SHAWNEE CAVES CAVE USE STUDY FY2003 REPORT

TO THE ILLINOIS DEPARTMENT OF NATURAL RESOURCES

by

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INTRODUCTION

Cave environments are unique and delicate and easily disturbed by outside intruders, especially humans. The wildlife living inside the caves is highly adapted and does not respond well to being disturbed. The idea for this study was originally based on the author's curiosity concerning just how much human use these caves are getting, what kind of use, what are the main motivations of people for entering caves, what are the associated impacts, and can the cave wildlife and the caves themselves sustain with elevated human use.

The State of Illinois has few caves compared with some of its neighboring states, specifically Indiana, Kentucky, and Missouri, whose numbers dwarf those of Illinois. Does this mean that a lower number of caves means lower visibility and subsequent lower priority by land managers? Management of cave resources poses many unique issues land managers may not be prepared to address. Hall (1995) states "Because cave protection involves unique species and an environment unfamiliar to many scientists, the problems and challenges of cave protection are often daunting to managers assigned this responsibility" (p. 123). Foster (1989) feels that discussion concerning the management of caves is really concerned with control of the amount of damage that people inflict.

The caves causing the most concern to members of the Little Egypt Grotto, as well as other regional grottos, were Ava Cave in Jackson County and Equality Cave (often referred to as Cave Hill Cave) in Saline County, both of which get a great deal of human visitation. These caves have suffered greatly from vandalism, careless use and littering, and impact from the sheer number of people visiting them. Foster (1989) feels that recreational caving has had the most impact on caves. He states:

> The damage done by visitors to caves includes both intentional vandalism and accidental damage. Intentional vandalism includes actions such as spraypainting walls, breaking cave formations, killing bats and other animals, removing Indian artifacts, leaving behind garbage, etc. The accidental damage includes such actions as accidental breakage of cave formations, disturbance of sleeping bats, stepping on unseen cave animals, stepping on prehistoric footprints, and the sheer wear and tear on the cave from the hundreds and sometime thousands of cavers over a period of time (Foster, 1989, p. 82).

Atz (1999) describes an incident in which he observed a group of "flashlight cavers" killing hibernating bats in an Indiana cave. He was so upset he contacted the conservation police and was able to have one of the perpetrators prosecuted (he had also removed cave formations), and the man was given jail time, community service, and charged fines. Mr. Atz was later awarded $1000 for his efforts from the NSS (National Speleological Society) Cave Vandalism Deterrence Award. In this situation, the vandals were pretty much caught in the act, and the law enforcement officers cooperated. The prosecution of this vandal was a small victory, but most cave vandalism is not prosecuted or even reported.

While law enforcement may be effective in best-case scenarios like the one above, it is a form of intervention, when what is really needed is prevention. Trash and spray paint are regularly removed from Ava Cave by conscientious cavers and in the long run this may help prevent some intentional vandalism, but this is also a form of intervention and a short-term cure. Caves on federal lands that are granted significant status are protected under the Federal Cave Resources Protection Act of 1988. What

about the caves that are not so significant? D. Buecher (1995) feels the process of granting significant status to caves tends to favor the more spectacular caves or the ones with the rarest features or wildlife, leaving many caves in a more marginal status.

Abused caves like Ava and Equality still have value to the creatures residing in them, as well as for the recreational users. Some experienced cavers still visit them, and put forth quite a bit of effort cleaning them, even though they have been deemed "sacrificial."

Rich's Cave and Guthrie Cave, both in Union County, have also been included in this study for comparison. Human impact in them is minimal compared with Ava and Equality Caves, but given enough visitation over time they could become abused caves as well. These caves need good management plans, and to make a good plan one needs to have a good understanding of what is going on in the caves. The findings of this study will hopefully provide land managers a better understanding of the human use of and impacts to these caves.

MATERIALS AND METHODS

The ease of access to a cave entrance plays a large role in the amount of human visitation the cave will receive. Guthrie Cave is in Union County and requires a hike of almost a mile, with the trail hard to follow and in places overgrown. It had the least amount of visitation and seemed to be the least impacted by visitors. Guthrie Cave is also a State Nature Preserve and requires a permit to enter. The manager informed the author that he was the only person to ever apply for one. It has a large sign at the entrance, which simply says "Guthrie Cave," and is only visible immediately in front of the cave.

