



2002 FROG AND TOAD SURVEY

ISLE ROYALE NATIONAL PARK, MICHIGAN

RESOURCE MANAGEMENT REPORT 02-2

SEPTEMBER, 2002

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 2002, 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 10 or 12 survey points, totaling 42 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, and 2000-2002. During the 2002 survey, five of the 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.

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INTRODUCTION

Declining numbers of several of Michigan's frog species in recent years have raised concerns about the status of regional anuran populations (Michigan DNR 1996). Since wetlands are commonly impaired by human development, frogs and toads are especially vulnerable to human exploitation of their habitat. 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. 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. Methodology has been revised, along with minor changes in survey routes, and 2002 marks the first year of conducting surveys in this amended manner. 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. Data is generally kept to 2002, but occasionally 1996-2001 data is used for comparison.

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 miles northwest of Copper Harbor, MI, and approximately 20 miles 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:

1. **Vernal Pond (abundant)** -- a small body of standing water that forms in the spring from meltwater and is often dry by mid-summer. On Isle Royale, these areas are usually depressions in wooded areas. There are 7 survey points in this habitat.
2. **Wet Meadow (rare)** -- 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. Surface water is temporary or seasonal in the spring. There are 2 survey points in this habitat.
3. **Bog (common)** -- located on saturated, acidic peat soils. On Isle Royale these are often adjacent to small lakes. They support shrubs, herbs, and often tamarack (*Larix laricina*) or black spruce (*Picea mariana*) on a mat of sphagnum moss. Some are totally overgrown and some consist of open water surrounded by floating vegetation. Common plant species include Labrador tea, orchids, sundew, and pitcher plants. Bogs are underrepresented in the survey since trails often avoid such areas. There is 1 survey point in this habitat.
4. **Marsh (uncommon)** -- has standing water from less than an inch to up to 3 feet deep, which can fluctuate seasonally or from year to year. They are dominated by soft-stemmed emergent plants. Vegetative cover is usually around 50%. There are 10 survey points in this habitat.
5. **Wooded Swamp (abundant)** -- dominated by woody plants such as shrubs or trees, and the soil is generally saturated throughout the growing season. On Isle Royale these areas are often found along streams, and trees found here include northern white-cedar (*Thuja occidentalis*), alder, and balsam fir (*Abies balsamea*). There are 16 survey points in this habitat.
6. **Pond (common)** -- open body of water that is less than 20 acres in size and does not dry up in the summer months. Often this classification includes occupied or abandoned beaver ponds and related terraced areas in close proximity to the main pond. The status of a survey point at one of these locations is subject to change with the fortunes of the occupying beaver family. Fluctuations in water level should be noted yearly, and a comparison of call indexes may be interesting if levels rise or fall. There are 6 survey points in this habitat.

Abundance status of wetland types across the island given above is from personal observation. The total number of survey points is 42.

METHODS

Four standardized frog and toad survey routes were used in 2002. These were the same routes that were used in previous surveys, although minor changes in point locations occurred between 2001 and 2002. Survey runs were conducted in early May, early June, and early 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 to twelve points adjacent or within 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" contains information on site locations, site wetland types, site numbers, maps of each transect, survey dates and field data sheets (Natural Resource Management files). The transects follow the Mt. Ojibway loop trail (MTOJ), the Three Mile to Lane Cove trail (TMLC), Moskey Basin to the LeSage-Livermore portage trail (MBLS), and the Huginnin Cove loop trail (HUGI).

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. 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.

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. Habitats at each survey location are delineated on the survey route maps and route descriptions. 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 of guideline dates 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 Michigan DNR 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 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. 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

Data Analysis

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.

RESULTS

Table 1. Number and percent of survey points (n = 42) at which each species was heard in 2002.

