A Preliminary Assessment of the Fowler's Toad (*Bufo fowleri)* Population in Rondeau Provincial Park

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Abstract

*Although Rondeau Provincial Park protects one of only three viable populations of Fowler's toads (*Bufo fowleri) *(status: Threatened) remaining in Canada, there had never been a quantitative assessment of the park's population. In 2004 a mark/recapture study was conducted which resulted in a population estimate of between 459 and 663 toads. Toads were found along the entire beach (~12km) although population densities varied. Surprisingly, the main public beach showed a population density similar to the park average, despite intense day-use pressure. A distinct lack of juveniles was noted in the northern half of the park suggesting that reproduction was not occurring in those areas; this is almost certainly due to the lack of suitable breeding ponds in those areas. A number of research and management recommendations are suggested including ongoing mark/recapture studies, radio telemetry, a continued ban on mechanized beach cleaning, and the development of experimental breeding ponds.*

Keywords: *assessment, species at risk, Fowler's Toad*

Introduction

The Fowler's toad (*Bufo fowleri*) has a very limited distribution within Canada. Its range is widespread throughout the eastern United States but in Canada it is restricted to the north shore of Lake Erie. Although historically found in a number of locations along the north shore, viable populations are currently found only at Rondeau Provincial Park and adjacent Erieau, Long Point, and a number of sites along the Niagara Peninsula (Green, 1999; Green *et al.,* 2005).

The Fowler's toad is currently listed as "*Threatened"* by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and the Ministry of Natural Resources, and has been given a provincial rating of *S2* (very rare) by the Natural Heritage Information Centre (NHIC) (COSEWIC, 2000; Oldham, 2003; NHIC, 2005a). This assessment is based on a population viability analysis which showed an extinction probability of 20% in 100 years (Green, 1999; Green and Smith 2000). A recovery team has been established for the Fowler's Toad, and a National Recovery Strategy is being prepared (Green *et al.,* 2005).

Fowler's toads occupy beach and sparsely vegetated dune habitats during the summer. During the day they burrow in sand or hide under driftwood or other debris (Green, 1989). Shortly after dusk they emerge from the sand and move down the beach to the surf line to feed and re-hydrate (Green, et al 2005). Since toads spend most of their time on or buried in the sand along the open beach, they are highly sensitive to mechanical beach cleaning (Green *et al.,* 2005).

Rondeau Provincial Park is located on a peninsula situated on the north shore of Lake Erie, approximately 40 km southeast of Chatham. The peninsula is an asymmetrical, triangular shaped cuspate sandspit, composed of two sandbars that converge to create the "cusp" which points away from the shoreline (Figure 1). There are approximately 12 km of beach habitat in the park, located along the entire outside edge (south and east) of the peninsula (Dobbyn and Pasma, in prep).

The NHIC's element occurrence data base lists 56 records of toad occurrences within the park, but there have been numerous other sightings (NHIC, 2005b; Dobbyn, 2005). Despite the numerous observations, there has never been a quantitative assessment of the toad population at Rondeau and the recovery team has identified population assessments at Rondeau and adjacent areas as a high priority (Green *et al.,* 2005). In response to that recommendation, field work was initiated in 2004 as part of a multi-year project to assess the toad population in and adjacent to the park (Dobbyn, 2005). This paper summarizes the findings of the first year of the project with respect to the distribution of toads within the park and the implications of those findings.

Methods

Surveys were conducted at night and the beach was searched with flashlights from the waters edge up to the edge of the vegetated dune. When a toad was captured the location was determined by GPS (Garmin GPS 12) and the

UTM coordinates were recorded (NAD 83). Captures were also assigned to specific survey zones in the park for purposes of analysis, the boundaries of which were assigned based on a variety of natural and anthropogenic characteristics (Figure 1, Table 1).

Figure 1. Rondeau Provincial Park and Fowler's toad survey zones.

