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Report to Department of Conservation and Land Management:
Spicospina flammocaerulea, January 18, 2000

Natural Heritage Trust Project 983165.

Project Title: Sunset Frog Recovery Plan (preparation)

Aims

During 1998 - 1999, funding was received from the National Heritage Trust, for population studies on the sunset frog, *Spicospina flammocaerulea*, with a view to generating data to decide conservation status and work towards developing a recovery plan for this species.

Field work was conducted in the spring of 1998 with some additional work in spring 1999. Work was curtailed in 1999 as funding was not guaranteed until late in 1999. Further work will be conducted in 2000 now that funding is assured.

Field work in 1998 - 99 had five aims

- 1) to investigate the population biology of four of the 13 known populations with the aim of estimating the population size of these populations. This involved the trial of two capture methods to be used in mark-release-recapture population estimates: namely pitfall trapping and hand capture of calling males.
- 2) to undertake counts of calling males and determine their value as an indicator of population size.
- 3) to trial low time and cost investment methods for capturing *Spicospina* tadpoles.
- 4) to investigate the use of playback of pre-recorded *Spicospina* calls in stimulating calling activity.
- 5) to develop and deploy automated cassette recorder to determine the annual pattern of calling activity

Methods

The 1998 field program involved a total of four weeks of field work: two weeks from November 8th to November 22nd and two weeks from December 1st to December 13th.

Experimental studies were only undertaken on four of the 13 populations, in order to minimise impact on other sites. Studies were done on a rotational basis with 2 of the 4 sites being censused for calling males and trapped for tadpoles, whilst the other 2 sites were pit-trapped. After 5 days, this was then switched. This minimised disturbance and impact on frogs by allowing them time to recover between visits, rather than being subjected to intensive activity for the duration of the study.

Study sites examined were Boronia Road 1, Boronia Road 2, Nornalup Road and Mountain Road (Site details in Table 1).

To obtain information on the physical environment, 5 data loggers were placed in the study sites for the duration of the project. These measured air and water temperature. In addition, a complete set of precipitation records was obtained from the Department of Conservation and Land Management for Walpole.

1. Mark-release-recapture studies

Two methods were used to capture frogs to assess population density by mark-release-recapture methods: pitfall trapping and capture of calling males.

1.1 Pitfall Trapping

Pitfall trapping involved the use of approximately 20 cm lengths of 15 cm diameter PVC pipe. Traps were placed flush with the soil surface in the swamps at each study site. Each of the four study sites had four lines of 6 traps, for a total of 24 traps per site. Trap lines were spaced approximately 20 m apart in four lines of 6 traps. Trap lines were placed in or near areas known to previously contain calling males. These were usually near water seeps or large semi-permanent pools.

Pitfall traps were opened on a rotational basis for 5 nights at two of the four sites. During non-trapping periods, pitfalls were closed with a tight-fitting lid. Pitfall traps were checked and cleared each morning, before 7 AM.

At each site, pits had one of four surface treatments: a pitfall trap flush with the surface, a pitfall trap with a funnel, a pitfall trap with a drift fence, and a pitfall trap with both a drift fence and a funnel. Drift fences were fly-screen wire mesh cut into 50 cm lengths, about 30 cm high with three lengths radiating from the trap entrance. The variation in surface topology and the density of vegetation precluded installation of conventional drift fences connecting all traps at most locations.

Frogs captured in pitfall traps were placed into plastic screw-top jars along with moistened paper towelling and held overnight for processing.

Captured frogs were weighed, and right tibia length and snout-vent length were measured. After measuring, a single toe was removed from each individual: the second toe for frogs captured in November, the third toe for frogs captured in December. Toes were placed in liquid nitrogen for use in genetic studies and skeletochronology. Frogs were marked with a unique number (continuous within each site) by freeze branding. A photograph of the ventral pattern of each captured frog was also taken to aid identification of re-captured individuals.

After processing, frogs were returned to the site of capture and released at dusk or at night. No animals were released during the day, to reduce the chance of desiccation.

