The following file contains two documents for the listed taxon:

1) Federal Conservation Advice[1] and 2) Victorian Threatened Species Assessment[2]

This taxon is listed under the *Flora and Fauna Guarantee Act 1988* (FFG Act), and uses the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) conservation status.

The Threatened Species Assessment Report is the outcome from the bulk assessment process held between 2018 and 2021, and documents the Victorian conservation status, listing criteria and the reasons for satisfying those criteria. All these assessments were conducted in accordance with the national Common Assessment Method (CAM).

The EPBC conservation advice is the repot of the national assessment under the EPBC Act, also conducted in accordance with the CAM.

Both documents help inform the threats and management actions relevant to the species in Victoria.

Under the CAM, Victoria adopts the conservation category and extinction risk for all taxa that have been assessed as nationally threatened, and listed under the EPBC Act. Over time. this alignment at the state and national level will lead to a Single Operational List (SOL) – a list where all FFG-listed taxa have the EPBC status, if that status has been applied in accordance with the CAM.

However, we do not yet have a SOL, because many EPBC taxa (mostly prior to 2014) are not compliant with the CAM (i.e., are 'legacy" taxa), and there will be inconsistencies between the FFG and EPBC lists until these legacy taxa are re-assessed.

[1]National assessment under the national *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

[2.] Victorian assessment under the *Flora and Fauna Guarantee Act 1988* (FFG Act).

FLORA & FAUNA
GUARANTEE

Nomination No. 892
Taxon ID 903498

FLORA AND FAUNA GUARANTEE - SCIENTIFIC ADVISORY COMMITTEE

FINAL RECOMMENDATION ON A NOMINATION FOR LISTING

***Galaxias* sp. nov. 'Yalmy' -** Yalmy Galaxias

DOCID107-417469679-742

Date of receipt of nomination: 27 September 2020

Date of preliminary recommendation: 20 October 2021

Date of final recommendation: 21 January 2022

Validity: The nomination is for a valid item.

Prescribed Information: The prescribed information was provided.

Name of the Nominator is adequately provided.

Name of the Item is adequately provided.

The nominated taxon is accepted by the Scientific Advisory Committee (SAC) as a valid taxon. The taxon is accepted by Dr T.A. Raadik (Research Associate, Museum Victoria, taxonomist and expert in Australian Galaxiidae taxonomy) and Dr Martin Gomon, (Curator, Fishes, Museum Victoria). Voucher specimens have been lodged at Museum Victoria (NMV A 30569-002 Galaxias sp. nov. 'Yalmy')."

This taxon is a recently identified putative new species within the *Galaxias olidus* species complex (sensu Raadik 2014). Allozyme genetic results (2017) now support this taxon as a new species, with morphological analysis underway, to be followed by formal description as a new taxon (Raadik unpublished data, Raadik 2014).

Current conservation status

The nominated taxon is not currently listed as threatened in Victoria.

The nominated taxon was listed as 'Critically Endangered' in Australia by the International Union for Conservation of Nature (IUCN) in 2019 (Raadik 2019).

Eligibility for listing as a taxon under the Flora and Fauna Guarantee Act 1988

The Scientific Advisory Committee has assessed the eligibility of this nomination based on its extinction risk within Australia (as the species is endemic to Victoria) in accordance with Section 16C(4)(c) of the *Flora and Fauna Guarantee Act 1988* (the FFG Act) and the criteria for determining eligibility for listing prescribed in the Flora and Fauna Guarantee Regulations 2020. In its application of the relevant eligibility criteria, the SAC has, as required by the nationally adopted Common Assessment Method, had regard to the *IUCN Red List Categories and Criteria (Version 3.1)* and the *Guidelines for Using the IUCN Red List Categories and Criteria (version14, 2019).*

Species information

Description, Life History, Generation Length

The Yalmy Galaxias is a small (to 80mm total length), scaleless fusiform freshwater fish. The taxon is genetically (fixed allozyme differences), phenotypically and ecologically distinct from the closely related Mountain Galaxias (*Galaxias olidus*) and McDowall's Galaxias (*Galaxias mcdowalli*) (Raadik 2014). This species is distinguished from McDowall's Galaxias and other species in the *Galaxias olidus* species complex, by multiple characters: a distinctive orange-brown body colouration with

brown to dark grey blotches/bands on the dorsal and lateral surfaces, a degree of setback of the origin of the anal fin from that of the dorsal fin, large eyes, seven pelvic fin rays (eight rays in *G. mcdowalli*), a long caudal peduncle and the unique shape of the snout and jaws, including thick fleshy lips. Further, the species has a unique swimming style, usually laying on the substrate then darting very rapidly through the water column. The spawning period is unknown, though possibly late spring to summer: as fish collected in late February/early March were at an early stage of gonad development, though a male (74.2 mm LCF) appeared to be almost ripe (NMV A.30572-2), and the smallest presumed 0+ age fish recorded (33.9 mm LCF) was collected in early March (NMV A.30574-1).

The generation length for this taxon is unknown but is assumed to be 3 years based on data for *Galaxias olidus*, a closely related and sympatric species (Raadik 2019).

Distribution

This species is only known from the mid-reaches of the Yalmy River and Serpentine Creek, and the lower Rodger River, partly within the Snowy River National Park, Victoria, at an elevational range of 140–250 m asl. It is known from a 9.0 km reach of stream (~3.0 m average width). This species is restricted to a very short section of foothill stream in one system (single small population), and therefore has a small Extent of Occurrence (EoO) (Raadik 2019, Raadik and Nicol 2015, Raadik 2016). Most recent survey data indicates a further reduction in distribution (relative to prior distribution estimates undertaken in the 1990s) due to post-fire sedimentation leading to fragmentation and severe habitat reduction (Raadik 2021 unpublished data).

Habitat

The Yalmy Galaxias has been recorded from cool to warm streams (2.0-5.5 m wide) in a forested catchment which are shallow, clear and flowing, and partly shaded. The substrate consists predominantly of cobbles (Raadik 2019). The species appears to be a habitat specialist, as juveniles and adults are found among the substrate on the stream bed. They favour very fast flowing areas and are absent from deeper pools or seemingly suitable habitat in areas of slower flowing water. Where streams are impacted by sediment and instream cover is minimal, the species can be very low in abundance and restricted to the few small patches of fast flowing riffle habitat in which the stream bed is not infilled with sediment. In these areas one, occasionally two, individuals are found in each patch, with this being considered a response to a decrease in overall suitable habitat due to sedimentation leading to a reduction in fish abundance. Young fish (age 0+) are present, swimming mid-water or near the surface and occasionally schooling. Adults are solitary and cryptic during the day and located on the stream bed among rocks (Raadik 2019).

Threats

The Yalmy Galaxias is also closely related to the FFG Act listed Barred Galaxias (*Galaxias fuscus*) (Raadik 2014) and faces similar threats. The primary threats to the Yalmy Galaxias are stochastic processes that cause instream sedimentation, reduced stream flow and reductions in habitat quality and quantity. Elevated stream sedimentation can be attributed to soil disturbance in the headwaters of the catchment, particularly due to post-fire rainfall events and potentially to timber harvesting operations. Predicted increasing fire frequency and severity (leading to occurrences of debris flow during high intensity post-fire rainfall events, rapid rise in water temperature and increased fish mortality due to lower water levels), and fire suppression activities (i.e., toxic retardants and sediment mobilization causing fish mortality) are escalating threats (Raadik 2019, Raadik & Nicol 2015, Raadik unpublished data). In January 2020, extensive bushfires burnt through the entire known distribution of the Yalmy Galaxias. Heavy rains following these fires have further threatened this species by washing ash, sediment and toxic chemicals into rivers and streams, and exacerbated additional habitat loss or degradation. These multiple threats cumulatively reduce habitat availability and structure and may see long-term changes imposed on stream geomorphology that precludes demographic recovery of the species.

Other potential threats include predation by alien trout (currently Brown Trout, but possibly also Rainbow Trout). Yalmy Galaxias are found only in reaches of streams at lower elevations and downstream of populations of trout. They do not persist in the presence of trout (Raadik unpublished data). There is a high risk of impact on the population from trout moving downstream during cooler periods and floods, particularly as the preferred habitat has been reduced by sedimentation, reducing the ability for Yalmy Galaxias to find shelter from predation (Raadik unpublished data).

Climate Change is predicted to lead to increased severity and frequency of drought (leading to a decrease in surface and groundwater quality and quantity/availability, loss of instream refuge habitats, increased water temperatures) and severe storms and flooding (leading to increased erosion, ecosystem disturbance and sediment input into streams, including opportunities for predator invasion through barrier down-out and new, temporary pathways) (Raadik 2019, Raadik and Nicol 2015, Raadik unpublished data).

Decision by the Scientific Advisory Committee

The eligibility of the nominated taxon (including the extinction risk and the category of threat that applies to the taxon) to be specified in the Threatened List must be determined in accordance with the eligibility criteria prescribed for the purposes of Division 2 of Part 3 of the FFG Act.

The relevant eligibility criteria are prescribed in Schedule 1 of the Flora and Fauna Guarantee Regulations 2020, which provides that a taxon is at risk of extinction in a particular category of threat if a primary criterion is met, and is therefore eligible to be specified in the Threatened List.

As required under the Intergovernmental Memorandum of Understanding - Agreement on a Common Assessment Method for Listing of Threatened Species (to which Victoria is a signatory), eligibility has also been assessed in accordance with the IUCN Red List Categories and Criteria (Version 3.1) and Guidelines for Using the IUCN Red List Categories and Criteria.

For details of the IUCN criteria see Appendix 1.

Criterion A – Population Size Reduction

Eligible as Critically Endangered under IUCN Criteria A2bce+3ce+4bce (FFG Primary Criterion 3.1 - Subcriterion 3.1.1)

Evidence:
Recent surveys since 2014 have identified a significant reduction in Yalmy Galaxias population size, of over 95% from 8.8 individuals/m^2 in 2015 to 0.07 and 0 individuals in 2020 and 2021 (Raadik unpublished data 2021). This is also consistent with a major reduction in the quantity and quality of habitat due to threats such as post-fire sedimentation and the effects of drought (Raadik pers. comm. 2021). The Threatened Species Recovery Hub (2021) estimate that the 2019-20 bushfires (and associated sedimentation) overlapped with approximately 92% of the Yalmy galaxias' distribution. The taxon is considered to have been historically more widespread in the Snowy River system, and the catchment has been significantly impacted over the past 20 years from recurring drought and fire (Raadik 2019).

Over the next 10 years, the population is projected to be further reduced by up to 95%. The population reduction over *any* 10-year period (including both past and future) is estimated to be 95% (DELWP unpublished). This is based on limited recruitment, low genetic variability and ongoing threats from sedimentation induced habitat loss, trout predation and climate change related impacts on the extremely small remaining population. These ongoing threats are likely to drive the taxon to extinction in the absence of appropriate, targeted management (DELWP unpublished, Raadik pers. comm 2021).

