**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 <u>Memorandum of Understanding</u> 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 <u>https://www.qld.gov.au/environment/plants-animals/wildlife-permits/common-assessment</u>.

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 <u>EPBC.nominations@environment.gov.au</u>.



#### 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 <u>personal communication</u> 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 <u>SpeciesTechnical.Committee@des.gld.gov</u> 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 <a href="mailto:speciesTechnical.committee@des.gld.gov.au">SpeciesTechnical.committee@des.gld.gov.au</a>.

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

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 <u>www.environment.gov.au/cgi-bin/sprat/public/sprat.pl</u>.

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

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

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 <a href="http://www.environment.gov.au/system/files/pages/d72dfd1a-f0d8-4699-8d43-5d95bbb02428/files/nomination-form-species.pdf">http://www.environment.gov.au/system/files/pages/d72dfd1a-f0d8-4699-8d43-5d95bbb02428/files/nomination-form-species.pdf</a>, and email it to <a href="mailto:epbc.nominations@environment.gov.au">epbc.nomination@environment.gov.au</a>. Further information on the EPBC Act nomination, prioritisation and assessment process is available at <a href="http://www.environment.gov.au/biodiversity/threatened/nominations">http://www.environment.gov.au/biodiversity/threatened/nominations</a>. 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 <u>SpeciesTechnical.Committee@des.gld.gov.au</u>.
- 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: <u>www.environment.gov.au/cgi-bin/sprat/public/publiclookupcommunities.pl</u>.

#### 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*:
   <a href="http://www.environment.gov.au/system/files/pages/d72dfd1a-f0d8-4699-8d43-5d95bbb02428/files/tssc-guidelines-assessing-species-2018.pdf">http://www.environment.gov.au/system/files/pages/d72dfd1a-f0d8-4699-8d43-5d95bbb02428/files/tssc-guidelines-assessing-species-2018.pdf</a>.

#### **\*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: <a href="http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl">www.environment.gov.au/cgi-bin/sprat/public/sprat.pl</a>.

#### 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
  <u>SpeciesTechnical.Committee@des.qld.gov.au</u>.
- 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 <u>www.environment.gov.au/cgibin/sprat/public/sprat.pl</u>.
- 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 <u>http://s3.amazonaws.com/iucnredlist-newcms/staging/public/attachments/3151/redlistguidelines.pdf</u>.

#### 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 binzayedi Coughran & Furse, 2013

#### COMMON NAME(S)

Embezee'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 in Furse et al. (2013).

#### **\*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.

Click or tap here to enter text.

#### \*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 binzayedi* is a small, poorly spinose crayfish from the upland rainforests of Lamington National Park, Southeast Queensland (Qld), near the Qld – New South Wales (NSW) border. Furse et al. (2013) reported the maximum occipital carapace length (OCL) as 32.23 mm, but specimens ~20% larger have been measured since (McCormack et al. 2021). Its back is generally brown, with red-brown patches on the underside and sides, and the walking legs are brown tipped with blue on two pairs (Furse et al. 2013). The claws are usually mottled brownish green, with the underside fluorescent orange (Furse et al. 2013). However, colour is often not a useful diagnostic characteristic in freshwater crayfish as it can vary greatly within species, even within a section of stream (J. Furse pers. comm. 2020). *Euastacus binzayedi* is part of the poorly spinose group of *Euastacus* species (*sensu* Coughran 2008), which is characterised by a small body size and few spines (Furse et al. 2013).

The Gondwana Rainforest World Heritage Area along the Queensland – NSW border, which is home to *Euastacus binzayedi*, also hosts at least eight other species of poorly spinose spiny crayfishes (Furse et al. 2013). Two of these species look broadly similar to *Euastacus binzayedi*, namely *E. dalagarbe* (mud gully crayfish) and *E. angustus* (slender dwarf crayfish). *Euastacus binzayedi* can be differentiated from *E. dalagarbe* as *E. binzayedi* has many bumps and protrusions on the dorsal and ventral surfaces of its chelae, and from *E. angustus* as *E. angustus* has a laterally compressed body and a big ventromesal carpal spine (Furse et al. 2013). These two morphologically similar species are not sympatric with *E. binzayedi*, but occur 7-20 km to the south (R. McCormack pers. comm. 2021). However, the larger *E. sulcatus* (Lamington spiny crayfish) is found sympatrically with *E. binzayedi*, including at its type location (Furse et al. 2013). *E. binzayedi* is readily differentiated from *E. sulcatus* as *E. sulcatus* as *E. sulcatus* as *e. sulcatus* is much larger (max OCL ~100 mm, Coughran 2008; reportedly as large as 120 mm; McCormack 2012) and is a vibrant blue among Lamington populations (Queensland Museum 2007). Larger crayfish, like *E. sulcatus*, tend to frequent wider, deeper streams, whereas small crayfish like *E. binzayedi* tend to be in smaller, more marginal creeks (McCormack 2012). However, juvenile *E. sulcatus* have white bands on somites 1 and 6 (McCormack 2012).

