CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES
OF WILD FAUNA AND FLORA

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REVIEW OF THE STATUS OF SOUTHERN GASTRIC-BROODING FROG (*RHEOBATRACHUS SILUS*)

The attached information document has been submitted by Australia in relation to agenda item 13[*].

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Review of the status of northern gastric-brooding frog (*Rheobatrachus vitellinus*)

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Department of Sustainability, Environment, Water, Population and Communities. Australia

Introduction

At the 24th meeting of the Animals Commitee (Geneva, April 2009), the northern gastric-brooding frog (*Rheobatrachus vitellinus*) was selected for the periodic review of animal species included in the CITES Appendices. In response, the Australian Scientific Authority has provided information on the northern gastric-brooding frog for the review of the species by the Animals Committee.

A. Proposal

The northern gastric-brooding frog (*Rheobatrachus vitellinus*) is considered extinct. Only one year after its discovery, the northern gastric-brooding frog disappeared from the wild in 1985 and extensive survey efforts have failed to re-locate the species. Trade is not considered to be a factor in the extinction of the species and, should the species be rediscovered, is unlikely to become a threatening factor. Australia, therefore, considers it would be appropriate to remove *R. vitellinus* from CITES Appendix II.

B. Proponent

Australia

C. Supporting statement

1. Taxonomy

1.1 Class: Amphibia

1.2 Order: Anura

1.3 Family: Myobatrachidae

1.4 Species: *Rheobatrachus vitellinus* Mahony, Tyler & Davies, 1984

1.5 Scientific synonyms: None

1.6 Common names:

English: northern gastric-brooding frog, Eungella gastric-brooding frog, stream frog, northern platypus Frog.

Dutch: noordelijke maagbroedkikker

French: grenouille á incubation gastrique

1.7 Code numbers:

2. Overview

The northern gastric-brooding frog was discovered and described in January 1984. It occupied a small area of less than 500 km^2 (193 mi^2) of the Clarke Range in Eungella National Park and Mt Pelion State Forest of mid-coastal Queensland. It was found in rocky fast running streams and creeks of undisturbed rainforest at elevations above 400 m (1312 ft).

Rheobatrachus vitellinus was one of only two species known to brood their offspring within their stomach which are regurgitated through the mouth as fully formed metamorphs. While closely resembling its sister species the southern gastric-brooding frog (*R. silus*) it was distinguished by its paler brown colouration and the yellow patches under its limbs and abdomen (Mahony *et al.* 1984).

Little is known about the ecology or behaviour of *R. vitellinus* owing to its rapid extinction. Only one year after its discovery, in January 1985, surveys revealed that the population might be in decline as it could no longer be found in the areas at the edges of its range. By March 1985, the northern gastric-brooding frog could not be found in the wild and extensive survey efforts since have failed to relocate it (McDonald 1990; Ingram & McDonald 1993; McNellie & Hero 1994; Winter & McDonald 1986).

The most likely cause for the rapid decline and extinction of *R. vitellinus* was chytridiomycosis resulting from infection with the chytrid fungus. Evidence of infection by the chytrid fungus has been found in remnant populations of the Eungella torrent frog (*Taudactylus eungellensis*) which also suffered drastic population declines around the same time as the extinction of *R. vitellinus* (McDonald 1990; Rettalick *et al.* 1997). The Eungella torrent frog has also been implicated as a host and reservoir for the chytrid fungus (Retallick *et al.* 2004). The northern gastric-brooding frog not only co-inhabited streams with Eungella torrent frog but also actively preyed on them (Winter & McDonald 1986), and hence transmission of the chytrid fungus between these two species was likely.

3. Species characteristics

3.1 Distribution

The northern gastric-brooding frog was found in the Clarke Range at altitudes between 400 m to 1000 m (1312 to 3280 ft), in Eungella National Park and Mt Pelion State Forest of mid-coastal Queensland (21°00'S, 148°35'E to 21°04'S, 148°41'E)

(McDonald 1990). The species was restricted to an area of less than 500 km^2 (193 mi^2) (McDonald 1990). The discrete and isolated nature of the Clarke Range suggests the distribution was not more widespread prior to its discovery in 1984 (Covacevich & McDonald 1993).