Criterion B – Geographic Range (Extent of Occurrence and Area of Occupancy)

Eligible as Critically Endangered under IUCN Criterion B1ab (i, ii, iii, iv, v) (FFG Primary Criterion 3.1 - Subcriterion 3.1.2 (a), (b) (i, ii, iii, iv, v))
Eligible as Endangered under IUCN Criterion B2ab (i, ii, iii, iv, v) (FFG Primary Criterion 4.1 - Subcriterion 4.1.2 (a), (b) (i, ii, iii, iv, v))

Evidence:

The Yalmy Galaxias is an extremely range restricted species and has been recorded only from the mid-reaches of the Yalmy River and Serpentine Creek, and the lower Rodger River (partly within the Snowy River National Park). Within this area, there is a single small population known from a 9.0 km reach of stream. It is therefore determined to have only one threat-based location, as all sites are very close to each other in the same stream system and would be impacted at the same time by the identified threats.

Raadik (2019) estimated the Extent of Occurrence (EoO) to be 16.6km^2 but this has been adjusted to match the Area of Occupancy (AoO) which is estimated to be 36km^2. Both the EoO and AoO are predicted to continue to decline into the future due to the ongoing (and in some cases, escalating) threats outlined above, and the habitat degradation that occurred after the Eastern Victorian fires in 2019–20.

The taxon appears to be a habitat specialist, found as juveniles and adults among substrate on the stream bed (cobbles), particularly in very fast flowing areas. It avoids deeper pools or habitat in areas of slow flow. This habitat preference is restricted within the range of the species and, as such, there is little flexibility for the species to utilise other areas if its

preferred habitat is impacted by threats such as sedimentation, trout invasion or reduced water flow during periods of drought. The area and quality of suitable habitat are predicted to decline due to the ongoing threats in the absence of appropriate, targeted management.

Criterion C – Small Population Size and Decline

Eligible as Critically Endangered under IUCN Criteria C1+2a (ii) (FFG Primary Criterion 3.1 - Subcriterion 3.1.3 (a), (b) (ii))

Evidence:
Raadik (2019) estimated the population size to be 1000 to 2000 mature individuals prior to the 2019-20 bushfires, based on extrapolation from annual monitoring point data, with all individuals in one subpopulation. The population has dramatically declined following the eastern Victorian fires in early 2020 with no evidence of recovery. Fish density within areas of suitable habitat is very low (Raadik and Nicol 2015) and no individuals were detected in the most recent 2021 survey (Raadik unpublished data). The number of mature individuals is predicted to continue to decline in the absence of targeted conservation actions or threat management. The projected continuing decline exceeds the Criterion C1 threshold of 25% within one generation (DELWP unpublished).

Criterion D – Very Small or Restricted Population
Eligible as Endangered under IUCN Criterion D (FFG Primary Criterion 4.1 - Subcriterion 4.1.4)

Evidence:
The Yalmy Galaxias is considered a single declining population. The most recent population estimates indicate the number of mature individuals is likely to be <200 (Threatened Species Recovery Hub 2021). It is known to only occupy specific habitat within a 9.0 km reach of stream and is estimated to have only one threat-based location.

Criterion E – Quantitative Analysis

Evidence: Insufficient data to determine eligibility.
Population viability analysis has not been undertaken. Therefore, there is insufficient information to determine the eligibility of the species for listing in any category under this criterion.

Documentation

The published information provided to and sourced by the SAC has been assessed. To the best of their knowledge, the SAC believes that the data presented are not the subject of scientific dispute and the inferences drawn are reasonable and well supported.

Advertisement for public comment
In accordance with the requirements of Section 16D of the FFG Act, the preliminary recommendation (PRR) was advertised for a period of at least 30 days.
The preliminary recommendation was advertised in:

- Victorian Government Gazette on 28 October 2021
- DELWP website
- DELWP social media

Public submissions closed on 28 November 2021

Additional Information considered by the Scientific Advisory Committee
Following publication of the PRR, the SAC received one submission, which supported the recommendation. In formulating its Final Recommendation on this item, the SAC has considered the submission and is not aware of any compelling evidence to warrant a change to the preliminary recommendation that the nominated taxon is eligible for listing.

Final Recommendation of the Scientific Advisory Committee

As outlined above, the nominated taxon satisfies at least one criterion of the set of criteria prepared and maintained under Division 2 of Part 3 of the FFG Act and stated in Schedule 1 of the Flora and Fauna Guarantee Regulations 2020.

The SAC concludes that on the evidence available, the nominated taxon is eligible for listing as Critically Endangered in Australia because Primary Criterion 3.1 – Subcriteria 3.1.1, 3.1.2 (a), (b) (i, ii, iii, iv, v) and 3.1.3 (a), (b) (ii) of the FFG Regulations 2020 have been satisfied (IUCN criteria A2bce+3ce+4bce, B1ab (i, ii, iii, iv, v) and C1+2a (ii)).

Critically Endangered, in relation to a taxon of flora or fauna, means that the taxon is facing an extremely high risk of extinction in the wild in the immediate future.

The Scientific Advisory Committee therefore makes a final recommendation that the nominated taxon be supported for listing as Critically Endangered in Australia under the Flora and Fauna Guarantee Act 1988.

Endorsement by the Convenor of the Scientific Advisory Committee **Date**

Dr. Michelle T. Casanova **21 January 2022**
Convenor

References:

DELWP (unpublished) RAMAS expert assessment of Yalmy Galaxias.

Raadik, T.A. (2011) Systematic revision of the Mountain Galaxias *Galaxias olidus* Günther, 1866 species complex (Teleostei: Galaxiidae) in eastern Australia. PhD Thesis, University of Canberra, Canberra.

Raadik, T.A. (2014) Fifteen from one: a revision of the *Galaxias olidus* Günther, 1866 complex (Teleostei, Galaxiidae) in south-eastern Australia recognises three previously described taxa and describes 12 new species. Zootaxa 3898(1): 001–198.

Raadik, T.A. (2016) Galaxias species complex in eastern Victoria (east of the Hume Highway) – information and advice to the Forest Industry Taskforce. Unpublished client report. Arthur Rylah Institute for Environmental Research, Department of Environment, Land, Water and Planning, Heidelberg, Victoria.

Raadik, T.A. Unpublished survey data from 2002–2021.

Raadik, T.A. (2019) Galaxias sp. nov. 'Yalmy'. The IUCN Red List of Threatened Species 2019: e.T128972900A128972908. http://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T128972900A128972908.en

Raadik, T.A. and Nicol, M.D. (2015) Post-fire recovery of McDowall's Galaxias, and additional aquatic fauna, in East Gippsland 2014-2015. Client Report to Gippsland Region, DELWP. Arthur Rylah Institute for Environmental Research, Department of Environment, Land, Water and Planning, Heidelberg, 48 pp.

Threatened Species Recovery Hub (2021) Estimation of population declines caused by the 2019-20 fires, for conservation status assessment. Appendix 1. Unpublished report by Threatened Species Recovery Hub, Queensland.

In person communications

Raadik, T.A – Senior Research Scientist, aquatic fauna/native fish biologist, DELWP – ARI, Heidelberg.

Appendix 1: IUCN Red List Categories and Criteria

SUMMARY OF THE FIVE CRITERIA (A-E) USED TO EVALUATE IF A TAXON BELONGS IN AN IUCN RED LIST THREATENED CATEGORY (CRITICALLY ENDANGERED, ENDANGERED OR VULNERABLE).[1]

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

	Critically Endangered	Endangered	Vulnerable
A1	≥ 90%	≥ 70%	≥ 50%
A2, A3 & A4	≥ 80%	≥ 50%	≥ 30%

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

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

A3 Population reduction projected, inferred 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 the following:

(a) direct observation *[except A3]*
(b) an index of abundance appropriate to the taxon
(c) a decline in area of occupancy (AOO), extent of occurrence (EOO) and/or habitat quality
(d) actual or potential levels of exploitation
(e) effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.

B. Geographic range in the form of either B1 (extent of occurrence) AND/OR B2 (area of occupancy)

	Critically Endangered	Endangered	Vulnerable
B1. Extent of occurrence (EOO)	< 100 km²	< 5,000 km²	< 20,000 km²
B2. Area of occupancy (AOO)	< 10 km²	< 500 km²	< 2,000 km²
AND at least 2 of the following 3 conditions:			
(a) Severely fragmented **OR** Number of locations	= 1	≤ 5	≤ 10
(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			
(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			

C. Small population size and decline

	Critically Endangered	Endangered	Vulnerable
Number of mature individuals	< 250	< 2,500	< 10,000
AND at least one of C1 or C2			
C1. An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in 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)
C2. An observed, estimated, projected or inferred continuing decline AND at least 1 of the following 3 conditions:			
(a) (i) Number of mature individuals in each subpopulation	≤ 50	≤ 250	≤ 1,000
(ii) % of mature individuals in one subpopulation =	90–100%	95–100%	100%
(b) Extreme fluctuations in the number of mature individuals			

D. Very small or restricted population

	Critically Endangered	Endangered	Vulnerable
D. Number of mature individuals	< 50	< 250	**D1.** < 1,000
D2. *Only applies to the VU category* 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.	-	-	**D2.** typically: AOO < 20 km² or number of locations ≤ 5

E. Quantitative Analysis

	Critically Endangered	Endangered	Vulnerable
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% in 100 years

1 Use of this summary sheet requires full understanding of the *IUCN Red List Categories and Criteria* and *Guidelines for Using the IUCN Red List Categories and Criteria*. Please refer to both documents for explanations of terms and concepts used here.

Australian Government
Department of Climate Change, Energy, the Environment and Water

Conservation Advice for *Galaxias* sp. nov. *'Yalmy'* (Yalmy galaxias)

In effect under the *Environment Protection and Biodiversity Conservation Act 1999* from 25 March 2023.

This document combines the approved conservation advice and listing assessment for the species. It provides a foundation for conservation action and further planning.

Galaxias sp. nov. *'Yalmy'* (Yalmy galaxias) © Copyright, Tarmo A. Raadik

Conservation status

Galaxias sp. nov. *'Yalmy'* (Yalmy galaxias) is listed in the Critically Endangered category of the threatened species list under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwth) (EPBC Act) effective from 25 March 2023.

