

Hyridella glenelgensis Glenelg Freshwater Mussel

Taxonomy

Hyridella glenelgensis (Dennant, 1898)

The Narracan Freshwater Mussel (*Hyridella narracanensis*) is closely related to the Glenelg Freshwater Mussel. Its range extends east and west of the distribution of the Glenelg Freshwater Mussel, though it is not found in the Glenelg River system. Due to their morphological similarity and 'odd' distribution with respect to each other, they require genetic and morphological investigation to confirm their identification as separate species (Walker et al. 2016).

Current conservation status

Listed as Critically Endangered under the *Environment Protection and Biodiversity Conservation Act 1999*.

Listed as threatened under the *Flora and Fauna Guarantee Act 1988* (SAC 2001).

Categorised as Critically endangered in the 2009 Advisory list of threatened invertebrate fauna in Victoria (DSE 2009).

Proposed conservation status

Critically Endangered in Australia

Criteria A2abce+3bce+4abce; B1ab(i,ii,iii,iv,v)

Species Information

Description and Life History

The Glenelg Freshwater Mussel is a bivalve mollusc that attains 51-80 mm in length. The shell is strong and almond-shaped, and both the umbo (peak along the hinge line) and the shell surface are marked with sculpture (wrinkles). The periostracum (flaky shell covering) is olive-green in immature individuals and dark purple-brown in mature individuals (Playford and Walker, 2008).

It is a sedentary freshwater resident. It reproduces in summer, when mature males release spermatozoa into the water. Females take in the spermatozoa to fertilise eggs they have developed. Mature embryos are known as glochidia and are brooded in special pouches in the gills of female mussels for approximately 8 weeks before release (Jones et al. 1986). Glochidia are ectoparasites and attach to the gills or fins of a host fish that provides them with nutrition and dispersal during metamorphosis. The host fish for the Glenelg Freshwater Mussel are not known, but are likely to include a number of native species (Walker et al. 2001). Once the glochidia have metamorphosed to become juvenile mussels, they adopt the burrowing habit typical of the adults.

Spawning can be influenced by floods, water temperature, conditions of females and the presence or absence of host fish. If females are in good 'body' condition, multiple clutches may be spawned. Clutch sizes for the Glenelg Freshwater Mussel are not well known, but other larger mussel species can have clutches from less than 100 to more than 100 000 (DSE 2009b). Glenelg Freshwater Mussels, like all Hyriidae mussels, are omnivorous filter feeders. They draw in water through a siphon, and food particles are trapped by ciliated ctenidia (gills), sorted and passed to the mouth. Food particles include phytoplankton (bacteria, algae), organic detritus and zooplankton. Feeding is assisted by normal stream flows delivering food particles to the gills (MDFRC 2006; DSE 2009)



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Generation Length

The generation length of *Hyridella glenelgensis* is estimated to be 5 to 6 years. Within the class Bivalvia, mussel taxa from the Hyriidae family are considered long-lived, with some New Zealand species known to survive 7-33 years (MDFRC 2006). Based on other freshwater mussel species, the Glenelg Freshwater Mussel is likely to reach sexual maturity between 2-4 years of age (Byrne 1998; Jones et al. 1986) and probably lives for 8-10 years (Walker, pers. comm. 2009).

Distribution

The Glenelg Freshwater Mussel is found only in the lower reaches of the Crawford River, a tributary of the Glenelg River, in south-west Victoria (Playford and Walker 2008). Two specimens at the Australian Museum are recorded from "Port Fairy" (McMichael and Hiscock 1958) but these are considered erroneous (Playford and Walker 2008). It is now only found in the lower reaches of the Crawford River, Glenaulin Creek and Moleside Creek, in the Glenelg River catchment, western Victoria (Raadik unpublished data).

Habitat

The Glenelg Freshwater Mussel is found in shallow, narrow, flowing sections of streams with dense riparian vegetation that shade the water thus moderating water temperatures. Woody debris from the riparian vegetation that falls into streams is an important habitat feature, providing stable sediments and a refuge from strong currents (Playford and Walker 2008).