### 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.

Euastacus binzayedi was originally described from a single site in Lamington National Park on the Lamington Plateau of the McPherson Range (Furse et al. 2013) in Southeast Queensland. This is part of the Gondwana Rainforests of Australia World Heritage Area that straddles the Queensland - NSW border (DERM 2011), and consists of the World's largest area of subtropical forest (Furse el a. 2013), much of it montane rainforest. The type location is at 900 m elevation in dense subtropical rainforest and is part of upper Canungra Creek, Albert River drainage. Euastacus binzayedi was considered very rare (Furse el a. 2013), as the type location is its only currently published locality, along with a nearby record (1.5 km) from WildNet (record by I. Gynther in 2013; see QDES 2020). More recent surveys (McCormack et al. 2021) have revealed a few dozen additional sites, some of which extend to the upper reaches of Gold Coast creeks (Coomera, Nerang), and all of which are within the north-eastern part of Lamington National Park (Fig. 1). None of the new sites is more than 7 km from the type location. The species' Area of Occupancy (AOO) is 44 km<sup>2</sup>, and Extent of Occurrence (EOO) is 44 km<sup>2</sup> (calculated with GeoCat, available at: geocat.kew.org; Bachman et al. 2011). The calculated EOO is actually 37 km<sup>2</sup>, but is considered to be 44 km<sup>2</sup> as EOO cannot be smaller than AOO (IUCN Standards and Petitions Subcommittee 2019). Euastacus binzayedi is considered to inhabit a single location (upland subtropical rainforest community of Lamington National Park) as defined by the IUCN (IUCN Standards and Petitions Subcommittee 2019), based on common threats (see Criterion B below for more information) and a small contiguous area.

All of the sites where *E. binzayedi* is recorded are within the Lamington National Park (206 km<sup>2</sup>). More than 70% of the sites are within the Queensland Regional Ecosystem (RE) type 12.8.5 (Complex notophyll vine forest on Cainozoic igneous rocks, Altitude usually >600 m; Queensland CRA/RFA Steering Committee 1998; Queensland Herbarium 2019). *Euastacus binzayedi* receives the umbrella protection of being found entirely within a national park, however it is not actively managed (DERM 2011; W. Buch pers. comm. 2020). The significance of *Euastacus* in general is recognised within the Lamington National Park as *Euastacus sulcatus* appears on the cover of its management plan (DERM 2011).

The section of the Gondwana Rainforests of Australia World Heritage Area along the Queensland – NSW border is a biodiversity hotspot for crayfishes, with at least 14 species of *Euastacus* present (Furse et al. 2013). It is conceivable that *Euastacus binzayedi* could be more widely distributed than the 37 km<sup>2</sup> within Lamington National Park. Efforts have been made to look for this species within parts of the Park, but the landscape is challenging, being steep, thickly vegetated and isolated (McCormack et al. 2021). There is a large amount of similar habitat in the many upland rainforests of the area on both sides of the State border. The same type of complex notophyll vine/rainforest favoured by *E. binzayedi* (RE 12.8.5) is also found at Springbrook, Mt. Barney, Mt. Chinghee and Main Range National Parks on the Queensland side of the border (Queensland CRA/RFA Steering Committee 1998; Queensland Herbarium 2019). Similar small, poorly spinose *Euastacus* specimens have been sampled from the identified potential habitat in the southern part of Lamington National Park, but their taxonomic affiliation is unclear, likely being an unnamed new species (R. McCormack pers. comm. 2021).

### 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. binzayedi*, however it is recognised that *Euastacus* species have a suite of common biological characteristics, and many of these characteristics apply to *E. binzayedi* (Furse & Coughran 2011). The life-cycle of *E. binzayedi* is likely similar to other small, 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. dalagarbe*, to which it is closely related (Austin et al. 2021).

Furse et al. (2013) collected E. *binzayedi* females in the size range of 18.56 – 32.23 mm (OCL), and speculated that females reached sexual maturity when they achieved an OCL of about 30 mm. Recent work has suggested that the OCL size females need to achieve before sexual maturity is a little larger than 30 mm (McCormack et al. 2021). The actual growth rates, population sizes and generation lengths of *E. binzayedi* are not known.