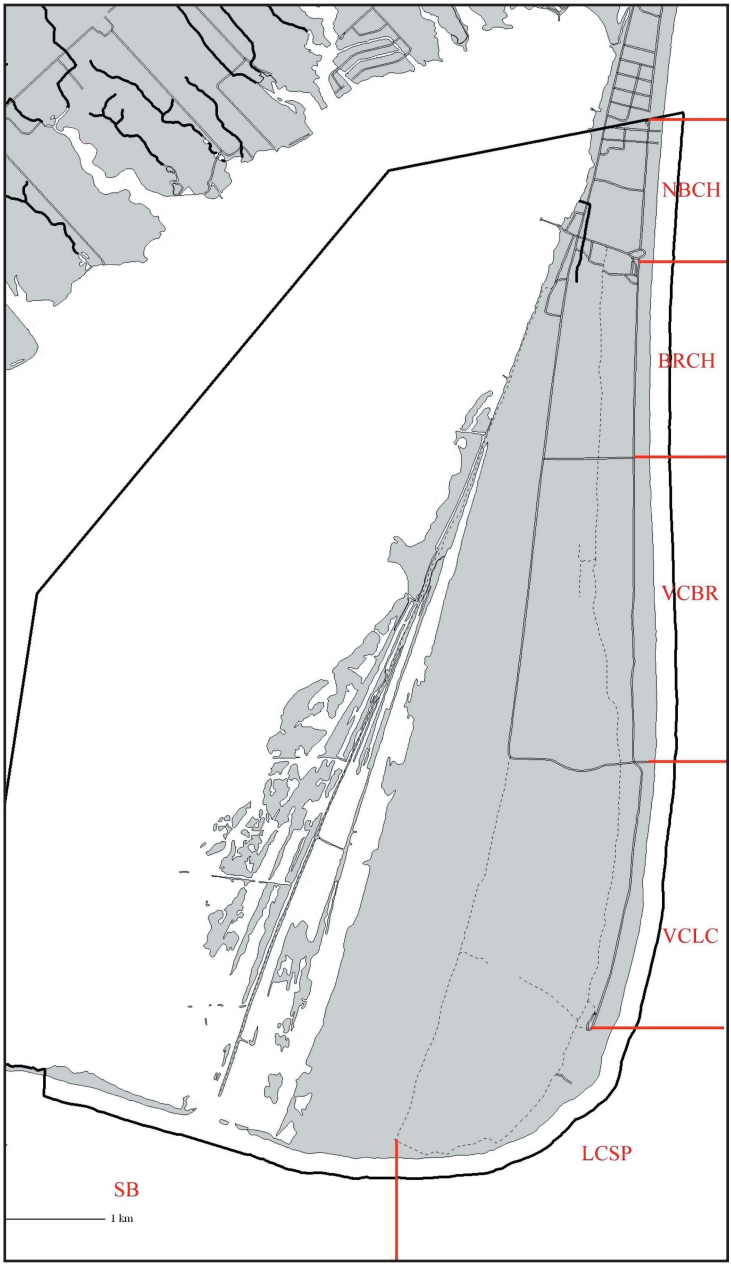


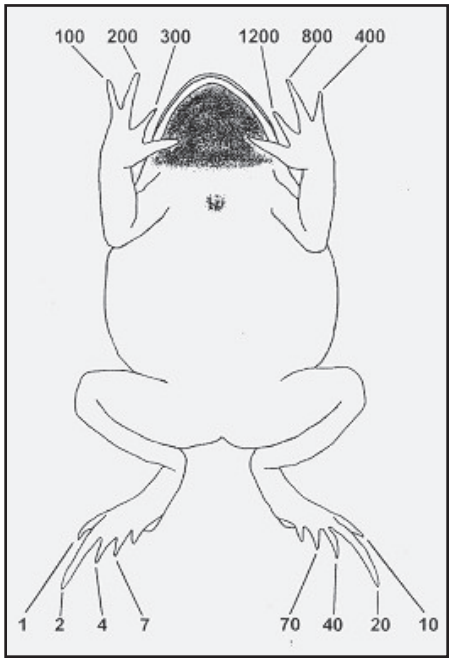
Table 1. Survey Zone codes, length, and description.

