habitat degradation, water quality issues, predation pressure), and how it well it can recover after bushfires in the future.
Climate change	The precarious nature of the montane and upland areas of the Daintree in the face of climate change is recognised, in particular with a hotter and drier climate (QPWS 2019). Detailed monitoring of the health of both *E. robertsi* populations (numbers, distribution, population dynamics, etc.) and its habitat (vegetation, water availability, water quality parameters) should be undertaken to see if these are being adversely affected by the various factors associated with climate change. Given that *E. robertsi* is gravely threatened by rising temperatures due to climate change, obtaining some data on its thermal tolerance is particularly vital. This is a common issue, as only 6% of crayfish worldwide have any data available on their thermal tolerance (Bland 2017). Species-specific thermal tolerance thresholds and environmental parameters (Richman et al 2015) are very important information for understanding *E. robertsi's* long-term extinction risk. Baseline water temperatures at a number of sites in streams known to be home to *E. robertsi* should be collected to monitor any temperature change over time. In conjunction with this, there should be yearly standardised population monitoring of crayfish in the same streams to track any population change. As there is very little background information on *E. robertsi*, research should focus on population assessment and monitoring, biology, life history, habitat requirements, and resilience to invasive species and disease. Because the actual population status and health of most crayfish species is so poorly known, 88% of all crayfish listings use range-based criteria rather than data on population decline (Richman et al. 2015).
Future threats – potential	**Abatement or recovery action underway**
	Abatement or recovery action proposed

IMPACT OF TRANSFERRING A THREATENED SPECIES TO NEAR THREATENED OR LEAST CONCERN

Omit this section and proceed to 'Listing class/category' if the nomination does not involve transferring a species from a threatened class to Least Concern or Near Threatened.

If the threatened species (Extinct, Extinct in the Wild, Critically Endangered, Endangered or Vulnerable) were moved to Least Concern or Near Threatened, what would be the impact if conservation actions for the species were reduced or ceased? Would the species decline at such a rate that it would be eligible for listing under a threatened class again in the foreseeable future? Provide evidence, expert advice and appropriate references to support your response.

Conservation action	Impact on the species if abatement/recovery action is reduced or ceases

Listing class/category

CURRENT LISTING CLASS/CATEGORY

[Please mark the boxes that apply by double clicking them with your mouse.]

In what class is the species currently listed under the **NC Act**?

☐Extinct	☐Extinct in the Wild	☐Critically Endangered	☐Endangered
☐Vulnerable	☐Near Threatened	☐Least Concern	☒Not listed

In what category is the species currently listed under the **EPBC Act**?

☐Extinct	☐Extinct in the Wild	☐Critically Endangered	☐Endangered
☐Vulnerable	☐Conservation Dependent		☒Not listed

NOMINATED LISTING CLASS

To what class under the **NC Act** is the species being nominated?

☐Extinct	☐Extinct in the Wild	☐Critically Endangered	☒Endangered
☐Vulnerable	☐Near Threatened	☐Least Concern	☐Not listed

Nominating a species to transfer to another class

REASON FOR A NOMINATION TO TRANSFER TO ANOTHER CLASS

What is the reason for the nomination?

☐Genuine change of status	☒New knowledge	☐Mistake	☐Other
Taxonomic change - ☐'split'	☐newly described	☐'lumped'	☐no longer valid

INITIAL LISTING

Describe the reasons for the species' initial listing under the NC Act and/or the EPBC Act and, if available, the criteria under which it was formerly considered eligible.

Click or tap here to enter text.

CHANGES IN SITUATION LEADING TO THE NOMINATION TO TRANSFER TO ANOTHER CLASS

Please complete (a), (b) OR (c) as appropriate to the nomination.

(a) Critically Endangered, Endangered, Vulnerable or Near Threatened

Describe the change in circumstances that make the species eligible for listing in a class other than Extinct and Extinct in the Wild.

