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

Sixteenth meeting of the Conference of the Parties
Bangkok (Thailand), 3-15 March 2013

CONSIDERATION OF PROPOSALS FOR AMENDMENT OF APPENDICES I AND II

A. Proposal

Delist the extinct *Rheobatrachus silus* from Appendix II in accordance with the Resolution Conf. 9.24 (Rev. CoP 15). The species does not meet the trade criteria (Annexes 2a and 2b) for inclusion in Appendix II.

B. Proponent

Australia*, as requested by the Animals Committee, to delete the species from Appendix II (AC 26 WG1 Doc. 2).

C. Supporting statement

1. Taxonomy

| | | |
|---|---|---|
| 1.1 | Class: | Amphibia |
| 1.2 | Order: | Anura |
| 1.3 | Family: | Myobatrachidae |
| 1.4 | Species: | *Rheobatrachus silus* Liem, 1973 |
| 1.5 | Scientific synonyms: | none |
| 1.6 | Common names: | English: southern gastric-brooding frog, southern platypus frog<br>Dutch zuidelijke maagbroedkikker<br>French: grenouille plate à incubation gastrique<br>German Australische magenbrüterfrosch<br>Spanish: rana incubadora gástrica de Australia<br>Swedish magruvargroda |
| 1.7 | Code numbers: | |

2. Overview

At the 24th meeting of the Animals Committee (Geneva, April 2009), the southern gastric-brooding frog (*Rheobatrachus silus*) was selected for the periodic review of animal species included in the CITES Appendices. At their 26th meeting (Geneva, March 2012), the Animals Committee recommended that the southern gastric-brooding frog be removed from Appendix II (AC 26 WG1 Doc. 2). The recommendation was made based on information provided by the Australian CITES Scientific Authority.

* *The geographical designations employed in this document do not imply the expression of any opinion whatsoever on the part of the CITES Secretariat or the United Nations Environment Programme concerning the legal status of any country, territory, or area, or concerning the delimitation of its frontiers or boundaries. The responsibility for the contents of the document rests exclusively with its author.*

The southern gastric-brooding frog was discovered in 1972, although some reports suggest that it was known as early as 1914 (Liem 1973; Ingram 1991). It was endemic to south-east Queensland of Australia in the Blackall and Cononale Ranges at elevations between 350 m and 800 m above sea level. The entire distribution of the species was estimated to be limited to an area of less than 1,400 km$^2$.

The southern gastric-brooding frog had a unique reproductive mode in that once the eggs were fertilised externally, they were swallowed by the female for further development in her stomach. Fully formed metamorphs (i.e. a young frog that has almost completed metamorphosis from a tadpole into an adult) were then released through the female's mouth after 36 to 43 days (Ingram 1983).

The southern gastric-brooding frog was last sighted in the wild in September 1981 in the Blackall Range (Richards *et al.,* 1983). The last known specimen died in captivity in November 1983 (Tyler and Davies 1985). *R. silus* is listed as Extinct nationally under the *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) and internationally under the International Union for Conservation of Nature (IUCN) Red List 2011.

The cause(s) of the declines of wild populations and extinction of the species are not known. It is suspected that the chytrid fungus is responsible for the extinction of the southern gastric-brooding frog and is also responsible for the extinctions and declines of at least 13 other high-elevation rainforest frog species in Queensland, Australia (Laurance *et al.,* 1996, 1997; Retallick *et al.,* 2004). Consequently, trade was not considered to be a factor causing the extinction of the species and is not considered to be a risk in the highly unlikely event that the species is rediscovered.