Survey Zone	Length of Zone (km)	Description
NBCH	0.9	North Park Boundary south to the Children's Hut
BRCH	1.5	Children's Hut south to Bennett Avenue
VCBR	2.3	Bennett Avenue south to the Visitor Centre at Gardiner Rd.
VCLC	2.1	Visitor Centre (Gardiner Road) south to the last cottage
LCSP	2.0	Last cottage south and west to the end of South Point Trail
SB	3.3	The south barrier beach
Total	**12.1**	

The snout-vent length (SVL) was measured using a pair of vernier calipers and the sex and age determined (Dobbyn, 2005). The distance from the waters edge and the beach substrate where the toad was first observed were also recorded. Beach substrate refers to the coarseness of the beach material and was categorized as sand, pebbles, or gravel.

First-time captures were marked by clipping individual toes in a unique pattern using surgical scissors. Our methods generally followed those described by Green (1992; 1997). Each of the toes on a toad is assigned a numerical value which allows individual "numbering" of every toad by removing a unique pattern of toes. No more than two toes on any one foot were removed and the thumbs (innermost toes) were never cut. Only half of the long second toe on each hind foot was removed. Figure 2 illustrates the value of each toe used in the scheme.

Figure 2. The numerical value for each toe that could be removed as part of the numbering scheme for identifying individual toads upon recapture.



Recaptured toads were not remarked, but the toad number was determined and recorded. All measurements were taken and recorded as with the original captures.

All capture data were mapped and the distance between original captures and recaptures was determined using ArcMap. Population estimates and variances were calculated using the Chapman modification of the Lincoln-Petersen index (Wilson *et al.,* 1996).

Results

Original Captures

Rondeau's entire beach shoreline was surveyed three times between July 30 and August 30, 2004. A total of 311 Fowler's toads were captured and marked, of which 52% were females, 25% were males, and 23% were juveniles. Table 2 summarizes the number of toads caught by survey zone, sex and age. Figure 3 shows the location of all captures in the park.

The highest capture rate (54.8 toads/km) occurred in the survey zone that extended from the Visitor Centre south to the last cottage, followed by the zone from the Visitor Centre north to Bennett Avenue (26.5 toads/km). This was contrary to what we assumed to be the area of highest toad concentration in the park: the south barrier beach, which attained the third highest capture rate (24.9 toads/km). The most northern survey zone, which contains the main public beach, experienced a similar capture rate (23.3 toads/

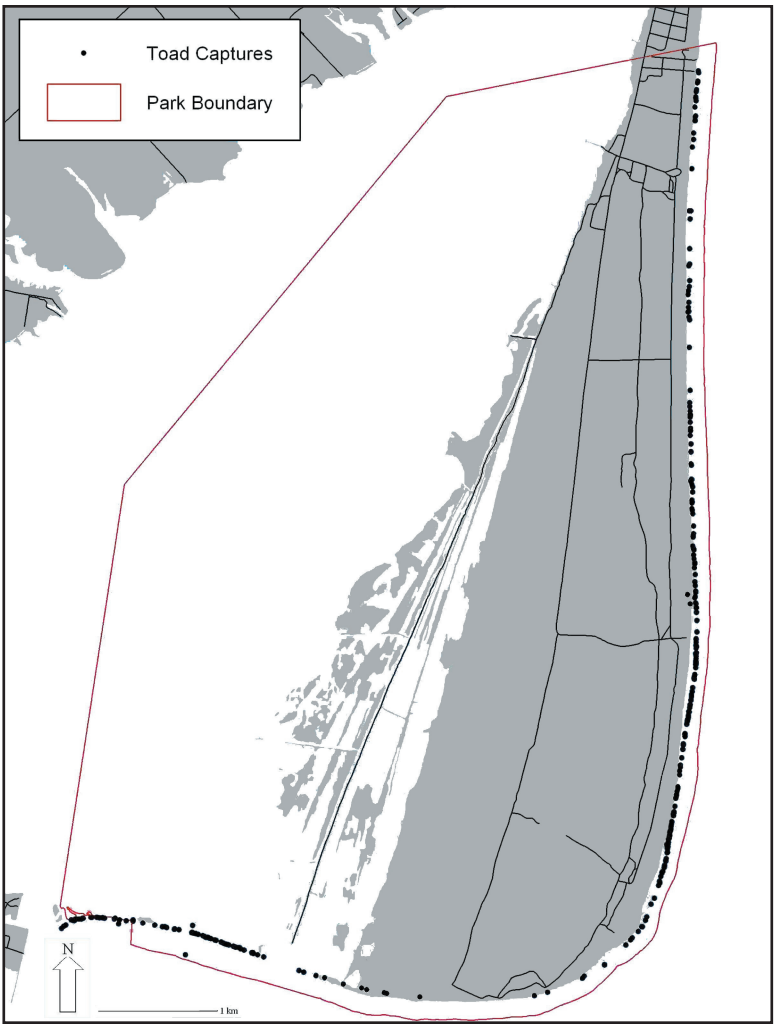
Table 2. Number of captures and percent of capture by sex and survey zone.