Galaxias sp. nov. *'Yalmy'* was assessed by the Threatened Species Scientific Committee to be eligible for listing as Critically Endangered under criteria 1, 2 and 3. The Committee's assessment is at Attachment A. The Committee's assessment of the species' eligibility against each of the listing criteria is:

- Criterion 1: A2bce+4bce: Critically Endangered
- Criterion 2: B1ab(i,ii,iii,iv,v): Critically Endangered
- Criterion 3: C1+C2a(ii): Critically Endangered
- Criterion 4: D Endangered
- Criterion 5: Insufficient data

The main factors that make the species eligible for listing in the Critically Endangered category are projected very severe population reduction, very restricted distribution and locations, continuing decline due to multiple threats (inappropriate fire regimes, introduced species, climate change leading to habitat loss, disturbance and modification impacts), and a very small population size.

Species can also be listed as threatened under state and territory legislation. For information on the current listing status of this species under relevant state or territory legislation, see the Species Profile and Threat Database.

Species information

Taxonomy

Galaxias sp. nov. *'Yalmy'* is a recently identified, undescribed species in the *Galaxias olidus* Günther (1866) (mountain galaxias) species complex (sensu Raadik 2014). Genetic results (allozyme and mitochondrial DNA SNPs) and preliminary morphological data confirm this taxon as a new species, to be followed by formal description as a new species (Raadik 2021. pers comm 18 October).

The validity of the new species status was accepted by Dr Tarmo Raadik (Honorary Associate, Museum Victoria, Taxonomist, Expert in Australian Galaxiidae taxonomy) and Dr Martin Gomon (Curator, Fishes, Museum Victoria). Voucher specimens lodged at Museum Victoria (NMV A 30569-002 *Galaxias* sp. nov. *'Yalmy'*) (Raadik 2019a).

Description

The Yalmy galaxias (family Galaxiidae) is a small, native freshwater fish, which has an elongate, tubular and scaleless body with a lateral line. The species commonly grows to 55–70 mm length to caudal fin (LCF) but can reach a maximum of 78 mm LCF (Raadik & Nicol 2015). The Yalmy galaxias is superficially similar to *Galaxias mcdowalli* (McDowall's galaxias) (Raadik 2011, 2014), but tends to be smaller in overall size, has a unique snout and mouth morphology, distinctive dark brown pattern along sides and dorsal surface, over a yellow-brown body colouration, and yellow fins (Raadik 2021. pers comm 18 October). The species also has a unique swimming style, usually laying on the substrate then darting very rapidly through the water column (Vic SAC 2022).

Distribution

Current distribution

The Yalmy galaxias is a non-migratory, freshwater resident, which is endemic to Victoria (Vic) (Map 1). It is only known from the mid-reaches of the Yalmy River system (including the Little Yalmy and Serpentine Creek) and the lower Rodger River (approximately 140–250 m above sea level (ASL)), which are connected tributaries of the Snowy River in East Gippsland (Snowy River Basin (River Basins of Victoria); East Gippsland River Region (Australian Hydrological Geospatial Fabric River Regions)) (Map 1) (Raadik 2011, 2014; Raadik & Nicol 2015).

The species is known from one presumably interconnected subpopulation in the Rodger River/Yalmy River system (Raadik 2021. pers comm 18 October) in national park and state forest. The subpopulation is suspected to extend from the Rodger River, upstream into the Yalmy River, Little Yalmy River and Serpentine Creek (Raadik 2021. pers comm 18 October), as it has been collected from four sites: two sites in the Yalmy River (at Yalmy Road and upstream of the confluence with the Little Yalmy River), one site in Serpentine Creek (at Yalmy Road), and one site in the Rodger River (upstream of Varney's Track) (Raadik 2011, 2014; Raadik & Nicol 2015). However, given that the species is likely to be a habitat specialist (requiring cobble microhabitat), there may be long reaches of poor habitat (e.g., completely silted stream bed without exposed areas of cobble), which could fragment the species' distribution within the Rodger River/Yalmy River system (Raadik 2021. pers comm 18 October).

The predatory brown trout (*Salmo trutta*) is present in the Rodger River/Yalmy River system, but has contracted to the mid- to upper-reaches since the end of the Millennium drought in 2010 (Raadik 2011; Raadik & Nicol 2013; Raadik 2014; VFA 2021a). No instream barriers exist to prevent trout incursions downstream (into the area where the Yalmy galaxias occurs), suggesting that the brown trout is highly likely to be restricting the upstream distribution of the species (Raadik 2021. pers comm 18 October).

Unconfirmed subpopulations and further surveys

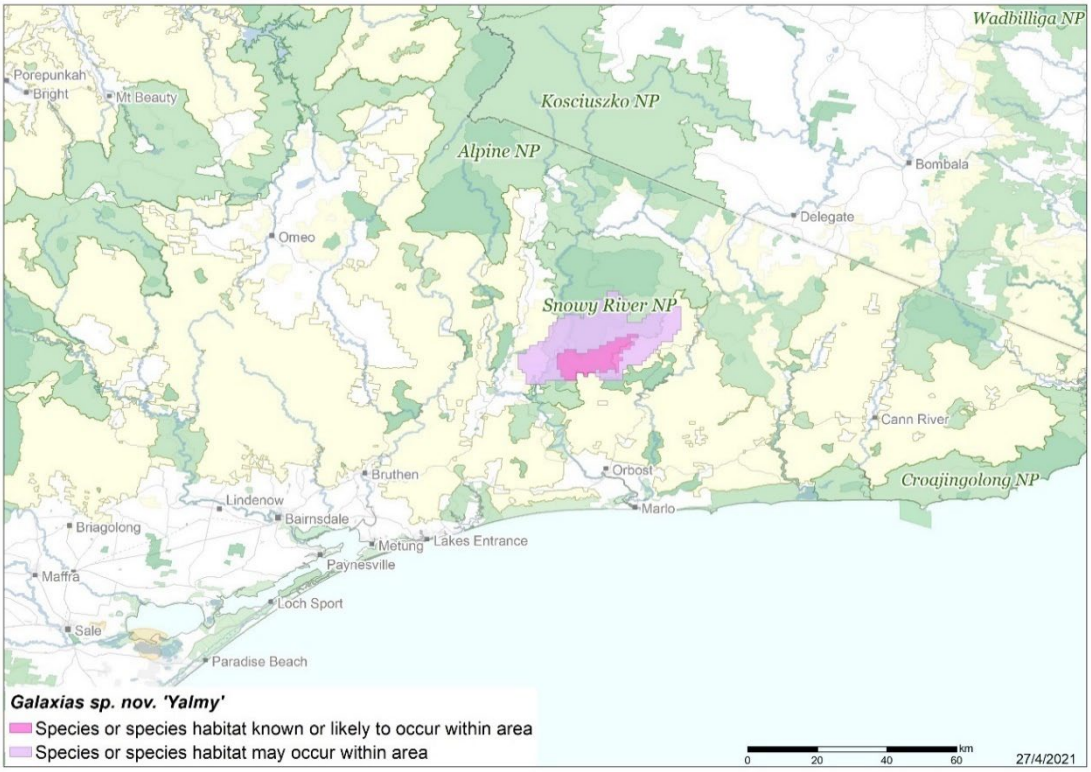
The species may also occur in the Snowy River near the confluence with the Rodger River (Raadik & Nicol 2015). Further surveys of the Snowy River near the confluence with the Rodger River, the Rodger River near/upstream of the confluence with the Yalmy River, the mid-reaches of the Yalmy River and the lower to mid-reaches of the Little Yalmy River and Serpentine Creek, are needed to define the species' range (Raadik & Nicol 2015).

Past and future distribution and decline

The Yalmy galaxias is considered to have been historically more widespread (further upstream) throughout the Snowy River system (unpublished data cited in Raadik 2019a).

The population size of the Yalmy galaxias has declined (from ~2007 to 2019) by >50 percent due to the combined effects of drought stress (from the Millennium drought) and sedimentation particularly following the Orbost fire complex in 2014 (unpublished survey data cited in Lintermans et al. 2020). Additionally, the Yalmy galaxias was impacted by the 2019-20 bushfires and is projected to decline by >50 percent within three generations of the 2019-20 bushfires (see Appendix A) (Legge et al. 2021, 2022). Following the 2019-20 bushfires, seven individuals (one adult and six injured juveniles) were captured in February 2020, held in temporary housing and the surviving adult released back to the capture site in September 2020 (DELWP 2020a; Raadik 2021. pers comm 18 October; Shelley et al. 2021).

Map 1 Modelled distribution of the Yalmy galaxias



Source: Base map Geoscience Australia; species distribution data Species of National Environmental Significance database.

Caveat: The information presented in this map has been provided by a range of groups and agencies. While every effort has been made to ensure accuracy and completeness, no guarantee is given, nor responsibility taken by the Commonwealth for errors or omissions, and the Commonwealth does not accept responsibility in respect of any information or advice given in relation to, or as a consequence of, anything containing herein.

Species distribution mapping: The species distribution mapping categories are indicative only and aim to capture (a) the specific habitat type or geographic feature that represents to recent observed locations of the species (known to occur) or preferred habitat occurring in close proximity to these locations (likely to occur); and (b) the broad environmental envelope or geographic region that encompasses all areas that could provide habitat for the species (may occur). These presence categories are created using an extensive database of species observations records, national and regional-scale environmental data, environmental modelling techniques and documented scientific research.

Cultural and community significance

Cultural and community significance to Indigenous Australians

The cultural, customary and spiritual significance of species and the ecological communities they form are diverse and varied for Indigenous Australians and their stewardship of Country. This section describes some examples of this significance but is not intended to be comprehensive or applicable to, or speak for, Indigenous Australians. Such knowledge may be held by Indigenous Australians who are the custodians of this knowledge and have the rights to decide how this knowledge is shared and used.

The Yalmy galaxias and its habitat occur on the lands of the Krauatungalang Clan of the Gunaikurnai People, as well as the lands of the Bidawal People. No Registered Aboriginal Parties (i.e., Traditional Owner groups, legally recognised under the Aboriginal Heritage Act with responsibilities for managing and protecting Aboriginal Cultural Heritage on Country) have been appointed east of the Snowy River (VAHC 2021). However, the area has significant cultural heritage for Indigenous peoples.

The names of the 'Yalmy' galaxias and the 'Yalmy' River may be derived from a word meaning 'shark' in an Indigenous Australian language (DELWP 2021). Further consultation with the Traditional Owners of these lands will benefit the conservation of the species by providing awareness of Traditional Knowledge and management practices on Country.

Cultural and community significance to commercial/recreational fishing

The mountain galaxias complex is not a commercial or recreational fishing target (Native Fish Australia 2021).

Relevant biology and ecology

Habitat ecology

The Yalmy galaxias has been recorded from cool to warm streams in the Yalmy River system (average width: 2.0–5.5 m), which are shallow, clear, flowing and partly shaded in a forested catchment, mostly with cobble as the substrate (unpublished data cited in Raadik 2019a). The species microhabitat preferences are unknown. However, juveniles have been observed swimming mid-water or near the surface, occasionally schooling, while adults are solitary and cryptic on the stream bed (unpublished data cited in Raadik & Nicol 2015; Raadik 2019a).