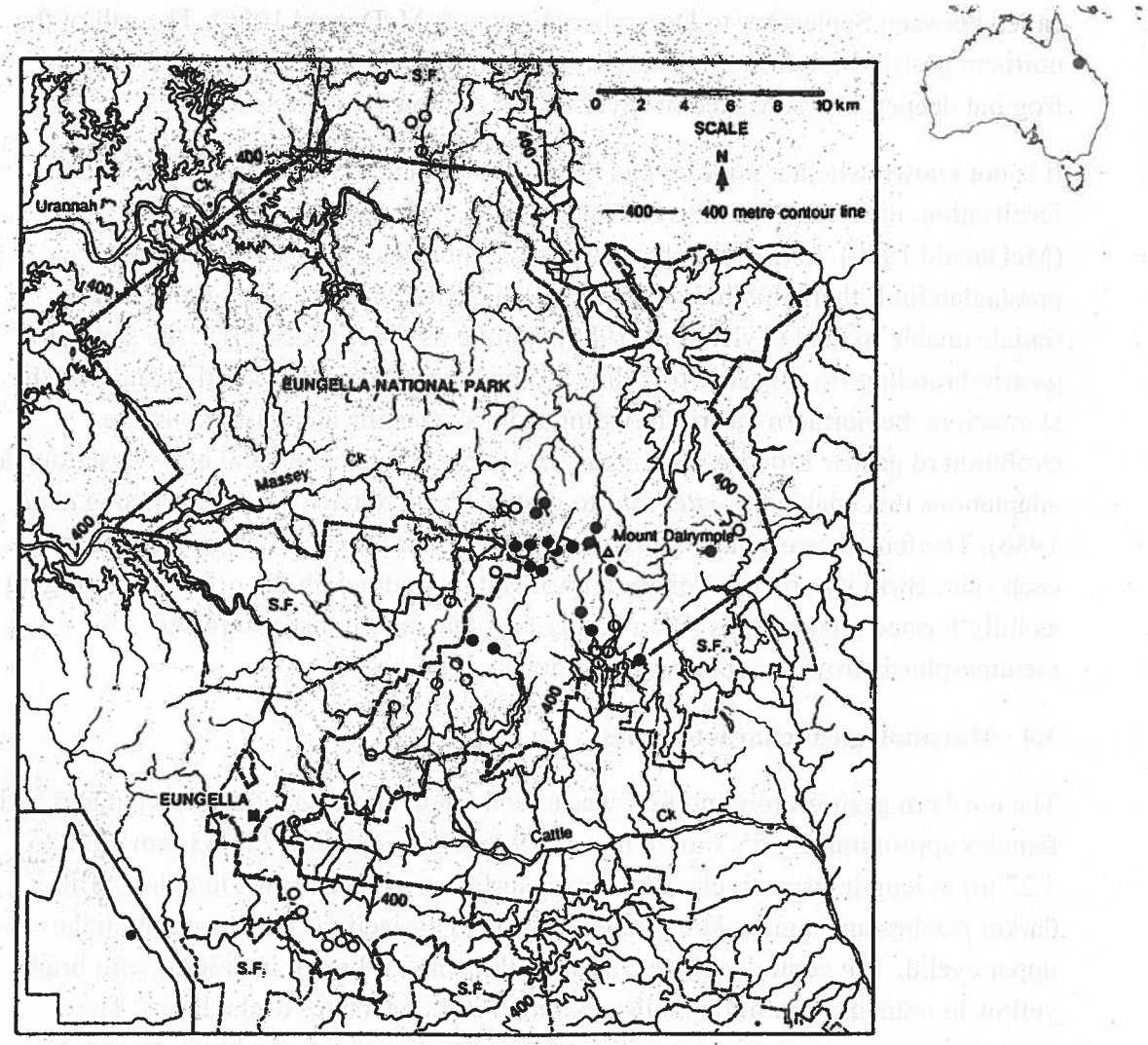

Figure 1. Distribution of *Rheobatrachus vitellinus* in Eungella National Park to January 1985. Closed circles indicate sites at which frogs were located; open circles indicate sites searched, but in which frogs were not found. Triangle indicates Mt Dalrymple. S.F. = State Forest (figure reproduced from Northern Queensland Threatened Frogs Recovery Team 2001)