Rich's Cave is also in Union County, and is most easily accessed through a private landowner's property. This landowner is a steward for the cave and takes an active interest in discussing it with visitors who park on his property. The hike to the cave is considerably shorter, with a wide, well maintained trail. Rich's Cave is in the Shawnee National Forest, and is designated an Illinois Natural Heritage Landmark. It has a sign to this effect, and also a closure sign for the dates September 1 through April 30 to protect bats. This cave is very well maintained, with a minimum amount of graffiti and trash.

Ava cave is in Jackson County and is also in the Shawnee National Forest. It has three entrances, with the main entrance only about fifty feet from a pullout on a remote forest road. This ease of access has without a doubt led to high visitation numbers. There are no signs for this cave. It is highly impacted, and gets quite of bit of illicit use, resulting in large amounts of trash and graffiti at times. However, this cave also benefits from quite a bit of stewardship from NSS grotto members and other organized groups, who periodically clean trash and scrub off graffiti.

Equality Cave is in Saline County and is also in the Shawnee National Forest. Access to the entrance is by parking at an abandoned church and hiking about a half mile uphill on a well-defined trail. Continuing on this trail will eventually lead to Glenn O. Jones Lake State Park, where there was (at least a couple of years ago) a small sign pointing the way to the cave. The driveway to the church continues on a short distance to a private landowner's residence. These landowners do not seem to want to have anything to do with the cave. There is a spray painted sign at the driveway entrance that says, "Stay out after dark," and there is another that says, "Cave," pointing the direction to get on the trail so visitors will not continue on the driveway to the owners' residence. Equality Cave is by far the most heavily impacted of the four caves, and receives a high degree of illicit use. It is a maze cave, and extremely easy to get lost in. For this reason, many visitors tie string at the entrance and end up leaving it there when they leave, resulting in literally miles of string in the cave. It is very heavily spray painted with quite a bit of trash. The Little Egypt Grotto of the NSS has held an annual clean up at the cave for the last six years and has been making progress, but it is very saddening to see such reckless and careless use of this cave.

The first objective of this study was to gain a somewhat accurate knowledge of the actual amount of human visitation to the four caves concerned. This was accomplished in three ways, with the first being a register installed in the caves. This involved clamping a closeable tube to a structure in the cave with wire rope so it would be harder to steal. Instructions for filling out the register were taped to the outside of the tube and were also on the cover of the register (Appendix A). The registers (Appendix B) were obtained from the Contemporary Cave Use Study (CCUS) of the National

Speleological Society (NSS). The NSS is a national non-profit organization of which the author is a member, and it is dedicated to the preservation and conservation of caves worldwide. The CCUS is a long-term study of cave use, and the registers are used to gather information on user demographics, purpose for entering the cave, length of stay, number of people in group, NSS affiliation, personal equipment, first entry to a non-commercial cave, how the cave was found, organizations caving with, and the number of cave trips been on. Register pages that had been filled out were removed on each research visit for data entry. The registers were placed in zip-lock bags with sharpened pencils.

The second method of gaining evidence of human visitation was through the use of "Hobo on/off loggers" light sensing monitors, which were used to detect outside light sources and were provided by the Shawnee National Forest. The light monitors were disguised by putting them in packaging that had been painted flat brown, leaving a small window open for sensing. The l.e.d. (light emitting diodes) lights were covered with tape, and a small laminated card (Appendix C) was placed in each. They were set at the most sensitive setting and installed in the caves. It was necessary to dig small holes and cover them with mud in a way to avoid cave user detection. This was challenging, as they needed to see without being seen. They were placed in a way that would best detect lights from users moving in a logical pattern within the cave. They were also placed in close proximity to the CCUS registers (With the exception of Guthrie Cave, whose register is just inside the entrance and monitor quite some distance inside the cave.) to try to gain knowledge of cave user compliance with filling out the registers. The monitors were dug up on each research visit to the caves, and the data downloaded to a shuttle for transfer to a personal computer. The monitors were then re-disguised. Batteries in all of the light

monitors were replaced in the fall of 2002, as the manufacturer claims a one-year battery life.

