

**EXECUTIVE SUMMARY FOR
RESOURCE MANAGEMENT REPORT 00-2**

2000 FROG AND TOAD SURVEY AT ISLE ROYALE NATIONAL PARK, MICHIGAN

During a survey of Michigan's herpetofauna in 1963 and 1964 it was discovered that Isle Royale National Park was home to six species of anurans. They were the American toad (*Bufo americanus*), spring peeper (*Pseudacris crucifer*), boreal chorus frog (*Pseudacris triseriata maculata*), green frog (*Rana clamitans melanota*), mink frog (*Rana septentrionalis*), and the wood frog (*Rana sylvatica*).

Since that time, there has been a growing concern for the apparent decline in several species of anurans (frogs and toads). There is not only concern for the individual species but for the role these populations serve as an indicator of environmental quality. Isle Royale National Park, Michigan, established a frog survey program to monitor and integrate island population data with the Michigan Department of Natural Resources Frog and Toad Survey program.

In 1996 two transects were created. The first transect followed the Mount Ojibway loop (MTOJ), and the second was established along the trail between Three Mile and Lane Cove (TMLC). In 1997 a third transect was created between Moskey Basin and the north LeSage portage and was surveyed in 1998. A fourth survey was surveyed in 1999, on the Huginnin trail near Windigo. A call index was used to obtain a measurement of calling males for future comparison.

During the 2000 survey, all of the previously known anurans were heard. Mink frogs were only heard in small amounts during survey runs, but were heard by Natural Resource Management staff several times outside of the survey periods during the summer. It is postulated that mink frog phenology is brief, therefore mink frogs are not commonly heard during survey times.

Comparison between the first five years has demonstrated a close correlation between the frog populations and the amount of rainfall during the summer. Low amounts of rainfall during the first 3 years of the survey was reflected in low frog calling numbers. With an increase of rainfall in 1999 and 2000 frog calling numbers likewise increased.

In 2001, the survey will continue will continue on the existing four transects. In addition, the numbers of American toads seen between survey points will also be recorded. If possible, more intensive surveys will be conducted in specific areas along the transect routes to more accurately record the "singing season" of Isle Royale's anurans.



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AUGUST, 2000

ABSTRACT

The populations of anurans (frogs and toads) have been noticeably declining throughout worldwide habitats in recent years, initiating a cause for concern. Frog and toad populations may well serve as indicators of general environmental quality. They are both aquatic and terrestrial species, partially breathing through their skin, which in turn makes them susceptible to environmental degradation. In the occurrence of a decline, concerns must certainly be raised, not only dealing with the populations themselves, but also taking into consideration the habitats in which they exist. Isle Royale National Park (ISRO), Michigan, established a survey of frogs and toads in 1996 to monitor anuran populations on the island, as well as to integrate these findings with those of the Frog and Toad Survey Program conducted by the Michigan Department of Natural Resources (DNR). Originally, two transects were established along park trails, with a third added in 1997, and a fourth added in 1999.

In 2000, frog and toad surveys at ISRO were conducted in the early spring, late spring and summer on all four transects. Each transect has ten survey points, totaling 40 points surveyed per run. The survey is based upon the calls given by the male frogs and toads during their various mating seasons. Call indexes of 0, 1, 2 or 3 (0 being none present, 3 being a full chorus) were used to indicate the relative abundance of frogs and toads calling. These indexes were averaged and compared to those recorded in previous years. In order to include the breeding seasons of all species surveyed, three different runs of each transect were conducted throughout the spring and summer.

Five of the six species present on Isle Royale have been heard each year since surveys began in 1996. The exception is the mink frog, which was heard on formal surveys only in 1998 and 2000. During the 2000 survey, all six species were heard on survey routes. The abundance of each species was similar to previous ISRO surveys and closely matches separate regional data. Species richness varied per habitat type, and comparisons between call index and rainfall has shown a close correlation for four of the six species present.

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INTRODUCTION

Concerns have been raised as to the low numbers of several of Michigan's frog species in the past several years (Michigan DNR 1996). Frogs and toads are especially vulnerable to human exploitation of their habitat, as they depend on wetlands, which are often destroyed by development. Fluctuations in frog and toad populations are therefore a possible indicator of the changing environmental quality of an area and the well being of its ecosystem. Thus, it is important to be aware of changes in abundance or distribution of anurans. By comparing data gathered on Isle Royale with that collected on the mainland, insights may be reached regarding the apparent decline in frog and toad numbers. With the assistance of the Michigan DNR, a frog and toad survey was established on Isle Royale in 1996 and has been continued and expanded over the ensuing four years.