Survey Zone	Length of Zone (km)	# Captures	% of Total Capture	Captures/Km	%Female	%Male	%Juvenile	#Females/Male Captured
NBCH	0.9	21	6.8%	23.3	61.9%	38.1%	0.0%	1.6
BRCH	1.5	17	5.5%	11.3	94.1%	5.9%	0.0%	16.0
VCBR	2.3	61	19.6%	26.5	75.4%	19.7%	4.9%	3.8
VCLC	2.1	115	37.0%	54.8	60.0%	27.0%	13.0%	2.2
LCSP	2.0	16	5.1%	8.0	31.3%	43.8%	25.0%	0.6
SB	3.3	81	26.0%	24.9	17.3%	23.5%	59.3%	0.7
Total	12.1	311		25.7	52.1%	25.1%	22.8%	2.1

km) to the south barrier beach and the beach north of the Visitor Centre as well as to the average for the park as a whole (25.7). The remaining two survey zones (Children's Hut to Bennett Avenue and last cottage to South Point) experienced much lower capture rates than the others (11.3 and 8.0 toads/km respectively).

Overall the ratio of females to males captured was 2:1, with all areas north of the last cottage having more females than males (average of 2.8 females/male) and all areas south and west of the last cottage having more males

Figure 3. Location of all toad captures along the east and south beaches of Rondeau Provincial Park in 2004.



(0.69 females/male). The percent of juveniles in the capture varied significantly, with the highest rate of juvenile capture occurring on the south barrier beach (59%). The next two zones to the north experienced the next highest capture rates of juveniles respectively (25% and 13%). Only 4.9% of the captures were juveniles in the zone between Bennett Avenue and the Visitor Centre and no juveniles were detected in the two zones north of Bennett Avenue.

Toads were almost always found on the open sand part of the beach, close to the waters edge. The average distance from the active surf line that toads were initially captured from was 1.8 m, and ranged from 0 to 15 m. In all, 85% of the toads were found within 2 m of the active surf line and 96% within 5 m.

Eighty-two percent of the toads were found on sand substrate and 18% on pebbles. None of the toads were found on gravel (larger stone) substrate; however, the only zone within the park with larger stone on the beach is in the last cottage to South Point zone, which only had 16 captures.

The number of captures varied considerably between the three survey periods. The most captures occurred during the first sampling period (July 30-Aug 4), and numbers decreased in both of the next two sampling periods (Table 3). The first sampling period experienced somewhat warmer temperatures than the second two periods.

Table 3. Total number of captures by survey zone and survey period.

Survey Zone	July 30-Aug 4	Aug 7-Aug 15	Aug 19-Aug 30
NBCH	13	8	0
BRCH	5	12	0
VCBR	37	21	3
VCLC	74	39	2
LCSP	0	12	4
SB	58	15	8
Total	187	107	17

Recaptures

A total of 71 toads was recaptured at least once, producing an overall recapture rate of 22.8%. Two toads were recaptured twice and six toads were recaptured in a different survey zone than original capture. Of the recap-

tured individuals, 53 (74.7%) were female, 13 (18.3%) were male and only 5 (7.0%) were juveniles. Table 4 shows the number of original captures, recaptures, and percent of recapture by survey zone and for the entire park.

Table 4. Number of original captures and number and percent of recaptures by survey zone.