The third method of gaining evidence of human visitation was through verbal communication with cave users at the entrance to and parking area for Equality Cave only. On three occasions in 2002 groups of visitors encountered exiting the cave were engaged in polite conversation and asked about their experience in the cave and whether or not they had found the register. Only one of the three groups claimed to have found the register and signed in, which in fact they did. A pair of visitors was encountered entering the cave and informed about the register, which they did not fill out. Another pair of visitors was encountered in the parking area, and they simply stated that they were going to the cave and walked away, not wanting to converse. In 2003 six groups of two to three visitors were encountered in or near the cave, all during the two clean up efforts held there. Notes were taken on the numbers, gender, and equipment of the visitors for data entry.

Another objective of the study was to determine if elevated human use affected the temperature of the caves. "Hobo H8 Pro Series" temperature monitors were installed in the caves to measure the cave temperature, and these were also provided by the Shawnee National Forest. Protective boxes were fabricated to orient the monitor in an upside down position to prevent moisture from collecting on a humidity sensor. These were also painted flat brown for disguise, as well as given a laminated card (Appendix C) to inform visitors who may find and potentially tamper with the equipment. The temperature monitors were much easier to camouflage, as they were placed in high crevices and were not easily viewable without some climbing. The monitors were set to

measure the temperature every eight hours or three times a day. The monitors' data were downloaded on each research visit to a shuttle for transfer to a personal computer. Through testing, one of the monitors was determined to be malfunctioning. It was mailed to the Onset Corporation for repair, resulting in a delay installing it in Guthrie Cave. The monitor in Equality Cave displayed a communication failure, and was removed from the cave for a period of one week for troubleshooting. A new battery was installed and it has worked fine ever since.

The cave register was installed in Guthrie Cave on January 24, 1998, and the light and temperature monitors were installed October 22, 2001. Therefore, the register covers a period of about 5 years and 6 months, whereas the monitors only cover about 20 months. Final data retrieval for FY 2002 was conducted on June 16, 2002, and May 26, 2003 for FY 2003.

All equipment was installed in Rich's Cave on August 21, 2001, and final retrieval for FY 2002 was conducted on June 30, 2002, and July 23, 2003 for FY 2003. This represents about 23 months worth of data.

All equipment was installed in Ava Cave on August 5, 2001, and final retrieval for FY 2002 was conducted on June 29, 2002, and June 16, 2003 for FY 2003. This represents about 22 months worth of data.

All equipment was installed in Equality Cave on August 23, 2001, and final retrieval for FY 2002 was conducted on June 23, 2002, and June 29, 2003 for FY 2003. This represents about 22 months worth of data.

Each cave was also briefly visually inspected on each research visit, primarily looking for amounts of trash, graffiti, vandalism, or other blatant forms of human disturbance or stewardship. A cursory inspection of visible wildlife was also performed.

RESULTS AND DISCUSSION

The number of visitors was determined through register information, light monitor data, and in the case of Equality Cave, verbal communication at the entrance and parking area. "Group visit" will be used to express a separate and distinct group visiting the cave, and this was determined in the same way. The light monitor data only shows distinct group visits, and not the number of distinct visitors. This means that a visit logged on the light monitor, but not in the cave register, could be one person or a very large group. Each light monitor log is counted as only one visitor in this report, unless the log corresponded with entries in the cave register. Compliance refers to the percentage of visits logged on the monitor that registered. Success rate refers to the percentage of visits (which were verifiable through register and light monitor data) that were detected by the light monitor.

Table 1

Total number of visitors by cave

Cave	Guthrie	Ava	Equality	Rich's
Visitors 2002	85 (16)	184	156	38
2003	22	181	115	154
Group visits	28 (5)	39	45	17
2003	7	38	73	40
Light monitor logs	(5)	26	23	11
2003	4	23	67	30
Compliance	(3 or 60%)	13 or 50%	12 or 52.17%	6 or 54.55%
2003	50%	14 or 60.87%	11 or 16.42%	25 or 62.50%
Success	(100%)	66.67%	51.11%	64.71%
2003	57.10%	60.53%	91.78%	75.00%
Male	40 or 63.49%	99 or 63.46%	72 or 78.26%	23 or 85.19%
2003	9 or 90.00%	87 or 78.38%	44 or 86.27%	54 or 62.79%
Female	23 or 36.51%	57 or 36.54%	20 or 21.74%	4 or 14.81%
2003	1 or 10.00%	24 or 21.62%	7 or 13.73%	32 or 37.21%
Average age	30.8	23.5	30.8	27.7
2003	27.8	26.0	37.0	21.1
Length of stay	1.85 hours	2.33 hours	3.55 hours	1.34 hours
2003	1.65 hours	2.60 hours	2.98 hours	1.89 hours
Number in group	4.4	11	6.8	4.3
2003	5.7	10	9	11
Year first entered non-commercial cave	1990	1997	1991	1989
2003	1998	1990	1991	1998
Zip code mode	62901	62901	62958	62958
2003	62901	62901	62958	62901
NSS members	19 or 22.35%	15 or 8.15%	15 or 9.62%	5 or 13.16%
2003	2 or 11.11%	14 or 10.07%	17 or 53.13%	7 or 8.53%