3. Species characteristics

3.1 Distribution

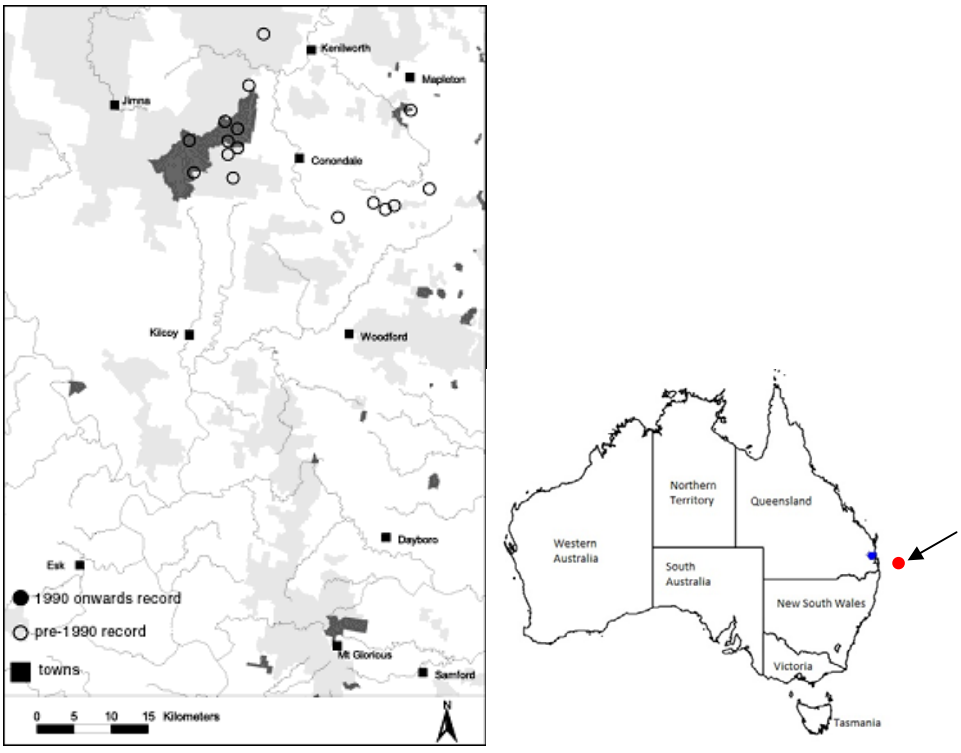


**Figure 1:** Records of the southern gastric-brooding (*Rheobatrachus silus*) frog sightings in south east Queensland (left) (Image reproduced with permission from Hines and the South-east Queensland Threatened Frogs Recovery Team, 2002) and map of Australia showing occurrence records (right) (Atlas of Living Australia, 2012)

The southern gastric-brooding frog was discovered in 1972 but Ingram (1991) reported that the first specimen was collected in 1914 from the Blackall Ranges, south east Queensland in Australia. The species was restricted to elevations between 350 m and 800 m above sea level in the Blackall and

Cononale Ranges between Coonoon Gibber Creek (26º 33'S, 152º 42'E) and Kilcoy Creek (26º 47'S, 152º 38'E). It inhabited streams in the catchments of the Mary, Stanley and Mooloolah Rivers. It was also found in Kondalilla and Conondale National Parks, Sunday Creek State Forest, State Forest 311, Kenilworth State Forest and from private land outside these areas (Hines *et al.,* 1999). The geographic range of the species was limited to less than 1,400 $km^2$ in south east Queensland.

3.2 Habitat

The southern gastric-brooding frog lived in rainforest, wet sclerophyll forests and tall open forest with a closed understorey where it was closely associated with rocky mountain streams, rock pools and soaks (Czechura 1991). It was predominantly an aquatic species inhabiting mostly permanent water bodies that ceased to flow only in years of very low rainfall (Meyer *et al.,* 2001) and not recorded more than 4 m from water (Ingram 1983). The non-breeding winter habitat is unknown although the species was suspected to hibernate in deep crevices in rocks, terrestrial or underwater, during the colder months (Ingram 1983).

3.3 Biological characteristics

The minimum age at which *R. silus* females are suspected to reproduce is 2-3 years old. The minimum age for breeding for males was not determined before the species become extinct (Ingram 1983). Breeding was during the warmer months (between October and December) and appeared to be dependent on the summer rains (Ingram 1983). Males called from rock crevices above pools during the breeding season to attract the attention of females (Ingram 1983). The call was described as an 'eeeehm....eeeehm' with an upward inflection lasting for around half a second repeated every 6 to 7 seconds for approximately 30-34 pulses. (Tyler and Davies 1983; McDonald 2005).