The taxon lives in firm, coarse sandy sediments that supply ideal burrowing substrate, and allows feeding, respiratory and reproductive organs to function without clogging. The species is also reliant on flowing water, as this assists in maintaining suitable water temperatures and restricting algal growth. Mussels burrow using their hard shell as a blade and a strong muscular 'foot' as an anchor, leaving only the hindmost part of their shell above the sediments. They may occur singly in marginal habitats, and in small aggregations or shoals in more favourable environments. Due to the physical attributes of the Glenelg Freshwater Mussel, it is suggested that the taxon favours smaller streams with less forceful water movements (Playford and Walker 2008).

Recent observations also suggest that the taxon occupies perennial streams, probably sustained by groundwater outflow during droughts, and cannot survive without surface water (Raadik unpublished data).

Threats

Low water flows may increase salinity, water temperatures and lower oxygen levels, all of which threatens the survival of the Glenelg Freshwater Mussel. The more shallow regions of streams, that are preferred habitat of the species, are prone to drying out during low flows, causing the species to burrow or follow the receding water. Cessations in flow can threaten the refuge habitats used by species in drier periods (DSE 2009). Periods of low flows and cessations in flow are increasing in the Crawford River due to growth in plantations in the area and drought. More than 18 000 ha of Eucalyptus spp. plantations have been established in the Crawford River sub-catchment since 1990, lowering water tables and causing reduced flows and drying of springs (SKM 2008 cited in FWPA 2009). Drought has also affected the catchment, with flow records since 1970 indicating an increase in months of low to nil flows (DSE 2009b).

Erosion, siltation and loss of riparian vegetation caused primarily by trampling and grazing stock affect the taxon's habitat. It is not found where cattle have access to the river bank, as loss of vegetation increases soft silts in stream beds that can then clog feeding, respiratory and reproductive organs of the taxon, or bury them totally (Playford and Walker 2008). Loss of riparian vegetation also removes shading, increasing water temperatures and promoting algal growth that is unfavourable to mussels, and removes in stream debris that provides a refuge for mussels. De-snagging of the river system in the 1960s and 1970s is partly responsible for bank and bed instability and siltation, and may have contributed to the contraction of the local range of the taxon (Playford and Walker 2008). A study by Brainwood and colleagues (2006) suggests that the width of riparian vegetation surrounding populations may play an important protective role against surrounding land uses. Habitat requirements of freshwater mussels means they are often found 'patchily' in waterways, often in dense clusters. The reliance on specific substrate and water flows makes these species highly susceptible to any changes in riparian vegetation, water flows and sedimentation. Clearing of riparian areas, urban build-up close to streams, and intensive farming have all been implicated in the loss of freshwater mussel species within Australia and Northern America (Brainwood et al. 2006).

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Freshwater mussels are affected by contamination of waterways by chemicals such as pesticides (Ruessler et al. 2009) due to their filter feeding habit that may cause them to see them accumulating large quantities of contaminants in tissue (ROPME 2010; DSE 2009). Pesticides are used as part of eucalypt plantation forestry along the Crawford River catchment (FWPA 2009; DSE 2009b).

Introduced Carp (*Cyprinus carpio*) first appeared in the Glenelg River in 2001 and are likely to invade the whole system, including the Crawford River (Raadik 2001, DPI 2010). Carp pose a serious predation risk to juvenile mussels, and also disturb bottom sediments, damage or destroy aquatic vegetation and compete with native fish. Experimental trials suggest that the glochidia of Australian freshwater mussel species may not utilise Carp as a host, but this requires confirmation (Walker 1981).

An essential component of the life cycle is the requirement for newly released glochidia to attach to a fish host. A reduction in the abundance of, or complete loss of, fish hosts can severely reduce or prevent recruitment.

Bushfires can cause destruction of riparian and catchment vegetation and severe degradation of aquatic habitats (DSE 2009b). A very large part of the taxon's habitat has been impacted by the bushfires of 2019/2020, as it occurred upstream of the main population. The taxon is threatened by sediment and decline in water quality as result of fire. Sediment barriers have been installed and individuals have been extracted as a security measure. Although the degree of damage is yet to be determined, such a loss of habitat is likely to have resulted in a decline in population.