Survey Zone	Original Captures	Recaptures	Percent Recaptured
NBCH	21	5	23.8%
BRCH	17	4	23.5%
VCBR	61	22	36.1%
VCLC	115	34	29.6%
LCSP	16	1	6.3%
SB	81	5	6.2%
Total	311	71	22.8%

Population Estimate

The estimated population of Fowler's Toads for the park, based on the first two rounds of sampling, is 561 with a 95% confidence interval of 459 to 663 toads. This estimate was based on the first two sample periods because the third sample period was conducted very late in the summer and experienced much lower capture rates (Table 3).

Population estimates were also calculated for some of the individual survey zones (Table 5). Two of the zones (last cottage to South Point and Children's Hut to Bennett Avenue) did not have sufficient recapture rates to calculate a population. The south barrier beach population had a very large variance in the population estimate, which was likely due to the much smaller capture rate in the second sampling period (Table 3).

Table 5. Modified Lincoln-Petersen population estimates for four of the survey zones.

Survey Zone	Population Estimate	95% Confidence Interval
NBCH	36	18-54
VCBR	95	65-125
VCLC	173	138-208
SB	236	79-393

Discussion

The Distribution of Fowler's Toads in Rondeau

This study indicates that Fowler's toads are currently found along almost the entire length of Rondeau Provincial Park's beach (Figure 3). The concentration of toads was highest from Bennett Avenue south to the last cottage and on the western portion of the south barrier beach.

The study did reveal a few areas in the park where few or no toads were detected. These areas include South Point proper (the south-east tip of the peninsula), the area immediately adjacent to Bennett Avenue, and sections of the beach from the Children's Hut south to about half way to Bennett Avenue (Table 2 and Figure 3). Here are some possible explanations for the lack of toads in these areas. Parts of the South Point zone have been severely eroded over the last few years, resulting in almost no open beach above the surf line. Thus sufficient unvegetated habitat may not be sufficient in those areas for Fowler's toads to inhabit. Areas of South Point are also very rocky and are largely composed of larger stones which would make it hard for toads to burrow down into the substrate. Results of this year's study found that 82% of all toads were found on sand substrate, with only 18% on pebble substrate and none on larger gravel or stone.

The beach immediately adjacent to Bennett Avenue has received higher levels of tractor use than other areas because there is a tractor accessible beach access at that location. Tractors can significantly increase the mortality of burrowing toads as a result of direct crushing and substrate compaction. In the area south of the Children's Hut, the unvegetated beach is quite narrow and the surf often runs all of the way up to the vegetated dune, leaving no beach habitat for foraging.

It is encouraging to note that the density of toads along the main public beach is close to the average density for the park as a whole. This means that low-impact beach activities (even at high levels) can co-exist with Fowler's toads. It is important to note, however, that there has been very little mechanical beach cleaning at Rondeau in recent years.

Distribution of Toads by Sex and Age

The distribution of age and sex classes varied considerably throughout the park. The proportion of juveniles was fairly high along the south barrier beach (59% of capture) but declined steadily from south to north along the east beach. The zone with the highest density of toads (Visitor Centre to last cottage) had only 13% juveniles and the area with the second highest

density (Bennett Avenue to Visitor Centre) had less than 5% juveniles. No juveniles were detected north of Bennett Avenue.

This trend is likely due to the proximity of suitable breeding ponds. Fowler's toads breed in the shallow water of semi-permanent ponds, temporary pools, and lake shores in shallow bays (Laurin and Green, 1990; Green *et al.,* 2005). At present this kind of habitat is restricted to the south end of Rondeau's marsh in Rondeau Bay adjacent to the barrier beach, which is where the greatest proportion of juveniles was detected.

No suitable breeding ponds exist along the east beach. Ponds exist further inland but are forested swamps rather than open marsh type ponds. At the north end of the park, toads have been heard calling in the bay on the west side of the peninsula, but it is not known if these toads travel from the east beach (800 m distant). If they do, it does not appear that the juveniles disperse to the eastern shoreline as none were detected in that area. Radio telemetry studies are proposed for 2005 to determine where these adults go once breeding activity ceases.