Euastacus robertsi is being nominated as Endangered because of its restricted distribution (EOO = 21 km^2; AOO = 20 km^2) in three locations (upland tropical rainforest communities of Mt. Finnigan in Ngalba Bulal National Park, and Mt. Pieter Bott and Thornton Peak in Daintree National Park). The entire population is threatened by a warming climate associated with intensifying climate change as the species is marooned on three mountaintops. Its habitat area and quality will lessen as the pressure from bushfires and feral predators is likely to increase due to climate change.

(b) Extinct in the Wild

A native species is eligible to be included in the Extinct in the Wild class if: (a) thorough searches have been conducted for the species; and (b) the species has not been seen in the wild over a period appropriate for its life cycle or form. The species may still survive in cultivation, captivity or as a naturalised population (or populations) well outside the historic range.

Describe how circumstances have changed that now make the species eligible for listing as Extinct in the Wild. Provide details of the last valid record or observation of the species in the wild.

Click or tap here to enter text.

(c) Extinct

A native species is eligible to be included in the Extinct class if there is no reasonable doubt that the last member of the species has died. A taxon is presumed Extinct when exhaustive surveys in the known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual.

Describe how circumstances have changed that now make the species eligible for listing as Extinct. Provide details of the last valid record or observation for the species in the wild and captivity.

Click or tap here to enter text.

Eligibility against the criteria

Standard of scientific evidence and adequacy of survey

For this assessment is it considered that the survey of the species has been adequate and there is sufficient scientific evidence to support the listing outcome

CRITERION A

Population size reduction (reduction in total numbers) measured over the longer of 10 years or 3 generations based on any of A1 to A4

	Critically Endangered (CR)	Endangered (EN)	Vulnerable (VU)	Near Threatened (NT)
A1	**≥ 90%**	**≥ 70%**	**≥ 50%**	**≥ 20%**
A2, A3, A4	**≥ 80%**	**≥ 50%**	**≥ 30%**	**≥ 20%**

A1 Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.

A2 Population reduction observed, estimated, inferred or suspected in the past where the causes of the reduction may not have ceased OR may not be understood OR may not be reversible.

A3 Population reduction, projected or suspected to be met in the future (up to a maximum of 100 years) [(*a) cannot be used for A3*]

A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.

based on any of (a) to (e)

(a) direct observation [*except A3*]

(b) an index of abundance appropriate to the taxon

(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat

(d) actual or potential levels of exploitation

(e) the effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites

Please identify whether the species meets A1, A2, A3 or A4. Include an explanation, supported by data and information, on how the species meets the criterion (A1 – A4). If available include information on:

- whether the population trend is increasing, decreasing or static
- estimated generation length and method used to estimate the generation length

You must provide a response. If there is no evidence to demonstrate a population size reduction, this must be stated.

Insufficient data to determine eligibility.

There is insufficient information to assess *Euastacus robertsi* against the thresholds for listing under Criterion A. Little is known about population size of *E. robertsi*, although McCormack (2012) speculated that it was small given the paucity of burrows. Nothing is known about any past or current changes. It is very likely that the population size will decline in the face of climate change (especially with predicted hotter weather and reduced moisture) since this species is a cool mountain specialist restricted to mountain tops that are surround by hot lowland areas. As temperatures increase, the available amount of suitable habitat is likely to decrease as the areas of rainforest habitat contract higher up the mountain. There will also be likely population reduction due to more frequent and intense bushfires and feral pig impacts. Given the current small size of this species'

distribution, any further reductions will make it susceptible to a single stochastic event which could drive it to extinction.

CRITERION B:

Geographic distribution is precarious for either extent of occurrence AND/OR area of occupancy				
	Critically Endangered (CR)	**Endangered (EN)**	**Vulnerable (VU)**	**Near Threatened (NT)**
B1. Extent of occurrence (EOO)	**< 100 km²**	**< 5,000 km²**	**< 20,000 km²**	**< 40,000 km²**
B2. Area of occupancy (AOO)	**< 10 km²**	**< 500 km²**	**< 2,000 km²**	**< 4,000 km²**
AND at least 2 of the following 3 conditions for CR, EN or VU:				AND (b) for NT
(a) Severely fragmented OR Number of locations	**= 1**	**≤ 5**	**≤ 10**	**Not applicable**
(b) Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals				**≥ 10% within the longer of 10 years or 3 generations**
(c) Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals				**Not applicable**

Please refer to the 'Guidelines for Using the IUCN Red List Categories and Criteria' for assistance with interpreting the criterion particularly in relation to calculating 'extent of occurrence', 'area of occupancy' and understanding of the definition and use of 'severely fragmented', 'locations', 'continuing decline' and 'extreme fluctuations'.