IUCN Criteria

Criterion 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%

<p>A1 Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.</p> <p>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.</p> <p>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]</p> <p>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.</p>	<p>based on any of the following:</p>	<p>(a) direct observation [except A3]</p> <p>(b) an index of abundance appropriate to the taxon</p> <p>(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat</p> <p>(d) actual or potential levels of exploitation</p> <p>(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites</p>
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Evidence:

Eligible under Criterion A2 as Critically Endangered

The population reduction over the past 15 to 18 years is estimated to be 80 to 95%, based on (a), (b), (c) and (e) above.

The reduction is based on comparison with existing coarse survey data and reduction in water level and mussel abundance. A very large part of the taxon's habitat has been impacted by the bushfires of 2019/2020, as it

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occurred upstream of the main population. The taxon is threatened by sediment and decline in water quality as result of fire. Sediment barriers have been installed and individuals have been extracted as a security measure, but the degree of damage is yet to be determined.

The causes of the reduction may not have ceased, be understood or be reversible.

Eligible under Criterion A3 as Critically Endangered

The population reduction over the next 15 to 18 years is projected to be 95 to 98%, based on (b), (c) and (e) above.

The known threats are assumed to continue to impact the taxon, such that it is very likely to become extinct.

Eligible under Criterion A4 as Critically Endangered

The population reduction over any 15 to 18 year period, including both past and future, is estimated to be 90 to 95%, based on (a), (b), (c) and (e) above.

Criterion B. Geographic range in the form of either B1 (extent of occurrence) and/or B2 (area of occupancy)			
	Critically Endangered Very restricted	Endangered Restricted	Vulnerable Limited
B1. Extent of occurrence (EEO)	< 100 km ²	< 5,000 km ²	< 20,000 km ²
B2. Area of occupancy (AOO)	< 10 km ²	< 500 km ²	< 2,000 km ²
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			

Evidence:

Eligible under Criterion B1 as Critically Endangered

The Extent of Occurrence (EoO) across the taxon's range is estimated to be 81 km², based on accepted, post-1970 records from the Victorian Biodiversity Atlas, and on intensive field sampling.

The taxon is estimated to be severely fragmented. Both subpopulations are relatively small and at risk from alien predator invasion, climate change and reduced stream flow, continuing instream and riparian habitat decline, increased wildfire and instream sedimentation, such that there is increased extinction risk and little or no probability of recolonisation should either subpopulation become extinct.

It is estimated to have one location. The main threats to the taxon (i.e. reduction of water and flow from Climate Change, loss of groundwater input, alien predators, extreme events such as fire, flood and drought, increased sedimentation) have a non-reversible impact on the individuals of the taxon and have the potential over time to threaten most individuals. Both subpopulations are geographically very close and the main threats are expected to impact both.

It has a continuing decline in (i), (ii), (iii), (iv) and (v) above, based on the assumption that the known threats will continue to impact the taxon and may intensify in the longer term.

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Eligible under Criterion B2 as Endangered

The Area of Occupancy (AoO) across the taxon's range is estimated to be 24 km², based on 2 x 2 km grids derived from accepted, post-1970 records in the VBA. As above, it is severely fragmented, has 1 location, and has a continuing decline in (i), (ii), (iii), (iv) and (v).

Criterion 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 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			

Evidence:

Eligible under Criterion C as Endangered

It is estimated that there are 500 to 1,000 (midpoint 800) mature individuals. These figures are based on field assessments, and extrapolation from data in Playford and Walker (2008), TSSC (2011).

There is estimated to be a continuing decline of 60 to 70% within two generations.

Criterion D. Very small or restricted population		Critically Endangered	Endangered	Vulnerable
Number of mature individuals (observed or estimated)		< 50	< 250	< 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 species to critically endangered or Extinct in a very short time.		-	-	D2: Typically: AoO < 20 km ² or number of locations ≤ 5

Evidence:

Eligible under criterion D as Vulnerable

It is estimated that there are 500 to 1,000 (midpoint 800) individuals, and the taxon is estimated to be very restricted.

Criterion E (Quantitative Analysis) was not addressed as the taxon does not have a detailed Population Viability Analysis.



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