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2001 FROG AND TOAD SURVEY

ISLE ROYALE NATIONAL PARK, MICHIGAN

RESOURCE MANAGEMENT REPORT 01-2

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ABSTRACT

Isle Royale National Park, 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. Originally, two survey transects were established along park trails, with a third added in 1997, and a fourth added in 1999. In 2001, frog and toad surveys at Isle Royale were conducted in the early spring, late spring, and summer on all four transects. This method includes the breeding season of all species surveyed. 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. 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, 2000, and 2001. During the 2001 survey, all six species were heard on survey routes. The abundance of each species was similar to previous Isle Royale surveys, and also agrees with regional population trends, which indicate relatively low abundance for mink frogs, high abundance for spring peepers, and intermediate abundance for the other four species. Species richness varied with habitat type, and comparisons between mean call index and rainfall have shown a close correlation for four of the six species. Mean call index was also shown to be somewhat related to temperature.

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INTRODUCTION

Declining numbers of several of Michigan's frog species in recent years have raised concerns about the status of anuran populations (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 the local ecosystem. Thus, it is important to be aware of changes in the abundance and distribution of anurans. The Michigan Frog and Toad Survey has been conducted every year since 1996 in an effort to gain information on the distribution, abundance, and population dynamics of Michigan's frog and toad species. 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 since that time. By comparing data gathered on Isle Royale (ISRO) with that collected on the mainland, insights may be reached regarding changes in frog and toad numbers.

A previous inventory of Isle Royale's frogs and toads was conducted in 1963-64 and revealed six species of anurans to be 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 wood frog (*Rana sylvatica*).

The current survey of Isle Royale's frogs and toads allows a comparison of recent population information with the information obtained in 1963-64. These records will be helpful in determining current population figures and tracing population trends over the years. The current survey may also aid the Michigan DNR in determining the ranges and population sizes of anuran species found in the state.

STUDY AREA

Isle Royale National Park (Keweenaw County, MI) is an archipelago of more than 200 islands in northwestern Lake Superior. It lies approximately 50 mi northwest of Copper Harbor, MI, and approximately 20 mi southeast of Grand Portage, MN. At its closest point to the mainland, Isle Royale is about 15 mi from Ontario's Sibley Peninsula. The park encompasses about 210 mi² (544 km²) 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 (Table 1). The Michigan DNR (1996) describes these wetland types as follows:

1. **Vernal Pond** -- a 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 water-loving grasses and sedges. Wet meadows 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 feet 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.

Table 1. The wetland types present within the current survey transects as compared to the wetland types present before the addition of the fourth transect in 1999.

Wetland Type	Number of Survey Points	
	1996-1998	1999-2001
Vernal Pond	7	7
Wet Meadow	2	3
Bog	1	1
Marsh	4	4
Wooded Swamp	12	19
Pond	4	6
Total	30	40

METHODS

Four standardized frog and toad survey routes were used in 2001. These were the same routes that were previously used for the 1999 and 2000 surveys. Survey runs 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, were 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 was chosen and an aluminum tag was 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 trail (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 Huginnin Cove loop trail (HUGI) was surveyed for the first time. This transect, located on the west end of the island, was added to the three existing east-end transects. All four transects were surveyed in 1999, 2000, and 2001.

Census Techniques

Each transect is surveyed in the early spring (approximately May 1 – 15), late spring (approximately June 1 – 15), and summer (approximately July 1 – 15) by one skilled observer, generally accompanied by an assistant data recorder. Upon arrival at a survey point the observer listens for a five-minute period, during which all species heard, regardless of distance, are recorded and indexed. All data is recorded on data sheets provided by the Michigan DNR. 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 identification can be made. The effectiveness of the five-minute listening period varies considerably with wind and weather conditions and the audibility of calls. Thus, it is more valuable to extend the listening period in order to obtain a positive identification on a species than to adhere strictly to the five-minute time frame. A call index is used to estimate the number of calling males of a particular species (Michigan DNR 1996). The index values are as follows:

- 0 -- No individuals of this species are 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 -- A full chorus of constant, continuous and overlapping calls

In determining appropriate survey dates, frog and toad breeding periods and air temperature are both considered. Temperatures on Isle Royale tend to be significantly lower than on the mainland, so temperatures during surveys occasionally drop below the recommendations given by the DNR in their survey guidelines. Modified temperature guidelines have been minimums of 35°F for May, 45°F for June, and 55°F for July. Survey dates from 1996-2001 are given in Table 2. The census begins at dusk on each sampling date and continues until the survey transect is complete. The survey is cancelled and completed on another night if rainfall or wind interferes with the audibility of the calls.