3.2 Habitat

The northern gastric-brooding frog was only found in pristine and undisturbed rainforest at elevations above 400 m (1312 ft) where the only form of human disturbance was poorly defined walking trails. It was a predominantly aquatic species that inhabited shallow, rocky, fast flowing creeks and streams (McNellie & Hero, 1994).

3.3 Biological characteristics

The northern gastric-brooding frog was mostly nocturnal. During rain, individuals were observed on exposed rocks in and adjacent to steams (McDonald 1990). Males called between September to December (Winter & McDonald 1986). The call of the northern gastric-brooding frog was similar to that of the southern gastric-brooding frog but deeper, and consisted of several staccato notes (McDonald 2005).

It is not known whether females laid their eggs on land or in water. After external fertilisation, the female would swallow the eggs for brooding in her stomach (McDonald 1990). In the jelly that surrounded the eggs was a substance called prostaglandin E that inhibited the secretion of gastric acids, making the brooding female unable to feed (Tyler *et al.* 1985). Unlike its sister species (i.e. the southern gastric-brooding frog) gastric brooding did not cause major structural changes to the stomach in the northern gastric-brooding frog, suggesting a dichotomy in the evolution of gastric brooding (Leong *et al.* 1986). The biochemical and physiological adaptations that enabled *R. vitellinus* to gastric brood remain unknown (Leong *et al.* 1986). The female was ready to give birth to up to 20 young in January to February each year. Birth was by regurgitation through the mouth with the offspring emerging as fully formed metamorphs (i.e. a young frog that has almost completed metamorphosis from a tadpole into an adult).

3.4 Morphological characteristics

The northern gastric-brooding frog was a moderately large squat frog with males and females approximately 55.7 to 58 mm (2.19 to 2.28 in) and 62.2 to 83 mm (2.45 to 3.27 in) in length respectively. The dorsal surface was pale brown in colour with darker patches and a granular texture. Large skin projections were present on the upper eyelid. The ventral surface was smooth, white or brown in colour, with bright yellow to orange colouration on the abdomen and undersides of the limbs. The tympanum (ear cavity) was not visible externally. The snout was blunt, fingers free and the toes fully webbed (Cogger 2000; Mahony *et al.* 1984).

3.5 Role of the species in its ecosystem

The northern gastric-brooding frog was an aquatic and stream edge feeder with a diet including small caddisflies, caddis fly larvae, terrestrial and aquatic beetles, and a sympatric frog species, *Taudacdtylus eungellensis* (Winter & McDonald 1986). The northern gastric-brooding frog was also a food source for fauna of higher trophic levels such as birds, fish and other aquatic fauna.

4 Status and trends

4.1 Habitat trends

Eungella was declared a National Park in 1936 and has since spread to extend over 54,000ha of land. Although there are a number of walking trails, much of the park has

remained inaccessible. The northern gastric-brooding frog was formerly found in undisturbed tracts of rainforest at elevations of 400 to 1000m in Eungella National Park (McNellie & Hero, 1994).

4.2 Population size

There are no recorded estimates of the population size of *R. vitellinus*. A monitoring program initiated by the Queensland government immediately after the species was discovered in 1984 found *R. vitellinus* to be quite common across its range with up to six frogs occurring in a 2 by 5 m (6 by 16 ft) stream (McDonald 1990).

4.3 Population structure

There are no published studies on the population structure of *R.vitellinus*.