1.2 Capture of calling males

Calling males, non-callers and females were captured by hand at night. Each site was censused for consecutive 5 nights to count the number of calling males. Calling frogs were triangulated and hand captured. A large number of non-calling males, females and amplexing pairs were also seen and captured.

The site of capture of each frog was marked with a reflective tag, numbered with the individual number of the frog. Frogs were then returned to the exact site of capture the following night, after processing.

Frogs captured in this fashion were processed in the same way as frogs captured in pitfall traps.

2. Counts of calling males

All four study sites were censused for calling males during each of the November and December field trips. As previously described, two sites were censused for five days, and then the other two sites were censused for five days.

Counts of calling males occurred after dark or on dusk. This involved listening in complete silence, for a minimum of 20 minutes, at each census site. During this time, the number of calling frogs was recorded. In addition to the experimental sites, all of the other populations were censused at least once during the field program in 1998 and again in 1999

3. Tadpole trapping

Tadpole trapping was undertaken at all of the study sites, on the rotational basis described above. Tadpole traps were constructed from 500 ml PET drink bottles using the design in Richter (1995, Herpetological Review 26, 90-91).

These traps were checked daily and any captured tadpoles removed and identified. A small number of individuals of each species were preserved as voucher specimens. All other tadpoles were released immediately at their site of capture after identification.

We also hand netted pools known to contain *Spicospina* populations for 30 second sweeps to capture tadpoles.

4. Playback experiments

A continuous play tape recording of a *Spicospina* chorus was played at all four study sites in order to gauge the response of calling males. A portable amplifier and cassette recorder were connected to speakers and the recorded *Spicospina* chorus was played for different lengths of time. Playback was undertaken for 5, 10 and 30 seconds and then as a series of short (approximately 1 second) bursts. Each time period was replicated and 30 seconds was allowed to elapse after each playback in order to record the response of calling males. The response of calling males was documented in terms of the number of frogs responding and the number of calls.

5. Automatic cassette recorders - call activity logging.

Mike Smith, Ph D student, Department of Zoology and I have developed a system for remote recording of calling activity with a programmable interface to allow selection of different time intervals over a 24 hour period. Five call boxes were constructed and were deployed at Trent Road 1 and 2, Boronia Road 2 and 3 and at a fifth site on Middle Road which appears suitable for *Spicospina* but frogs have not been heard calling there.

CALM volunteers from Walpole are currently changing cassettes and replacing and recharging batteries. We have tapes from throughout December 1999 and plan to continue this program over a 12 month period. Using standard meteorological data from Walpole or Rocky Gully plus phase of the moon, the data on calling activity can be used to generate a predictive model for assessing occurrence of this species by surveying for calling males or putting out further call boxes.

Results

1. Mark-release-recapture studies

1.1 Pitfall Trapping

In total, 13 individuals were captured in pitfall traps, 7 at Mountain Road, 3 at Boronia Road 1, 2 at Boronia Rd 2 and 1 at Nornalup Road. There were no recaptures. Five frogs were caught in traps with funnels, 7 in traps with drift fences, 1 in a trap with both and only 2 frogs were caught in traps with neither drift fences nor funnels.

1.2 Capture of calling males

38 individuals were hand-captured in breeding choruses. Of these, 16 were from Trent Road 2 (not one of the major the study sites), 9 at Mountain Road and 12 at Boronia Road 2. A single frog was hand captured at Boronia Road 1 crossing the road but this frog was not part of a chorus. No frogs were heard or captured at Mountain Road, during the December trip. However, 2 new captures were made at Boronia Road 2. There were no recaptures at Mountain Road, but there were 11 recaptures of 6 individuals at Boronia Road. Frogs moved a mean distance of xx cm ($n = 11$, SE xx) between recaptures.

The Boronia Rd 2 data were used to estimate population size using a Petersen estimate with November treated as the first mark, December as the recapture period: population size of 21 (SE 6.1, population estimate and error term corrected for small sample size as in Heyer et al. 1994).