Following external fertilisation of around 40 ripe eggs the female would swallow the eggs which would further develop in her stomach. The eggs, measuring up to 5.1 mm in diameter, had large yolk sacs which nourished the embryos during their development. Only 21-26 juveniles were ever observed in the stomach of a female which is almost half of the number of eggs produced. It is not known whether the female failed to swallow all the eggs or some eggs swallowed were digested (Tyler 1989). Hormones produced by the young cause major structural and physiological changes to occur in the stomach of the female including stopping the secretion of digestive acids (Fanning *et al.,* 1982; Tyler *et al.,* 1983). During the brooding stage, the female would stop feeding until the juveniles were released after 36 to 43 days as fully formed metamorphs from the female's mouth (Ingram 1983). The digestive tract of the female would return to its normal state and feeding would resume within four days of releasing the young (Tyler *et al.,* 1983). Given the duration of brooding it is unlikely that the females bred more than once per breeding season (Ingram 1983).

Juveniles were mobile and would move into newly created pools where they then tended to stay. Ingram (1983) recorded the largest distance travelled by an individual as 53 m between seasons. During the breeding season, movements by individuals tended to remain within the same pool or group of pools moving distances of less than 7 m except during periods of high flow or flooding (Ingram 1983).

3.4 Morphological characteristics

The southern gastric-brooding frog was a medium size frog with males approximately 33 mm to 41 mm and females 44 mm to 54 mm in length. Colouration on the dorsal surface ranged from olive, olive-brown to almost black with small scattered darker and lighter patches (Tyler and Davies 1983). A dark streak ran from the eye to the base of the forelimb. There were darker cross-bars on the limbs and pale and dark patches and variegations on the digits and webbing. The ventral surface was white or cream with yellow markings on the limbs. The skin was finely granular above and smooth below. The snout was blunt and rounded, with the eyes and nostrils directed upwards. The species' eyes were large and prominent, located close together and to the front of the head. The tympanum (ear cavity) was hidden. The fingers lacked webbing, while the toes were fully webbed. Digits had small discs (Liem 1973; Tyler and Davies 1983; Cogger 2000).

**Figure 2** Southern gastric brooding frog (*Rheobatrachus silus*). Photographer unknown. Source: http://www.thinkquest.org

3.5 Role of the species in its ecosystem

The southern gastric-brooding frog foraged on insects from both land and water (Ingram 1983). The species was a food source for other species of higher trophic levels such as birds, fish and other aquatic fauna.

4. Status and trends

4.1 Habitat trends

Some areas within the habitat of the southern gastric-brooding frog were subject to logging activities between 1972 and 1979.

4.2 Population structure

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

4.3 Population trends

Since its discovery in 1972, there was little known about the wild populations of *R. silus*. There were reports that the species underwent a decline in 1979 (Czechura and Ingram 1990; Tyler and Davies 1985) and the last sighting in the wild was in September 1981 in the Blackall Range (Richards *et al.,* 1983). The species declined rapidly and disappeared the same time as a sympatric species – the southern day frog (*Taudactylus diurnus*). The last known specimen of *R. silus* died in captivity in November 1983 (Tyler and Davies 1985).

Ingram (1983) studied one population of *R. silus* in the headwaters of Booloumba Creek, Conondale Range and estimated that there were 78 individuals present in 1976. No other estimates of population size are available.

4.4 Geographic trends

*R. silus* inhabited streams in the Mary, Stanley and Mooloolah Rivers of the Blackall and Conondale Ranges in south-east Queensland. Populations declined across its entire range in 1979 and disappeared by 1981. Rapid population declines and extinction occurred at the same time for the southern day frog (*T. diurnus*).

5. Threats

The reason(s) for the declines and subsequent extinctions of populations of *R. silus* remain unknown (Tyler and Davies 1985). Logging of catchments occurred between 1972 and 1979. The effects of logging on populations was not investigated, however the southern gastric-brooding frog did continue to persist during logging activities (McDonald 1990).