Please identify whether the species meets B1 or B2. Except for Near Threatened species, include an explanation, supported by data and information, on how the species meets at least 2 of (a), (b) or (c). For Near Threatened species, include an explanation, supported by data and information, on how the species meets (b).

Please note that locations must be defined by a threat. A location is a geographically or ecologically distinct area in which a single threatening event can rapidly affect all individuals of the species present.

If available, include information on:

- Whether there are smaller populations of the species within the total population and, if so, the degree of geographic separation between the smaller populations within the total population
- Any biological, geographic, human induced or other barriers enforcing separation

You must provide a response. If there is no evidence to demonstrate that the geographic distribution is precarious for either extent of occurrence AND/OR area of occupancy, this must be stated.

Euastacus robertsi meets the thresholds for listing as **Endangered (EN)** under criteria **B1ab(iii)** and **B2ab(iii)** based on a three locations threatened by climate change, bushfire and feral pigs.

1) B1: EOO of 215 km^2 (calculated in GeoCat; Bachman et al 2011). Nearly the entirety of this area is not suitable habitat for this species.

2) B2: AOO of 20 km^2. As this species is restricted to the linear-like stream network and near-stream habitats, the actual area of habitation will be significantly smaller. *Euastacus robertsi* was previously assessed under IUCN criteria (Coughran & Furse 2010) as Critically Endangered B1ab(iii). This assessment did not include Mt. Pieter Bott sites, and so the calculated EOO and AOO now both exceed the thresholds for Critically Endangered (100 km^2 and 10 km^2 respectively).

a: Known from three locations (Fig. 1), namely the dense upland tropical rainforest community of Mt. Finnigan in Ngalba Bulal National Park, and Mt. Pieter Bott and Thornton Peak in Daintree National Park. Although found on three discrete isolated, mountain tops, they are not far away from each other in practical terms. The most serious plausible threat (climate change) will impact the entire species population simultaneously. Rising temperatures will make their current habitat less suitable and will reduce the potential area of occupancy. Because of their restriction to a very particular habitat (cool mountain rainforest), there is little chance of natural migration to cooler areas up the mountain because this species is already near the top (summits: Mt. Finnigan 1148 m, Thornton Peak 1374 m, Mt. Pieter Bott 1009 m), and is restricted to aquatic habitats. Migration to cooler southern areas is unlikely because of the hot tropical lowlands surrounding the mountains (Ponniah & Hughes 2006). Similarly, climate change will likely increase the impact of future bushfires. The species' presence in rainforest is also not considered protection from fire and climate change, given the burning of some rainforest areas witnessed in the 2019-20 bushfire season.

b(iii): Projected decline in area, extent and/or quality of habitat due to climate change, bushfires, and feral pigs. This decline could be slow (via climate change) or very rapid (via future intense bushfires or a heat wave).

CRITERION C

Small population size and decline					
		Critically Endangered (CR)	**Endangered (EN)**	**Vulnerable (VU)**	**Near Threatened (NT)**
Estimated number of mature individuals		**< 250**	**< 2,500**	**< 10,000**	**< 20,000**
AND either (C1) or (C2) is true					AND (C1) is true
C1 An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in the future		**25% in 3 years or 1 generation (whichever is longer)**	**20% in 5 years or 2 generations (whichever is longer)**	**10% in 10 years or 3 generations (whichever is longer)**	**10% in 10 years or 3 generations (whichever is longer)**
C2 An observed, estimated, projected or inferred continuing decline AND its geographic distribution is precarious for its survival based on at least 1 of (a) or (b):					
(a)	(i) Number of mature individuals in each subpopulation	**≤ 50**	**≤ 250**	**≤ 1,000**	**Not applicable**
	OR				
	(ii) % of mature individuals in one subpopulation =	**90 – 100%**	**95 – 100%**	**100%**	**Not applicable**
(b) Extreme fluctuations in the number of mature individuals		**Applicable**	**Applicable**	**Applicable**	**Not applicable**