Table 2. Survey dates by transect and survey period, 1996-2001.

	1996	1997	1998	1999	2000	2001
<u>May Run</u>						
TMLC	5/23	5/22	5/18	5/4	5/9	5/11
MTOJ	5/20	5/16	5/23	5/12	5/11	5/8
MBLS	*	5/21	5/23	5/5	5/8	5/1
HUGI	*	*	*	5/20	5/10	5/10
<u>June Run</u>						
TMLC	6/24	6/13	6/8	6/3	6/6	6/4
MTOJ	6/19	6/12	6/9	6/4	6/5	6/6
MBLS	*	6/11	6/8	6/2	6/6	6/7
HUGI	*	*	*	6/19	6/2	6/5
<u>July Run</u>						
TMLC	7/17	7/3	7/17	7/15	7/6	7/12
MTOJ	7/18	7/3	7/10	7/16	7/5	7/11
MBLS	*	7/3	7/8-7/9	7/16	7/7	7/10
HUGI	*	*	*	7/13	7/8	7/13

* Survey transect was not established at this time.

Data Analysis

Upon completion of the 2001 survey runs, the mean call indices for each run and for the year were determined for each species. A species' mean call index for individual months was obtained by summing the call indices from the four transects for that run, and dividing it by the total number of survey points at which the species occurred during that run. To calculate the mean call index for the year, the mean call index for each run (May, June, and July) was multiplied by the number of survey points at which the species was heard during that run. The sum of these three values was then divided by the total number of survey points at which the species was heard during the entire season. The number and percentage of survey points at which each species was heard on each run were calculated. Species richness was evaluated by counting the number of different species present at each type of wetland. Mean call index, number and percentage of survey points, and species richness values obtained in the current year were compared to previous years' data. The 2001 mean call indices were also compared to species averages calculated over all six survey seasons. Total rainfall for June and July was determined for 1996-2001 and compared to the mean call index for each species using Microsoft Excel® Standard Correlation. The number of species present on each survey run and the mean call indices were also compared to the mean daily temperature, again using Microsoft Excel® Standard Correlation.

RESULTS

All six frog and toad species presently known to inhabit Isle Royale were heard in the 2001 survey. Mink frogs were heard only on the TMLC transect, while the other five species were detected on all four transects. Because each species' breeding season peaks at a slightly different time, not every species was heard on all three runs. The wood frog and chorus frog were heard only on the May run, the American toad was heard only on the June run, and the mink frog was heard only on the July run. Spring peepers were heard on the May and June runs while green frogs were heard on the June and July runs. Table 3 shows the number (out of 40) and percent of survey points at which each of the six anuran species was heard in 2001. The number of calling individuals also varied among species and runs. Table 4 shows each species' mean call index for the three runs and for the year. Species richness in the different wetland types ranged from four to six species. Only the mink and wood frogs were missing from some habitats (Table 5).

Table 3. Number and percent of survey points (n = 40) at which each species was heard in 2001.

	Wood Frog	Chorus Frog	Spring Peeper	American Toad	Mink Frog	Green Frog
<u>May Run</u>						
# of sites	8	14	29	0	0	0
% of sites	20.0	35.0	72.5	0.0	0.0	0.0
<u>June Run</u>						
# of sites	0	0	29	21	0	10
% of sites	0.0	0.0	72.5	52.5	0.0	25.0
<u>July Run</u>						
# of sites	0	0	0	0	2	19
% of sites	0.0	0.0	0.0	0.0	5.0	47.5

Table 4. Mean call indices for each species during the 2001 season. The mean call index for all six survey seasons is also shown for comparison.