It is suspected that the chytrid fungus caused declines in *R. silus*. The chytrid fungus (*Batrachochytrium dendrobatidis*) has been implicated in the declines and extinctions of at least 13 other high-elevation rainforest frog species in Queensland, Australia (Berger *et al.,* 1999; Laurance *et al.,* 1996; McDonald and Alford 1999).

Current threats to potential *R. silus* habitat include feral pigs, invasion by weeds (especially the Mistflower *Ageratina riparia*) and altered water flow due to upstream disturbances (Hines *et al.,* 1999).

6. Utilization and trade

6.1 National utilization

There is no trade in the southern gastric-brooding frog as the species is considered extinct.

6.2 Legal trade

The southern gastric-brooding frogs were collected from the wild for research purposes due to their unique reproductive strategy. Over-collection by scientists has been speculated as one of the causes for declines and extinction of the species (Tyler, 1985).

6.3 Parts and derivatives in trade

No parts or derivatives of the southern gastric-brooding frog were used in trade.

6.4 Illegal trade

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

6.6 Actual or potential trade impacts

Should the southern gastric-brooding frog be rediscovered, the collection and potential trade in this species would be strictly regulated under domestic Australian law.

7. Legal instruments

7.1 National

The southern gastric-brooding frog, *R. silus*, is listed nationally as Extinct under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

7.2 International

The species is listed as Extinct under the International Union for Conservation of Nature (IUCN) Red List 2012 (Meyer *et al.,* 2004). *R. silus* 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 *National Recovery Plan for Stream Frogs of South-East Queensland (2001-2005)* included the southern gastric-brooding frog (Hines, H. B. and the South-east Queensland Threatened Frogs Recovery Team 2002). Management actions included surveys and population monitoring to re-establish species and populations.

While a range of factors, such as habitat disturbance by logging, may have contributed to the decline of the species it is suspected that chytrid fungus most likely caused the extinction of the southern gastric-brooding frog. The chytrid fungus is thought to have contributed to the extinction of 13 other high-elevation rainforest frog species (Laurance *et al.,* 1996; Berger *et al.,* 1999; Hines *et al.,* 1999; McDonald and Alford 1999). The Queensland Government developed a threat abatement plan,

*Infection of amphibians with chytrid fungus resulting in chytridiomycosis* (2006) to address the spread and impact of the disease.

8.2 Population monitoring

Despite continued efforts, *R. silus* has not been re-located in the wild since its disappearance in 1981 (Richards *et al.,* 1993). Over 50 surveys have been conducted in an effort to find the southern gastric-brooding frog. Efforts since 1993 to find the species have been (as summarised by Hines *et al.,* 1999):

a. Regular monitoring at Ingram's (1983) study site – Beauty Spot 100 on Booloumba Creek and Bundaroo, Peters and East Kilcoy Creeks in the Conondale Range, and at Picnic Creek (the type locality near Kondalilla) on the Blackall Range.

b. 1995 intensive "frog search" of Conondale Range.

c. 1997 "frog search" of the headwaters of Kilcoy, North Booloumba and Bundoomba Creeks, Conondale Range.

d. Since 1996, systematic surveys of many streams in the Conondale and Blackall Ranges. Some sections of streams were visited on many occasions over a range of weather conditions. Poorly surveyed streams in the Upper Stanley River were targeted.

e. Opportunistic surveys by various frog biologists.

8.3 Control measures

8.3.1 International

The EPBC Act regulates trade in CITES listed and Australian native wildlife and their products. Export of live Australian native amphibians is strictly prohibited for commercial purposes but may be exported for specific non-commercial purposes (e.g. for research, education or exhibition). As an Australian native amphibian an Australian export permit would be required for the export of *R. silus* even if it was delisted from CITES.

8.3.2 Domestic

Should the southern gastric-brooding frog be rediscovered, any take from the wild would be strictly regulated by relevant Australian domestic environmental legislation.

8.4 Captive breeding and artificial propagation

Captive breeding programs were not established before the extinction of *R. silus.* The last known specimen died in captivity in November 1983 (Tyler and Davies 1985).