Please identify the estimated total number of mature individuals and either an answer to C1 or C2. Include an explanation, supported by data and information, on how the species meets the criteria. Note: If the estimated total number of mature individuals is unknown but presumed to be likely to be >10 000, you are not required to provide evidence in support of C1 or C2, just state that the number is likely to be >10 000.

You must provide a response. If there is no evidence to demonstrate small population size and decline this must be stated.

There are **insufficient data** to assess *Euastacus robertsi* against the thresholds for listing under Criterion C as there is little information available to determine a robust estimate of the number of mature individuals.

CRITERION D:

Very small population				
	Critically Endangered (CR)	**Endangered (EN)**	**Vulnerable (VU)**	**Near Threatened (NT)**
D1. Number of mature individuals	**< 50**	**< 250**	**D1. < 1,000**	**D1. < 3,000**
OR				
D2. [Only applies to the VU and NT categories] Restricted area of occupancy or number of locations with a plausible future threat that could drive the taxon to CR or EX in a very short time.	**Not applicable**	**Not applicable**	**D2. Typically: AOO < 20 km² or number of locations ≤ 5**	**D2. Typically: AOO < 40 km² or number of locations ≤ 10**

Please identify the estimated total number of mature individuals and evidence of how the figure was derived.

For Criterion D2, please provide information on the species' area of occupancy, number of locations and plausible threats.

You must provide a response. If there is no evidence to demonstrate eligibility, this must be stated.

There are **insufficient data** to assess *Euastacus robertsi* against the thresholds for listing under Criterion D1 as there is little information available to determine a robust estimate of the number of mature individuals. However, *Euastacus robertsi* does qualify under Criterion D2 as **Vulnerable (VU)**. This is because it is found in

three locations, and the combined threats of enhanced climate change, bushfires and feral predators could drive the species towards extinction in a short timeframe.

CRITERION E:

Quantitative Analysis				
	Critically Endangered (CR)	**Endangered (EN)**	**Vulnerable (VU)**	**Near Threatened (NT)**
Indicating the probability of extinction in the wild to be:	**≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.)**	**≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.)**	**≥ 10% within 100 years**	**≥ 5% within 100 years**

Please identify the probability of extinction and evidence of how the analysis was undertaken.

You must provide a response. If there has been no quantitative analysis undertaken this must be stated.

Euastacus robertsi is **not eligible** for listing under this criterion because no quantitative analysis of the probability of extinction of the populations is available.

SUMMARY OF CRITERIA UNDER WHICH THE SPECIES IS ELIGIBLE FOR LISTING AS: CR, EN, V, NT, EW or EX

Please mark the criteria and sub-criteria that apply.

☐Criterion A	☐A1 (specify at least one of the following) ☐a) ☐b) ☐c) ☐ d) ☐e); **AND/OR** ☐A2 (specify at least one of the following) ☐a) ☐b) ☐c) ☐d) ☐e); **AND/OR** ☐A3 (specify at least one of the following) ☐a) ☐b) ☐c) ☐d) ☐e); **AND/OR** ☐A4 (specify at least one of the following) ☐a) ☐b) ☐c) ☐d) ☐e)
☒Criterion B **Endangered**	☒B1 (specify at least two of the following) ☒a) ☒biii) ☐c); **AND/OR** ☒B2 (specify at least two of the following, other than NT) ☒a) ☒biii) ☐c)
☐Criterion C	☐estimated number of mature individuals **AND** ☐C1 **OR** ☐C2 ☐a (i) **OR** ☐a (ii) **OR** ☐C2 ☐b)
☒Criterion D **Vulnerable**	☐D1 **OR** ☒ D2
☐Criterion E	
☐EX	
☐EW	
☐LC	Species nominated to change from a higher conservation class to Least Concern. No above boxes apply.