	Wood Frog	Chorus Frog	Spring Peeper	American Toad	Mink Frog	Green Frog
May Run	1.13	1.21	2.38	0.00	0.00	0.00
June Run	0.00	0.00	1.38	1.19	0.00	1.20
July Run	0.00	0.00	0.00	0.00	1.00	1.26
2001 Year	1.13	1.21	1.88	1.19	1.00	1.24
1996 - 2001	1.22	1.15	2.13	1.27	0.50	1.21

Table 5. Species richness for each of the six wetland types. A + indicates that the species was present on the 2001 survey.

	Wood Frog	Chorus Frog	Spring Peeper	American Toad	Mink Frog	Green Frog	Species Richness
Vernal Pond	+	+	+	+		+	5
Wet Meadow	+	+	+	+		+	5
Bog	+	+	+	+		+	5
Marsh	+	+	+	+		+	5
Wooded Swamp		+	+	+		+	4
Pond	+	+	+	+	+	+	6

ANALYSIS

Individual Species Trends

The **wood frog** had a lower mean call index for the year and was recorded at fewer points in 2001 than in the previous two seasons (Figure 1). Although it was recorded at low abundance on the June runs of 1998 and 2000, this species was heard only on the May run in 2001 (and similarly, in 1996, 1997, and 1999). The wood frog's mean call index over the six survey seasons is 1.22, which is slightly higher than this year's value. In comparison to recent (2000) data for the rest of the state, especially the Upper Peninsula, Isle Royale's wood frogs had a lower mean call index and were heard at a lower percentage of survey points (Michigan DNR 2000).

The **chorus frog** was heard at a much smaller percentage of survey points in 2001 than in 2000 (35.0% compared to 62.5%). Despite this, the mean call index for this year was higher than those of the past two years (Figure 1). The mean call index for this year was also higher than the six-year (1996 – 2001) average of 1.15. Although in 2000 this species was detected on both the May and June runs, calling was limited to the May run in 2001. The mean call index for this species is lower than that observed in all other areas of Michigan, except the western portion of the Upper Peninsula (Michigan DNR 2000). However, chorus frogs on Isle Royale were heard at a greater percentage of survey points than most other regions of the state (Michigan DNR 2000).

