July 2015

Ref. No. PD 61
File No. FSC 00/10

PROPOSED DETERMINATION

***Notopala hanleyi* – Hanley's River Snail as a Critically Endangered Species**

The Fisheries Scientific Committee, established under Part 7A of the *Fisheries Management Act 1994* (the Act), is proposing to list *Notopala hanleyi* – Hanley's River Snail as a CRITICALLY ENDANGERED SPECIES in NSW in Part 1 of Schedule 4A of the Act.

The listing of Critically Endangered Species is provided for by Part 7A, Division 2 of the Act.

The Fisheries Scientific Committee, with reference to the criteria relevant to this species, prescribed by Part 16, Division 1 of the *Fisheries Management (General) Regulation 2010* (the Regulation) has found that:

Background

1) Two river snails belonging to the live-bearing freshwater genus *Notopala* from New South Wales were each described as distinct species, *viz. N. sublineata* Conrad, 1850 and *N. hanleyi* Frauenfeld, 1864. A third, related taxon *N. alisoni* Brazier, 1879 occurs outside New South Wales. In recent years these three taxa have sometimes been considered to be subspecies of a single species for which *N. sublineata*, the earliest available name, is the species-level name. Although *N. alisoni* was indeed synonymised with another species *N. waterhousei* (Adams and Angas, 1864) by Stoddart (1982), there has not been a formal publication synonymising *N. hanleyi* and *N. sublineata*. Consequently the species must be regarded as distinct, as listed by Iredale (1943) and Smith (1992).

2) Genetic analyses combining the data of Carini and Hughes (2006) and Holmes *et al*. (2013) strongly suggest that *N. hanleyi* and *N. alisoni* are distinct species (Holmes *et al*., 2013). Genetic data are not available for *N. sublineata*. Morphological analyses (Sheldon and Walker, 1993; Holmes *et al*., 2013) show that the shells of the taxa can be distinguished conchologically, supporting their status as distinct species.

3) *Notopala hanleyi* was once common and widely distributed in the Murray River catchment, including the Lachlan and Murrumbidgee Rivers. Australian Museum collections show 12 historical records of the species from this distribution but living specimens were most recently collected from natural habitats in 1971. These were found in the Lachlan River near Lake Cargelligo.

4) The family Viviparidae is characterised by females brooding their young to a crawl-away stage, so *N. hanleyi* has limited dispersal abilities. This species principally grazes on the bacterial biofilms that occur on hard substrates in free flowing bodies of water, such as rivers (Sheldon and Walker, 1997).

5) In view of the above, the Committee considers that *Notopala hanleyi* is a valid, recognised taxon and is a species as defined in the Act.

Criteria – reduction in abundance, geographic distribution or genetic diversity (Regulation clause 271)

1) *Notopala hanleyi* was once common in the Murray River, supporting collections of thousands of individuals for research by Johnston and Beckwith (1945, 1947). However populations rapidly declined in the 1960 and 1970s and by the 1980s were reduced to a handful of locations, principally in irrigation pipelines (Sheldon and Walker, 1993).

NSW Department of Primary Industries – PO Box 1305 CROWS NEST NSW 1585
Phone: (02) 8437 4975 Email: fsc@dpi.nsw.gov.au

2) Recent surveys of sites in the Murray River between Tocumwal and Mildura (Mitchell, 2005), the Murrumbidgee River below Narrandera (Mitchell, 2005) and the Murray River between Mildura and Banrock Station in South Australia (Holmes *et al*., 2013) failed to find living snails in their natural habitat. Living snails do still survive in artificial habitat at three locations; Banrock Station and Kingston Squatters Tank in South Australia (Holmes *et al*., 2013) and an irrigation pipeline at Dareton in New South Wales (Mitchell, 2005; Western Murray Irrigation, pers. comm. 2015).

3) The lack of recent records of *N. hanleyi* in its natural habitat and the absence of living specimens in recent surveys indicate that the species has undergone an extremely large reduction in population size and geographic distribution.

4) In determining the extent of the reduction in the abundance of the species, the Fisheries Scientific Committee has had particular regard to the implications of the species' highly restricted habitat which exposes it to a very high risk of extinction through recruitment failure (Regulation clause 271 (2) (d) (i)) and the pressures imposed by the use and management of the habitat (Regulation clause 271 (2) (e) (ii)) for town water supplies.

Criteria – threatening processes (Regulation clause 272)

1) The causes of decline in *N. hanleyi* may include changes to benthic biofilm biomass as a consequence of river regulation (principally weir and dam building) that reduces flow variability (Walker and Thoms, 1993; Walker 2001) and favours the growth of algal substrates instead of bacterial substrates. This has been suggested as a cause of the decline of *N. hanleyi* (Sheldon and Walker, 1997) who propose that it is not able to thrive on the relatively low nutrient content provided by algae.

2) The decline in *N. hanleyi* may also be associated with predation by common carp, or habitat degradation caused by these fish (Sheldon and Walker, 1993; Mitchell, 2005; Holmes *et al.* 2013).