Small ponds are occasionally formed on the open beach by wave action. These ponds are temporary and fed by groundwater and wave action. When these ponds are present in the spring, toads are often found calling from them (Dobbyn, unpublished data). These ponds tend to form naturally along the south-east corner of the park or along the barrier beach. It should be possible, however, to artificially construct similar ponds on the open beach further north in the park.

Also, an interesting distribution of sexes occurs at Rondeau. In the northern portion of the park the female to male ratio is approximately 2:1, while in the southern areas (south of the Visitor Centre) and on the barrier beach the ratio is 0.69:1. This is particularly interesting since the majority of the breeding must occur along the barrier beach. The observed sex ratio may be somewhat skewed, however, as a result of late season sampling. As summer progresses the black marking on the male's throat fades, and they are also less likely to chirp or vibrate when handled (Dobbyn, Pers. Obs.). This could result in some males mistakenly being recorded as female.

An Estimate of Rondeau's Fowler's Toad Population

The population estimate for Rondeau Provincial Park's Fowler's toad population is 561 with a 95% confidence interval of 459 to 663 toads. This is the first quantitative assessment of the Rondeau population and will provide a benchmark for future survey work. The NHIC rates the Rondeau population

of Fowler's toads as possibly fitting the category of 5-49 breeding females, or a C rank (NHIC, 2005b). Since more than 150 females were detected during this study alone, the Rondeau population is much more substantial than previously thought.

One factor that might affect the equal catchability assumption of the Peterson-Lincoln index is the timing of our surveys. We were unable to begin our surveys prior to the end of July and all three rounds of surveys were conducted in August. We noted a significant decline in the total number of toads captured during the three sample periods: from 187 to 107 to 17 (Table 3). Basically there were fewer toads foraging during both subsequent surveys. This decline was also observed by Clarke (1974) who noted a significant reduction in toad numbers beginning in early July and progressing through August and September.

Although the proportion of marked versus unmarked toads may remain the same during later season sampling, a higher number of toads in the original capture would have resulted in a higher population estimate. Thus late season sampling could have significantly lowered the population estimate at Rondeau Provincial Park. To test this hypothesis, sampling should be initiated earlier (e.g., May or June) in future years.

Management Implications and Recommendations

This study has found that the population density of Fowler's toads in the north end of the park along the main public beach is similar to the average for the park as a whole. Thus, it appears that toads can co-exist with large numbers of people on the beach. It is important to note, however, that Rondeau Provincial Park does not currently use mechanized beach cleaning equipment. Since the main public beach supports a viable population of Fowler's toads, and the toad is listed by COSEWIC and MNR as a "Threatened" species, the park has been encouraged to continue with its ban on mechanized beach cleaning.

The use of tractors on Rondeau's beach also has the potential to reduce the number of toads. Although a definitive relationship has not been established, there is a distinct lack of toads in the area immediately adjacent to Bennett Avenue where tractors have traditionally accessed the beach for the purpose of launching boats. Although against park regulations, tractors have regularly been driven onto the beach by cottagers in a variety of other locations as well. Cottagers have recently been informed that the regulation prohibiting the use of tractors is now being enforced, and the park should ensure that enforcement is carried out.

This study has provided a good baseline upon which to build future research. It is apparent that beach surveys should be conducted earlier in the season (i.e., June) in order to obtain a more accurate population estimate. It has also been shown that Fowler's toad breeding areas within the park need to be located. This can be accomplished by call count surveys conducted during the main breeding period, spanning from May to June. Call count surveys should be conducted along the entire beach to determine if toads are breeding in the lake as well as the marsh.

It is known that Fowler's toads breed in the bay at the north end of the park, but we do not know where these animals go after the breeding season. To determine this, the use of radio telemetry is recommended. Radio telemetry should also be used to determine day-to-day habitat use within the park and to characterize hibernation sites.

Since it is apparent that there is a lack of breeding habitat on the east beach, a small number of artificial ponds should be dug on the open beach to determine if Fowler's toads will utilize them. Construction of artificial ponds can be done with the use of a front end loader to dig a pit deep enough to fill with ground water. The ponds should be long and narrow and built parallel to the shoreline to mimic those that are formed naturally.

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