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Madeleine H. Linck
Hennepin Parks Natural Resources Management

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Reduction in Road Mortality in a Northern Leopard Frog Population

MADELEINE H. LINCK

Hennepin Parks Natural Resources Management, 3800 County Rd. 24, Maple Plain, Minnesota 55359
Email: mlinck@hennepinparks.org

Since spring of 1994, Hennepin Parks Natural Resources Management staff, assisted by numerous volunteers, has been working to reduce road mortality among migrating Northern Leopard Frogs (Rana pipiens) adjacent to Baker Park Reserve in Maple Plain, Hennepin County, Minnesota. A county road separates the overwintering site from breeding habitat within the park. With steadily increasing traffic over the years, this population of frogs was in serious decline. For the first two years (1994 and 1995) rescue efforts were limited to the spring collection of frogs as they migrated out of the overwintering lake toward the breeding wetlands, although the road was monitored in the fall. Beginning in 1996, fall rescue efforts were added with the set up of a temporary 800-foot (244 m) drift fence equipped with 5-gallon buckets placed at 50-foot intervals. Volunteers were utilized to empty buckets and to transport frogs across the road. While only 300 frogs were transported in spring 1994, approximately 3,925 frogs were transported in fall 1997.

Information is presented that suggests that project efforts have reversed the trend of decline at this specific location. This report reviews the use of volunteers, signs, and a drift fence and the resulting nation-wide publicity that has helped to educate the public about factors causing amphibian decline.

INDEX DESCRIPTORS: Rana pipiens, road mortality, volunteers, public education.

Baker Park Reserve is one of seven Park Reserves administered by Hennepin Parks, a natural resources-based park system within the Minneapolis, Minnesota, metro area. The park district's land use policy specifies that 80% of each of its park reserves is to be maintained in a natural state. The remaining 20% may be developed for recreational activities such as boating, swimming, skiing and biking. The Park District conducts wildlife management and restoration through its Department of Natural Resources Management (NRM). NRM projects have involved woodland and prairie restorations, Trumpeter Swan and Osprey reintroductions and deer management. Over the past few years, reptiles and amphibians have also been included in the wildlife management priorities.

The Northern Leopard Frog project reported here began as an experimental project utilizing volunteers in spring 1994. The site is a 1/4 mile (400 m) section of County Road (CR) 19 in Baker Park Reserve which is approximately 25 miles (40 km) west of Minneapolis, Hennepin County, Minnesota (45° 01' 98" N, 93° 38' 04" W). Baker Park Reserve contains 2,700 acres (1,092.7 ha) of woodland, open upland, marsh and lake habitat. NRM wildlife staff believe that a large percentage of the northern leopard frogs that breed in Baker Park overwinter in Lake Independence, a popular ice fishing and boating 828-acre (335.1 ha) lake, maximum depth 58 ft. (18 m), on the western edge of the Park. CR19 runs north-south along the eastern shore of Lake Independence (Fig. 1). Shallow marshes that freeze to the bottom during winter are east of CR19 within the Park. The frogs that hibernate in Lake Independence and breed and forage in Baker Park must cross CR19 twice each year. The project was an attempt to reduce the number of road kills, especially among breeding frogs.

The northern leopard frog is not listed in Minnesota as a State endangered, threatened, or special concern species. It is well known, being recorded from every county within Minnesota (Oldfield and Moriarty 1994) and is found throughout Wisconsin as well. However, as Vogt (1981) has noted, this species is in general decline. High traffic counts have been shown to increase amphibian mortality (Ashley and Robinson 1996, Fahrig et al. 1995). It is likely that road mortality is having a significant impact on Baker Park Reserve's population. The average daily traffic count is more than five times higher than what it was in 1965 (Table 1). The northern leopard frog population that crosses CR19 has been reduced drastically and if the trend continued, it would be eliminated. Anecdotal evidence from local residents and park staff indicated the county road "used to be covered with frogs," suggesting a much larger northern leopard frog population in Baker Park during the 1970s. However, there is no documentation that anyone was actually counting back then. Nevertheless, in the early 1990s, one specific 1/4 mile (400 m) stretch of CR19 was observed to still be a defined spring and fall migration route for this species.

Other species of frogs observed in Baker Park include spring peeper (Pseudacris crucifer), western chorus frog (Pseudacris triseriata), gray treefrog (Hyla versicolor), wood frog (Rana sylvatica), and American toad (Bufo americanus), but none of these species are as greatly impacted by road traffic since they overwinter on land within the park. The northern leopard frog, in contrast, hibernates in deep, well-oxygenated lakes, but successfully breeds in shallow fishless wetlands. The shallow wetlands in Baker Park Reserve routinely winter kill.