2. Counts of calling males

The results of counts of calling males can be seen in Table 2. Of the four study sites, Boronia Road 2 was the most consistently active. There was never any night during which no calling was recorded. Counts, however, did fluctuate between one and 10 males but 3 or 4 males were heard on 8 of the 11 nights surveyed. Boronia Road 1 was consistently inactive, with no frogs ever heard except during two nights after rain (18/11/98 and 19/11/98). One individual was heard on each of these nights, but was not present in the study area to the south of Boronia Road. It was heard calling just north of the road. Nornalup Road had no calling frogs. Mountain Road was active during the November field trip, climbing from 2 to 4 frogs during the first week of censusing but had no frogs calling during the December trip.

Counts were also conducted for all other known populations, at least once (Table 3). Trent Road 1 (previously the largest known population) had approximately 10 frogs calling during the early evening and morning, but no frogs were heard calling at all during subsequent night censuses. Trent Road 2 was accurately counted over a number of nights, and numbers fluctuated from 5 during early November, to a peak of 27 on November 18th.

No calling males were recorded at any other site, except for 3 individuals at Rose Road in November, and 3 individuals at Hazelvale Road 1, also in November.

At Boronia Road 2, Mountain Road and Trent Rd 2, removal of calling males resulted in a new set of callers detected the next evening before the previous nights captures had been released. At Trent Rd 2 particularly there were often non-calling males present in the chorus. These two observations coupled with the variation between nights observed at most sites indicates counts of calling males are not a reliable index of population size.

At Boronia Road #1 males only called after rain (Table 2).

Calling males were counted again in late September and early November 1999. The number of males calling at Tent Rd 1 was high, comparable to numbers observed in 1997, but no frogs were heard at Mountain Road, Nornalup Road, Boronia Rd #1 or Hazelvale Road 2 (Table 3).

Detailed site data were collected for Hazelvale Road 1 and for the Rose Road site. The former site had two calling males, the latter had frogs spread over the valley bottom, including males calling in flooded hollows in cattle pasture and in a small chorus about 3- 500 m north east of the site where GPS data were collected. Trent Road 2 was deliberately burnt in October and the number of frogs calling at that site was high in

early November (Table 3) and early (Smith pers. comm.) and late in December (Berry pers. comm.).

Details of updated site locations are given in Table 1. Peak numbers of males by year are given in Table 3 for all sites.

3. Tadpole trapping

The results of tadpole trapping can be seen in Table 4. Tadpoles of *Crinia glauerti* were caught at all of the four study sites and in addition, at Trent Road 2, Trent Road 1 and Boronia Road 3. *Crinia georgiana* tadpoles were only caught at Boronia Road 3. No *Spicospina* tadpoles were captured at any of the sites surveyed. Traps were placed at sites where amplexing pairs were observed, including Trent Road 2 and Boronia Road 2 in the assumption that breeding was occurring.

Netting was also trialed at Boronia Road 2 and Trent Road 2 (presumed breeding sites, both with amplexing pairs). However, due to the prolific growth of dense green algal mats, netting resulted in no captures. Nets were rapidly clogged with green algae and sediment, making it almost impossible to use this technique for capturing tadpoles.

4. Playback experiments

Playbacks were conducted at the four main study sites and at Trent Road 2. Playbacks did not induce any response at sites where male had not been heard calling (Nornalup Rd and Boronia Road 1). At Mountain Road and Boronia rd 2, any playbacks induce calling but responses were stronger to short durations (1- 30 seconds) or individual calls rather than continuous chorusing. Playbacks of a continuous chorus at Tent Rd 2 may have inhibited calling.

Call playbacks are not a useful tool for assessing occurrence of this species.

5. Automatic cassette recorders - call activity logging.

Tapes have been collected from early December 1999. The systems are working but tapes have not been analysed.

6. Fire impacts

Trent Road 2 was deliberately burnt by the landowner late in October 1999. We have no pre fire counts but do have data from 1998 for this site (Table 5). The impression is that the number of calling males and frog activity was generally much higher at this site post fire than in 1998. In 1998 frogs were concentrated about a single deep pool at the northern end of the swamp. After fire there were frogs calling this pool but also over the flat area below the pool to the south and out to the eastern margin of the swamp - most of the swamp area.

This mirrors the situation at Mountain Road in 1994 where there few calling males pre fire but a booming chorus that continued into early December post fire.