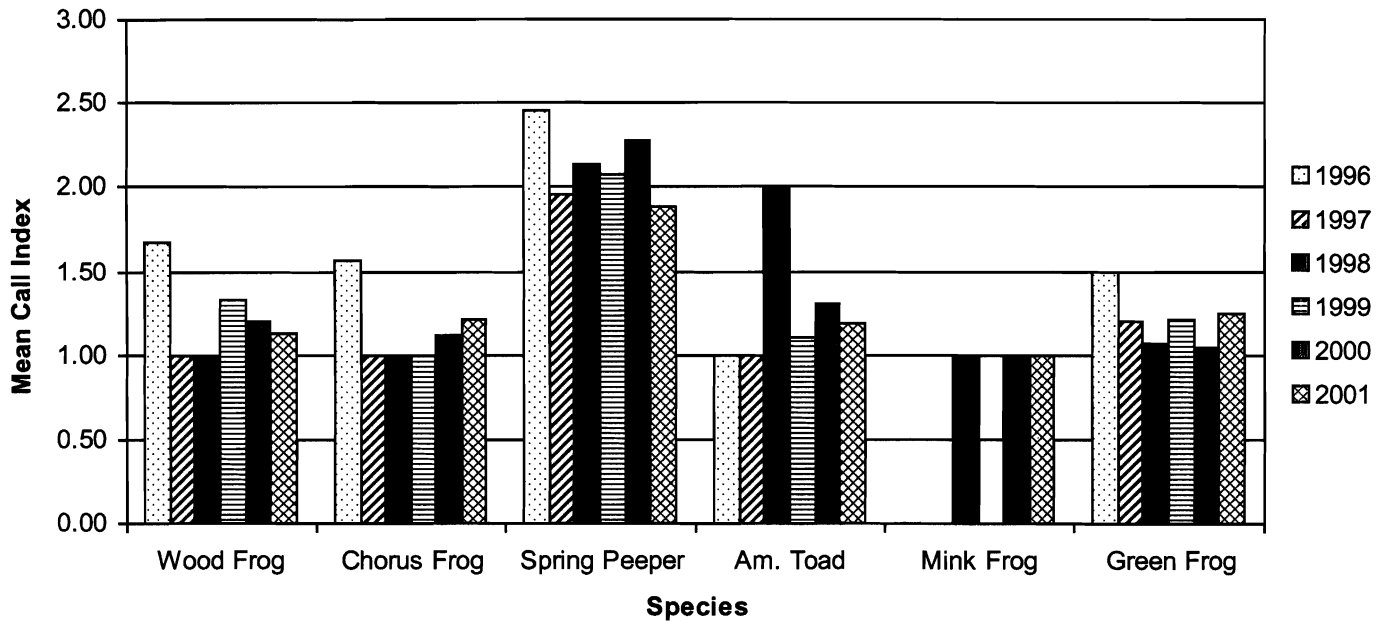
As in previous years, the **spring peeper** was observed in high abundance during the May and June runs (72.5% of the survey points). However, the percentage of sites at which the spring peeper was found in 2001 was lower than in 2000 and 1999, as was the intensity at which they were calling (Figure 1). Furthermore, the mean call index for this species was lower this year than the six-year (1996 – 2001) average call index of 2.13. The high abundance of spring peepers on Isle Royale is similar to abundance data for marshes in the Great Lakes region (Chabot and Helferty 1995, Dobbryn and Weeber 2000), but with a slightly lower mean call index and percent presence at survey points than the rest of Michigan (Michigan DNR 2000).

Although the **American toad** was observed at 37.5% of survey points on the May run of 2000, this species was not heard at all during the May run of this year, perhaps due to colder temperatures. The 2001 June run showed a continuing increase in the percentage of sites occupied by American toads, with 52.5% compared to 35.0% in 2000 and 20.0% in 1999. As in 2000, no American toads were heard calling during the July run. The mean call index for 2001 fell between the 1999 and 2000 values (Figure 1), but below the six-year (1996 – 2001) mean call index of 1.27. Comparisons with recent data for mainland Michigan indicate a lower mean call index but higher percent presence at survey points for Isle Royale's American toads (Michigan DNR 2000).

Though the **mink frog** was not recorded in the 1996, 1997, or 1999 surveys, it was heard in the 1998, 2000, and 2001 surveys. When observed, mink frogs were heard only at a few survey points and only at the lowest call index (Figure 1). The six-year mean call index for 1996 – 2001 was 0.50 for this species. It is common, both on Isle Royale and regionally, for mink frogs to be found in low abundance (Chabot and Helferty 1995, Dobbryn and Weeber 2000). The percent of survey points occupied and the mean call index are very similar for the island and mainland populations (Michigan DNR 2000).

The **green frog** was the most common species heard and documented on the July run, found at 47.5% of the survey sites. This percentage is higher than that recorded in the 2000 (45.0%) and 1999 (37.5%) survey seasons. This species was also observed at 25.0% of the survey points on the June run, which is similar to the high June abundances documented in the past two years. The 2001 mean call index for this species is greater than the six-year (1996 – 2001) average of 1.21, as well as the mean call indices calculated for 1999 and 2000 (Figure 1). The mean call index for this species is similar to that observed in other areas of Michigan, but the percentage of survey points at which it was observed tended to be slightly lower on Isle Royale (Michigan DNR 2000).