Note. Values enclosed in parentheses for Guthrie Cave represent the data gathered from October 22, 2001 when the light monitor was deployed, through June 16, 2002. All other 2002 values for Guthrie Cave represent data gathered from January 24, 1998 when the register was deployed, through June 16, 2002. 2003 Values for Guthrie Cave represent data gathered from June 16, 2002 through May 26, 2003.

The amount of visitation the caves received varied considerably, with the number of visitors shown in Table 1 being much lower in Guthrie and Rich's Caves, and much higher in Ava and Equality Caves in 2002. The figures for 2003 show continued lower visitation to Guthrie Cave and a much higher amount for Rich's Cave. Rich's increase is a result of large youth group visits registering, when in the previous year they did not. This parallels the state of abuse in these caves. Ease of access seems to play a major role in visitation as well. Guthrie Cave, which is the hardest cave to access, had the least amount of visitation. Ava Cave, which is by far the easiest cave to access, had the most visitations.

Equality Cave is the second hardest cave to get to, but had the second highest amount of visitation in 2002. In 2003 it had less total visitors, but had more than a 50% increase in group visits. It most likely had more, due to how well known its location is in the local community, as well as through consistent physical evidence (trash, string, graffiti). Unfortunately, the light monitor was found destroyed at the entrance on the last research visit of 2002 (June 22, 2002). Richard Young and Les Vaughn (personal communication, 25 June, 2002) stated that they had briefly checked and thought the monitor was still in place on a visit to the cave a week prior on June 15, 2002. This resulted in a loss of all light monitor data from the previous research visit (April 20, 2002) on for the FY 2002 data.

A new light monitor was provided by the Shawnee National Forest, and installed on September 22, 2002 in a different location, which proved to be more effective. The new location was only about two meters from the existing register, and placed in the mud bank that must be climbed to continue on in that part of the cave. This resulted in 67 light

monitor logs compared with 23 the previous year, and of these 67 only 11 registered. Equality Cave's 115 visitor count for 2003, is most likely extremely low, as 56 light monitor logged group visits were counted as only one visitor each. Also, the maze-like passages offer visitors many different ways to go upon entering the cave. The light monitor and register were placed in the most logical passage a visitor may follow, but they could both be easily bypassed.

Most visitors access Rich's Cave by passing through the property of a private landowner with an active interest in the cave. In fact, one must pass directly between the owner's house and antique barn. This probably has a positive effect in keeping out visitors who may otherwise enter the cave for illicit purposes. The bat closure sign at the entrance to Rich's Cave most certainly has some effect on keeping visitors out during the colder months as well.

As shown in Table 1, visitor compliance with filling out the registers ranged from a low in Ava Cave of 50% to a high in Guthrie Cave of 60% in FY 2002. Compliance in FY 2003 ranged from a low of 16.42% in Equality Cave to a high of 62.50% in Rich's Cave. The light monitors were fairly successful in detecting group visits, with the exception of the very high success rate of 91.78% in Equality Cave. The damaged state of this cave suggests non-compliance may be due to more illicit use. On average, just under half of the groups visiting the cave did not fill out the register, and perhaps these noncompliant groups were either lazy or did not want anyone to know that they were in the cave. On one research visit to Ava Cave, the lid to the tube containing the register had been found put on too tightly, and it took quite a bit of effort to remove it. This could cave.

There was more visitation by males than females to all of the caves, with exceptionally higher male visitation to Equality and Guthrie Caves as shown in Table 1. The average age of the visitors to all of the caves was fairly consistent for Guthrie and Ava Caves, with the exception of a lower average for Rich's Cave and a much higher average for Equality Cave. Rich's Cave's low figure is probably due to the large amount of youth group visits, while Equality's high number is due to experienced volunteers at the clean-ups who sign the register.

