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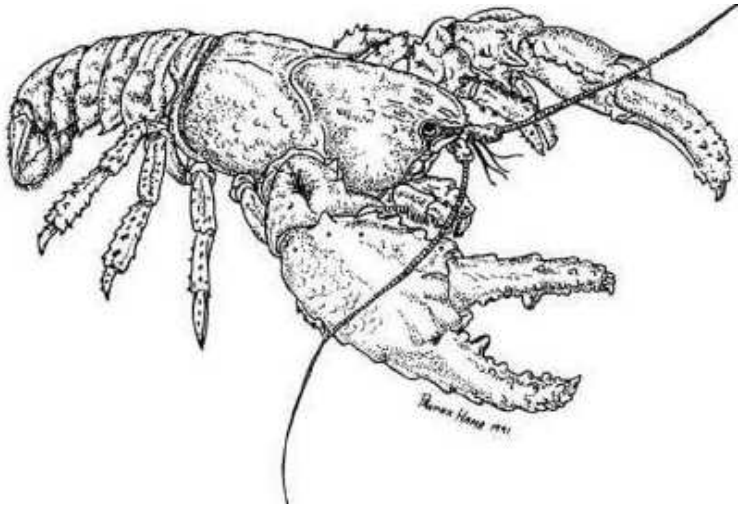


Amphibian Chytrid Fungus
A Study of the local frog population of the Trevallyn Nature Recreation Area, Launceston, Tasmania

by **Lisa Clarkson**

Limnodynastes dumerilii

BACKGROUND

In late 2004, several members of the CNFN formed an amphibian research group to conduct a survey for the presence of the chytrid fungus (*Batrachochytrium dendrobaditis* or *Bd*). Although declines in local frog populations and in the range and abundance of some species had been documented in Tasmania, at the time *Bd* had not been reported. The survey work of the CNFN amphibian group confirmed the presence of the fungus in several locations around Tasmania including our major cities and towns (Obendorf and Dalton, 2006). I was involved in surveying sites around Launceston and in particular conducted surveys of several water bodies in the Trevallyn Nature Recreation Area (TRNA) where *Bd* was confirmed in several ponds. As I reside in close proximity to the TRNA I decided to observe the local frog populations in the years subsequent to the survey in an attempt to understand the implications of the presence of the fungus in the Reserve. In

addition, the original survey work has left me concerned about the potential impact of *Bd* on Marsh frogs (Genus *Limnodynastes*). These frogs were revealed to be particularly susceptible to chytridiomycosis (the potentially fatal disease caused by *Bd*) manifesting all the symptoms of the disease and ultimately dying several weeks after metamorphosing. On the other hand, some frog species such as the Brown Tree Frog (*Litoria ewingii*) on exhibiting chytrid-induced depigmentation of the mouthparts as tadpoles have not succumbed to the infection and indeed have survived 40 months as captive frog specimens.

METHODS

Bearing in mind the above concerns, my survey work has consisted of observing and documenting regularly (for the past 40 months) the frog species present in the proximity of the ponds tested in the TRNA (using call identification and sighting) and to record their abundance. It also included documenting timing of calling, reproductive evidence (spawning), timing and success of spawning and identification and abundance of tadpoles. Any unusual events such as spawning failure or mass mortality were recorded, along with observations concerning weather conditions (such as extreme events - heat waves, drought and unusual cold etc.), timing of ponds drying out and water quality. This last observation was limited to comments on the presence of algal blooms, turbidity etc. and was not measured quantitatively.