Many *Euastacus* species are winter brooders (mating in late summer/autumn with females carrying eggs over winter) and brooding periods may be long (6–10 months is typical). Some species only breed biennially and pleopodal egg fecundity varies considerably between species, typically ranging from 20–1500 eggs per female (Clark 1937; Barker 1992; Honan & Mitchell 1995; Turvey & Merrick 1997; Borsboom 1998; Honan 1998; Morey 1998; Furse & Wild 2004; Coughran 2006; McCormack et al. 2010; Coughran 2013). Due to the small size of *E. binzayedi*, pleopodal egg fecundity is likely in the range of about 20–100 eggs (McCormack et al. 2010; Coughran 2011).

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

*E. binzayedi*'s habitat is small, montane creeks, shaded by dense subtropical rainforest (Furse et al. 2013; McCormack et al. et al. 2021). The type location is at 900 m ASL, but additional sites have since been located a few hundred metres higher and lower (McCormack et al. 2021). Nearly all of the sites (82%) are located in complex notophyll vine forest on Cainozoic igneous rock (Queensland Regional Ecosystem types 12.8.5, 12.8.3; Queensland Herbarium 2019). Other similar upland rainforest *Euastacus* species, such as *E. jagara* (Jagara hairy crayfish) from the nearby Main Range National Park, are often collected in association with specific species of vegetation (McCormack et al. 2010). *Elatostema reticulatum* (rainforest spinach) is a useful indicator of suitable *E. jagara* habitat (McCormack et al. 2010), and it is also found at Lamington National Park and so may also be an indicator for *E. binzayedi*.

*Euastacus binzayedi*, like most small rainforest *Euastacus* species, lives in complex burrows (Coughran 2005, 2007). This species is known to occupy simple shallow excavations under rocks and vegetative debris, as well as complex burrow networks where standing water may not be apparent (Coughran & Furse 2010; Furse et al. 2013). As this species has rarely been observed (Furse et al. 2013), it likely does not move around the landscape much during the day, and may be largely nocturnal, like *E. jagara* (McCormack et al. 2010). The diet of *E. binzayedi* is not well understood.

# 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). <i>Euastacus binzayedi</i> may have been buffered to some extent as dense rainforest burns much less often than open woodland. The complex notophyll vine forest (QLD RE 12.8.5, 12.8.3) that is <i>E. binzayedi</i> 's home is fire sensitive and does not usually burn (Queensland Herbarium 2019). Nevertheless, the very small, restricted distribution of the species in a single location places it at great risk in the event that fire does impact its very limited area. |
|              | As Lamington is on top of a plateau, fires often enter the park through the lower slopes of the valleys that run up to the plateau (DERM 2011). Recurring fires of high or low severity, or high frequency, are a recognised major threat to the rainforests of the Gondwana World Heritage Area. This is because 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,<br>however another rainforest crayfish (Ellen Clark's Crayfish; <i>Euastacus clarkae</i> )<br>suffered a mass kill directly after a fire (McCormack 2015). Similarly, <i>E. bispinosus</i>  |

|                             | (Glenelg spiny crayfish) abundances declined after fire events, perhaps due to<br>associated reduction of habitat quality (Johnston et al. 2014). Indirect impacts of<br>fire are potentially long-lasting, and include serious habitat degradation and/or<br>destruction, and ensuing water quality issues that highly impact freshwater<br>species (Bryant et al. 2012). Sediment and ash run-off from fires can degrade<br>water quality, leading to a change in the pH of the water and low dissolved oxygen<br>(Silva et al. 2020). Level of past impact = low.   |  |  |  |  |
|-----------------------------|--|--|--|--|--|
| Drought                     | Drought is a common feature of the general Australian environment, including in<br>Southeast Queensland over a long timescale (Barr et al. 2019). Severe drought is<br>obviously a challenge for a freshwater species, shrinking the available habitat.<br>Total annual rainfall decreased by 75.8 mm between 1950 and 2003 in the<br>Gondwana Rainforest World Heritage Area (ANU 2009). This declining rainfall<br>continued during the Millennium Drought (1996 – 2010), when rainfall in the<br>Lamington NP area was very much below average (BOM 2015). Effects of drought<br>may be amplified by interactions between drought and fire. Level of past impact =<br>low.  |  |  |  |  |
| Unauthorised collection     | All <i>Euastacus</i> species ("spiny crayfishes") are "no take" species under the Queensland <i>Fisheries Act 1994</i> (Furse & Coughran 2011). It is unknown if <i>E. binzayedi</i> in particular has been the subject of illegal collecting for the aquarium trade (Coughran & Furse 2012), however the sympatric <i>E. sulcatus</i> has definitely been taken. There has been crayfish poaching in Lamington NP at Gwongoorool Pool on the Coomera River in 2012-2013, which included leaving opera house traps that drowned platypuses (W. Buch pers. comm. 2020). An individual of <i>E. sulcatus</i> was even taken from the visitor centre at neighbouring Springbrook NP in the 1990s (W. Buch pers. comm. 2020). Lamington National Park receives a very large number of visitors per year (~ half a million; DERM 2011), to the point that water quality and riparian vegetation are being degraded in some areas by recreational swimming (W. Buch pers. comm. 2020). Therefore, if even a very small percentage of these people take crayfish, it could impact local populations. As <i>E. binzayedi</i> is rare, it could be targeted for illegal collection as it may be even more valuable on the black market than <i>E. sulcatus</i> . For this reason, <i>E. binzayedi</i> could be particularly at risk. Given the very small, restricted distribution of <i>E. binzayedi</i> any removal of specimens could be very harmful to the population as |  |  |  |  |
|                             | a whole I evel of past impact = unknown/ low   |  |  |  |  |
| Current threats             | a whole. Level of past impact = unknown/ low. Impact of threat   |  |  |  |  |
| Current threats<br>Bushfire | a whole. Level of past impact = unknown/ low.<br>Impact of threat<br>During the bushfire season of 2019-20, fires occurred at 9% of the sites known to<br>host <i>E. binzayedi</i> , and 32% of the <i>E. binzayedi</i> sites were within 2 km of the fire<br>front (Fig. 2). No site was more than 6 km from the fire. It is not currently clear how<br>the crayfish or their sites fared in the fires, although the canopy has recovered well<br>in some burned areas after rain in February 2020 (W. Buch pers. comm. 2020).<br>Because the entire distribution of this species is within a single block of a few<br>dozen square kilometres, any bushfire impacts could be very significant to <i>E. binzayedi</i> 's long-term future. Level of current impact = moderate.  |  |  |  |  |