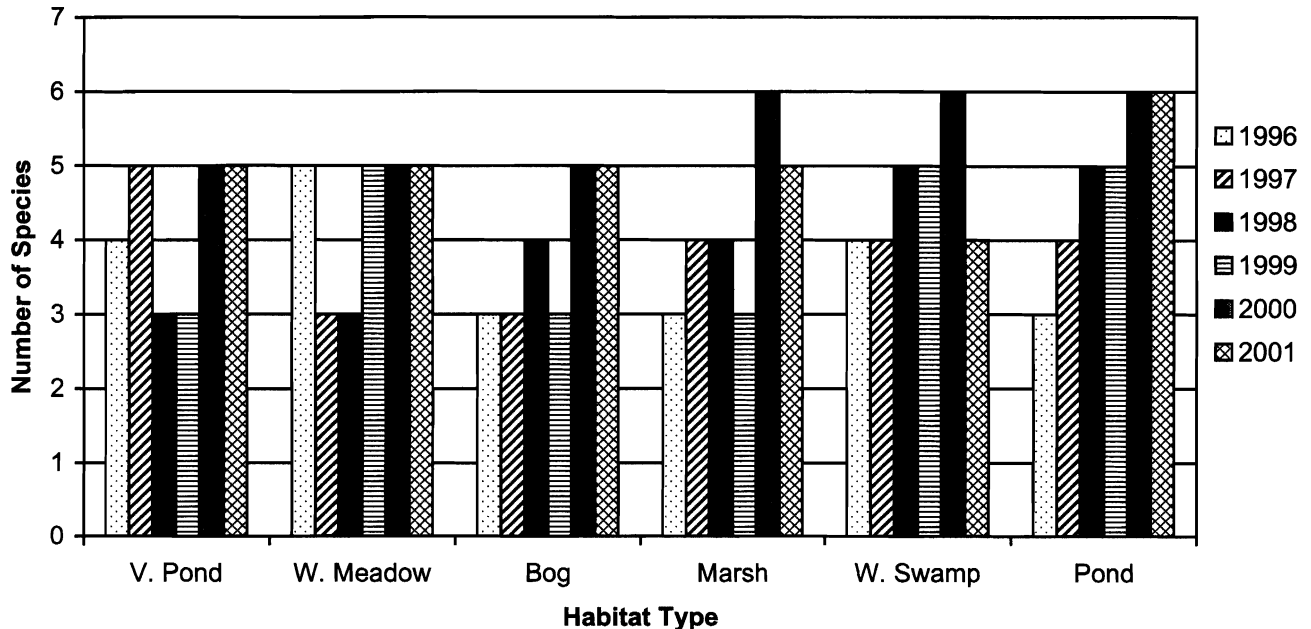
Figure 1. Yearly mean call indices for each anuran species for the 1996 – 2001 survey seasons.



Species Richness

The survey transects include six different wetland types, defined previously. Species richness values ranged from four to six species in 2001. Values for 2001 were identical to those obtained in 2000 for the vernal pond, wet meadow, bog, and pond habitats. The marsh and wooded swamp habitats showed a decline in species richness from 2000 to 2001. The addition of the fourth survey transect in 1999 increased the number of survey points found in wet meadows, wooded swamps, and ponds (Table 1). The species richness values for these wetland types were higher on average in 1999 – 2001 than in 1996 – 1998 (Figure 2). However, these changes may also be related 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 Isle Royale.

Figure 2. Species richness by wetland type in the years 1996 – 2001.



Rainfall Correlation

The total amount of rainfall experienced during the months of June and July ranged from 3.68 to 8.55 inches over the past six survey seasons (Figure 3). The mean call indices for the 1996 – 2001 seasons have also shown considerable variation, which may be due in part to rainfall. When the values for rainfall and mean call index from 1996 to 2001 are compared for the wood frog, chorus frog, and green frog, there is a strong positive correlation (R values = 0.804, 0.801, and 0.845 respectively), indicating that these species are more abundant when there is more rainfall (Figure 4). In contrast, rainfall and mean call index show a strong negative correlation for the American toad (R value = 0.847). The American toad is a terrestrial species (Harding 1997) and would thus be less dependent on the availability of water sources. From this data it appears that this species is more abundant during dry periods (Figure 4). There does not appear to be a strong relationship between rainfall and mean call index for either the spring peeper or the mink frog, although the spring peeper was slightly more abundant during years of high rainfall (data not shown). The mink frog data is inconclusive at this time because this species was not heard consistently from year to year.