RESULTS

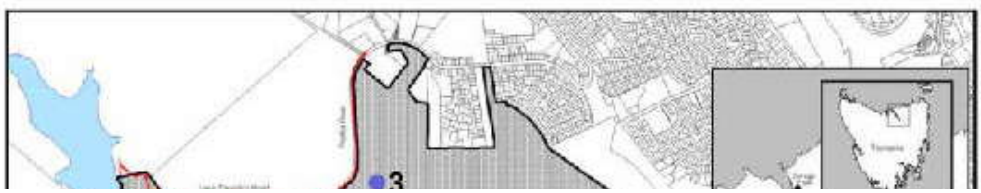
Map 1 shows the catchment system of the TRNA and it can be seen that the Archery and Pobblebonk ponds both overflow into the Reedy Gully pond and that the South Esk satellite pond overflows into the South Esk pond. In most cases, the source of water is predominantly rainfall run-off from roads and cleared or vegetated slopes. Of interest, the Horse paddock pond is maintained artificially by overflow from a horse jump water obstacle upstream that is filled by tap water.

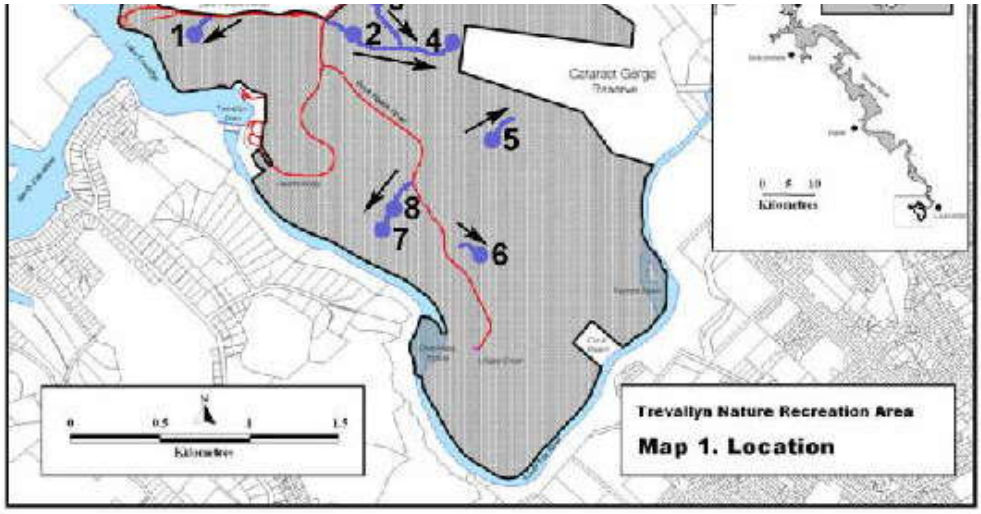
Table 1 lists the ponds studied and their chytrid status at the time of the survey work (December 2004) along with other observations obtained since then (up until April 2008).

Table 1: Summary of Observations

Name of Pond#	Chytrid status Dec 2004	Ponds have dried up since surveying?	Unusual events
1 - Aquatic Point	unknown*	No	No
2 - Pobblebonk	positive	No	Yes, several
3 - Archery	positive	Yes	No
4 - Reedy Gully	unknown*	No	Yes
5 - Snake Gully	positive	Yes	No
6 - Horse paddock	negative	No	No
7 - South Esk	negative	Yes	Yes
8 - Satellite South Esk	unknown*	Yes	Yes

the pond names are my own used for ease of identification
*Status unknown because tadpoles were not present at the time of the survey work





Map of site

(based on TNRA Draft Management Plan 2006, Parks and Wildlife Service)
Arrows indicate drainage flow

There are currently six species of frogs in the Reserve namely, *Litoria ewingii, Lymnodynastes dumerilii, Crinia signifera, Geocrinia laevis, Pseudophryne semimarmorata* and recorded for the first time in 2007, *Crinia tasmaniensis*. Table 2 shows which species have been found associated with each pond.