|                         | <b>Fig. 2:</b> <i>Euastacus binzayedi</i> actual Extent of Occurrence (in blue) overlaid with extent of bushfires (in red) between August & December 2019 (Queensland Government 2020). Displayed in Google Earth Pro (version 7.3.2.5776).  |  |  |  |  |
|-------------------------|--|--|--|--|--|
| Drought                 | Severe drought is a potential driver of habitat and population loss for <i>E. binzayedi</i> ,<br>even within a national park. Rainfall deficits (2017 – 2019) have been extreme in<br>Southeast Queensland, with cool season rain the lowest on record in most of<br>subtropical Queensland (BOM 2019). Reduced rainfall means less water in the<br>creeks from run-off and a lower water tables, and this is believed to have<br>adversely affected crayfish at Lamington National Park as well as depleting much<br>surface and ground water prior to the fires (W. Buch pers. comm. 2020). Level of<br>current impact = low/moderate  |  |  |  |  |
| Unauthorised collecting | There are reports of poachers taking <i>E. sulcatus</i> illegally from neighbouring<br>Springbrook NP (ABC Gold Coast 2019). Australian crayfish are for sale in<br>Australia and overseas (legally and illegally, including online), although it is not<br>known if <i>E. binzavedi</i> are among these Level of current impact – unknown/low   |  |  |  |  |
| Future threats – actual | Impact of threat   |  |  |  |  |
| Bushfire                | Climate projections for Southeast Queensland indicate the likelihood of harsher<br>fire conditions, meaning that fires like those of 2019-2020 may not be unusual<br>events in the near future (ANU 2009; DEHP 2016) (see Climate change below).<br>The fires of the future are likely to be even more intense and come with a greater<br>frequency. A drier climate will make the upland rainforest habitat of <i>E. binzayedi</i><br>more likely to burn, especially with the encroachment of more fire-prone<br>sclerophyll forest species and from lantana ( <i>Lantana camara</i> ) and other weeds<br>moving up the slope in response to a warming climate, and the prediction of more<br>fuel being made available in future (ANU 2009; Murphy et al. 2012; Queensland<br>Herbarium 2019). The entire distribution of <i>E. binzayedi</i> is in an area of proven fire<br>risk, and because the species has such a small, restricted distribution (which will<br>shrink further with climate change), there is a real possibility of future extinction in<br>the wild given the predicted more intense and more frequent bushfires of the<br>future. Level of future impact = high.   |  |  |  |  |
| Drought                 | The frequency and intensity of drought is likely to increase (see Climate change below) (ANU 2009). Predictions for the northern part of the Gondwawa Rainforest World Heritage Area (where <i>E. binzayedi</i> is located), are that annual rainfall will decrease by 3.5% by 2030, especially in the autumn, winter and spring (ANU 2009). Increased evaporation from higher temperatures will also reduce the amount of water available (ANU 2009). Level of future impact = moderate/high.   |  |  |  |  |
| Climate change          | The Earth is warming rapidly and the climate changing. 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 for the planet (Arguez et al. 2020). Climate modelling for the Southeast region of Queensland in general (DEHP 2016), and the Lamington Area in particular (ANU 2009), predicts significant, rapid future changes to climate. This includes higher temperatures, more hot days, reduced rainfall, increasing drought, more extreme and frequent weather events, and harsher fire weather (ANU 2009; DEHP 2016). Climate change works in concert with, and as an intensifier of, many of the previously mentioned threats (e.g. bushfires, droughts). Similarly, extreme weather events, such as cyclones and floods, can also severely impact freshwater crayfish. Intense storm events can scour high-altitude streams and this can be deadly to juvenile <i>Euastacus</i> that seek refuge under leaves/fallen palm fronds, small loose rocks and logs (R. McCormack pers. comm. 2020). Mass mortality has been recorded in <i>E. valentulus</i> (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 adult <i>E. binzayedi</i> (30-40 mm OCL). There are also reports of <i>E. sulcatus</i> in Lamington National Park having been killed in large numbers in large log jams following flooding associated with Ex-Tropical Cyclone Debbie in March 2017 (W. Buch pers. comm. 2020). |  |  |  |  |