Figure 3. Total June and July rainfall recorded in 1996 – 2001 (Ojibway Tower weather data).

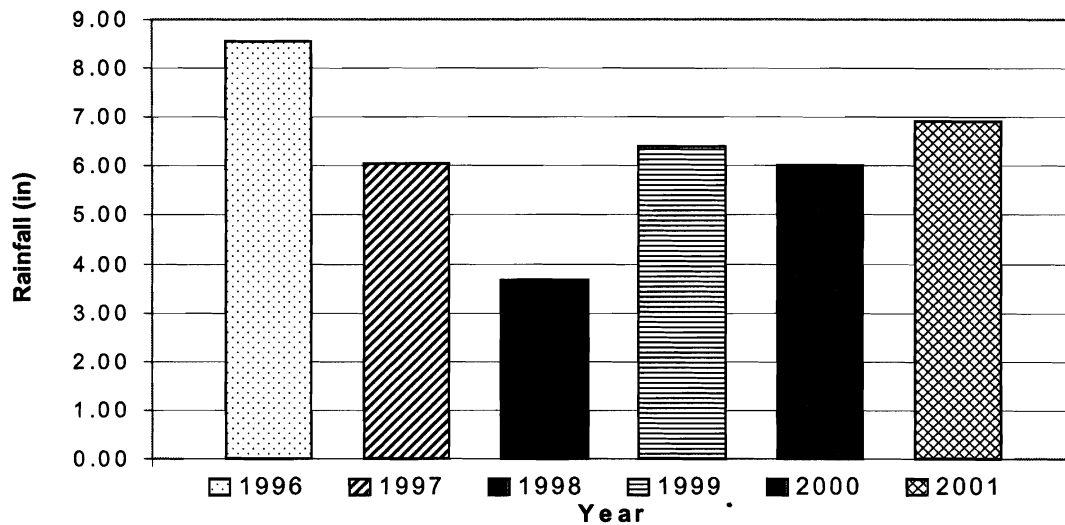
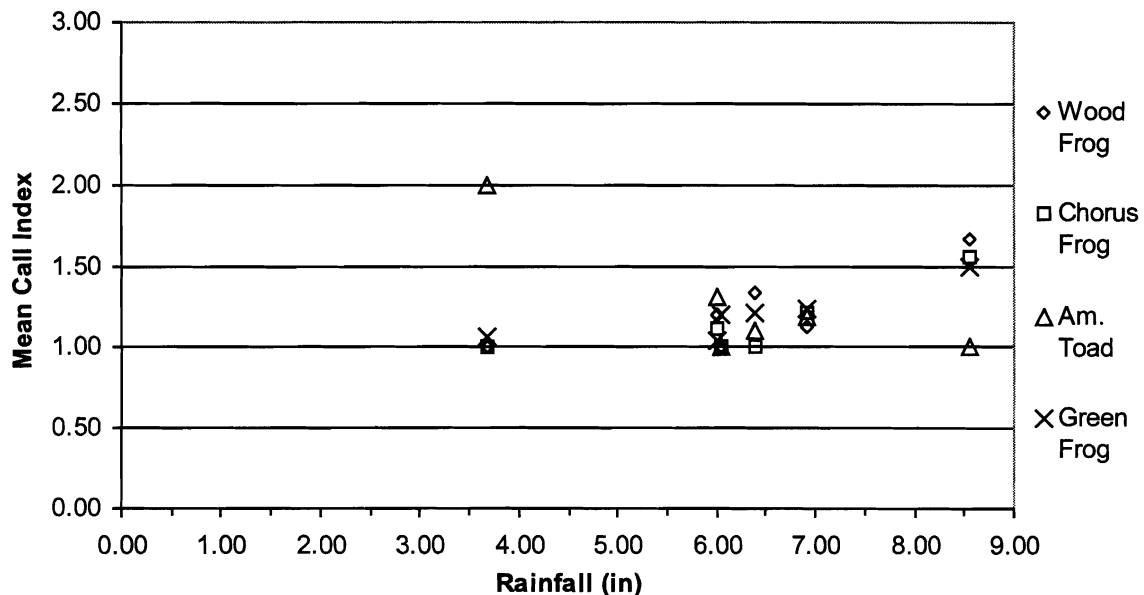


Figure 4. Total June and July rainfall vs. mean call index for 1996 – 2001.