The last known inventory of Isle Royale's frogs and toads was conducted in 1963-64 and revealed six species of anurans present on the island (Johnson 1965). The species found were the American toad (*Bufo americanus americanus*), spring peeper (*Pseudacris crucifer*), boreal chorus frog (*Pseudacris triseriata maculata*), green frog (*Rana clamitans melanota*), mink frog (*Rana septentrionalis*), and the wood frog (*Rana sylvatica*).

The current survey of Isle Royale's frogs and toads has served as a comparison of recent population information with presence/absence data from 1963-64. These records will be helpful in providing a means to determining current population figures and tracing population trends over the years. This survey may also aid the Michigan DNR in determining the ranges and population sizes of many species.

STUDY AREA

Isle Royale National Park (Keweenaw Co., Michigan) is an archipelago of more than 200 islands in northwestern Lake Superior. It lies approximately 118 km (73 miles) from Michigan's Keweenaw Peninsula and at its closest point is approximately 24 km (15 miles) from Ontario's Sibley Peninsula. The Park encompasses about 544 km² (210 mi²) of land and water, of which 99% of the land base is federally designated wilderness.

The survey transects follow established park trails, and survey points are located in six different wetland types. As described by the Michigan DNR, these wetland types are as follows:

1. **Vernal Pond**—small body of standing water that forms in the spring from meltwater and is often dry by mid-summer. The area is usually dominated by annual vegetation.
2. **Wet Meadow**—looks similar to a fallow field, except that they are dominated by waterloving grasses and sedges. They contain nearly 100% vegetative cover with very little or no open water.
3. **Bog**—located on saturated, acidic peat soils. They support shrubs, herbs, and often tamarack (*Larix laricina*) or black spruce (*Picea mariana*). Some are totally overgrown and some consist of open water surrounded by floating vegetation.
4. **Marsh**—has standing water from less than an inch to up to 3 ft deep. They are dominated by soft-stemmed emergent plants. Vegetative cover is usually around 50%.
5. **Wooded Swamp**—soil is saturated throughout the growing season. On Isle Royale, trees found here include northern white-cedar (*Thuja occidentalis*) and balsam fir (*Abies balsamea*).
6. **Pond**—open body of water that is less than 20 acres in size and does not dry up in the summer months. There is little emergent vegetation present.

(Michigan DNR, 1996)

Table 1 shows the wetland types present within the current survey transects as compared to the types present before the addition of the fourth transect.

Table 1. Number of Sites by Wetland Type

Wetland Type	# Sites-1998	# Sites-1999/2000
Bog	1	1
Wooded Swamp	12	19
Wet Meadow	2	3
Vernal Pond	7	7
Pond	4	6
Marsh	4	4
Total	30	40

METHODS

Four standardized frog and toad survey routes were used in 1999. Those same routes were again used for the surveys in 2000. The survey routes were conducted in early May, June, and July based upon temperature and weather conditions during these periods.

Selection of survey sites

Survey transects, all following established park trails, are assessed prior to the first survey to determine the suitability of the route. Ten points near various wetland types are established along each of the four trails used as transects. A tree near each site is chosen and an aluminum tag is placed on the tree to mark the site for future reference. A file labeled "ISRO Frog Survey Transects" has been created and contains information on site locations, site wetland types, site numbers, maps of each transect, survey dates and field data sheets. This file is held within the Natural Resource Management files. The two transects created in 1996 follow the Mt. Ojibway loop (MTOJ) and the Three Mile to Lane Cove trail (TMLC). In 1997 a third transect was created from Moskey Basin to the area near the north Lake LeSage portage trail (MBLS). In 1999 the Huginn Cove loop (HUGI) was surveyed for the first time. This transect, located on the west end of the island, was added to the existing three east-end transects. All four transects were surveyed in 1999 and again in 2000.