| change, since they are refugia for many cool-adapted flora and fauna species, E.        |
|---|
| <i>binzayedi</i> among them. Available habitat may shrink as narrow, suitable "climatic |
| envelopes" might migrate up the mountains in the face of rising temperatures, and       |
| may eventually disappear completely (Krockenberger et al. 2003). For example, a         |
| rise of only 1.0°C by 2030 could result in a 50% decrease in the area of upland         |
| tropical 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 now       |
| facing the accelerated warming due to human activities.                                 |

As the rainforest habitat degrades with climate change, the pressure from invasive species is predicted to increase, as the habitat becomes more suitable for their persistence. These include *Lantana camara* (see Bushfire, Future Threats – actual) and feral pigs (*Sus scrofa*). Feral pigs can have direct negative impacts for crayfish, including predation, habitat degradation through digging and rooting, and indirect impacts, like changing plant species composition, and poor water quality (Commonwealth of Australia 2017), although feral pig levels are currently low in Lamington National Park (W. Buch pers. comm. 2020; DERM 2011).

Climate change is a real threat to freshwater crayfish since *Euastacus* are sensitive to changes in temperature, 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 2004).

However, increased temperatures will almost certainly severely impact *E. binzayedi*. Higher temperatures, decreased rainfall, and an intensified bushfire regime could also cause a change in the species composition of riparian vegetation, which could restrict the distribution of *E. binzayedi* further (R. McCormack pers. comm. 2020).

Bland (2017) undertook a large-scale meta-analysis that considered the multiple interacting factors that influence extinction risk in freshwater crayfish. The single most important factor in extinction risk was range size, with high-altitude habitat also leading to a higher risk of extinction. Both of these factors are relevant to *E. binzayedi*. Because of its highly restricted, small 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 stochastic 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. binzayedi* in the face of climate change are limited. One possibility is adaptation, *as E. sulcatus* has shown some ability to deal with warmer temperatures, although this was a very small effect, much smaller than the predicted increases in temperature (Bone et al. 2014). Adaptation does not seem likely as *E. binzayedi* is almost certainly cool-adapted, and has been so for a long time, and the rate of current climate change makes this unlikely. Another possibility is that *E. binzayedi* could move to cooler, higher altitudes to retain its preferred climate envelope. This is not likely as *E. binzayedi* has already been found at a similar height (1125 m) to the highest local altitudes (1165 m) (McCormack et al. et al. 2021). A third possibility is that *E. binzayedi* could migrate to other areas. This is problematic as similar nearby rainforest areas will feel the same effects of climate change, already host their own species of *Euastacus*, and (other than the Border Ranges National Park) would require crossing unsuitable, warm lowland habitat. Level of future impact = high.

| potential               |  |
|-------------------------|--|
| Unauthorised collecting | The level of future unauthorised collecting is difficult to estimate. However,           |
|                         | E. binzayedi's rarity and very small distribution places it at a great risk of depletion |
|                         | of numbers from any level of exploitation or collection (legal or otherwise) or an       |
|                         |  |