	Wood Frog	Chorus Frog	Spring Peeper	American Toad	Mink Frog	Green Frog
<u>May Run</u>						
# of sites	12	0	20	0	0	0
% of sites	28.5	0.0	47.6	0.0	0.0	0.0
<u>June Run</u>						
# of sites	0	0	20	3	0	3
% of sites	0.0	0.0	47.6	7.14	0.0	7.14
<u>July Run</u>						
# of sites	0	0	3	0	6	13
% of sites	0.0	0.0	7.14	0.0	14.2	30.9

Table 2. Mean call indices for each species during the 2002 season.

	Wood Frog	Chorus Frog	Spring Peeper	American Toad	Mink Frog	Green Frog
May Run	1.25	0.00	2.35	0.00	0.00	0.00
June Run	0.00	0.00	2.10	1.33	0.00	1.00
July Run	0.00	0.00	1.00	0.00	1.16	1.15
2002 Total	1.25	0.00	2.13	1.33	1.16	1.12

Table 3. Species richness for each of the six wetland types. A + indicates that the species was present on the 2002 survey. See also Figure 2.

	Wood Frog	Chorus Frog	Spring Peeper	American Toad	Mink Frog	Green Frog	Species Richness
Vernal Pond	+		+				2
Wet Meadow	+		+			+	3
Bog						+	1
Marsh	+		+	+	+	+	5
Wooded Swamp	+		+		+	+	4
Pond	+		+	+	+	+	5

Figure 1. Yearly mean call indices for each anuran species for the 1996 – 2002 survey seasons.