The average length of stay in Equality Cave seems to be a little high compared with the others. However, Equality is the only maze cave of the four, and one could easily spend a great deal of time exploring it. Equality Cave is also frequently used as a "hang out" or "party" spot, and people engaging in this type of behavior probably spend more time in the cave then those having more legitimate reasons. The wet nature of Guthrie and Rich's could lead to visitors spending less time in them as well.

The average number of visitors in Ava and Rich's Caves seems exceptionally high, and this is due to the many youth and other large groups using the cave. There were several large group visits with some having as many as eighteen people in their group. The average number of visitors in Equality Cave is higher than Guthrie Cave, most likely due to the large clean up efforts held by grottos.

Commercial caves are generally considered to be ones that visitors pay to enter, and are generally guided, and are often illuminated with electric lighting. The average year the visitors listed as first entering a non-commercial cave was very similar for Ava and Equality Caves, and likewise for Guthrie and Rich's.

The most frequently occurring zip codes, as shown in Table 1, were Carbondale, IL for Guthrie, Rich's, and Ava Caves, and Makanda, IL for Equality Cave. The majority of visitors to all of the caves were from southern Illinois and fairly local. However, all of the caves had some out of state visitors, with Equality Cave showing the most diversity. Other states having visitors represented in the registers were Kentucky, Missouri, Tennessee, and Wisconsin. Makanda is a very small town, and it was surprising to see it as the mode in Equality Cave, which is 55 miles away. This is most likely due to the high number of research visits performed by the author, who resides in Makanda.

The National Speleological Society (NSS) is a non-profit organization dedicated to preserving and conserving cave environments. Rouse (2001) states "The National Speleological Society (NSS) was established in 1939, but experienced slow growth until the 1960's" (p. 18). Kimmel (2002), however, states the founding of the NSS to have occurred in 1941. Rouse is probably referring to the foundation of the Washington D.C. Grotto in 1939, from which the NSS later emerged. It has nearly 200 local chapters (called grottos) nationwide (Kimmel, 2002), including the Little Egypt Grotto in Carbondale, IL. Grottos from outside the area also visit these caves, and the register shows visits from SEMO Grotto in Cape Girardeau, MO, Stygian Grotto and Meramec Valley Grotto from St. Louis, MO, Near Normal Grotto in Bloomington, IL, Windy City Grotto in Chicago, Sub-Urban Chicago Grotto, and the Nashville (TN) Grotto. The number of NSS visitors to the caves was high in Equality, and rather low in the other caves. Once again, this is probably due to the experienced cavers on clean-up efforts signing the register.

Table 2

Reasons for entering the caves

Cave	Guthrie	Ava	Equality	Rich's
Education or training 2002	4 or 3.54%	111 or 42.05%	13 or 10.40%	6 or 15.00%
2003	0 or 0.00%	56 or 37.33%	0 or 0.00%	58 or 35.37%
Conservation or clean-up	4 or 3.54%	14 or 5.30%	33 or 26.40%	0 or 0.00%
2003	0 or 0.00%	10 or 6.67%	22 or 50.00%	0 or 0.00%
Mapping	0 or 0.00%	2 or 0.76%	6 or 4.80%	2 or 5.00%
2003	0 or 0.00%	0 or 0.00%	0 or 0.00%	4 or 2.43%
Exploration	33 or 29.20%	21 or 7.95%	17 or 13.60%	13 or 32.50%
2003	2 or 9.52%	32 or 21.33%	9 or 20.45%	53 or 32.32%
Photography	8 or 7.08%	7 or 2.65%	4 or 3.20%	3 or 7.50%
2003	0 or 0.00%	3 or 2.00%	0 or 0.00%	2 or 1.22%
Recreation or sightseeing	38 or 33.63%	85 or 32.20%	37 or 29.60%	11 or 27.50%
2003	9 or 42.86%	38 or 25.33%	8 or 18.18%	34 or 20.73%
Scientific	20 or 17.70%	10 or 3.79%	13 or 10.40%	5 or 12.50%
2003	10 or 47.62%	9 or 6.00%	4 or 9.09%	13 or 7.93%
Other	6 or 5.31%	14 or 5.30%	2 or 1.60%	0 or 0.00%
2003	0 or 0.00%	2 or 1.33%	1 or 2.27%	0 or 0.00%
Total responses	113	264	125	40
2003	21	150	44	164

Note. Multiple responses possible. Percentages based on total number of responses. 2002 data for Guthrie Cave represents data collected from January 24, 1998 through June 16, 2002.