Census Techniques

Each transect is surveyed in the early spring, late spring and in the summer by one skilled observer and usually an assistant. Upon arrival at a survey point, the observer and recorder remain silent for approximately one minute to ensure that their presence does not disturb calling frogs and toads. The observer then listens for a five minute segment, during which all species heard, regardless of distance, are recorded and indexed. If the observer is not able to identify a calling species within the five minutes, it is acceptable to extend the time by a few minutes until a positive ID can be made. Effectiveness of the five minute listening period varies with conditions of weather and wind, and the audibility of calls. Thus, it is more valuable to extend the listening period and obtain a positive ID on a species than to adhere strictly to the five-minute time frame. Data is recorded on data sheets provided by the Michigan DNR. A call index is used to estimate the numbers of calling males of a particular species (Michigan DNR 1996). The index is as follows:

0. No individuals of this species calling
1. Individuals can be counted; there is space between calls
2. Calls of individuals can be distinguished but there is some overlapping of calls
3. Full Chorus. Calls are constant, continuous and overlapping

The dates for the surveys are determined by a combination of frog and toad breeding periods and air temperature. Temperatures on Isle Royale tend to be significantly lower than on the mainland, so temperatures during surveys occasionally drop below recommendations of the DNR in their survey guidelines. Survey dates from 1996-2000 are given in Table 2. The census is begun at dusk on each sampling date and continues until the survey transect is complete. The survey is aborted if rainfall or wind interfere with the audibility of the calls.

Table 2. Survey dates by transect and survey period, 1996-2000.

	1996	1997	1998	1999	2000
<u>Spring Run</u>					
TMLC	5/23	5/22	5/18	5/4	5/9
MTOJ	5/20	5/16	5/23	5/12	5/11
MBLS	*	5/21	5/23	5/5	5/8
HUGI	*	*	*	5/20	5/10
<u>June Run</u>					
TMLC	6/24	6/13	6/8	6/3	6/6
MTOJ	6/19	6/12	6/9	6/4	6/5
MBLS	*	6/11	6/8	6/2	6/6
HUGI	*	*	*	6/19	6/2
<u>July Run</u>					
TMLC	7/17	7/3	7/17	7/15	7/6
MTOJ	7/18	7/3	7/10	7/16	7/5
MBLS	*	7/3	7/8-9	7/16	7/7
HUGI	*	*	*	7/13	7/8

* No survey transects established at this time.

Data Analysis

After completing the runs for the 2000 survey, the mean call index was determined for each species surveyed and comparisons were made with the data from the previous four years. Average indexes (for each run) were calculated using the sum of the call indexes for each run of each transect and dividing it by the number of survey points at which each species occurred. In turn, the total average call indexes for the season were calculated by using the sum of call indexes for the entire season for each species then dividing by the total number of sites where each occurred. The species richness was also determined for each wetland type by specifying the number of species present at each type of wetland site. June-July rainfall was calculated for 1996-2000 and compared to the mean call index for each species using Microsoft Excel® Standard Correlation.

ANALYSIS and RESULTS

All six anuran species presently known to inhabit Isle Royale were heard in the 2000 survey. Though the mink frog was not recorded in the 1999 survey, it was heard and documented in the 1998 survey, then again at four different sites during the 2000 survey. It is common, both on ISRO and regionally, for the mink frog to be found in low abundance (Chabot and Helferty, 1995; Dobbyn and Weeber, 2000).

The gray tree frog, which was reported several times in 1998 but never confirmed, was neither heard nor reported during the 1999 or the 2000 seasons. It is possible that the sound reported was

an evening call of the winter wren (*Troglodytes troglodytes*), which can be mistaken for the call of the gray tree frog.

The chorus frog was more prevalent in the 2000 spring run than both the 1998 and 1999 runs, occurring at 23 of the survey points (compared to 2 points previously). Site percentage increased from 5% to 57.5%. The wood frog was similarly recorded at more points in 2000 than in previous seasons. It was also recorded in the June run of 2000. The wood frog had not been heard in the 1999 season during this run, but it was recorded during the 1998 survey to the same intensity.

The spring peeper once again dominated the spring run (found at 92.5% of sites surveyed) as well as the June run (found at 50.0% of sites surveyed). Though the percentage of sites at which the spring peeper was found in 2000 is the same number as in the 1999 spring run, the intensity in which they were calling was higher in the 2000 season. During the June run of the 2000 season, the spring peeper call index was higher than in the previous year. However, this season yielded a lower site percentage (50% compared to 65%) during the June run (Table 3). The high abundance of spring peepers matches abundance data for marshes in the Great Lakes region (Chabot and Helferty, 1995; Dobbyn and Weeber, 2000)

The green frog was the most common species heard and documented on the July run, found at 45% of the survey sites. This percentage is up from the previous survey season by 7.5%. (Table 3).