Temperature Correlation

When the number of species observed on each transect run is compared to the mean daily temperature, there does not appear to be any relationship. In other words, on average, there are about the same number of species heard at low temperatures and at high temperatures. However, each species has a different temperature range over which it was observed. In 2001, wood frogs were recorded at temperatures between 37 – 54°F; chorus frogs were recorded between 37 – 54°F; spring peepers were recorded between 37 – 55°F; American toads were recorded between 46 – 55°F; mink frogs were recorded between 61 – 63°F; and green frogs were recorded between 46 – 63°F. Of the six species, the mink frog has the most limited temperature range for calling, although it is unclear whether this is a real trend or a consequence of the small data set for this species. Mean call index is related to mean temperature for some species when the entire season is considered. The mean call indices for the wood frog, chorus frog, spring peeper, and American toad decrease as the temperature increases. The mean call indices for the green frog and mink frog increase as the temperature increases, although this trend may be inaccurate for the mink frog due to the small number of survey points at which the species was actually heard.

On 27 April 2001, a full chorus and mating frenzy of both wood frogs and spring peepers was seen in a marsh west of Siskiwit Bay. This was notable since it was in the early afternoon on a cloudless day. The temperature was warmer than previous days and the frogs appeared to be taking advantage of the warmth to breed. Evening temperatures were still in the low 30's (F) at this time. On previous and following days at the same site, the frogs were either not heard at all or only as scattered individuals. A full chorus of wood frogs has never been documented on the nighttime anuran surveys, so this sighting suggests that at least one low-abundance species on ISRO may do much of its breeding on a single day (varying by wetland due to area-specific temperature) during warmer daytime hours.

Comparisons with Historical Data

In his 1963-64 survey of Michigan's reptiles and amphibians, Johnson (1965) concluded that there were only six anuran species present on Isle Royale: the wood frog, chorus frog, spring peeper, mink frog, green frog, and American toad. The more recent surveys, conducted in 1996 – 2001, have shown that these six species are still present, and no new anuran species have been observed. Because Johnson does not give any indication of the abundance of each anuran species, it is difficult to tell whether island populations have changed in size or distribution since that time. Furthermore, it is unclear exactly when during the summer or exactly where on the island Johnson conducted his sampling, although he noted general northern Michigan survey dates from mid-June to late August and appears to have surveyed only one site in the Rock Harbor area. Johnson's report briefly describes the terrestrial and aquatic environments each species was observed to inhabit (Johnson 1965). This habitat data, however, cannot be directly compared to the 1996 – 2001 surveys because current survey points are located only in wetland habitats.

Conclusions

As data continues to be added to this survey, it should become possible to interpret the factors that control anuran populations on Isle Royale. At this point, trends seem to indicate that rainfall (and possibly temperature) is related to the population dynamics of some anuran species. The data gathered between 1996 and 2001 provide evidence that frog and toad populations are not in steady decline on Isle Royale, but are instead 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, Isle Royale'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 FOR 2002

Problems have been identified with the Isle Royale anuran survey, specifically involving habitat data. Various Isle Royale observers have interpreted the model of Michigan DNR's survey differently. Due to the ridge-valley topography, habitats on the island often change very quickly, with several smaller wetland habitats in close proximity to each other. The DNR methodology of surveying "all species heard, regardless of distance" and "listen[ing] to all calls audible...not just those emanating from a particular [site]", has resulted in some observers recording all species from any habitat within earshot, and some observers recording only those species calling from each point's habitat designation. The MDNR and the Canadian Marsh Monitoring Program (MMP) both use these "unlimited distance" counts, citing difficulty in gauging distance to calling individuals in the dark (Long Point *et al.*, 1996). However, this method undermines habitat designations by point and has caused confusion among observers at ISRO. Clearly this compromises the ISRO survey's 1996-2001 habitat data and likely misrepresents abundance, favoring the loudest species. Proposed changes to the survey methodology are listed below.