People enter caves for a variety of reasons. Meinhardt (2001) questioned cavers from the Chouteau Grotto in Columbia Missouri, and found that many of the cavers felt

that what they were doing was very unique and special. All of the reasons listed below have one thing in common: They all take place in a specific cave environment, which makes it a unique experience to the visitor. As shown in Table 2, the register lists eight reasons for entering the cave, and they are education or training, conservation or clean up, mapping, exploration, photography, recreation or sightseeing, scientific, and other. A visitor can check as many of these areas as they want.

Ava and Rich's Caves had exceptionally high numbers listing education and training, and this is probably due to the high number of youth groups entering the caves for educational purposes. While the high number of these visitors does impact the cave, one has to feel that they are receiving training in safety and environmental ethics. These groups are probably not the ones intentionally harming the caves.

Equality Cave had a rather high number listing conservation and clean up (50%), which is probably very deceptive due to most grotto cavers visiting the cave end up picking up trash beyond the annual organized clean up efforts. Also, the visitors doing the vandalism and littering probably do not fill out the register out of fear of being caught.

Cave mapping is a fairly technical process, and any visitors reporting mapping on the registers probably were not in 2002. Cave surveyors are very passionate about their hobby, and Dasher (1994) notes that cave mapping can lead to a great feeling of accomplishment and an ultimate appreciation of a cave. The Little Egypt Grotto is presently mapping in Rich's Cave when it is not closed for bat protection, and the data shown in this area for Rich's Cave is accurate.

Exploration had high numbers in Rich's Cave (32.32%). This cave requires some immersion in cold water, and perhaps this gives visitors more of a feeling that they are exploring.

Photography had very low numbers in all of the caves. Cave photographers are most likely visiting the larger, more decorated and less vandalized caves in neighboring states.

Recreation or sightseeing had high numbers in all of the caves, and these figures show the most consistency between the caves for reasons for entering them. Overall, this motivation results in the most visitation to the caves in this study.

Scientific reasons for entering the cave scored exceptionally high in Guthrie (47.62%). Guthrie cave is visited periodically by Illinois Department of Natural Resources (IDNR) personnel. There are also records of Southern Illinois University at Carbondale (SIUC) students doing cave salamander research there in the past.

Other reasons for entering the cave were fairly low for all of the caves. However, Ava and especially Equality Cave get a great deal of visitation for illicit purposes. People frequently use Equality Cave (and to a lesser extent Ava Cave) as a hang out spot and drink, use drugs, and litter and vandalize. These visitors probably do not frequently fill out the registers out of fear of being caught.

Table 3

Equipment

Cave	Guthrie	Ava	Equality	Rich's
Hard hat 2002	49 or 57.65%	118 or 64.13%	49 or 31.41%	5 or 13.16%
2003	17 or 77.27%	108 or 59.67%	29 or 25.22%	55 or 35.71%
Carbide lamp	21 or 24.71%	5 or 2.72%	10 or 6.41%	1 or 2.63%
2003	2 or 9.09%	10 or 5.52%	12 or 10.43%	7 or 4.55%
Electric light	48 or 56.47%	115 or 62.50%	46 or 29.49%	8 or 21.05%
2003	7 or 31.81%	104 or 57.46%	27 or 23.48%	19 or 12.34%
Flashlight	70 or 82.35%	54 or 29.35%	65 or 41.67%	20 or 52.63%
2003	15 or 68.18%	89 or 49.17%	34 or 29.57%	113 or 73.38%
Flashlight only	19 or 22.35%	8 or 4.35%	22 or 14.10%	14 or 36.84%
2003	0 or 0.00%	21 or 11.60%	18 or 15.65%	57 or 37.01%
Other lighting	16 or 18.82%	35 or 19.02%	27 or 17.31%	5 or 13.16%
2003	20 or 90.90%	36 or 19.89%	14 or 12.17%	7 or 4.55%
Total responses	75 or 88.24%	133 or 72.28%	87 or 55.77%	22 or 57.89%
2003	20 or 90.90%	145 or 80.11%	49 or 42.61%	125 or 81.16%

Note. Multiple responses possible. Percentages based on total number of visitors. The percentage of visitors listing at least one piece of equipment in the registers is represented as total responses. 2002 data for Guthrie cave represents data gathered from January 24, 1998 through June 16, 2002.