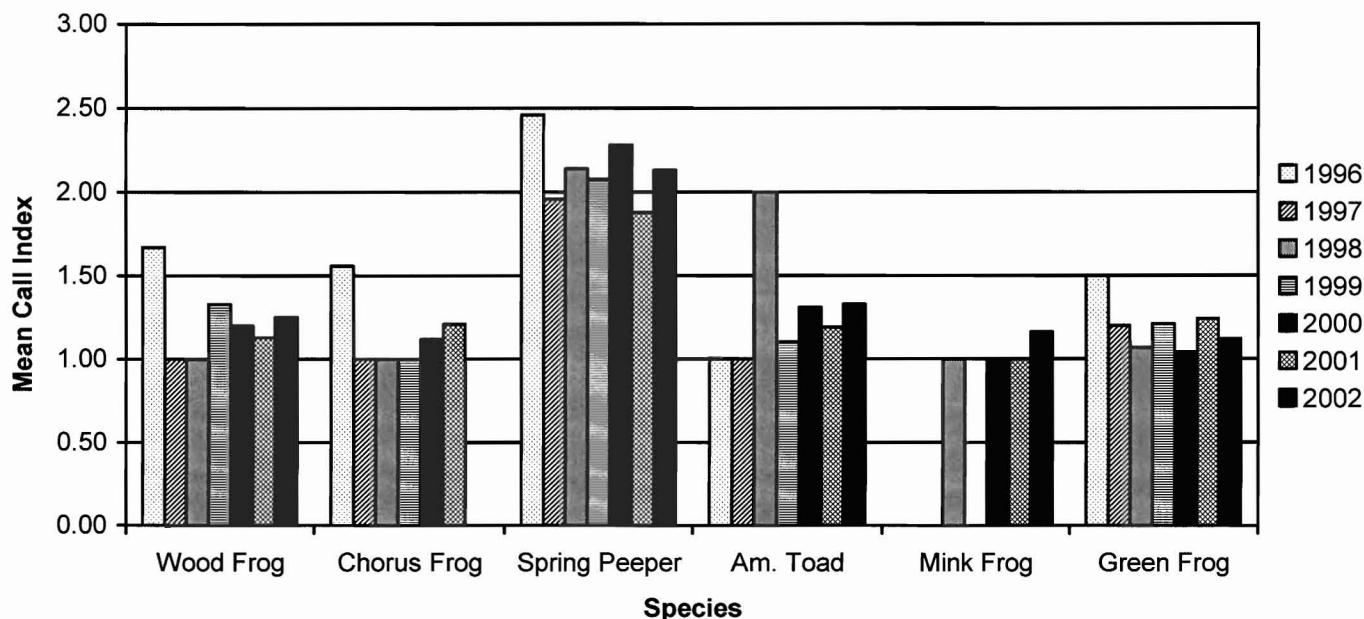
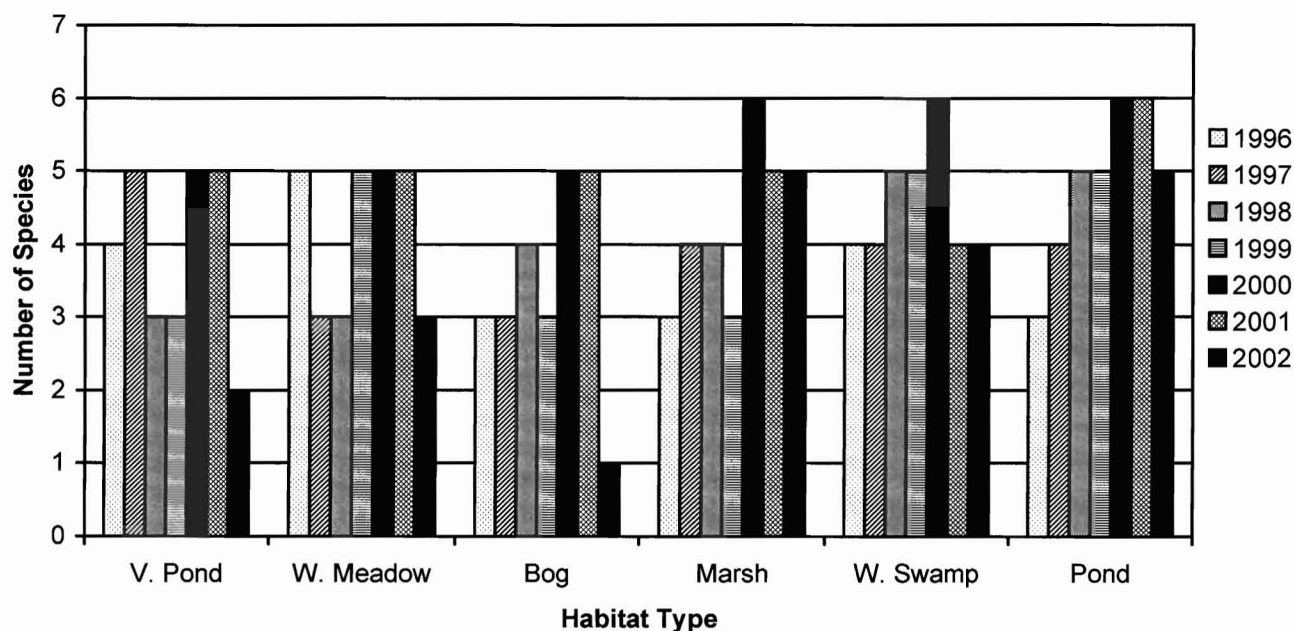


Figure 2. Species richness by wetland type in the years 1996 – 2002. See also Table 3.



ANALYSIS

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*). These are also the six species that have been heard since 1996, along with a probable Eastern Gray Tree Frog heard in 2002 on Huginnin point 4 during an assignment unrelated to the anuran survey.

Five of the six frog and toad species presently known to inhabit Isle Royale were heard in the 2002 survey. Chorus frogs were not heard on any transect this year. Of the five species heard this year, all except for the American toad and the mink frog were heard on all four transects. The American toads were absent from the MTOJ transect while the mink frogs were not heard on the MBLS transect. Because each species' breeding season peaks at a slightly different time, not every species was heard on all three runs. The wood frog was 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 all three runs while green frogs were heard on the June and July runs. Table 1 shows the number (out of 42) and percent of survey points at which each of the anuran species was heard in 2002. The number of calling individuals also varied among species and runs. Table 2 shows each species' mean call index for the three runs and for the year. Species richness in the different wetland types ranged from one to five species. No species was detected in every habitat. Green frogs, spring peepers and wood frogs were missing from only one habitat, while mink frogs were absent from three and American toads were absent from four habitats (Table 3).