American Toads have made a significant return in the 2000 survey season, advancing from a site percentage of 5% (1999 survey results) to a 37.5% site percentage during the spring run of this season's survey. The June run was also higher for the percent of sites occupied by American toads with 35% (compared to 20% in 1999). However, none were heard calling within any of the four transects during the summer run. Significant numbers of toads were observed on the trails during the July run of the 2000 survey. Though they were not heard calling, a total of 110 toads were seen on three transects throughout the course of the July survey (excluding the Huginnin Cove transect).

The survey transects include six different wetland types, defined previously. Species abundance by wetland type varied from 5 to 6 species in 2000. These numbers are significantly higher for some habitats than those numbers found in the past survey seasons (Figure 1). Numbers from 2000 were identical to those from 1999 for the wet meadow, and identical to the results of 1997 for the vernal pond. All other 2000 species richness results surpassed those findings in previous survey seasons. The mink frog was present at all habitat types except the wet meadow and vernal pond. The American toad was absent from the bog habitat but present at all others. When analyzing data in Figure 1, it would appear that the increase in the number of sites for some wetland types between 1996 and 2000, as shown in Table 1, has not affected species richness numbers. Changes seem to be related directly to rainfall and wetland water levels. It has been noticed that beaver ponds, with open water, abundant shoreline grasses, and floating vegetation, are generally the most productive locations for anurans on ISRO.

Table 3 is a comparison chart developed to show the mean call index of each anuran species for each of the three runs of the 2000 survey season. The chart also displays the number, as well as the percentage of sites in which each species occurred. The 2000 mean call index appears at the bottom of the chart.

FIGURE 1. SPECIES RICHNESS BY HABITAT TYPE*

*Due to an abundance of certain habitat types, distortion may occur (see table 3).

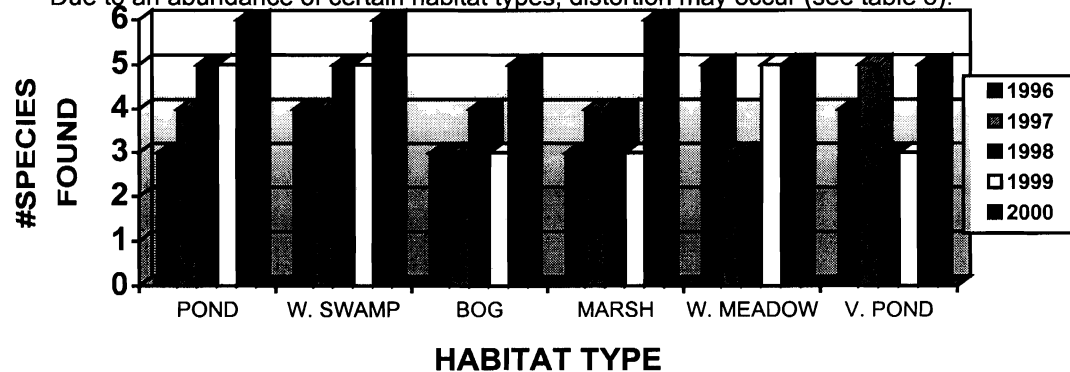
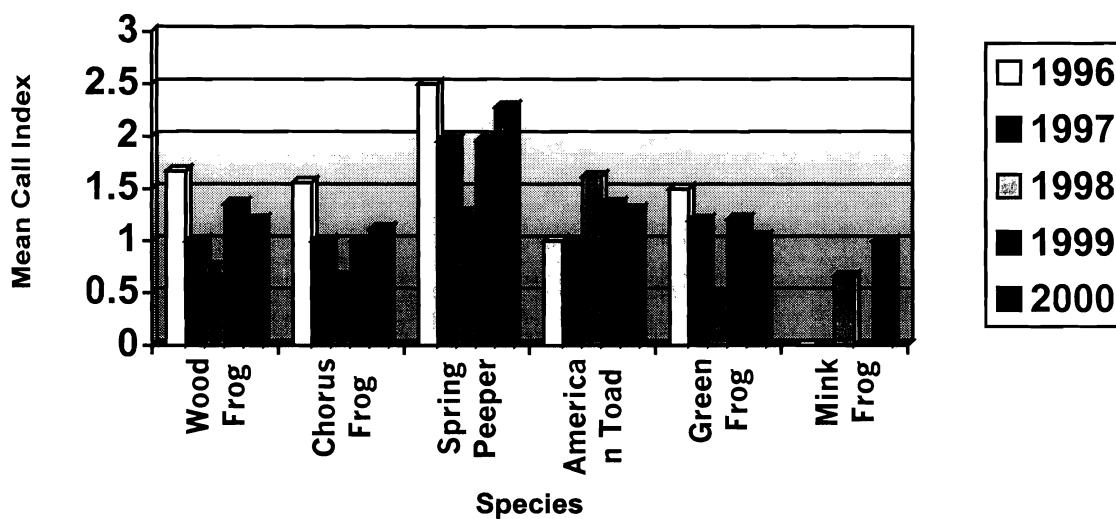