The equipment items from the cave registers are concerned with a hard hat and lighting systems. NSS standards dictate a helmet mounted light source and at least two additional light sources at a minimum. The helmet mounted light allows cavers to climb and negotiate obstacles while using their hands, making them much safer and protecting their head in the process. Many experienced cavers use two helmet-mounted lights in

case the first goes out. A visitor with only one light runs a serious risk of being stranded and lost in a cave if this light should fail. Knutson (1994) states "The extent of safety one wishes to realize is part of what one expects or hopes to experience while caving. Some want a lot of risk, some want little…but everyone should know what the hazards are" (pp.374). Many visitors have little knowledge of the hazards they face, and put themselves and possibly others at a greater risk by not being properly equipped. In Putnam's (2000) breakdown of caving accident and incident statistics from 1986-1998, the category for incident type "Aid, no injury" had the highest number of entries almost every year. Putnam (2003) states:

> Most incidents in this category are rescues of individuals that cavers often refer to as "spelunkers." They are typically poorly equipped and inexperienced, and are often stranded when they break or lose their flashlights, run out of batteries, descend pits hand-over-hand, or get lost (p. 3).

McFarland (2003) described the recent rescue of three local teens that had become lost in Equality Cave on April 28, 2003. They were ill equipped, unprepared, and inexperienced. At least they let someone know where they were going, and the sheriff's department was contacted, who then contacted the IDNR mine rescue team. It is interesting to note that while the article talks of safety aspects to cave exploration, there is a picture of one of the rescuers in the cave not wearing a helmet and wearing cotton clothing, which does not insulate when wet. The incident was shown on the local news the next night, and they described the cave as being on Cave Hill, which it is. This could cause others who did not know about Equality Cave to seek it out. Also, the rescuers (or the teens) did not sign the register, though they did log on the light monitor.

Visitors were to check off each piece of equipment they were using. For instance, a visitor who has a helmet mounted carbide lamp and electric back up light, a spare flashlight, and a candle and matches, would check all of the equipment categories. A properly clothed caver with multiple light sources can survive a very long time in the cold, wet environment. The percentages listed in the results, as shown in Table 3, were figured by dividing the total for each piece of equipment by the total number of cave visitors.

The use of hard hats was fairly high in Guthrie and Ava, and quite low in Rich's and Equality. The high number in Ava Cave is probably due to the high numbers of properly equipped youth groups, while the low number of visitors to Rich's Cave using hard hats was probably due to much more casual, shorter trips into a smaller cave with a much larger and easier to find (from inside) entrance.

The use of carbide lamps was low in all of the caves. As electric lighting systems have become much more efficient and affordable, carbide lamp use has been on the decline. They require more effort to use and clean, and are considered by some to be less reliable than electric lights. Also, carbide is much harder to obtain than it used to be, due to its hazardous material classification. The main advantage of carbide is its low cost, and grottos often purchase bulk containers through vendors in the caving community for sale to their membership.

The use of electric lights was high in Ava, and this is most likely due to the same reasons listed above. The author understands "electric" to mean a helmet mountable

battery powered light. There was probably some visitor confusion in this area, most likely leading to flashlight cavers listing "electric" as well.

The use of a flashlight had typically high numbers in all of the caves, with the exception of Equality Cave. This makes sense, as flashlights are readily available to the public and can be purchased rather inexpensively.

The flashlight only category showed a high of 37.01% in Rich's and a low of 0% in Guthrie. Caving with only a flashlight is very dangerous, as it could fail with catastrophic results. The author feels that the fairly low number for Equality and Ava should be much higher, and this is probably due to visitors not filling out the register.

The use of an "other light source" was low for Rich's and high for Guthrie. This source is normally considered to be for emergencies, but may be checked off for candles, lanterns, lighters, torches, or any other source not covered by the other categories.