Galaxias species can burrow into substrate to escape declining water level during periods of surface water loss (unpublished data cited in Raadik et al. 2010). In 2014-15, individuals were captured mainly among rocky substrate on the stream bed in very fast-flowing areas (Raadik & Nicol 2015). At this time, all sites had extensive silt and fine sand deposits blanketing the stream bed, indicating recent extensive sediment input into the streams (Raadik & Nicol 2015). No adults were collected from cobble microhabitat in areas where the interstitial spaces between cobbles were infilled with coarse sand or silt (Raadik & Nicol 2015). This suggests the Yalmy galaxias may be specialising in cobble microhabitat in fast-flowing riffles (Raadik & Nicol 2015), however, further studies evaluating the species' microhabitat preferences are required to confirm this.

Co-occurring species

The Yalmy galaxias is the only species in the mountain galaxias complex now known from the lower to mid Rodger River/Yalmy River system, however, McDowall's galaxias occurs in the headwaters of the Rodger River (Raadik 2011, 2014). *Galaxias brevipinnis* (climbing galaxias), *Galaxias maculatus* (common galaxias) and *Galaxias truttaceus* (trout galaxias) also occur in the Rodger River/Yalmy River system (Raadik 2011, 2014).

The brown trout occurs further upstream in the Rodger River in cooler water (unpublished data cited in Raadik 2019a), while the rainbow trout occurs elsewhere in the Snowy River Basin (VFA 2021c).

Diet

The diet of the Yalmy galaxias has not been investigated. However, the species is likely to be macroinvertorous, as observed in other species of the mountain galaxias complex, and consume benthic, drifting aquatic and terrestrial invertebrates, such as insects, crustaceans, molluscs, worms and spiders (Cadwallader et al. 1980; Closs 1994; Raadik 2014).

Reproductive ecology

The reproductive ecology of the Yalmy galaxias is largely unrecorded. The spawning period is undocumented, but thought to be in spring to summer, as fish collected in late February/early March were at an early stage of gonad development, though a male (74.2 mm LCF) appeared to be almost ripe, and the smallest presumed 0+ age fish recorded (33.9 mm LCF) was collected in early March (Vic SAC 2022). Other species of the mountain galaxias complex have low fecundity (<400 eggs annually) with the sticky eggs generally attached to the underside of rocks in riffles (Cowden 1988; O'Connor & Koehn 1991; Lintermans 2007). Eggs in other members of the mountain galaxias complex are small (approximately 2 mm in diameter), spherical, demersal and adhesive, and hatch after 20–30 days (Cowden 1988; O'Connor & Koehn 1991). Larvae in other members of the mountain galaxias complex are approximately 9 mm long upon hatching (O'Connor & Koehn 1991).

Generation length

The generation length of the Yalmy galaxias is unknown. However, it is likely to be similar to that of other species in the mountain galaxias complex, which is between two and four years (Allen et al. 2002; Raadik 2021. pers comm 18 October).

Habitat critical to the survival

The Yalmy galaxias is only known from the mid-reaches of the Yalmy River, Serpentine Creek and the lower Rodger River in East Gippsland, approximately 140–250 m ASL (Map 1) (Raadik 2011, 2014; Raadik & Nicol 2015). The species has been recorded from streams (average width: 2.0–5.5 m), which are shallow, clear, flowing and partly shaded in a forested catchment, mostly with cobble as the substrate (unpublished data cited in Raadik 2019a). The Yalmy galaxias may be a habitat specialist requiring cobble microhabitat in fast-flowing riffles (Raadik & Nicol 2015) (see 'Habitat Ecology' above for further information). Such habitat is likely to be necessary for long-term maintenance and evolutionary development of the species.

The habitat critical to the survival of the Yalmy galaxias includes the area of occupancy of known subpopulations; areas of similar habitat adjoining known subpopulations (as described above), which provide potential habitat for natural range extension; areas of similar habitat that may contain the species or be suitable for translocations (as described above, in particular, areas where introduced salmonids are absent or have been removed, and barriers exist or can be erected to prevent their return); and the local catchment for the surface and/or groundwater that maintains the habitat of the species.

Actions required to preserve the species' habitat are identified in the Conservation and Recovery Actions.

No Critical Habitat as defined under section 207A of the EPBC Act has been identified or included in the Register of Critical Habitat.

Threats

The threats impacting the Yalmy galaxias are similar to those impacting other *Galaxias* species in south-eastern Australia.

The Yalmy Galaxias is threatened by fire regimes that cause declines in biodiversity, predation/competition by introduced salmonids, climate change leading to habitat loss, disturbance and modification, which are likely to have substantially reduced the species' distribution and abundance (Table 1) (Raadik and Nicol 2015; Raadik 2021, pers comm 18 October). The species' restricted distribution and small population size are likely to increase its' probability of extinction due to genetic decline (Frankham et al. 2002; IUCN 2012) and render the species more vulnerable to the impacts of threats, including inappropriate fire regimes, incursion by introduced salmonids, the impacts of climate change, other habitat loss, disturbance and modification impacts, and disease (Table 1). Indeed, Lintermans et al. (2020) used expert elicitation to predict that the Yalmy galaxias had 50–69 percent probability of extinction by 2040 without additional conservation actions (prior to the 2019-20 fires). Additionally, preliminary results from population genetic analysis indicate that the Yalmy galaxias has lost most of its genetic diversity and has a high level of inbreeding (Tarmo A. Raadik, pers. comm. Oct 2021).

Metacercarial cysts, the second life stage of parasitic flatworms (flukes), have been reported in the skin and fins of other species in the mountain galaxias complex (Raadik 2011, 2014). Galaxiids appear to be particularly susceptible to infection with metacercarial cysts, with some fish carrying hundreds of cysts on the body and fins (VFA 2008). Heavily infected galaxiids are weak and slow-moving, making them an easy target for predators (Collyer & Stockwell 2004; VFA 2008). The prevalence of metacercarial cysts in the Yalmy galaxias population is unknown and requires further investigation. Accordingly, this threat has not been included in Table 1.

Threats in Table 1 are noted in approximate order of highest to lowest impact, based on available evidence.

Table 1 Threats impacting the Yalmy galaxias

Threat	Status [a]	Evidence
Fire		
Fire regimes that cause declines in biodiversity[b]	• Timing: current • Confidence: observed • Likelihood: likely • Consequence: major • Trend: increasing • Extent: across the entire range	Fires have been implicated in the decline of *Galaxias* species, including other species in the mountain galaxias complex, due to their fragmented distribution and limited recolonisation/dispersal abilities (Stoessel et al. 2012; Raadik & Nicol 2013; Raadik & Nicol 2015; NSW FSC 2016). Sedimentation following fires (compounding existing drought stress), has been implicated in the severe decline (>50%) of the Yalmy galaxias since 2002 (unpublished survey data cited in Lintermans et al. 2020). 'Fire regimes that cause declines in biodiversity' is listed as a key threatening process under the EPBC Act (DAWE 2022). Fires can degrade stream habitats by increasing water temperature and sediment load, reducing dissolved oxygen levels and altering water chemistry, which can impact aquatic ecosystems up to 80 km downstream of burnt areas (Lyon & O'Connor 2008; Crowther et al. 2015; Harper et al. 2019; Nyman et al. 2019; Alexandra & Finlayson 2020; Silva et al. 2020). Physiologically, species of the mountain galaxias complex are highly susceptible to such changes in water quality, with an upper thermal tolerance of approximately 33 °C, which declines with reductions in dissolved oxygen and mild exposure to ash and sediment (Mulvey 2021). Increased sediment load (especially following high rainfall events) can suffocate fish and smother stream substrate, which reduces food availability, refuge and spawning areas (Lyon & O'Connor 2008; Raadik et al. 2010). Given the Yalmy galaxias may be a habitat specialist (requiring interstitial spaces between stream substrate) (Raadik & Nicol 2015), sedimentation/siltation caused fires could dramatically reduce the available habitat for this species in the streams where it occurs. Indeed, the 2019-20 bushfires (including the associated sedimentation risk) are predicted to cause a 61% decline (80% confidence limits: 39–90%) in the Yalmy galaxias' population size after 3 generations (Legge et al. 2021, 2022). This predicted decline is supported by field observations in 2020-21, which suggest decline greater than or equal to the worst-case estimate (≥80 percent) and very few individuals to be found (Raadik 2021. pers comm 18 October). As the species is non-migratory, all life history stages (eggs, larvae, juveniles, adults) are susceptible to post-fire impacts. Although salmonids are also susceptible to the impacts of fires (Novak & White 1990; Rinne 1996), they can quickly recolonise streams after fire-related disturbances (Novak & White 1990; Lyon & O'Connor 2008). Accordingly, fires can increase predation risk for galaxiids, by reducing shading/protective cover from predators, and drowning out instream barriers (via sedimentation) and facilitating salmonid invasion (DSE 2011; NSW FSC 2016). . Fires may also create new instream barriers, which can increase fragmentation of the species (DSE 2011; NSW FSC 2016). Additionally, impacts from toxic fire suppression chemicals, such as foam/fire retardants, can weaken or kill fish if introduced into waterways (Raadik et al. 2010; Raadik 2016, 2019a).

Threat	**Status** [a]	**Evidence**
Introduced species impacts		
Predation by introduced salmonids	• Timing: current/future • Confidence: inferred • Likelihood: possible • Consequence: catastrophic • Trend: unknown • Extent: across the entire range	Predation by introduced salmonids, including the brown trout and the rainbow trout, has been implicated in the decline of *Galaxias* species throughout Australia, including other members of the mountain galaxias complex (Tilzey 1976; Wager & Jackson 1993; Cadwallader 1996; Lintermans 2000; McDowall 2006; Lintermans 2013; Lintermans et al. 2020; Kaminskas 2022). Predation on *Galaxias* species by introduced salmonids has been directly documented via gut contents analyses (Vidal et al. 2020) and the distribution of *Galaxias* species and salmonids are usually mutually exclusive (e.g. Tilzey 1976; Lintermans 2000), suggesting that *Galaxias* species have been eliminated by salmonid predation. Indeed, the role of salmonids in the fragmentation of *Galaxias* subpopulations has been well documented in Australia (Lintermans 2000; Raadik & Kuiter 2002; Green 2008b). *Galaxias* species do not respond with avoidance behaviour to odour cues from the rainbow trout, but do respond with such behaviour to odour cues from the native predator, the *Anguilla australis* (southern shortfin eel) (McLean et al. 2007). This suggests that *Galaxias* species may lack an effective anti-predator response to introduced salmonids (McLean et al. 2007). Although this threat was included in the key threatening process 'Novel biota and their impact on biodiversity' listed under the EPBC Act (DSEWPaC 2013), salmonid restocking occurs regularly in Vic, mostly in lakes and impoundments, with minor stocking in wild rivers (VFA 2021b). Additionally, wild salmonids now successfully breed in many Victorian waterways and have formed self-sustaining populations (DSEWPaC 2013), including in the Rodger River/Yalmy River system (Raadik 2011, 2014; Raadik & Nicol 2015). The Yalmy galaxias is found downstream of the brown trout (in warmer waters) and no individuals have been found where salmonids are present (unpublished data cited in Raadik 2019a). No instream barriers exist to prevent trout incursions downstream into the Yalmy galaxias population and therefore trout are highly likely to be restricting the upstream distribution of the species (Raadik 2021 pers comm 18 October). The brown trout may move downstream to areas occupied by the Yalmy galaxias during cooler periods and floods (unpublished data cited in Threatened Species Recovery Hub 2018; Raadik 2019a). As all size classes of the Yalmy galaxias are within the optimal prey size range for brown trout (3–97 mm) (Bannon & Ringler 1986; Sánchez-Hernández & Cobo 2015), rapid and severe population decline is anticipated following invasion (Threatened Species Recovery Hub 2018; Raadik 2019a; Lintermans et al. 2020).