Individual Species Trends

The **wood frog** had a higher mean call index for the year and was recorded at a greater portion of points in 2002 than in previous seasons. 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 2002 (and similarly, in all other years since 1996 through 2001).

The **chorus frog** was not heard on the 2002 survey. Between 1996 and 2001, the average call index was 1.15, and it was often heard on many transects. It is unknown why it was not heard in 2002.

The **spring peeper** was observed in lower abundance during the May and June runs than in previous years (heard at 47.6% of sites compared with 72.5% previously). This is due to the revised protocol used for the survey. Spring peepers were also audible on the July survey this year, although in small quantities (7.14% of sites). Despite the drop in percentage of sites where the spring peeper was found, the mean call index for this species was greater this year than in 2001 (2.13 as opposed to 1.88). 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, Dobbyn 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).

The **American toad** was observed audibly only on the June run of 2002. The percentage of sites where it was heard fell from 52.5% in 2001 to 7.14% in 2002. Once again, this is due to the change in protocol for the survey. The mean call index for the American toad was 1.30 in 2002. No American toads were heard on the July run, but many were seen on the trail between or at survey points.

Though the **mink frog** was not recorded in the 1996, 1997, or 1999 surveys, it has been heard every other year since the inception of the survey in 1996. When observed previously, mink frogs were heard only at a few survey points and only at the lowest call index (Figure 1). It was heard at 14.2% of total sites in July 2002 as opposed to 5.0% in 2001. The mean call index was 1.16 this year, higher than any other years' index of 1.00 for the mink frog. It is common, both on Isle Royale and regionally, for mink frogs to be found in low abundance (Chabot and Helferty 1995, Dobbyn and Weeber 2000). The percent of survey points occupied and the mean call index are very similar between 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 30.9% of the survey sites. This percentage is lower than that recorded in previous survey seasons. This species was also observed at 7.14% of the survey points on the June run, which is also lower than June abundances documented in the past. The 2002 mean call index for this species is 1.12. 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).

Species Richness

The survey transects include six different wetland types, defined previously. Species richness values ranged from one to five species in 2002. Values for 2002 were quite different than in previous years because of the change in survey protocol. Often, separate habitats are adjacent at a survey point, and in years past species richness was inadvertently inflated for some locales because of the vicinity of other habitats. While marsh, wooded swamp, and pond species richness numbers remained similar to previous

years, vernal pond, wet meadow, and bog species richness values were considerably altered. Marshes and wooded swamps again had five and four species present, respectively. Vernal ponds had only two species audible this year, compared to five previously. Wet meadows contained three species, with five species present in the past. Bogs suffered the greatest reduction in species heard, falling from five to one (Figure 2). As in the past, beaver ponds, with open water, abundant shoreline grasses, and floating vegetation, are generally the most productive locations for anurans on Isle Royale. Marshes and wooded swamps, however, are nearly as prolific.

Conclusions

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.

As data continues to be added to this survey, it should become possible to interpret the dominant factors that control anuran populations on Isle Royale. The data gathered between 1996 and 2002 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 2003

It may prove useful to expand our knowledge of interactions between anurans and other factors on ISRO. Comparing the degree to which anuran populations depend on various weather factors such as rainfall, temperature and humidity could reveal clues to anuran needs and fluctuations on Isle Royale.

The Huginnin Loop route should be dropped for reasons of time and fuel economy, unless an employee in Windigo has a strong interest in assisting with this route. The "frog-logger" should be set at point 4 on this route at appropriate times in order to attempt confirmation of the Eastern Gray Treefrog.

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