Future threats -

notential

|                 | accidental introduction of a pathogen during this collection (see Crayfish plague below).<br>Crayfish poaching for <i>E. sulcatus</i> has occurred in Lamington National Park and at neighbouring Springbrook National Park and <i>E. sulcatus</i> is also present at Lamington National Park, sympatric with <i>E. binzayedi. Euastacus sulcatus</i> is now available for legal online purchase (from a breeding stock). These are being sold for high prices, and this may increase their popularity and value, and thus increase poaching for it, and potentially for any other sympatric crayfish (including <i>E. binzayedi</i> ) (A. Northam pers. comm. 2019). Level of future impact = unknown/low.  |
|-----------------|--|
| Crayfish plague | <i>Aphanomyces astaci</i> (crayfish plague) is a highly contagious fungal disease that is<br>uniformly fatal (100% mortality) to susceptible species (e.g., Panteleit et al. 2017),<br>and it is considered one of the world's worst invasive species (Lowe et al. 2000).<br>Many strains of the disease prefer cooler temperatures, which is also the<br>preference of <i>E. binzayedi</i> . Crayfish plague is not currently known in Australia, but<br>is documented as fatal to Australian freshwater crayfish (Unestam 1975), and it<br>poses an extremely high risk to native freshwater crayfish species (DAWE 2019).<br>Illegally imported specimens of the North American crayfish species known to<br>carry the disease have been seized in multiple Australian states (Department of<br>Primary Industries & Regional Development 2021; Business Queensland 2021),<br>but not known to be infected. A single, illegally-imported crayfish infected with<br>crayfish plague has the capacity to devastate the entire Australian crayfish fauna.<br>Increasing illegal wildlife/aquarium trade appreciably increases the risk and<br>probability of the disease's introduction to Australia. Level of future impact =<br>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                | Active fire management is carried out at Lamington National Park by the Queensland Parks and Wildlife Service (QPWS), including planned burns to reduce fuel loads and meet the ecological needs of a number of species and communities (DERM 2011). Over the last six years, twelve large-scale planned burns have been carried out following Ex-Tropical Cyclone Oswald in 2013. These significantly reduced the impacts of the 2019 bushfires, and included the Egg Rock, Riflebird Creek and Nixons Creek areas. At Nixons Creek, the fire intensity apparently dropped significantly and the wildfire scar followed the previous planned-burn scar exactly to the edge of Nixons Creek, before self-extinguishing (W. Buch pers. comm. 2020). The wildfire only made it into one previously long-unburned area on the eastern side of Binna Burra, between Riflebird and Chiminya Creek, where QPWS eventually contained it (W. Buch pers. comm. 2020). |
|                         | The particular upland rainforest ecosystem that is home to <i>E. binzayedi</i> , complex notophyll vine forest (QLD RE 12.8.5, 12.8.3), requires that the surrounding areas be actively managed to reduce the probability of fire incursion, as this community does not burn regularly (Queensland Herbarium 2019). This community needs active protection from fires in extreme conditions such as after long droughts.   |
|                         | Abatement or recovery action proposed  |
| Unauthorised collecting | Regular checks should be made of the internet to see if <i>E. binzayedi</i> 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 (J. Furse pers. comm. 2020).  |
| Future threats – actual | Abatement or recovery action underway  |
|                         |  |
|                         | Abatement or recovery action proposed  |
| Bushfire                | The entire distribution of <i>E. binzayedi</i> falls within the Gondwana Rainforest World<br>Heritage Area of the Southern Queensland Post-fire Response Project Areas<br>(Threatened Species Operations 2020). Lamington National Park, home to<br><i>E. binzayedi</i> , hosts many threatened priority species that are the focus of post-fire   |

|                               | responses. <i>Euastacus binzayedi</i> would benefit from many of the same remedial actions proposed for those species in this area, including pest management being stepped up. The recovery of the target species and overall environment should be monitored for both direct and indirect effects of fire (habitat degradation, water quality issues, predation pressure) to determine how well they can recover after  |  |  |  |  |
|-------------------------------|---|--|--|--|--|
|                               | bushfires in the future.  |  |  |  |  |
| Climate change                | Detailed monitoring of the health of both <i>E. binzayedi</i> 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.<br>Given that <i>E. binzayedi</i> is gravely threatened by rising temperatures due to climate change, obtaining some data on its thermal tolerance is particularly vital.<br>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 <i>E. binzayedi</i> 's long-term extinction risk. Baseline water temperatures at a number of sites in streams known to be home to <i>E</i> . |  |  |  |  |
|                               | <i>binzayedi</i> 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 <i>E. binzayedi</i> , 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 –<br>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 binzayedi* is being nominated as Critically Endangered (CR) because of its very restricted distribution (EOO =  $44 \text{ km}^2$ ; AOO =  $44 \text{ km}^2$ ) in a single location (upland subtropical rainforest community of Lamington National Park). The entire population is threatened by bushfire, drought, and climate change, which is predicted to increase and intensify other related threats (e.g. floods).