Threat	**Status** [a]	**Evidence**
Competition with introduced salmonids	• Timing: current/future • Confidence: inferred • Likelihood: possible • Consequence: major • Trend: unknown • Extent: across part of its range	To a lesser extent, competition with introduced salmonids has also been documented via trophic niche analyses (Vidal et al. 2020) and implicated in the decline of *Galaxias* species throughout Australia, including other species of the mountain galaxias complex (Glova 1989; Crowl et al. 1992; Cadwallader 1996; McDowall 2006; Raadik et al. 2010). Salmonids (usually juveniles) can compete with *Galaxias* species (usually adults) for foraging and sheltering resources via interference (aggressive behaviour used to exclude *Galaxias* species from resources) and exploitation competition (use of similar resources) (Crowl et al. 1992; Cadwallader 1996; Raadik et al. 2010). This can lead to starvation, displacement, reduced reproductive output and mortality of *Galaxias* individuals (Crowl et al. 1992; Cadwallader 1996; Raadik et al. 2010). Although the impacts of this threat on the Yalmy galaxias are undocumented, the species is likely to be affected if salmonids invade its habitat.
Altered water quality caused by feral ungulates	• Timing: current • Confidence: inferred • Likelihood: likely • Consequence: moderate • Trend: unknown • Extent: across the entire range	Feral pigs (*Sus scrofa*) and feral deer (multiple species) are found in association with river systems in East Gippsland, Vic (Parks Victoria 2016). Feral pigs have been listed as a key threatening process under the EPBC Act (DOEE 2017) and feral deer are considered a major emerging pest problem (DSEWPaC 2011). By trampling, wallowing and rooting, feral pigs and deer modify stream sides and increase erosion, which alters water quality via eutrophication (enrichment of water with nutrients), and increases sedimentation, siltation and turbidity (Singer et al. 1984; McDowell 2007; Doupé et al. 2010; Davis et al. 2016; DOEE 2017). Such changes to water quality have been implicated in the decline of other *Galaxias* species, including other species of the mountain galaxias complex (Allan & Lintermans 2018; Driscoll et al. 2019). Additionally, increased sediment load (especially following high rainfall events) can suffocate fish and smother stream substrate, which reduces food availability, refuge and spawning habitat (Raadik & Nicol 2012). Given the Yalmy galaxias may be a habitat specialist (requiring interstitial spaces between stream substrate) (Raadik & Nicol 2015), sedimentation caused by feral ungulates could dramatically reduce the available habitat for this species in the streams where it occurs. However, further research on the species' microhabitat preferences is required. Although the impacts of this threat on the Yalmy galaxias are undocumented, the species is likely to be affected by altered water quality if feral ungulates are present. Additionally, following the 2019-20 bushfires, feral ungulates may be putting additional pressure on habitat recovery (Parks Victoria 2021). However, both feral pigs and deer are being actively managed in East Gippsland to control this threat, especially following the 2019-20 bushfires (Parks Victoria 2016, 2021).

Threat	**Status** [a]	**Evidence**
Climate change impacts		
Increased frequency of extreme temperatures, droughts and fire danger weather, and changes in precipitation	• Timing: current/future • Confidence: observed • Likelihood: likely • Consequence: major • Trend: increasing • Extent: across the entire range	Native freshwater fishes are known to persist in severe droughts, where they have evolved under those conditions (Smith 1982). Indeed, species of the mountain galaxias complex have historically been able to persist through droughts in small pools (Closs & Lake 1996). However, the CSIRO & Bureau of Meteorology (2015) predict eastern Australia will experience decreased average rainfall, increased frequency of droughts and average temperatures. From 2017–2019, East Gippsland experienced its three driest years on record (Bureau of Meteorology 2020). These changes to rainfall patterns and temperatures are predicted to cause decreased surface run-off, which will impact streams (e.g., lower water levels and higher water temperatures) with increasing severity and frequency (DSE 2011; CSIRO & Bureau of Meteorology 2015; DELWP 2020b). Severe and prolonged droughts may also create new instream barriers, which can increase fragmentation and reduce spawning and recruitment (Lennox et al. 2019). Additionally, the frequency and severity of bushfires is increasing due to climate change (CSIRO & Bureau of Meteorology 2015), which is likely to cause long-term changes to water quality and threaten the persistence of native fish (Shu-ren 2003; Whitney et al. 2015). The increased sedimentation/siltation caused by fires (as well as feral ungulates and anthropogenic activities) is likely to smother and infill coarse substrate in the streambed (described above, e.g. Lyon & O'Connor 2008). This prevents *Galaxias* species from burrowing into substrate to escape declining water level, leaving them susceptible to mortality during periods of surface water loss (unpublished data cited in Raadik et al. 2010). Accordingly, the increased severity and frequency of droughts, compounded by the effects of increasing fires, feral ungulates and anthropogenic activities, is likely to cause decline in the Yalmy galaxias (Raadik 2019a). Fire-drought interactions are identified as part of a key threatening process (DAWE 2022) and are likely to increase under future climates. The frequency of extreme rainfall events in Vic is also increasing with climate change (CSIRO & Bureau of Meteorology 2015; DELWP 2020b). This may increase stream bank erosion and sedimentation, and alter water quality (Magilligan et al. 2015; Threatened Species Recovery Hub 2018; Ross et al. 2019; DELWP 2020b; Lintermans et al. 2020).

Threat	**Status** [a]	**Evidence**
Habitat loss, disturbance or modification impacts		
Altered water quality caused by anthropogenic activities, including timber harvesting operations and sedimentation from roads/tracks	• Timing: historical/current • Confidence: inferred • Likelihood: possible • Consequence: major • Trend: unknown • Extent: across part of its range	Anthropogenic activities associated with timber harvesting, including harvesting and road/track maintenance, can alter flow rates and mobilise sediment and/or toxins into streams, which alters water quality via eutrophication, increased sedimentation, siltation and turbidity (Campbell & Doeg 1989; Motha et al. 2003). Increased sediment load (especially following high rainfall events) can suffocate fish and smother stream substrate, which reduces food availability, refuge and spawning habitat (Lyon & O'Connor 2008; Raadik et al. 2010). Given the Yalmy galaxias is likely to be a habitat specialist (requiring interstitial spaces between stream substrate) (Raadik & Nicol 2015), sedimentation/siltation from unsealed roads/tracks and timber harvesting operations (should they occur) is likely to reduce the available habitat for this species. The Victorian Code of Practice for Timber Production 2014 includes general prescriptions such as protection and buffering of waterways. In recent years, modified harvesting and forest regeneration practices have been implemented in native forest that are designed to further mitigate the potential threat from forestry operations to threatened species and their habitats. Additionally, by 2030, native forest timber harvesting will cease under the Victorian Forestry Plan.

aTiming—identify the temporal nature of the threat
Confidence—identify the extent to which we have confidence about the impact of the threat on the species
Likelihood—identifies the likelihood of the threat impacting on the whole population or extent of the species
Consequence—identify the severity of the threat
Trend—identify the extent to which it will continue to operate on the species
Extent—identify its spatial content in terms of the range of the species

[b]Fire regimes that cause declines in biodiversity include the full range of fire-related ecological processes that directly or indirectly cause persistent declines in the distribution, abundance, genetic diversity or function of a species or ecological community. 'Fire regime' refers to the frequency, intensity or severity, season, and types (aerial/subterranean) of successive fire events at a point in the landscape

Each threat has been described in Table 1 in terms of the extent that it is operating on the species. The risk matrix (Table 2) provides a visual depiction of the level of risk being imposed by a threat and supports the prioritisation of subsequent management and conservation actions. In preparing a risk matrix, several factors have been taken into consideration, they are: the life stage they affect; the duration of the impact; and the efficacy of current management regimes, assuming that management will continue to be applied appropriately. The risk matrix and ranking of threats has been developed in consultation with experts and using available literature.

Table 2 Risk matrix for the Yalmy galaxias

Likelihood	Consequences				
	Not significant	**Minor**	**Moderate**	**Major**	**Catastrophic**
Almost certain				**Increased frequency of extreme temperatures, droughts and fire danger weather, and changes in precipitation**	
Likely			**Altered water quality caused by feral ungulates**	**Fire regimes that cause declines in biodiversity**	
Possible				**Competition with introduced salmonoids** **Altered water quality caused by anthropogenic activities**	**Predation by introduced salmonids**
Unlikely					
Unknown					

Risk Matrix legend/Risk rating:

Low Risk	Moderate Risk	High Risk	Very High Risk

Categories for likelihood are defined as follows:
Almost certain – expected to occur every year
Likely – expected to occur at least once every five years
Possible – might occur at some time
Unlikely – such events are known to have occurred on a worldwide bases but only a few ties
Unknown – currently unknown how often the incident will occur

Categories for consequences are defined as follows:
Not significant – no long-term effect on individuals or populations
Minor – individuals are adversely affected but no effect at population level
Moderate – population recovery stalls or reduces
Major – population decreases
Catastrophic – population extinction/extirpation

Priority actions have then been developed to manage the threat particularly where the risk was deemed to be 'very high' (red shading) or 'high' (yellow shading). For those threats with an unknown or low risk outcome (green and blue shading) it may be more appropriate to identify further research or maintain a watching brief.

Conservation and recovery actions

Primary conservation objective

By 2032-34, at least three geographically separated subpopulations of the Yalmy galaxias will be established and will have produced viable offspring. The species' probability of extinction in the wild will have declined, following the removal of introduced salmonid predators and improvement of lost or degraded habitats.