4.4 Population trends

In 1984, monitoring surveys found *R. vitellinus* to be quite common across its range (McDonald 1990). By January 1985, it was apparent that the population might be in decline with no frogs observed at the edges of its distribution although the species was still present at other sites (Winter & McDonald 1986; McDonald 1990). By March 1985, *R. vitellinus* could not be found in the wild. It was initially thought that the declines observed in 1984-1985 were a natural population fluctuation and that residual individuals had retreated to hidden refuges (Winter & McDonald 1986; McDonald 1990). However, despite continued efforts to re-locate *R. vitellinus* since its disappearance in 1985, the species has not been found (Ingram & McDonald 1993; McNellie & Hero 1994; Northern Queensland Frog Recovery Team 2001).

4.5 Geographic trends

The northern gastric-brooding frog was formerly restricted to an area of less than 500km^2 in Eungella National Park of the Clarke Ranges in Queensland, Australia (map in McDonald 1990). Range contraction and extinction was rapid within one year of the species' discovery in January 1984.

5 Threats

The cause(s) of extinction of *R. vitellinus* remain unknown. Investigations by McDonald (1990) found no evidence of over-collecting, drought, floods, habitat destruction, heavy parasite loads or stress due to handling for data collection as being responsible for the population declines. The most likely cause implicated for the extinction of the northern gastric-brooding frog was infection by the chytrid fungus, *Batrachochytrium dendrobatidis*.

The chytrid fungus has been identified in the co-occurring species – the Eungella torrent frog (*Taudactylus eungellensis*) (Retallick *et al.* 2004) – which also disappeared around the same time as the northern gastric-brooding frog but was later found persisting in small populations (McDonald 1990; Rettalick *et al.* 1997). Healthy individuals infected with

chytrid persist in the remnant populations and it has been suggested that Eungella torrent frog may act as a reservoir and vector of the chytrid fungus (Retallick *et al.* 2004). The northern gastric brooding frog co-inhabited streams with the Eungella torrent frog and was observed to feed on this species (Winter & McDonald 1986), and hence transmission of chytrid fungus between these two species was likely.

6 Utilization and trade

6.1 National utilization

Given its extinct status it is unlikely that any national utilization is occurring. Historical data suggest that it was unlikely that the northern gastric-brooding frog was subject to any form of trade activities.

6.2 Legal trade

Some northern gastric-brooding frogs were taken from the wild for research purposes but over-collection was unlikely to have contributed to its extinction (McDonald 1990).

6.3 Parts and derivatives in trade

There were no part or derivatives of the northern gastric-brooding frog used in trade.

6.4 Illegal trade

There was, and is currently, no indication of illegal trade.

6.5 Actual or potential trade impacts

The northern gastric-brooding frog was not subject to trade before its extinction. Over-collecting was found not to be a cause of its extinction (McDonald 1990). Should the species be rediscovered, international trade would be regulated by current legislation. Under the *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) a permit is required before native species can be exported from Australia for commercial or non-commercial purposes.

7 Legal Instruments

7.1 National

The northern gastric brooding frog, *Rheobatrachus vitellinus,* is listed nationally as Extinct under the EPBC Act and listed as Endangered in Queensland (*Nature Conservation Act 1992*). The species is also listed as Extinct under the International Union for Conservation of Nature (IUCN) Red List 2011.

7.2 International

Rheobatrachus vitellinus is listed in Appendix II under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Permits are required for the import and export of CITES Appendix II listed species.

8 Species Management

8.1 Management measures

The Queensland Government developed a threat abatement plan, *Infection of amphibians with chytrid fungus resulting in chytridiomycosis*, to address the spread and impact of this disease. Chytridiomycosis most likely caused the extinction of the northern gastric-brooding frog and contributed to the declines of 13 other high-elevation rainforest frog species (Berger *et al.* 1999; Laurance *et al.* 1996; Hines *et al.* 1999; McDonald & Alford 1999)

8.2 Population monitoring

As part of the *National recovery plan for the steam-dwelling rainforest frogs of the Eungella region of mid-eastern Queensland 2000-2004* (Northern Queensland Frog Recovery Team 2001) an intensive survey was carried out for the *R. vitellinus* during the peak breeding season. The search was present/absence surveys along streams at a range of altitudes including historical sites formerly occupied by the northern gastric-brooding frog.