Table 2:Frog species found in TNRA

Pond	Species present	Species confirmed as breeding in ponds
Aquatic Point	*Litoria ewingii, Crinia signifera#*	*L.ewingii*
Pobblebonk	*L. ewingii, C. signifera Lymnodynastes dumerilii*	*L ewingii, L. dumerilii*
Archery	*L.ewingii, L.dumerilii, Geocrinia laevis, C. signifera*	all
Reedy Gully	*L. ewingii, C. signifera, C. tasmaniensis, G. laevis*	*L. ewingii**
Snake Gully	*L. ewingii, L.dumerilii, C.signifera*	all
Horse paddock	*L ewingii, C. signifera*	*L. ewingii*
South Esk	*L.ewingii, C. signifera, L. dumerilii, G. laevis, Pseudophryne semimarmorata*	all but *P. semimarmorata* (suspected but not confirmed)
South Esk Satellite	*L.ewingii, C. signifera*	all

#It is my observation that C. signifera will preferentially breed in temporary pools, pond overflows and soaks associated with the ponds rather than ponds proper
*No tadpoles of any species seen over the study period until Jan 2008 when one L. ewingii tadpole was seen.

DISCUSSION

Unfortunately, the last two years in Launceston have witnessed very dry conditions which have complicated the picture considerably by causing unseasonal drying of ponds and interrupting the normal breeding cycle of some of the frog species. However, it is known that *Bd* is an opportunistic pathogen that is more likely to impact on frog populations that are under stress (New Scientist, 2004). This discussion will be limited to those ponds

that were tested for chytrid and/or those that revealed some interesting findings.

Pobblebonk Pond

This pond is situated in close proximity to Duck Reach and Reatta Roads (both sealed) and the start of a major walking track. It is situated adjacent to a steep hill, is a deep pond (fringed in *Typha* only), frequently shaded and has yet to dry out. I have been unable to ascertain its water source, as it seems to be permanent but it is possible that it is maintained by a spring at the base of the steep hill (in the absence of precipitation and run-off). Because of its permanent nature, overwintering tadpoles are commonly found and it is a pond where *L. dumerilii* (pobblebonks) are frequently heard calling. It also appears to be a pond in trouble in the TRNA as it has been suffering from high turbidity and recently algal blooms during summer/autumn. In August 2006, several sick and dying *L. dumerilii* tadpoles were found in this pond. An investigation of a dead tadpole revealed no obvious signs of disease or starvation but it presented with oral disc depigmentation – a sign of chytrid infection. Fellers et al (2001) reasoned that oral chytridiomycosis was the only cause of abnormal oral discs in tadpoles (in the absence of other abnormalities). At the same time, a noticeable decline in overwintering tadpoles became evident. It is known that *Bd* is more active in colder weather rather than warmer (Anon, 2006). A few *L. dumerilii* were heard calling from this pond at Christmas 2006, but no spawn or tadpoles was seen.

In the following year (August 2007), a small amount of *L. ewingii* spawn was evident but in September 2007 a large spawning event of *L. ewingii* resulted in the mass failure of the eggs to produce tadpoles. I have previously observed some individual egg masses (especially early in the breeding season of this species) to contain some eggs that fail to develop, however, in this case all the spawn (representing about 30-40 individual egg masses each containing approximately 15-30 eggs) produced only 1-2 tadpoles per mass. *Bd* is not known to infect spawn (as it infects keratin tissues associated with metamorphosing tadpoles) so it is unclear what caused this event. It is possible that some sort of contaminant got into the water body that prevented the development of nearly all the fertilised eggs. However, of interest the *L. ewingii* successfully bred in November 2007 but their tadpoles appeared to be in poor condition during that summer. A few *L. dumerilii* called again at Christmas time and continued to call through to February 2008 however, no spawn has been evident nor tadpoles. In December 2004, there were enough *L. dumerilii* tadpoles to survey for *Bd* infection in this pond, but since August 2006 there hasn't been any seen in this water body.