Conservation and management priorities

Fire, climate change and extreme weather impacts

- Provide fire and land managers with maps of known and likely habitat for the species and specific advice to support decision making in fire prevention, preparedness, response and recovery.
- Develop and implement a fire management strategy that optimises the survival of the species during fires.

Introduced species impacts

- Remove and control introduced salmonid predators in the catchment(s) where the Yalmy galaxias occurs (Raadik 2017) and catchmements where the species does not occur, but translocations could be established. Prevent any further introductions of non-native fish species, including via stocking, into the catchment(s) where the Yalmy galaxias occurs and catchmements where the Yalmy galaxias does not occur, but translocations could be established.
- Construct new instream barriers, where appropriate, to prevent incursion of introduced salmonid predators and other non-native fish species (Raadik 2019b). This should include annual inspection and maintenance of barrier integrity to ensure the continued effectiveness.
- Continue to implement strategies to remove and control feral ungulates, including feral pigs and deer, as detailed in the relevant management (Parks Victoria 2016) or threat abatement plans (DOEE 2017).

Habitat loss, disturbance and modifications impacts

- Maintain vegetated protection zones (no harvesting or soil disturbance) along the entire stream drainage network (wet or dry, stream channel to headwater drainage lines), within catchment(s) where the species occurs.
- Assess the effectiveness of current forestry management practices in ameliorating disturbance to catchment(s) where the species occurs. Revise management practices and protection prescriptions if necessary.
- Review management of roads and tracks in catchment(s) where the species occurs, including stream crossings (wet/dry, channel or drainage lines), to eliminate sources of direct sediment input into the stream drainage network and prevent illegal translocation of non-native fish species.
- Identify and conserve habitat characteristics that facilitate movement between subpopulations.

Ex situ recovery actions

- To ensure species persistence, establish a captive breeding program, informed by population genetic analysis, to augment extant or extirpated subpopulation(s) and/or establish translocated subpopulations.
- Translocations should be conducted according to relevant state legislation, policies, protocols and guidelines, including DPI (2005, 2014), Ayres et al. (2012) and Zukowski et al. (2021), where techniques for other *Galaxias* species are presented and can be applied for the Yalmy galaxias. Introduced salmonids/non-native fish species must be absent or excluded from any translocation sites. Translocation sites may include new catchments with potential to be habitat (assisted colonisation), historically occupied catchments where non-native fish species have been removed (reintroduction) or currently occupied catchments (for genetic management/reinforcement).
- For subpopulations with high extirpation risk (including any translocated subpopulations), prepare salvage/rescue plans to remove a proportion of individuals from the subpopulation and maintain them in captivity until the threat(s) abate (temporary captive maintenance). Implement strict biosecurity, disease prevention and aquarium maintenance procedures to allow the return of fish to the population following abatement of the risk.

Stakeholder engagement/community engagement

- Work with Traditional Owners to implement conservation actions, including Indigenous fire management practices and other survey, monitoring and management actions.
- Continue to liaise with government agencies, land managers and stakeholder groups in the catchment(s) where the species occurs and does not occur, but translocations could be established. Ensure up-to-date population data and scientific knowledge inform the implementation of conservation actions for this species, particularly regarding the removal and control of introduced salmonid predators.
- Promote community awareness of the Yalmy galaxias and identify opportunities for involvement in conservation actions.
- Contribute to impact assessment and planning processes on measures to protect the Yalmy galaxias and its habitat, including park management plans and environmental impact assessments.

Survey and monitoring priorities

- Undertake targeted surveys in suitable and potential habitat to locate any additional subpopulations and identify suitable translocation sites.
- Implement a long-term monitoring program (e.g., abundance, length and weight, or eDNA if robust methods have been developed) to assess population size/trends across the species' range and provide early-predator detection warning (e.g., absence of first four to five age classes indicates one or more predators present) (Raadik et al. 2010).
- Undertake annual monitoring of habitat condition and degradation, including the impacts of herbivores and weed invasion, and monitor and evaluate the efficacy of management interventions.
- Undertake annual monitoring of salmonid predators (e.g., presence and abundance, or eDNA if robust methods have been developed) and monitor and evaluate the efficacy of management interventions.
- Undertake annual monitoring of translocated populations, including genetic analysis, undertake genetic top-ups when required, and evaluate success after three generations.

Information and research priorities

- Investigate the ecological requirements of the traits, including:
  - population genetic structure, levels of genetic diversity, fragmentation, and minimum viable population size;
  - life history traits, such as time to maturity, longevity, fecundity, spawning period and number of young;
  - diet and habitat preferences;
  - desiccation, low dissolved oxygen, water temperature and sediment tolerance (adults, juveniles, larvae and eggs);
  - climbing ability, movements and dispersal patterns of adults and juveniles; and
  - predator-avoidance behaviour.
- Map habitat critical to the survival of the species and identify any critical habitat on Commonwealth land.
- Investigate techniques for captive maintenance, breeding, on-growing and translocation.
- Determine a target density for wild and translocated subpopulations, taking factors such as carrying capacity and the impacts of climate change into consideration.
- Investigate options to enhance the resilience of the species' current habitat to climate change and options for providing new habitat that would be suitable for the species under climate change scenarios.
- Undertake genetic analysis of preserved mountain galaxias specimens to identify historical distribution of the Yalmy galaxias.
- Investigate the identity, prevalence and consequences of diseases and parasites on the Yalmy galaxias.

Recovery Plan decision

As an approved, updated, and detailed Conservation Advice for the species would provide sufficient direction to implement priority conservation actions, mitigate key threats, enable recovery and provide foundation for further planning, a national Recovery Plan is not required at this time.

Consequently, the Threatened Species Scientific Committee has not recommended that a recovery plan be required (see Attachment A for TSSC recommendations regarding the need for a recovery plan).

Links to relevant implementation documents

This Conservation Advice is developed to be able to subsequently inform other planning instruments, such as a Bioregional Plan or a multi-entity Conservation Plan.

Guidelines for assessing translocations of live aquatic organisms in Victoria (2014)

Guidelines for the translocation of barred galaxias (*Galaxias fuscus*) for conservation purposes (2012)

Protocols for the translocation of fish in Victorian inland public waters (2005)

Threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*) (2017)

Threat abatement guidelines for the key threatening process 'Novel biota and their impact on biodiversity' (2013)

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The Threatened Species Scientific Committee finalised this assessment on 2 June 2022.

Attachment A: Listing Assessment for *Galaxias* sp. nov. *'Yalmy'*

Reason for assessment

This assessment follows prioritisation of a nomination from the TSSC following the 2019-20 bushfires.

Assessment of eligibility for listing

This assessment uses the criteria set out in the EPBC Regulations. The thresholds used correspond with those in the IUCN Red List criteria except where noted in criterion 4, sub-criterion D2. The IUCN criteria are used by Australian jurisdictions to achieve consistent listing assessments through the Common Assessment Method (CAM).

Key assessment parameters

Table 3 includes the key assessment parameters used in the assessment of eligibility for listing against the criteria.

Table 3 Key assessment parameters

Metric	Estimate used in the assessment	Minimum plausible value	Maximum plausible value	Justification
Number of mature individuals	190	190	1260	Based on monitoring data from 2014–2019, the number of mature individuals was estimated to be approximately 1000–2000 (midpoint = 1500) prior to the 2019-20 bushfires (Raadik 2021). However, the overall population is expected to have declined by approximately 55%, one year following the 2019-20 bushfires (80% confidence limits: 37–81% decline) (see Criterion 1) (Legge et al. 2021, 2022). These estimates of decline have been used to estimate minimum and maximum plausible values of the number of mature individuals in 2021 (see Criterion 3 for calculations). Field observations in 2020-21 suggest a decline greater than or equal to the worst-case estimate (≥80%), with very few individuals found following the 2019-20 bushfires (Raadik 2021. pers comm 18 October). Accordingly, the minimum plausible value of the number of mature individuals has been used in this assessment.

Metric	Estimate used in the assessment	Minimum plausible value	Maximum plausible value	Justification
Trend	Declining			As discussed above, the overall population is expected to have declined following the 2019-20 bushfires (Legge et al. 2021, 2022). This decline is projected to increase over the next 3 generations (Legge et al. 2021, 2022). Additionally, threats are ongoing and the number of mature individuals is likely to decline following the next threatening event to impact the subpopulation (e.g., salmonid incursion, sedimentation following fire, severe drought, etc.) (See Criterion 1/2).
Generation time (years)	2–4	2	4	The Yalmy galaxias is likely to have a generation time of approximately 2–4 years (see Criterion 1).
Extent of occurrence	46 km^2	36 km^2	<100 km^2	The estimate used in this assessment is the maximum plausible estimate and has been calculated by applying the shortest continuous imaginary boundary which can be drawn to encompass record data from 2014–2021, as outlined in the Guidelines for Using the IUCN Red List Categories and Criteria (IUCN 2019). The minimum plausible value is the estimate used by the IUCN (Raadik 2019a) and Lintermans et al. (2020) rapid assessments. The maximum plausible value is the estimate used in the Threatened Species Recovery Hub (2018) rapid assessment. All values are within the range of the Critically Endangered category of Criterion 2.
Trend	Contracted historically; likely to contract following next threatening event			The Yalmy galaxias is considered to have been historically more widespread, further upstream in the Snowy River system, suggesting range contraction occurred during the 20th century, following the incursion of salmonids (unpublished data cited in Raadik 2019a). Accordingly, EOO is considered to have contracted historically. As threats are ongoing, EOO is likely to undergo decline following the next threatening event (e.g., sedimentation following fire, severe drought, salmonid incursion, etc.) (See Criterion 2).
Area of Occupancy	16 km^2	<10 km^2	36 km^2	The estimate used in this assessment has been calculated using record data from 2014–2021 and applying 2 x 2 km grid cells, as outlined in the Guidelines for Using the IUCN Red List Categories and Criteria (IUCN 2019). The maximum plausible value is the estimate used by the IUCN (Raadik 2019a) and Lintermans et al. (2020) rapid assessments. The estimate used in this assessment and the maximum plausible value are within the range of the Endangered category of Criterion 2. The minimum plausible value is the estimate used in the Threatened Species Recovery Hub (2018) rapid assessment. The minimum plausible value is within the range of the Critically Endangered category of Criterion 2.