In the spring, the frogs begin moving to the eastern shore of Lake Independence just as the ice melts a few feet out from shore although there is still 80-90% ice cover. Beginning the last week in March, the eastern lake shore is checked daily for basking frogs. Typically, when the air temperature reaches 45–49°F (7–9°C), with sun and little wind, the frogs begin migrating by mid-morning after a period of basking. The majority of the first frogs migrating are mature males (identified by swollen thumbs). After approximately 4–5 d, more females begin to cross the road. Larger male and female frogs seem to move earlier than smaller ones. In a typical spring, when the night air and water temperatures are at or below freezing, the frogs migrate mainly during the middle of the day up until late...
Table 1. Traffic volumes on Hennepin County Road 24, Hennepin County, Minnesota. Data provided courtesy of Department of Public Works, Hennepin County, Minnesota.

<table>
<thead>
<tr>
<th>Year</th>
<th>Annual Average Daily Traffic (number of vehicles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>5,706</td>
</tr>
<tr>
<td>1994</td>
<td>4,475</td>
</tr>
<tr>
<td>1992</td>
<td>4,325</td>
</tr>
<tr>
<td>1990</td>
<td>3,225</td>
</tr>
<tr>
<td>1985</td>
<td>2,300</td>
</tr>
<tr>
<td>1980</td>
<td>1,550</td>
</tr>
<tr>
<td>1975</td>
<td>1,500</td>
</tr>
<tr>
<td>1970</td>
<td>1,375</td>
</tr>
<tr>
<td>1965</td>
<td>1,010</td>
</tr>
</tbody>
</table>

Table 2. Numbers of *Rana pipiens* transported across Hennepin County Rd. 19, Baker Park Reserve 1994–97. Letters indicate mode of transportation, v = volunteers and nets, d = drift fence, p = partial temporary fence.

<table>
<thead>
<tr>
<th>Year</th>
<th>Spring</th>
<th>Fall</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>300v</td>
<td>None</td>
</tr>
<tr>
<td>1995</td>
<td>325v</td>
<td>600v</td>
</tr>
<tr>
<td>1996</td>
<td>760v</td>
<td>1,400d</td>
</tr>
<tr>
<td>1997</td>
<td>233 vp</td>
<td>5,925d</td>
</tr>
</tbody>
</table>

Table 3. Dates of *Rana pipiens* spring and fall collection effort, Hennepin County Rd. 19.

<table>
<thead>
<tr>
<th>Year</th>
<th>Spring</th>
<th>Fall</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>Apr 1-17</td>
<td>—</td>
</tr>
<tr>
<td>1995</td>
<td>Mar 24-Apr 23</td>
<td>Oct 24-28</td>
</tr>
<tr>
<td>1996</td>
<td>Apr 11-28</td>
<td>Oct 15-Nov 4</td>
</tr>
<tr>
<td>1997</td>
<td>Apr 2-29</td>
<td>Oct 8-Nov 8</td>
</tr>
</tbody>
</table>

afternoon. However, there have been occasional foggy evenings when the air temperature has remained around 50°F (10°C) and migration has continued during the night. Wildlife staff observed a much lower success rate for those frogs attempting to cross on their own between 1500 and 1800h than for those frogs moving during times of lower traffic volume.

During 1994, rescue efforts were limited to the first 2 weeks in April (Table 3). Volunteers equipped with nets and wearing highway safety vests were stationed on the grass on the west side of CR19 and netted frogs as they moved up towards the road. Frogs were placed in 5-gallon buckets and transported and released into the wetland and woods on the east side of the road. Basking frogs were not disturbed near the lakeshore to avoid causing them to return to the lake, thus delaying migration. Volunteers of all ages, including a scout and school group, transported approximately 300 frogs (Table 2) 1–17 April. Several local television and radio stations as well as the Minneapolis *Star Tribune* covered the project. More volunteers expressed interest than could be accommodated (too many volunteers at one time have a negative impact on the migration movement). NRM also received a number of phone calls from people who said they could not help, but who wanted us to know they were glad that something was being done about the road-kill.

During the second year (1995) of the project, volunteers continued to monitor the road, but, in addition, two "FROG XING—NEXT ½ MILE" signs (with a large silhouette of a frog) were placed in the north and south bound lanes of CR19. Funding was provided by the Minnesota Herpetological Society. The use of frog crossing signs is not a new idea. The Netherlands, Switzerland, Germany, and England have been dealing with amphibian road mortality for years (Langton 1989). Massachusetts has closed roads and constructed tunnels for salamander migration. The CR19 signs attracted nation-wide attention. The story was carried over the Associated Press wire, prompting phone calls from radio stations as far away as Alaska and Virginia. In responding to the numerous media inquiries, I tried to stress that habitat fragmentation due to roads is one of a number of significant factors involved in amphibian decline.

During fall 1995 (Table 2), staff and volunteers netted approximately 600 frogs along the grassy shoulder on the eastside of CR19 and released them into Lake Independence. The fall migration is more dispersed both over time and space and is less predictable. Rain after dark or snow showers followed by sun and above freezing temperatures appeared to precipitate migration movements towards the lake. Because of the very unpredictable nature of fall migration, volunteers could not always be organized in time and many frogs got out onto the road, resulting in high frog mortality. The smell of dead frogs on the road was very noticeable despite the fact that scavengers quickly cleaned up carcasses.