Boronia Road 3 is scheduled for a fuel reduction burn in spring 2000. This is one of the five call monitoring sites. Data on calling activity pre- and post-fire should allow an assessment of the impact of fire on calling activity of this species. Although not the ideal design, there are no replicates and data are from different years, these data can be compared with changes at other monitored, unburnt sites and the data from Mountain Road and Trent Road 2. The three site data set might allow an inference that fire induces increased levels of calling and breeding activity.

The fate of populations post fire is still not clear. Two sites burnt heavily in 1994, Mountain Road and Nornalup Road both had no or few frogs calling in 1998 and 1999. Analyses of fire history indicate these populations have survived previous fuel reduction burns and wild fires (Roberts et al 1999).

Summary.

1. Counts of calling males are an unreliable index of population size. Maximum counts, if taken over repeated nights, may give a better index of size but may still radically underestimate true population size.
2. Population estimates based on recaptures of calling males suggest adult population sizes are 4.2 times the maximum number of calling males assuming all captures were males and adult sex ratio that is 1:1.
3. The fluctuations in numbers of calling males at Trent Road 1 and 2 between years suggest that local environmental factors may influence patterns of calling activity. It is not clear what these are but with temperature and rainfall data collected at sites in 1998 we plan to make some preliminary analyses. The total rainfall or seasonal distribution of rain events may both be contributing factors but this may interact with ground water levels in turn affected by burning.
4. Fire seems to induce high levels of calling and breeding activity possibly through opening sites up generating higher water temperatures or because ground water levels rise making more calling sites available.
5. Tadpole trapping, which had the potential to be a quick, low cost and reliable technique for assessing occurrence is of no value. Tadpole netting is also useless because most sites have very dense algal growth which rapidly clogs nets.
6. It is not clear why numbers of calling males decline post fire but this may be related to vegetation regrowth.
7. Two specimens examined by Ken Aplin, W A Museum, had no evidence of chytrid fungus infection. These are from the *Spicospina* type series which were all collected in 1994 from Mountain Road.
8. Although particular sites may show pattern of apparent decline in population size, there is not clear pattern emerging of a species wide decline in population size (Table 3). Variations between years may be related to rainfall totals or distributions. Rain fell late in 1998 either meaning a bad year for calling or possibly that our field effort should have been later.

Future work:- 2000

1. Call monitoring will be continued throughout 2000.
2. Early capture of this species were from burrows or active on the surface in 1994. In early February 2000 I plan to re-open existing pit lines and trial two other pit regimes:
 - 1) high densities of small plastic pits (15 - 20 cm deep)
 - 2) sloping pipes resembling crustacean burrows

I hope that pit trapping at this time will be more successful than in spring when most pits had problems with water seepage and filling or overflowing with water though they still caught some frogs

References.

- Heyer, W. R. et al. (eds) 1994. Measuring and monitoring biological diversity: standard methods for amphibians. Smithsonian Institution Press, Washington.
- Richter, K. O. 1995. A simple aquatic funnel trap and its application to wetland amphibian monitoring. *Herpetological Review* 26, 90-91.
- Roberts, J. D., Conroy, S. & Williams, K. 1999. Conservation status of frogs in Western Australia. Pp. 177-184, *in*, A. Campbell (ed.), *Declines and Disappearances of Australian Frogs*. Environment Australia, Canberra.

Table 1. Updated site details for all known *Spicospina* populations.