Metric	Estimate used in the assessment	Minimum plausible value	Maximum plausible value	Justification
AOO is a standardised spatial measure of the risk of extinction, that represents the area of suitable habitat known, inferred or projected to be currently occupied by the taxon. It is estimated using a 2 x 2 km grid to enable comparison with the criteria thresholds. The resolution (grid size) that maximizes the correlation between AOO and extinction risk is determined more by the spatial scale of threats than by the spatial scale at which AOO is estimated or shape of the taxon's distribution. It is not a fine-scale estimate of the actual area occupied. In some cases, AOO is the smallest area essential at any stage to the survival of existing subpopulations of a taxon (e.g., breeding sites for migratory species).				
Trend	Contracted historically; likely to contract following next threatening event			Using the same reasoning as 'EOO' (above), AOO is considered to have contracted historically and be likely to contract following next threatening event.
Number of subpopulations	1	1	>1	The species is known from one presumably interconnected subpopulation in the Rodger River/Yalmy River system (Raadik 2021. pers comm 18 October). However, there may be long reaches of poor habitat, which could fragment the species' distribution within the Rodger River/Yalmy River system, especially following the 2019-20 bushfires (Raadik 2021. pers comm 18 October). Further surveys are required to assess the species' distribution and habitat condition, to accurately determine the number of subpopulations.
Trend	Declined historically; likely to decline following next threatening event			Using the same reasoning as 'EOO' (above), the number of subpopulations is considered to have declined historically and be likely to decline following next threatening event.
Basis of assessment of subpopulation number	See justification for number of subpopulations.			
No. locations	1	1	1	Legge et al. (2021, 2022) estimate that the 2019-20 bushfires (and associated sedimentation) overlapped with approximately 92% of the Yalmy galaxias' distribution. As discussed above, the overall population is expected to have very severely declined following the 2019-20 bushfires (Legge et al. 2021, 2022). Field observations suggest decline greater than or equal to the worst-case estimate (≥80 %) and very few individuals have been found following the 2019-20 bushfires (Raadik 2021). Further evidence demonstrating the severe/rapid impact of fire on this species is available in Table 1. Accordingly, it is feasible for all individuals to be rapidly affected by a single threatening event (e.g., fire). One location has been used in this assessment.
Trend	Stable			One location has been used in this assessment, so it is not possible for the number of locations to decline any further.
Basis of assessment of location number	See justification for number of locations.			

Metric	Estimate used in the assessment	Minimum plausible value	Maximum plausible value	Justification
Fragmentation	The Yalmy galaxias is known from one presumably interconnected subpopulation in the Rodger River/Yalmy River system (Raadik 2021. pers comm 18 October). Given that the species is likely to be a habitat specialist, there may be long reaches of poor habitat, which could fragment the species' distribution within the Rodger River/Yalmy River system, especially following the 2019-20 bushfires (Raadik 2021. pers comm 18 October). However, further surveys are required to assess the species' distribution and habitat condition. Accordingly, there is insufficient evidence to demonstrate if the species is severely fragmented.			
Fluctuations	There are no known extreme fluctuations in EOO, AOO, number of subpopulations, locations or number of mature individuals.			

Criterion 1 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 Very severe reduction	**Endangered Severe reduction**	**Vulnerable Substantial reduction**
A1	≥ 90%	≥ 70%	≥ 50%
A2, A3, A4	≥ 80%	≥ 50%	≥ 30%

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 the following

(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, hybridization, pathogens, pollutants, competitors or parasites

Criterion 1 evidence

Eligible under Criterion 1 A2bce+4bce for listing as Critically Endangered

Generation length

The generation length of the Yalmy galaxias is unrecorded. However, it is likely to be similar to that of other species in the mountain galaxias complex, which is between two and four years (Allen et al. 2002; Raadik 2021. pers comm 18 October). This gives an estimated three-generation period of 6–12 years. However, given the minimum timeframe is 10 years, a timeframe of 10–12 years was used for this criterion.

Historical population reduction (prior to 2009)

The Yalmy galaxias is considered to have been historically more widespread, further upstream in the Snowy River system prior to the introduction of salmonids (unpublished data cited in Raadik 2019a). Accordingly, the species is presumed to have undergone population reduction and range contraction throughout the 20th century, following the incursion of introduced salmonids (but this is outside the timeframe relevant to this criterion).

Past population reduction (A2) (2009-11 to 2021)

The species is now known from one presumably interconnected subpopulation in the Rodger River/Yalmy River system (Raadik 2021. pers comm 18 October). The subpopulation is suspected to extend from the Rodger River, upstream into the Yalmy River, Little Yalmy River and Serpentine Creek (Raadik 2021. pers comm 18 October). The population size of the Yalmy galaxias declined by >50 percent from ~2007 to 2019, due to the combined effects of drought stress (due to the Millennium drought) and sedimentation (particularly following the Orbost fire complex) in 2014 (unpublished survey data cited in Lintermans et al. 2020).

Additionally, the Yalmy galaxias was impacted by the 2019-20 bushfires. Legge et al. (2021, 2022) estimate that the 2019-20 bushfires (and associated sedimentation) overlapped with approximately 92 percent of the Yalmy galaxias' distribution. Legge et al. (2021, 2022) also produced estimates of population change, using the proportion of the species' modelled distribution in areas at risk from fire and sedimentation, intersected with expert estimates of population change following fires. These estimates suggest that the overall population declined by 55 percent one year after the 2019-20 bushfires, but may have declined by as much as 81 percent (80 percent confidence limits: 37–81 percent decline) (Legge et al. 2021, 2022). This suggests substantial to very severe population reduction due to this fire event. Field observations suggest decline greater than or equal to the worst-case estimate (≥80 percent) and very few individuals have been found following the 2019-20 bushfires (Raadik 2021).

Collectively, this evidence suggests very severe population reduction within the past three generations. As such, the species is eligible for listing under A2 (past reduction).

Past and future population reduction (A4) (2019 to 2029-31)

Three generations after the 2019-20 bushfires, the overall population is predicted to decline by approximately 61 percent, but may decline by as much as 90 percent (80 percent confidence limits: 39–90 percent decline) assuming no further extensive fire events (Legge et al. 2021, 2022).

Additionally, the species is projected to undergo further very severe decline following future threatening events (particularly incursion of introduced salmonids, sedimentation following fire and severe drought), based on:

- Inferred historical reduction of the Yalmy galaxias throughout the 20th century, following the incursion of introduced salmonids (unpublished data cited in Raadik 2019a);
- Observed/inferred very severe reduction of other *Galaxias* species, including other members of the mountain galaxias complex, following the incursion of introduced salmonids (Tilzey 1976; Wager & Jackson 1993; Cadwallader 1996; Lintermans 2000; McDowall 2006; Lintermans 2013; Lintermans et al. 2020); and
- Observed/projected severe-very severe reduction of the Yalmy galaxias following the 2014 Orbost fire complex and 2019-20 bushfires (Legge et al. 2021, 2022; Raadik 2021).

A threatening event of this type (i.e., sedimentation following fire, severe drought or salmonid incursion) is considered likely to occur in areas where the Yalmy galaxias occurs, within the next three generations. Rapid and very severe population decline (with possible extinction) is anticipated following invasion of salmonids (Threatened Species Recovery Hub 2018; Lintermans et al. 2020). Additionally, increased temperatures, change to precipitation patterns and more extreme weather events (driven by climate change) are likely to cause decline in the species (see Table 1).

One or more of these events is projected to occur within the next three generations and is projected to result in very severe population reduction (>80 percent) of the Yalmy galaxias (adding to the very severe population reduction (≥80 percent) estimated following the 2019-20 bushfires). This is supported by the expert elicitation conducted by Lintermans et al. (2020), which predicted that the Yalmy galaxias had a 50–69 percent probability of extinction by 2040 without additional conservation actions.

Taking a precautionary approach, considering the impacts of the 2019-20 bushfires and the likelihood of future threatening events, the species meets the requirements for listing as Critically Endangered under A4 (past and future reduction).

Conclusion

The Committee considers that the species has undergone/is projected to undergo very severe population reduction within the next three generations, which is equivalent to at least 80 percent. The cause has not ceased. Therefore, the species has met the required elements of Criterion 1 to make it eligible for listing as **Critically Endangered**.

Criterion 2 Geographic distribution as indicators for either extent of occurrence AND/OR area of occupancy

		Critically Endangered Very restricted	Endangered Restricted	Vulnerable Limited
B1.	Extent of occurrence (EOO)	**< 100 km²**	**< 5000 km²**	**< 20,000 km²**
B2.	Area of occupancy (AOO)	**< 10 km²**	**< 500 km²**	**< 2000 km²**
AND at least 2 of the following 3 conditions:				
(a)	Severely fragmented OR Number of locations	**= 1**	**≤ 5**	**≤ 10**
(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			
(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			

Criterion 2 evidence

Eligible under Criterion 2 B1ab(i,ii,iii,iv,v) for listing as Critically Endangered

Extent of occurrence (EOO) and area of occupancy (AOO)

The EOO is estimated at 46 km² and AOO is estimated at 16 km². These figures are based on the mapping of point records from 2014–2021, obtained from state governments, museums and CSIRO. The AOO was calculated using a 2 x 2 km grid cell method (IUCN 2019).

The species' EOO meets the requirements for listing as Critically Endangered under B1 (<100 km²). The species' AOO meets the requirements for listing as Endangered under B2 (<500 km²).

Number of locations

The number of locations used in this assessment is one. The overall population of the Yalmy galaxias has declined by 55 percent one year after the 2019-20 bushfires, but may have declined by as much as 81 percent (80 percent confidence limits: 37–81 percent decline) (Legge et al. 2021, 2022). Field observations suggest decline greater than or equal to the worst-case estimate (≥80 percent) and very few individuals can be found following the 2019-20 bushfires (Raadik 2021). This evidence suggests the species occurs in one location over which a single fire could rapidly affect all individuals. The species' number of locations meets the requirement for listing as Critically Endangered under this criterion.

Severe fragmentation

The Yalmy galaxias is known from one presumably interconnected subpopulation in the Rodger River/Yalmy River system (Raadik 2021. pers comm 18 October). Given that the species is likely to be a habitat specialist (requiring cobble microhabitat), there may be long reaches of poor habitat (e.g., completely silted stream bed without exposed areas of cobble), which could fragment the species' distribution within the Rodger River/Yalmy River system, especially following the 2019-20 bushfires (Raadik 2021. pers comm 18 October). However, further surveys are required to assess the species' distribution and habitat condition throughout this river system.

Accordingly, there is insufficient evidence to demonstrate if the species is severely fragmented. The Yalmy galaxias does not meet the severe fragmentation requirement for listing under this criterion.

Continuing decline

As described in Criterion 1, the Yalmy galaxias' distribution is considered to have been historically more widespread throughout the Snowy River system (unpublished data cited in Raadik 2019a), prior to inferred range contraction during the 20th century (following the incursion of introduced salmonids). Accordingly, the EOO, AOO, area, extent and/or quality of habitat, and number of subpopulations and mature individuals are likely to have declined over this time period.