Spring 1996 saw an increase to 760 frogs transported (Table 2) by volunteers. The County Department of Public Works provided (unsolicited by Hennepin Parks) two large flashing construction road signs that blinked "CAUTION—FROG MIGRATION—REDUCE SPEED AHEAD." The signs were set on a timer to operate between 1000 and 1600h. There was a definite effect on the speed of the vehicles. Almost every vehicle slowed down which made it safer for volunteers and frogs alike. These large signs quickly caught the attention of the news media and prompted many questions about the project.

Due to the unpredictability of the timing of the fall migration and the tendency of the frogs to migrate on rainy fall nights (when safety is an issue for volunteers), staff decided to set up an 800-foot (244 m) drift fence for fall 1996. The fence was placed in the woods along a horse trail that runs parallel to CR19 on the east side of CR19. Fifteen 5-gallon (19 l) buckets were sunk in the ground at 50-foot (15 m) intervals. The buckets were covered with lids and the fence was left open to allow animal movement until it was determined that northern leopard frog were beginning to move towards the lake. At the first signs of frogs in the leaf litter or dead on the road, volunteers could not always be organized in time and many frogs got out onto the road, resulting in high frog mortality. The smell of dead frogs on the road was very noticeable despite the fact that scavengers quickly cleaned up carcasses.

During fall 1996, only 21 OORs were noted on CR19. This is in sharp contrast to 1995 when a minimum of 400 "splits" was counted. While it is difficult to count road kills accurately due to the heavy traffic and because scavengers quickly clean up the more intact frogs, the road was slick with dead frogs in 1995,
but road mortality was hardly noticeable in 1996. One general ob­
ervation was that juvenile frogs (<60mm snout-vent length) seemed
to migrate earlier while larger frogs migrated later in the season.
Often it seemed that the larger frogs waited dangerously late in the
season to move back to the lake.

The highest numbers of frogs collected was fall 1997 when ap­
proximately 5,925 northern leopard frogs (Table 2) were collected in
the buckets or along the fence during fall 1997 from 8 October–8
November (Table 3). Once again, the general trend was for the earlier
migrating frogs to be smaller and the larger frogs moving later, even
after several days of below freezing temperatures. One of the peak
movements took place in heavy rain on 31 October between 1700h
and 2100h which was also a very heavy traffic period.

Although not all frogs (especially during night collection) could
be examined individually, no deformed frogs were observed either in
the spring or fall.

DISCUSSION

What started as a small, experimental volunteer activity in 1994
has grown into a nationally publicized project. Although frog pop­
ulation trends need to be monitored very long term so that effects
of environmental conditions such as drought and winter-kill can be
determined, it appears that NRM efforts have had a positive impact
on the very local population of northern leopard frogs that winter
in Lake Independence. Roads take a heavy toll on amphibians all
over the world. Creative solutions both short and long-term are need­
ed. It must be emphasized that signing and collection efforts are not
meant for areas where frogs simply come out to hunt on rainy nights,
but rather only for specific, documented migration routes. It is im­
portant to spend time identifying specific locations where heavily
traveled roads bisect wintering and breeding habitats before under­
taking such a project.

Overall, the northern leopard frog project that we have undertaken
and expanded requires frequent monitoring and extreme flexibility
on the part of volunteers and staff. While it has proven to be a very
popular volunteer activity, it is not easy to get the right number of
volunteers out on short notice. Sudden changes in weather or just a
change in wind direction or velocity can mean a dramatic change in
migration movements. The use of the drift fence while initially labor

intensive, obviously makes collection much less frenzied and one
person can check the fence frequently without having to call out an
"army" of volunteers. Since the spring migration is largely diurnal
and confined to a smaller stretch of road (and one can monitor the
shoreline for basking frogs), the use of volunteers is still an excellent
option. It is obviously a popular "hands-on" activity and plays an
important role in educating the public. A combination of volunteers
and a 500-foot (152 m) drift fence placed just off the 30 foot (9 m)
right-of-way on the west side of CR19 will be used in spring 1998.

The use of highway signs plays a significant role in alerting mo­
torists as to why people are on the road shoulders. The education of
the public about the plight of declining amphibians is an important
consideration in continuing the program. The 800-foot (244 m) drift
fence will be used again in the fall. By monitoring the road each
spring and fall, the parks will be in a better position to provide
input to the County when it comes time to upgrade the present
county road. Suggestions such as a bridge or providing crossing cul­
verts will be taken much more seriously. In addition, a public edu­
cated about the plight of the frogs will be an important support in
helping to push for a more frog-friendly road design.

ACKNOWLEDGMENTS

I wish to thank the numerous volunteers of Hennepin Parks who
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