From this change in methodology, the hypothesis of species abundance by habitat, from personal observation, is that locations with a canopy cover (wooded swamps, vernal ponds) or little standing water (bogs) will be far less productive than open water areas (beaver flowages, wet meadows). Species richness by wetland type is expected to be very different from past surveys.

More intensive surveying, such as that suggested in the 2000 report recommendations, could be accomplished on a bi-weekly basis in order to more accurately track seasonal changes of each species. Methods for this should be sought from other national studies.

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.

Census Techniques for 2002 season

Each transect is surveyed in the early spring, late spring, and summer by one skilled observer, sometimes accompanied by an assistant data recorder. Observers should all be skilled and confident in identifying the anurans of Isle Royale before participating in the survey. Many ISRO observers begin by assisting current recorders before observing on their own. General guidelines for survey dates are May 1-15 for the early spring, June 1-15 for the late spring, and July 1-15 for summer. On a particular survey route there should be no less than 15 days separating survey runs (Long Point *et al.*, 1996). However, when determining appropriate survey dates, the air temperature, weather, and seasonal phenology are more important indicators than strict dates.

Habitats at each survey location will be delineated on the survey route maps. Only those anurans calling from within these areas should be censused for the survey. Anurans calling from outside the designated survey habitat can be recorded as miscellaneous, but will not be used in data analysis.

Avoid windy conditions due to both the drying effect on amphibian skin and interference with hearing calls (Beaufort Scale codes 0-3 are appropriate). Some species may breed in a very short time frame (wood, chorus, and mink frogs on ISRO), so surveying on the first few suitable nights are ideal. Delay may contribute to low indexes or missed species.

Evening temperatures on Isle Royale tend to be significantly lower than on the mainland, so temperatures during surveys occasionally drop below the recommendations given by both the MDNR and MMP in their survey guidelines. Temperatures for Isle Royale surveys should be

above 35°F/2°C for early spring, above 45°F/7°C for late spring, and above 55°F/13°C for summer. The census begins at dusk on each sampling date and continues until the survey transect is complete. The survey is discontinued if rainfall or wind interferes with the audibility of the calls. Light rain is acceptable as long as audibility is unaffected. Temperatures and humidity (with a belt weather kit) should be taken at each point in order to track the range in which each species calls on ISRO. This may prove interesting in light of the very different temperatures used for mainland surveys.

The observer listens for a five-minute period, during which all species heard within the specified habitat type are recorded and indexed. All data is recorded on data sheets provided by the Michigan DNR. 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 identification can be made. It is more valuable to extend the listening period in order to obtain a positive identification on a species than to adhere strictly to the five-minute time frame. A call index is used to broadly estimate calling males of a particular species (Michigan DNR 1996). The index values are as follows:

- 0 -- No individuals of this species are 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 -- A full chorus of constant, continuous and overlapping calls

Using the form in Appendix 1, numbers of American Toads will be counted between points. This number could serve as a secondary means to trace the toad population over the years. Comparisons between numbers counted terrestrially and numbers counted in breeding habitats may also prove interesting.

Miscellaneous observations of anurans should be reported each year. From personal observations, it has been noted that a few of the six species utilize sunny, warm daylight hours for some or most calling and breeding. Full choruses of wood frogs, spring peepers, and American toads were heard near noontime hours in April and May of 2001, while chorus frogs and mink frogs have more commonly been heard calling during daytime rather than vesper surveys. Personal observation also suggests that spring peepers, American toads, and green frogs are the most common nighttime songsters. It is possible that chorus frogs are less represented by survey habitat, wood frogs are less represented by the timing of the initial sampling period (dictated by arrival times of employees to the island in spring), and mink frogs are simply low in abundance at Isle Royale.

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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