The recovery plan also made the following recommendations:

- Monitor sites where the species was recorded historically to detect any recovery of the species.
- Investigate disease in preserved specimens and in other species occupying similar habitat.
- Train park staff and community volunteers in identification of this species.
- Implement monitoring by park staff of select locations within the national park estate where the northern gastric brooding frog formerly occurred.

In 2010, an extensive survey was carried out by the Amphibian Specialist Group (ASG) for the IUCN for several extinct species of frogs including the northern gastric-brooding frog.

Despite these efforts, *R. vitellinus* has not been relocated in the wild.

8.3 Control measures

8.3.1 International

The import and export of species included on the CITES Appendices is regulated and controlled by the EPBC Act. A CITES permit is required for export and import of CITES listed species including for products derived from CITES listed species.

8.3.2 Domestic

The EPBC Act prohibits the export of live Australian native amphibians for commercial purposes under any circumstances. Permits are required for exporting live native Amphibians for non-commercial purposes (e.g. for research, education or exhibitions) and for products derived from native amphibians.

8.4 Captive breeding and artificial propagation

Captive breeding programs were not established before the extinction of *Rheobatrachus vitellinus* in 1985.

8.5 Habitat conservation

The northern gastric-brooding frog formerly inhabited Eungella National Park which is currently managed by the Queensland Department of Environment and Resource Management under the *Nature Conservation Act 1992* (Qld) which aims to preserve and protect Queensland's natural and cultural values.

8.6 Safeguards

Should the species be rediscovered, *R. vitellinus* will be afforded protection from over-collection for international trade by provisions of the EPBC Act.

9 Information on similar species

The northern gastric-brooding frog, *R. vitellinus,* was one of two species of gastric brooding frog. Its sister species – the southern Gastric-brooding frog, *R. silus* – is also considered to be extinct and has not been located in the wild since 1981 (Richards *et al.* 1983) and the last known individual died in captivity in 1983 (Tyler & Davis 1985).

The northern gastric-brooding frog was readily distinguishable from the southern gastric-brooding frog by its distribution, paler brown colouration and bright yellow patches under the limbs and on its lower abdomen (Mahony *et al.* 1984). The calls of the northern gastric-brooding frog are similar to the southern gastric-brooding frog but of a deeper pitch, shorter and with less repeats.

10 Conclusion

The northern gastric-brooding frog has been declared extinct nationally and internationally. Trade has not been implicated as one of the factors contributing to declines, and subsequent extinction, of *R. vitellinus*. Should the species be rediscovered it is unlikely that trade will pose a threat to wild populations. Therefore, Australia proposes that *Rheobatrachus vitellinus* no longer warrants listing under CITES Appendix II and suggests the removal of *R. vitellinus* from all CITES Appendices.

11 References

Berger, L., Speare R., & Hyatt, A. 1999. Chytrid fungus and amphibian declines: Overview, implications and future directions. pp. 23-33. In: Campbell, A. (ed.) *Declines and disappearances of Australian frogs*. Canberra: Environment Australia.

Cogger, H. 2000. *Reptiles and amphibians of Australia*. Sixth edition. New South Wales: Reeds New Holland.

Covacevich, J.A., & McDonald, K.R. 1993. Draft recovery plan for the stream –dwelling frogs of th Eungella region of mid-east Queensland. Unpublished Report to the Australian Nature Conservation Agency, Canberra.

Hyer, W.R. & Liam, D.S. 1976. Analysis of the intergeneric relationships of the Australian frog family Myobatrachidae. *Smithsonian Contributions to Zoology* **233**: 1-28.