Other Considerations

*INDIGENOUS CULTURAL SIGNIFICANCE

Is the species known to have cultural significance for Indigenous groups within Australia? If so, to which groups? Provide information on the nature of this significance if publicly available.

There is no known cultural significance for Indigenous groups for *Euastacus robertsi*. However, all native species are considered important (K. Goodall pers. comm. 2020). Waterways are important to the Eastern Kuku Yalanji people for cultural, physical and biological reasons, and this includes the springs on Thornton Peak, which are home to *E. robertsi* (QPWS 2019). Ngalba Bulal and Daintree national parks are part of a successful native title determination by the Eastern Kuku Yalanji people (QDES 2013, QPWS 2019), who took formal ownership of this country in 2021 (ABC Far North 2021). Under an Indigenous Management Agreement, the Eastern Kuku Yalanji People will jointly manage the national parks in collaboration with the Queensland government (ABC Far North 2021).

FURTHER STUDIES

Identify relevant studies or management documentation that might relate to the species (e.g. research projects, national park management plans, recovery plans, conservation plans, threat abatement plans, etc.).

ADDITIONAL COMMENTS/INFORMATION

Please include any additional comments or information on the species such as survey or monitoring information, and maps that would assist with the consideration of the nomination.

IMAGES OF THE SPECIES

Please include or attach images of the species if available, and indicate if you are in a position to authorise their use.

Fig. 3: *Euastacus robertsi*, Mount Finnigan.
Photo by Rob McCormack (Australian Aquatic Biological). Used with permission.

Reviewers and references

REVIEWER(S)

Has this nomination been peer-reviewed? Have relevant experts been consulted on this nomination? If so, please include their names, current professional positions and contact details.

This nomination has been formally peer-reviewed by Dr. James Furse, and was read, commented on, and approved by Robert McCormack and Dr. Jonathan Marshall.

A number of experts were consulted in preparing this nomination, all of whom kindly provided information, advice and guidance. These include Rob McCormack (Australian Aquatic Biological), Jason Coughran (Sheridan College), James Furse (Griffith University), Jamie Whitehouse (Arborculture Pty Ltd), Jon Marshall (Water Planning Ecology), Kylie Goodall (QPWS), Charlotte Hurry (FLEET), Mark Ponniah, and Jane Hughes (Griffith University).

REFERENCE LIST

Please list key references/documentation you have referred to in your nomination.

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Nominator's Details

Note: Your details are subject to the provisions of the *Privacy Act 1988* and will not be divulged to third parties, except for state and territory governments and scientific committees that have agreed to collaborate on national threatened species assessments using a CAM. If there are multiple nominators please include details below for all nominators.

TITLE (e.g. Mr/Mrs/Dr/Professor/etc.)

Dr

FULL NAME

Timothy Page

ORGANISATION OR COMPANY NAME (IF APPLICABLE)

Griffith University

CONTACT DETAILS

DECLARATION

I declare that, to the best of my knowledge, the information in this nomination and its attachments is true and correct.

Signed: * *If submitting by email, please attach an electronic signature*	Date: 23/04/2020 (original submission) 5/10/2021 (minor revision)

Lodging your nomination

Completed nominations may be lodged either:
1. by email in Microsoft Word format to: SpeciesTechnical.Committee@des.qld.gov.au
2. by mail to: The Chair
   Species Technical Committee
   Queensland Herbarium
   Mount Coot-tha Rd
   Toowong QLD 4066

*** If submitting by mail, you must include an electronic copy on a memory stick.**

Suggested citation:

Page, T.J. (2021). Nomination to change the conservation class of *Euastacus robertsi* under the Queensland *Nature Conservation Act 1992* (minor revision of 2020 version). Department of Environment and Science, Brisbane.