Table 3. Mean Call Indexes and Percent of Sites Occupied by Species (n=40), 2000.

		WOOD FROG	CHORUS FROG	SPRING PEEPER	AMERICAN TOAD	MINK FROG	GREEN FROG
	Mean	1.21	1.13	2.65	1.13	-----	-----
Spring Run	# Sites	14	23	37	15	0	0
	% Sites	35.0	57.5	92.5	37.5	0	0
	Mean	1.0	1.0	1.7	1.5	-----	1.0
June Run	# Sites	1	2	20	14	0	8
	% Sites	2.5	5.0	50.0	35.0	0	20.0
	Mean	-----	-----	1.0	-----	1.0	1.06
July Run	# Sites	0	0	1	0	4	18
	% Sites	0	0	2.50	0	10.0	45.0
2000 mean		1.20	1.12	2.28	1.31	1.0	1.04

Mean indexes recorded in the 2000 survey were higher than those recorded in 1999 for three frog species (spring peeper, chorus frog and mink frog), and slightly lower for the American toad, wood frog and green frog (Figure 2).

Figure 2. MEAN OF CALL INDEXES BY SPECIES



The mean indexes for 1996 through 2000 seem to be closely correlated to the average June-July rainfall (Figure 3) for four out of six of the species surveyed (wood frog, chorus frog, spring peeper, and green frog). When the values for rainfall and mean call index from 1996 to 2000 are compared for these four species, the correlation is quite high (Figure 4). The American toad is a terrestrial species (Harding 1997) and would thus be less dependent on a water source, so it can be expected that the mean call index for this species will not be as affected by the amount of rainfall during the summer.

Due to the scattered occurrences of the mink frog over the survey seasons, this species was not included in the correlation. There may be the possibility that the window of the calling season for this species is quite brief. However, there were several occasions where Park Service employees observed calling of mink frogs (call index of 1 and 2) during the daylight hours several weeks following the last survey date. This may lead to the possibility that the mink frog population prefers warmer, daytime air temperature conditions for breeding activity. Because of Isle Royale's geographical location and the influence of Lake Superior, air temperatures can drop rapidly near twilight and remain unusually low for spring and summer temperatures.