#### (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<br>Endangered (CR)   | Endan<br>(El                        | gered<br>N)      | Vulnerable<br>(VU)  | Near Threatened<br>(NT)                    |
|-----|--|---|-------------------------------------|------------------|---|--|
| A1  |  | ≥ 90%   | ≥ 70                                | 0%               | ≥ 50%   | ≥ 20%                                      |
| A2, | A3, A4   | ≥ 80%   | ≥ 50                                | 0%               | ≥ 30%   | ≥ 20%                                      |
| A1  | Population reduction obs<br>inferred or suspected in<br>causes of the reduction a<br>reversible AND understo   | served, estimated,<br>the past and the<br>are clearly<br>ood AND ceased.  |                                     | (a) di<br>(b) al | rect observation [ <i>except A</i><br>n index of abundance appr                             | 3]<br>opriate to the taxon                 |
| A2  | A2 Population reduction observed,<br>estimated, inferred or suspected in the<br>past where the causes of the reduction<br>may not have ceased OR may not be<br>understood OR may not be reversible.                        |   | based<br>on any<br>of (a)<br>to (e) | (c) a            | decline in area of occupar<br>ccurrence and/or quality of<br>ctual or potential levels of e | icy, extent of<br>habitat<br>exploitation  |
| A3  | Population reduction, pro<br>suspected to be met in th<br>maximum of 100 years)<br>used for A3   | ojected or<br>he future (up to a<br>[( <i>a) cannot b</i> e   |                                     | (e) th<br>pa     | e effects of introduced tax<br>athogens, pollutants, comp                                   | a, hybridisation,<br>betitors or parasites |
| A4  | An observed, estimated,<br>projected or suspected p<br>reduction where the time<br>include both the past and<br>a max. of 100 years in fu<br>the causes of reduction r<br>ceased OR may not be u<br>may not be reversible. | inferred,<br>oopulation<br>e period must<br>d the future (up to<br>uture), and where<br>may not have<br>understood OR |                                     |                  |   |  |

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.

Available population data are insufficient to assess Criterion A, as little is known about population size of *E. binzayedi*. It is very likely that the population size will decline in the face of climate change (especially given projections for hotter weather and less moisture) since this species is a cool mountain specialist restricted to upland rainforests. As temperatures increase, the available amount of 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 reduced rainfall. 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<br>Endangered (CR)                      | Endangered<br>(EN)          | Vulnerable<br>(VU)   | Near Threatened<br>(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<br>Number of locations   | = 1  | ≤ 5                         | <b>≤ 10</b>  | 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<br>of 10 years or 3<br>generations |                         |
| (c) Extreme fluctuations in any of: (<br>locations or subpopulations; (iv) num  | i) extent of occurrence<br>ber of mature individua | ; (ii) area of occupa<br>ls | ncy; (iii) number of                                       | 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 binzayedi* meets the thresholds for listing as **Critically Endangered (CR)** under Criteria **B1ab(iii)** based on a single location threatened by bushfire, drought, and other impacts of climate change.

Euastacus binzayedi meets Criterion B1 for based on:

1) B1: EOO of 44 km<sup>2</sup>. As this species is restricted to the linear-like stream network and near-stream habitats, the actual area of habitation will be significantly smaller.

a: Known from single location (Fig. 1), namely the dense upland subtropical rainforest community of Lamington National Park. One stochastic event (bushfire, drought, heatwave) could drive the species to extinction. The known distribution of the species is a small contiguous area, part of which burned in the bushfires of 2019. The fire which impacted Lamington National Park was bigger than the entire distribution of *E. binzayedi* (Fig. 2). A single bushfire taking hold in this area could drive the species to extinction in a single event, and bushfires are predicted to become more frequent and fierce in future due to climate change, even in rainforests. Climate change, and in particular a warming climate, could impact the entire species' population simultaneously. Rising temperatures will impact *E. binzayedi*'s physiology directly, as well as making their current habitat less suitable, and will reduce the potential area of occupancy. *Euastacus binzayedi* is restricted to the cool, higher altitude areas on top of a plateau, with little chance of natural migration. Drought and heatwaves are also predicted to intensify and worsen, and would impact the whole population simultaneously.

b(iii): Projected decline in area, extent and/or quality of habitat due to bushfires, climate change, and drought. This decline could be very rapid, via future intense bushfires, heat wave, drought, flooding, or slow, mediated through the various effects of climate change.

2) B2: AOO of 44 km<sup>2</sup> which meets the Endangered (EN) category.