The population size of the Yalmy galaxias has severely declined following fires (and associated sedimentation) in early 2014 (Raadik 2021). The Yalmy galaxias population is projected to undergo further very severe reduction over the next three generations, following the 2019-20 bushfires (and associated sedimentation) (see Criterion 1) (Legge et al. 2021, 2022). This suggests decline in area, extent and/or quality of habitat, and number of mature individuals following these two fire events. As there is only a single subpopulation which was not extirpated, EOO, AOO and number of subpopulations did not decline.

The species is projected to undergo further very severe decline should similar threatening events occur in the very restricted distribution of the single remaining subpopulation (particularly incursion of introduced salmonids, sedimentation following fire and severe drought), based on:

- Inferred historical reduction of the Yalmy galaxias throughout the 20th century, following the incursion of introduced salmonids (unpublished data cited in Raadik 2019a);
- Observed/inferred very severe reduction of other *Galaxias* species, including other members of the mountain galaxias complex, following the incursion of introduced salmonids (Tilzey 1976; Wager & Jackson 1993; Cadwallader 1996; Lintermans 2000; McDowall 2006; Lintermans 2013; Lintermans et al. 2020); and
- Observed/projected severe-very severe reduction of the Yalmy galaxias following the 2014 Orbost fire complex and 2019-20 bushfires (Legge et al. 2021; Raadik 2021, 2022).

A threatening event of this type (i.e., sedimentation following fire, severe drought or salmonid incursion) is considered likely to occur in areas where the Yalmy galaxias occurs, within the next three generations (see Criterion 1 – future population reduction). This is likely to result in severe tovery severe decline (with possible extirpation), and therefore would constitute continuing decline in EOO, AOO, area, extent and/or quality of habitat, and number of subpopulations and mature individuals.

Additionally, the species' very restricted distribution and very small population size (impacting inbreeding, genetic drift, etc.) render it more vulnerable to reduced genetic diversity and genetic decline (Frankham et al. 2002; IUCN 2012). Genetic diversity is an important factor influencing a population's persistence (Frankham 2005; Bouzat 2010) and populations lacking genetic diversity often have higher rates of extinction (Markert et al. 2010). Lintermans et al. (2020) used expert elicitation to predict that the Yalmy galaxias had 50–69 percent probability of extinction by 2040 without additional conservation actions. Additionally, preliminary results from population genetic analysis indicate that the Yalmy galaxias has lost most of its genetic diversity and has a high level of inbreeding, which restricts its' evolutionary potential (Raadik 2021. pers comm 18 October). This is another factor that could cause continuing decline in EOO, AOO, area, and number of subpopulations and mature individuals.

The species is undergoing continuing decline in EOO, AOO, area, extent and/or quality of habitat, and number of subpopulations and mature individuals. Accordingly, the species meets the continuing decline requirement for listing under this criterion.

Extreme fluctuations

The density of the Yalmy galaxias has fluctuated among years (from 2014–2019), peaking in 2015 (one year following Orbost fire complex) at >10 times greater than density estimates 2014 or 2017 (Raadik 2021). These density estimates include recruits, so the high density estimate in 2015 indicates high post-fire recruitment, rather than fluctuation in the number of mature individuals (Raadik 2021).

There are no known extreme fluctuations in EOO, AOO, number of subpopulations, locations or mature individuals. The species does not meet the extreme fluctuations requirement for listing under this criterion.

Conclusion

The Committee considers that the species' EOO and number of locations are very restricted; and EOO, AOO, area, extent and/or quality of habitat, number of subpopulations and mature individuals are undergoing continuing decline. Therefore, the species has met the relevant elements of Criterion 2 to make it eligible for listing as **Critically Endangered**.

Criterion 3 Population size and decline

		Critically Endangered Very low	Endangered Low	Vulnerable Limited
Estimated number of mature individuals		**< 250**	**< 2500**	**< 10,000**
AND either (C1) or (C2) is true				
C1. An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future)		**Very high rate 25% in 3 years or 1 generation (whichever is longer)**	**High rate 20% in 5 years or 2 generation (whichever is longer)**	**Substantial rate 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 the following 3 conditions:				
(a)	(i) Number of mature individuals in each subpopulation	**≤ 50**	**≤ 250**	**≤ 1000**
	(ii) % of mature individuals in one subpopulation =	**90 – 100%**	**95 – 100%**	**100%**
(b) Extreme fluctuations in the number of mature individuals				

Criterion 3 evidence

Eligible under Criterion 3 C1+C2a(ii) for listing as Critically Endangered

Number of mature individuals

Based on monitoring data from 2014–2019, the number of mature individuals was estimated to be approximately 1000–2000 (midpoint = 1500) prior to the 2019-20 bushfires (Raadik 2021).

However, the overall population is expected to have declined by approximately 55 percent, one year following the 2019-20 bushfires (80 percent confidence limits: 37–81 percent decline) (see Criterion 1) (Legge et al. 2021, 2022). This suggests that the mid-range estimate (in 2021) is approximately 675 mature individuals (with 1500 mature individuals initially and 55 percent decline) but could range from approximately 190 mature individuals (worst-case estimate, with 1000 mature individuals initially and 81% decline) to approximately 1260 mature individuals (best-case estimate, with 2000 mature individuals initially and 37 percent decline).

Field observations suggest decline greater than or equal to the worst-case estimate (≥80 percent) and very few individuals have been found following the 2019-20 bushfires (Raadik 2021. pers comm 18 October). This suggests that the worst-case estimate of approximately 190 mature individuals is an appropriate estimate for this species following the 2019-20 bushfires.

Although the mid-range and best-case estimates falls within the Endangered category (<2500), the worst-case estimate (which appears to be the most appropriate estimate) falls within the Critically Endangered category (<250). Accordingly, the number of mature individuals meets the requirements for listing as Critically Endangered (<250).

Continuing decline

As discussed above, the Yalmy galaxias is estimated to have undergone severe decline (of at least 31 percent) within one year of the 2019-20 bushfires, and this decline is expected to continue over the next three generations (see Criterion 1) (Legge et al. 2021, 2022).

Given that this decline exceeds 25 percent within one generation, the species meets the C1 and C2 continuing decline requirement for listing as Critically Endangered under this criterion.

Percentage of mature individuals in a single subpopulation

The Yalmy galaxias is known from one presumably interconnected subpopulation in the Rodger River/Yalmy River system (Raadik 2021. pers comm 18 October). Accordingly, 100 percent of mature individuals occur within in a single subpopulation. The species meets the requirements for listing as Critically Endangered under this criterion.

Number of mature individuals in each subpopulation

As discussed above, an estimate of approximately 190 mature individuals is thought to be the most appropriate estimate for this species following the 2019-20 bushfires. As all mature individuals occur within the same subpopulation, the number of mature individuals in each subpopulation is also considered to be approximately 190. The species meets the requirements for listing as Endangered under this criterion.

Extreme fluctuations

There are no known extreme fluctuations in the number of mature individuals (see Criterion 2). The species does not meet the extreme fluctuations requirement for listing under this criterion.

Conclusion

The number of mature individuals is <250 with >25 percent continuing decline over the next generation and 100 percent of mature individuals in the same subpopulation. Therefore, the species has met the relevant elements of Criterion 3 to make it eligible for listing as **Critically Endangered**.

Criterion 4 Number of mature individuals

	Critically Endangered Extremely low	Endangered Very Low	Vulnerable Low
D. Number of mature individuals	< 50	< 250	< 1000
D2.[1] *Only applies to the Vulnerable category* Restricted area of occupancy or number of locations with a plausible future threat that could drive the species to critically endangered or Extinct in a very short time			D2. Typically: area of occupancy < 20 km² or number of locations ≤ 5

[1] The IUCN Red List Criterion D allows for species to be listed as Vulnerable under Criterion D2. The corresponding Criterion 4 in the EPBC Regulations does not currently include the provision for listing a species under D2. As such, a species cannot currently be listed under the EPBC Act under Criterion D2 only. However, assessments may include information relevant to D2. This information will not be considered by the Committee in making its recommendation of the species' eligibility for listing under the EPBC Act, but may assist other jurisdictions to adopt the assessment outcome under the *common assessment method*.

Criterion 4 evidence

Eligible under Criterion 4 D for listing as Endangered

Number of mature individuals

As per the evidence presented above for Criterion 3, the number of mature individuals is <250. The species meets the requirements for listing under this criterion.

Species cannot be listed under Criterion D2 under the EPBC Act (see [1]).

Conclusion

The number of mature individuals is likely to be fewer than 250. Therefore, the species has met the relevant elements of Criterion 4 to make it eligible for listing as **Endangered**.

Criterion 5 Quantitative analysis

	Critically Endangered **Immediate future**	**Endangered** **Near future**	**Vulnerable** **Medium-term future**
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% in 100 years

Criterion 5 evidence

Insufficient data to determine eligibility

Population viability analysis

Population viability analysis has not been undertaken for the Yalmy galaxias.

Conclusion

There are insufficient data to determine the eligibility of the species for listing in any category under this criterion.

Adequacy of survey

The survey effort has been considered adequate and there is sufficient scientific evidence to support the assessment.

Public consultation

Notice of the proposed amendment and a consultation document was made available for public comment for 35 business days between 14 February 2022 and 4 April 2022. Any comments received that were relevant to the survival of the species were considered by the Committee as part of the assessment process and provided to the Minister for the Environment with the Committee's advice.

Listing and Recovery Plan Recommendations

The Threatened Species Scientific Committee recommends:

i) that the list referred to in section 178 of the EPBC Act be amended by **including** *Galaxias* sp. nov. 'Yalmy' in the list in the Critically Endangered category.

ii) that there not be a Recovery Plan for this species in accordance with the provisions of the EPBC Act and the Committee's conservation planning principles as follows, and that consideration be given to the inclusion of this species, and other galaxiid species, in a multi-species Recovery Plan at a future date:

- An approved conservation advice is an effective, efficient and responsive document to guide the implementation of priority management actions, mitigate key threats and support the recovery for this EPBC Act listed Critically Endangered species, while an additional planning instrument is considered.

- An approved conservation advice would support the species recovery by identifying priority actions, stakeholders for engagement, and the survey and research priorities to facilitate a better understanding of key threats as well as biological and ecological knowledge gaps.
- The threats facing the entity, and the recovery actions needed can most effectively be guided via an approved conservation advice.
- The species is affected by serious threats, most notably predation and competition with introduced salmonids; fire regimes that cause declines in biodiversity; increased frequency of extreme temperatures, droughts and fire danger weather, and changes in precipitation; and altered water quality caused anthropogenic activities. However, these threats can be managed at local and state scales without the need for a single species Recovery Plan.
- The entity is known from a single subpopulation occurring in a single jurisdiction (Victoria) within national park and state forest. The key stakeholders are the Department of Environment, Land, Water and Planning (Victoria), Parks Victoria and VicForests.
- Having regard to the above factors, a single species Recovery Plan is not required as it would not provide a significant conservation planning benefit above existing mechanisms.

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