**Figure 3. COMBINED JUNE-JULY
RAINFALL, 1996-1999**

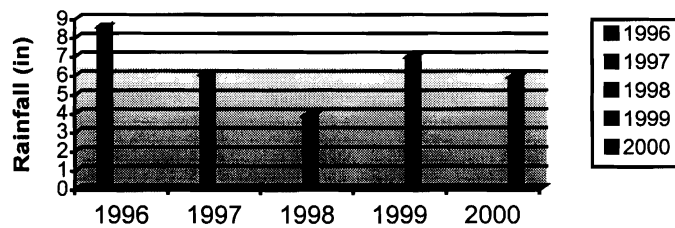
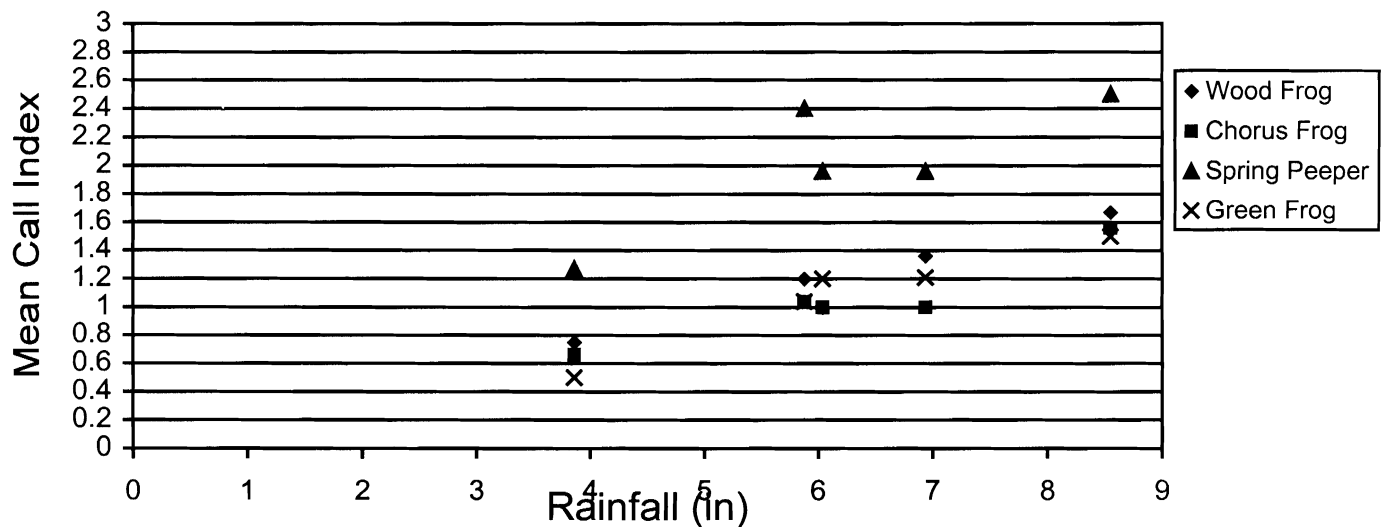


Figure 4. RAINFALL vs. MEAN CALL INDEX



As data continues to be added to this survey, it will become possible to interpret the factors that control anuran populations on ISRO. At this point, several trends seem apparent, such as the relation of rainfall to frog population. The data gathered between 1996 and 2000 seem to indicate that frog and toad populations are not in steady decline on ISRO, but fluctuating in response to environmental factors. However, we lack a great deal of knowledge as to which environmental factors are most important to the well being of Isle Royale's frog and toad populations. Barring atmospheric pollutants, ISRO's anuran population could be viewed as a control group to compare with the mainland populations, as watershed pollution and habitat encroachment are at a minimum on Isle Royale.

RECOMMENDATIONS

Currently, the frog and toad survey includes only three runs per season. Due to fluctuation of yearly phenology this may not always include the mating seasons of all species on Isle Royale. Also, the interval of time between surveys (approximately one month) leaves a large window of time during which peak calling of a given species may not be observed. If one site was chosen along each transect for a more intensive weekly survey (30 minutes or more at one location), the cycle of frog and toad singing may be observed more completely. These more regular surveys could focus on one area with high species richness, with the goal being to document the entire cycle of a species' calling. Some site suggestions are point 2 on MBLS, point 3 on TMLC, and points 3 or 6 on MTOJ for a more intensive survey as these are very productive points. The "frog logger," an automated recording device, could also be used in this more intensive survey. This information could be added to that gathered in the regular survey. These surveys could extend into August to help determine the singing season of the mink frog.

In addition to more frequent surveys, the number of American toads seen on each transect should also be recorded. As the toads are easy to see on the trails and do not move quickly, it is easy to obtain an accurate count of toads per survey (Appendix 1). This number could serve as a secondary means to trace the toad population over the years. There is also a possibility that toads on Isle Royale are larger than those found on the mainland (Johnson 1965). Samples of toads could be measured to determine whether or not this is in fact the case. Deformity surveys of American toads could be checked terrestrially either on survey runs or on separate nights.

Finally, it may prove useful to expand our knowledge of the degree to which anuran populations depend on various weather factors such as rainfall, temperature and humidity. If trends can be observed, this information could be used to help determine the causes of observed fluctuations in anuran populations.

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Appendix 1.

Toad Observation Form
Isle Royale National Park Frog and Toad Survey

Transect _____

Date _____

Record the number of toads seen on the trail between survey points.

	Run 1 #Toads Seen	Run 2 #Toads Seen	Run 3 #Toads Seen
Survey Points			
1-2			
2-3			
3-4			
4-5			
5-6			
6-7			
7-8			
8-9			
9-10			
Total			

	Comments	
Run 1	Run 2	Run 3