Site	Location (by road)	Loc. No./ Block	Location of Frogs	GPS data
Boronia Road 1	1.1 km W of Middle Road	London/Soho	north and south of road	34 49 06 S 116 55 19 E*
Boronia Road 2	2.3 km W of Middle Road	London	300 m north of road	34 49 04 S 116 54 34 E*
Boronia Road 3	0.2 km E of Middle Road	Thames	200 m south	50494210 E 6146737 N
Collis Road 1	2.5 km S of Boronia Road	Collis	approx. 300 m east of road	34 50 37 S 116 48 51 E*
Collis Road 2	0.8 km N of Kangaroo Road	Collis	300 m west, north west	50481861 E 61 42841 N
Hazelvale Road 1	Dam just NW of Tingledale BB turn off.	2243	east of road on dam apex	50486665 E 6134625 N
Hazelvale Road 2	6.35 km N of Valley of Giants Rd	1261	west on creek line	uncertain of exact site
Middle Road 1	1.4 km S of Boronia Road	Soho	300 m west of road	34 50 03 S 116 55 51 E*
Mountain Road	4.9 km W of Normalup Road	Surprise/London	north and south of road	50495924 E 6151453 N
Normalup Road	3.5 km N of Mountain Road	Surprise/Willmott	east side of road only	50498807 E 6154437 N
Rose Road	0.7 km S Trent Road,	2310	500 m west across paddock	50492040 E 61333457 N
Trent Road 1	0.5 km W of Middle Road	1677	100 m south of road	50494708 E 61333666 N
Trent Road 2	0.1 km S corner of Middle and Trent Roads	2692	300 m east, across paddock	50495297 E 61333845 N

Table 2. Variation between nights in number of calling male counts for five study sites in 1998.

Date	Bor. Rd #1	Bor. Rd #2	Mtn Rd	Norn. Rd	Trent Rd #2
8/11/98	0			0	5
9/11/98			2	0	
10/11/98			3	0	
11/11/98			3	0	
12/11/98			4	0	
13/11/98			4	0	
14/11/98			4	0	
15/11/98	0	10*			
16/11/98	0	3			
17/11/98	0	3			15*
18/11/98	1 [#]	4			27
19/11/98	1 [#]	4	0		4 [^]
20/11/98	0	4			4 [^]
2/12/98	0	4			
3/12/98	0	1			18
4/12/98	0	3			21 ^a
5/12/98	0	1			
6/12/98	0	3			
7/12/98			0	0	17
8/12/98			0	0	13 ^a
9/12/98			0	0	17 ^a
10/12/98			0	0	13
11/12/98			0	0	15

^a amplexing pair(s) observed

*estimated population size

[^]census occurred before dark ie. early evening

[#]calling males on north side of the road

Table 3. Maximum counts by year of calling males for all known populations of *Spicospina*. Mountain Road and Boronia Road 1 are split into northern and southern populations because of differences in fire management history.

	1994	1996	1997	1998	1999
Boronia Road 1 north	2	3	0	1	0
Boronia Road 1 south	0	0	2	0	0
Boronia Road 2	-	-	3	10	13
Boronia Road 3	-	-	2	0	2
Collis Road 1	-	10*	8	0	3
Collis Road 2	-	-	5	0	2
Hazelvale Road 1	-	-	8*	3	3
Hazelvale Road 2	-	-	10*	3	0
Middle Road	2	0	2	0	0
Mountain Road north	60	11	2	4	0
Mountain Road south	60*	10*	0	0	0
Normalup Road	-	-	3	0	0
Rose Road	-	-	4	3	20
Trent Road 1	-	-	150*	10	150*
Trent Road 2	-	-	3	21	30
Minimum total population size			202	55	223
Estimated total population **			848	231	937

* estimated number. For Trent Rd #1 numbers were too high to count accurately in 1997 and 1999.

** based on relationships between number of calling males and mark-release-recapture estimate for Boronia Road #2

Table 4. Tadpole captures and trapping effort for four study sites in 1998.
No tadpoles of *Spicospina* were trapped.

Site	Date	<i>C. glauerti</i>	<i>C. georgiana</i>	No. Traps
Boronia Rd #1	16/11/98	3	0	20
Boronia Rd #1	21/11/98	2	0	20
Boronia Rd #1	3/12/98	1	0	20
Boronia Rd #1	7/12/98	2	0	20
Boronia Rd #2	5/12/98	1	0	20
Boronia Rd #3	17/11/98	7	9	10
Boronia Rd #3	17/11/98	2	4	10
Trent Rd #1	20/11/98	1	0	10
Trent Rd #2	19/11/98	7	0	10
Trent Rd #2	20/11/98	8	0	10
Trent Rd #2	13/12/98	2	0	10
Normalup Rd	15/11/98	12	0	20
Normalup Rd	9/12/98	5	0	20
Mountain Rd	14/11/98	16	0	20