# **CRITERION C**

| Small population size and decline   |  |   |   |   |   |
|---|--|---|---|---|---|
|   |  | Critically<br>Endangered (CR)                                 | Endangered<br>(EN)  | Vulnerable<br>(VU)  | Near Threatened<br>(NT)   |
| Esti<br>indiv   | nated number of mature<br>viduals  | < 250   | < 2,500   | < 10,000  | < 20,000  |
|   | AND either (C1) or (C2) is true AND (C1) is true                         |   |   |   |   |
| C1 An observed, estimated or<br>projected continuing decline of at<br>least (up to a max. of 100 years in<br>the future |  | 25% in 3 years or<br>1 generation<br>(whichever is<br>longer) | 20% in 5 years<br>or<br>2 generations<br>(whichever is<br>longer) | 10% in 10 years or<br>3 generations<br>(whichever is<br>longer) | 10% in 10 years or<br>3 generations<br>(whichever is<br>longer) |
| C2<br>prec  | An observed, estimated, projected arious for its survival based on at lo | or inferred continuing<br>east 1 of (a) or (b):               | decline AND its geo   | graphic distribution is   |   |
|   | (i) Number of mature<br>individuals in each<br>subpopulation             | ≤ 50  | ≤ 250   | ≤ 1,000   | Not applicable  |
| (a)   | OR   |   |   |   |   |
|   | (ii) % of mature individuals in one subpopulation =                      | 90 – 100%   | 95 – 100%   | 100%  | Not applicable  |
| (b)<br>num  | Extreme fluctuations in the ber 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 binzayedi* against the thresholds for listing under Criterion C as there are no data to determine a robust estimate of the number of mature individuals.

# **CRITERION D:**

| Very small population  |                               |                    |   |  |
|--|-------------------------------|--------------------|---|--|
|  | Critically<br>Endangered (CR) | Endangered<br>(EN) | Vulnerable<br>(VU)  | Near Threatened<br>(NT)  |
| D1. Number of mature individuals   | < 50                          | < 250              | D1. < 1,000   | D1. < 3,000  |
| OR   |                               |                    |   |  |
| D2. [Only applies to the VU<br>and NT categories]<br>Restricted area of<br>occupancy or number<br>of locations with a<br>plausible future threat that<br>could drive the taxon to<br>CR or EX in a very short<br>time. | Not applicable                | Not applicable     | D2. Typically:<br>AOO < 20 km²<br>or number of<br>locations ≤ 5 | D2. Typically:<br>AOO < 40 km²<br>or number of<br>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 binzayedi* against the thresholds for listing under Criterion D1 as there are no data to determine a robust estimate of the number of mature individuals. However, *Euastacus binzayedi* does qualify under Criterion D2 as **Vulnerable (VU)**. This is because of a single location, and the

combined threats of enhanced bushfires, drought, and heatwaves associated with climate change could drive the species towards extinction in a short timeframe.

#### **CRITERION E:**

| Quantitative Analysis                                       |   |   |                           |                          |
|---|---|---|---------------------------|--------------------------|
|   | Critically<br>Endangered (CR)   | Endangered (EN)   | Vulnerable (VU)           | Near Threatened<br>(NT)  |
| Indicating the probability of extinction in the wild to be: | ≥ 50% in 10 years or<br>3 generations,<br>whichever is longer<br>(100 years max.) | ≥ 20% in 20 years or 5<br>generations, whichever<br>is longer (100 years<br>max.) | ≥ 10% within 100<br>years | ≥ 5% within 100<br>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 binzayedi* is **not eligible** for listing under this criterion because no quantitative analysis of the probability of extinction of the population 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                                      | <ul> <li>□A1 (specify at least one of the following) □a) □b) □c) □ d) □e); AND/OR</li> <li>□A2 (specify at least one of the following) □a) □b) □c) □d) □e); AND/OR</li> <li>□A3 (specify at least one of the following) □a) □b) □c) □d) □e); AND/OR</li> <li>□A4 (specify at least one of the following) □a) □b) □c) □d) □e)</li> </ul> |
|---|---|
| ⊠Criterion B<br>Critically<br>Endangered          | $\boxtimes$ B1 (specify at least two of the following) $\boxtimes$ a) $\boxtimes$ biii) $\square$ c); <b>AND/OR</b><br>$\square$ B2 (specify at least two of the following, other than NT) $\square$ a) $\square$ b) $\square$ c)   |
| □Criterion C                                      | □estimated number of mature individuals AND<br>□C1 OR<br>□C2 □a (i) OR □a (ii) OR<br>□C2 □b)  |
| ⊠Criterion D<br><b>Vulnerable</b><br>⊡Criterion E | □D1 <b>OR</b> ⊠ D2  |
| □EX   |   |
| □EW   |   |
| □LC   | Species nominated to change from a higher conservation class to Least Concern.<br>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.

It is not known if the Yugambeh people attach any particular cultural significance to Euastacus binzayedi.

#### 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.

Click or tap here to enter text.

#### **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 binzayedi*, Lamington National Park. 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 peer-reviewed by Dr. James Furse (Griffith University), and was read and commented on by Robert McCormack (Australian Aquatic Biological), Dr. Jonathan Marshall and Dr. Alisha Steward (Water Planning Ecology, DES).

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), and Wil Buch (QPWS).

### **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 J. 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:
 Date: 18/05/2020 (original submission)

 \* If submitting by email, please attach an electronic signature
 5/10/2021 (minor revision)

 Lodging your nomination
 5/10/2021 (minor revision)

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.

Recommended citation:

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