Archery Pond

The Archery Pond is also a stronghold of *L. dumerilii* and is found in close proximity to the Pobblebonk Pond. It too was found to be chytrid positive however it is a shallower pond that doesn't receive run-off from roads and has dried out in March 2007 and 2008. Conversely in those years when the pond didn't dry up (in autumn 2005 and 2006) overwintering tadpoles were evident. It has been suggested that the chytrid fungus is curtailed somewhat in ephemeral water bodies and of course, being shallower they are likely to warm up more quickly during summer, thus suppressing the activities of *Bd* (Anon, 2006). Despite its positive chytrid status, frogs have successfully bred in this pond and even with the severe drought event of 2006/07 all species bred again the moment rain returned and started to fill the pond at the end of March 2007. *Geocrinia laevis* tadpoles successfully overwintered in this pond last year. By very early September 2007, the *L. dumerilii* had bred again (spawn observed) and hatchlings became evident from November 2007

through until February 2008. Unfortunately, the pond dried out before any of these tadpoles could metamorphose. Unlike other species such as *L. ewingii* and *C. signifera* that seem to respond to changing environmental conditions rapidly, it is my observation that *L. dumerilii* tadpoles don't seem to be able to speed up their development in response to declining water level and/or temperature rise. This may have something to do with their preference for inhabiting the bottom of ponds.

Reedy Gully Pond

This deep, permanent steep-sided pond in a sheltered gully is an enigma for although frogs call from its vicinity, I have never seen any tadpoles in it until January 2008 when a lone *L. ewingii* was spotted. This pond is downstream of both the Archery and Pobblebonk ponds and therefore is probably chytrid positive as well.

Snake Gully

This pond tested positive for chytrid but has dried out in March 2007 and again in April 2008. It is like the Archery pond being shallow but larger in size and similarly, all frog species present have previously bred well producing an abundance of tadpoles. However, in Spring 2006 the *L. dumerilii* although calling did not produce spawn nor were their tadpoles seen (this was at the height of the El Nino drought). The pond dried out in Autumn 2007 but on refilling that winter/spring the pobblebonks still didn't seem to respond well until a heavy rainfall event in late December 2007. This cohort of tadpoles has succumbed to the drying out of the pond in April 2008 and so this species has failed to reproduce successfully for 2 consecutive years.

Horse paddock

This pond is small and quite deep. Interestingly it is chytrid free probably due to the fact it is artificially maintained by tap water and it is isolated from the other ponds. Intriguingly, no pobblebonks have been heard calling from this pond.

South Esk pond and its satellite pond

This pond exists on the other side of the road in a different catchment from the other water bodies and receives run-off from Duck Reach Rd via an upstream pond (satellite) when it overflows. At the time of surveying this water body was chytrid free and in the months subsequent it appeared to sustain perhaps the most robust and diverse population of frogs in the Reserve. However, in early spring 2006 an obvious and sudden reduction in overwintering *L. dumerilii* tadpoles occurred not unlike the event in the Pobblebonk pond. Similarly, dead *L. dumerilii* tadpoles presented with jaw sheath depigmentation. There was no evidence for *L. dumerilii* breeding that year (no calling, no spawn and no tadpoles of this species). The pond dried up in January 2007 but on filling in May 2007 was filled with many different cohorts of tadpoles from all species except *L. dumerilii*. One lone pobblebonk was heard calling on the last day of September and spawn appeared in mid-November 2007 but the water level was dropping rapidly and the pond dried up in January 2008 and hasn't refilled yet.

CONCLUSION

It is impossible to make any definitive conclusions regarding these results based on just over three years of observation. Other factors such as the extended drought

Litoria ewingi

may be at play here and could have interrupted the reproductive cycle of the pobblebonk. However, of interest it appears that other species such as *L. ewingii*, *C.signifera* and *G. laevis* don't seem to have been greatly impacted by the extended dry, as going by the number of calling frogs, there are healthy populations of these species in the TRNA. But the event at the South Esk pond is suspicious and is reminiscent of the way chytrid causes a wave of mortality (in susceptible species) when it first appears in a previously uninfected population. It is also possible that environmental drying may be causing crowding of amphibians at water bodies thus leading to increased rates of transmission (Daszak, 2005). This may be relevant because the ubiquitous *L. ewingii* is suspected of carrying aclinical infections of *Bd*. Time and further observations may or may not reveal the true picture.

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Back to top

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