Frost, D.R., Grant, T., Faivovich, J., Bain, R.H., Haas, A., Haddad, C.F.B., De Sά, R.O., Channing, A., Wilkinson, M., Donnellan, S.C., Raxworthy, C.J., Campbell, J.A., Blotto, B.L., Moler, P., Drewes, R.C., Nussbaum, R.A., Lynch, J.D., Green, D.M. & Wheeler, W.C. 2006. The Amphibian tree of life. *Bulletin of the American Museum of Natural History* **297**: 1-291.

Hines, H.B., Mahony, H. & McDonald, K. 1999. An assessment of frog declines in wet subtropical Australia. In: Campbell, A. (ed.) *Declines and disappearances of Australian frogs*. Canberra: Environment Australia

Ingram, G.J. & McDonald, K.R. 1993. An update on the decline of Queensland's frogs. Pp. 297-303. In: Lunney, D. & Ayers, D. (eds). *Herpetology in Australia. A Diverse Discipline*. Mosman: Royal Zoological Society of New South Wales.

IUCN 2011. *IUCN Red List of Threatened Species. Version 2011.1.* <http://www.iucnredlist.org>. Downloaded on 26 October 2011.

Laurance, W.F., McDonald, K.R. & Speare, R. 1996. Epidemic disease and the catastrophic decline of Australian rainforest frogs. *Conservation Biology* **10**: 1-9.

Leong, A, S.-Y., Tyler, M.J. & Shearman, D.J.C. 1986 Gastric brooding: a new form in a recently discovered Australian frog of the genus *Rheobatrachus*. Australian Journal of Zoology 34: 205-209.

Mahony, M.J., Tyler, M.J. & Davies, M. 1984. A new species of the genus *Rheobatrachus* (Anura: Leptodactylidae) from Queensland. Transactions of the Royal Society of South Australia 108(3): 155-162 [55].

McDonald, K.R. 1990. *Rheobatrachus* Liem and *Taudactylus* Straughan and Lee (Anura: Leptodactylidae) in Eungella National Park, Queensland: distribution and decline. *Transactions of the Royal Society of South Australia* **114**: 187-194.

McDonald, K.R. & Alford, R. 1999. A review of declining frogs in northern Queensland. pp. 14-22 In: Campbell, A. (ed.) *Declines and disappearances of Australian frogs*. Canberra: Environment Australia.

McDonald, K. 2005. Recording of the call of *Rheobatrachus silus*. Australian Frogs Database. Frogs Australia Network. Available from http://frogsaustralia.net.au/frogs/display.cfm?frog_id=85 (Date last accessed 30 October 2011).

McNellie, M. & Hero, J.M. 1994. Mission amphibian. The search for the missing rainforest frogs of Eungella. *Wildlife Australia* **31**: 22-23.

Retallick, R., Hero, J.-M. & Alford, R. 1997. Adult population monitoring and larval ecology of the stream-dwelling frogs at the Eungella National Park. Unpublished report to Queensland Department of Environment. 63 pp.

Retallick, R.W.R., McCallum, H & Speare, R. 2004. Endemic infection of the amphibian chytrid fungus in a frog community post-decline. *PLoS Biology* **2**(11): e 351. doi:10.1371/journal.pbio.0020351.

Richards, S.J., McDonald, K.R. and Alford, R.A. 1993. Declines in populations of Australia's endemic tropical rainforest frogs. *Pacific Conservation Biology* 1: 66-77.

Northern Queensland Threatened Frogs Recovery Team 2001. Recovery plan for the stream-dwelling rainforest frogs of the Eungella region of mid-eastern Queensland 2000-2004. Report to Environment Australia, Canberra. Queensland Parks and Wildlife Service, Brisbane

Tyler, M.J., & Davies, M. 1985. The Gastric Brooding Frog. pp. 469-470 In: Grigg G., Shine R., and Ehmann, H. (eds.) *Biology of Australasian frogs and reptiles*. Sydney: Royal Zoological Society of New South Wales.

Winter, J, & McDonald, K.R. 1986. Eungella, the land of cloud. *Australian Natural History* **22**: 39-43.