8.5 Habitat conservation

The southern-gastric brooding frog was formerly found in the Kondalilla and Conondale National Parks which are currently managed by Queensland Department of National Parks, Recreation, Sport and Racing.

8.6 Safeguards

Should the southern gastric-brooding frog be rediscovered, it would be afforded protection from international trade by provisions of Australian wildlife law (the EPBC Act).

9. Information on similar species

The southern gastric-brooding frog was one of two species of gastric-brooding frog. Its sister species, the northern gastric-brooding frog (*Rheobatrachus vitellinus)* is also considered to be extinct and has not been located in the wild since 1985 (McDonald 1990).

The southern gastric-brooding frog could be readily distinguished from the northern gastric-brooding frog by its distribution, colour pattern and mottled webbing. The calls of the northern gastric-brooding frog are similar to the southern gastric-brooding frog but of a deeper pitch, shorter and with fewer repeats.

10. Consultations

The species was endemic to Australia prior to its extinction and hence consultation with other range States is not required.

11. Additional remarks

None

12. References


Atlas of Living Australia website at http://bie.ala.org.au/species/Rheobatrachus+silus Accessed 2 October 2012.

Berger, L., Speare R., and 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.

Czechura, G.V. 1991. The Blackall-Conondale Ranges: frogs, reptiles and fauna conservation. pp. 311-324 In: Werren, G. and Kershaw, P. (eds.) *The rainforest legacy, Australian National Rainforest.* Canberra : Australian Government Publishing Service.

Fanning, J.C., Tyler, M.J. and Shearman, D.J.C. 1982. Converting a stomach of the gastric brooding frog, *Rheobatrachus silus*. *Gastroenterology* **82**: 62-70.

Frost, D.R., Grant, T., Faivovich, J., Bain, R.H., Haas, A., Haddad, C.F.B., De Sá, 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. and 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. and 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

Hines, H. B. and the South-east Queensland Threatened Frogs Recovery Team. 2002. Recovery plan for stream frogs of south-east Queensland 2001-2005. Report to

Environment Australia, Canberra. Brisbane: Queensland Parks and Wildlife Service.

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

Ingram, G,J. 1983. Natural History. pp. 16-35 In: Tyler M.J. (ed.) *The Gastric Brooding Frog*. London: Croome Helm.

Ingram, G.J. 1991. The earliest records of the extinct Platypus frog*. Memoirs of the Queensland Museum* **30**: 454.

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. and Speare, R. 1996. Epidemic disease and the catastrophic decline of Australian rainforest frogs. *Conservation Biology* **10**: 1-9.

Laurance, W.F. McDonald, K.R. and Speare, R. 1997. In defense of the epidemic disease hypothesis*. Conservation Biology* **11**: 1030-1034.

Liem, D.S. 1973. A new genus of frog of the family Leptodactylidae from SE Queensland, Australia. *Memoirs of the Queensland Museum* **16**: 459-470.

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

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=84 Last accessed on 26 October 2011.

Meyer, E., Hines, H. and Hero, J.-M. 2001. Southern Gastric Brooding Frog, *Rheobatrachus silus. Wet Forest Frogs of South-east Queensland*. Gold Coast: Griffith University.

Meyer, E., Newell, D., Hines, H., May, S., Hero, J-M., Clarke, J., Lemckert, F. 2004. *Rheobatrachus silus*. In IUCN 2012. IUCN Red List of Threatened Species 2012. www.iucnredlist.org Downloaded on 13 September 2012.

Retallick, R.W.R., McCallum, H and 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.

Tyler, M.J., and Davies, M. 1983. Superficial features. pp. 5-15 In: Tyler M.J. (ed.) *The Gastric Brooding Frog*. London: Croome Helm.

Tyler, M.J., Shearman, D.J.C., Franco, R., O'Brien, P., Seamark, R.F., and Kelly, R. 1983. Inhibition of gastric acid secretion in the gastric brooding frog, *Rhoebatrachus silus*. Science **220**: 609-610

Tyler, M.J., and 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.

Tyler, M.J. 1989. *Australian Frogs*. Victoria: Penguin Books.