3) Populations within the few remaining locations where it may still survive (irrigation infrastructure on the Murray River) are threatened by deliberate removal (using flushing with chemicals) from some sites.

4) The species has limited opportunity to reinvade its previous habitat. The construction of navigation locks on the Murray River in the 1920s and 1930s transformed the lower Murray River from a formerly lotic ecosystem into a continuous series of lentic weir-pool habitats, altering the hydrology, hydraulics, sedimentation rates and bio-film composition (Walker and Thoms 1993; Walker 2001). In addition to the altered hydrodynamics and biofilm composition of reaches adjacent to the remnant populations, carp biomass remains high.

Conclusion pursuant to section 220F(2) of the Act

In the opinion of the Fisheries Scientific Committee *Notopala hanleyi*, Hanley's River Snail is facing an extremely high risk of extinction in New South Wales in the immediate future, as determined in accordance with the criteria prescribed by the regulations as discussed above.

The species is eligible to be listed as a CRITICALLY ENDANGERED SPECIES.

Sources and Links

Adams, A. F. L. S. and Angas, G. F. (1864) Descriptions of new species of freshwater shells collected by Mr. F. G. Waterhouse, during J. McDonall Stuart's overland journey from Adelaide to the north-west coast of Australia. *Proceedings of the Zoological Society of London* **1863:** 414-415.

Brazier, J. (1879) Description of a new species of *Vivipara*. *Proceedings of the Linnean Society of New South Wales* **3**: 221-222.

Carini, G. and Hughes, J.M. (2006) Subdivided population structure and phylogeography of an endangered freshwater snail, *Notopala sublineata* (Conrad, 1850) (Gatropoda: Viviparidae), in Western Queensland, Australia. *Biological Journal of the Linnean Society of London* **88**: 1-16.

Conrad, R.A. (1850) Descriptions of new species of freshwater shells. *Proceedings of the Academy of Natural Sciences, Philadelphia* **5**: 10-11.

Frauenfeld, G.R. von (1864) Verzeichniss der Namen der fossilen und lebenden Arten der Gattung Paludina Lam. nebst. jenen der nachststehenden und einrechung derselben in der verschieden neneren Gattungen. *Verhandlungen Der Zoologisch-Botanischen Vereins In Wien* **14**: 561-672.

Holmes, S.P, Pynt, J. and Moore, S. (2013) The ecology and occurrence of the River Snail, *Notopala sublineata sublineata*, in New South Wales: a survey of the Darling River system and the viability of the habitats provided by it. Final Report to the NSW FSC: Student Research Grant 2013.

Iredale, T. (1943) A basic list of the freshwater Mollusca of Australia. *The Australian Zoologist* **10**: 188-230.

Johnston, T.H. and Beckwith, A.C. (1945) Larval trematodes from Australian freshwater molluscs, Part X. *Transactions from the Royal Society of South Australia* **69**: 229-242.

Johnston, T.H. and Beckwith, A.C. (1947) Larval trematodes from Australian freshwater molluscs, Part XII. *Transactions from the Royal Society of South Australia* **71**: 324-333.

Mitchell, P. K. (2005) *Notopala sublineata*: an endangered snail within the Murray-Darling Basin, NSW. Masters thesis, Department of Biological Sciences, Macquarie University. Available at: http://www.google.com.au/url?url=http://www.researchonline.mq.edu.au/vital/access/services/Download/mq:34262/SOURCE1&rct=j&frm=1&q=&esrc=s&sa=U&ei=1VX2VKHMKcjp8AWH1ILoBw&ved=0CD8QFjAH&usg=AFQjCNFM5xxw3Wa4mU_PwbSeWdk352Zs-A

Sheldon, F. and Walker, K.F. (1993) Shell variation in Australian *Notopala* (Gastropoda: Prosobranchia: Viviparidae), *Journal of the Malacological Society of Australia* **14**: 59-71.

Sheldon, F. and Walker, K.F. (1997) Changes in biofilms induced by flow regulation could explain extinctions of aquatic snails in the lower River Murray, Australia. *Hydrobiologia* **347**: 97-108

Stoddart, J.A. (1982) Western Australian viviparids (Prosobranchia: Mollusca). *Journal of the Malacological Society of Australia* **5**: 167-173.

Smith, B.J. (1992) Non-Marine Mollusca. In, Houston, W.W.K. (ed.) *Zoological Catalogue of Australia. Non-marine Mollusca.* Canberra: Australian Government Publishing Service Vol. 8, xii + 408 pp.

Walker, K. F. (2001) A river transformed: The effects of weirs on the River Murray. Pages 7 – 22 in S. Blanch (ed.) The way forward on weirs. Inland Rivers Network, Sydney.

Walker, K.F. and Thoms, M.C. (1993) Environmental effects of flow regulation on the lower River Murray, Australia. *Regulated Rivers: Research and Management.* **8**: 103-119.

Associate Professor Jane Williamson
Chairperson
Fisheries Scientific Committee