Table 4

Information source: How the visitors found the caves

Cave	Guthrie	Ava	Equality	Rich's
Friends 2002	32 or 45.07%	47 or 30.32%	28 or 40.58%	13 or 59.09%
2003	10 or 50.00%	34 or 26.77%	14 or 45.16%	23 or 26.44%
Book	1 or 1.18%	1 or 0.65%	2 or 2.90%	0 or 0.00%
2003	0 or 0.00%	3 or 2.36%	2 or 6.45%	0 or 0.00%
Club	26 or 30.59%	38 or 24.52%	27 or 39.13%	7 or 31.82%
2003	2 or 10.00%	14 or 11.02%	12or 38.71%	12 or 13.79%
Other	12 or 14.12%	69 or 44.52%	12 or 17.39%	2 or 9.09%
2003	8 or 40%	76 or 59.84%	3 or 9.68%	52 or 59.77%
Total responses	71	155	69	22
2003	20	127	31	87

Note. Multiple responses possible. 2002 data for Guthrie cave represents data gathered from January 24, 1998 through June 16, 2002.

Cave locations are quite often guarded with secrecy within the caving community, but not so much with the general public. Word of mouth has often resulted in high impact to some caves. Perez (2002) states the following:

> There are many sources of cave locations in the public domain including books, maps, and even web sites. There are not enough standards or policies for the disclosure of cave locations. There are no rules or sanctions for those who give out locations of sensitive sites. The caves pay the price for our indiscretion (p. 171).

This statement is probably more accurate concerning caves on privately owned lands. However, caves on federal lands which have been identified as being significant are protected under the Federal Cave Resources Protection Act of 1988 (1988), which states:

> Information concerning the specific location of any significant cave may not be made available to the public under section 552 of title 5, United States Code, unless the Secretary determines that disclosure of such information would further the purpose of this Act and would not create a substantial risk of harm, theft, or destruction of such cave (p. 4304). The Shawnee National Forest considers all caves located within its boundaries to be significant.

Additionally, Huppert (1995) notes that Illinois is one of many states that have specific laws to protect caves.

Visitors were offered four responses for how they found the caves, as shown in Table 4. Finding the caves through friends had the overall highest numbers in this category, which is a cause for concern. As friends tell friends, this area has the highest potential to create excessive and improper visitation to the caves.

Finding the caves through books had the overall lowest numbers in this category by far, and can be almost considered negligible. Distribution of cave locations through a written (or other media) format which is easily accessible, poses the most danger for increasing visitation. Fortunately, books available to the public detailing cave locations are definitely a thing of the past. Most are considered collector's items and their purchase is actively pursued by the caving community to keep them away from the general public.

Finding the caves through clubs had fairly consistent numbers, with the exception of Equality Cave, most likely due to advertisement of clean-up efforts through NSS grottos by the author. The majority of these clubs were NSS grottos, but there were also Christian groups, Scout groups, and Scout camps. There was even listed an illicit "CZR Bong Team," and a couple of individuals listing "LSD" as their organization.

Other means of finding the caves showed a very high number in Ava and Rich's Caves, and this is probably once again due to the large number of youth groups entering these caves who were guided by a camp or other organization.

Table 5

Number of caving trips the visitors have been on

Cave	Guthrie	Ava	Equality	Rich's
One 2002	1 or 1.52%	35 or 28.23%	5 or 7.94%	3 or 15.00%
2003	0 or 0.00%	29 or 28.16%	3 or 10.00%	21 or 48.83%
Two	1 or 1.52%	10 or 8.06%	7 or 11.11%	2 or 10.00%
2003	1 or 11.11%	7 or 6.79%	1 or 3.33%	5 or 11.62%
Three	3 or 4.55%	11 or 8.87%	7 or 11.11%	4 or 20%
2003	0 or 0.00%	4 or 3.88%	2 or 6.67%	1 or 2.32%
Four	2 or 3.03%	7 or 5.65%	1 or 1.59%	1 or 5.00%
2003	0 or 0.00%	9 or 8.74%	0 or 0.00%	3 or 6.97%
5 to 10	14 or 21.21%	23 or 18.55%	10 or 15.87%	3 or 15.00%
2003	5 or 55.55%	18 or 17.47%	4 or 13.33%	6 or 13.95%
11 to 25	9 or 13.64%	17 or 13.71%	11 or 17.46%	1 or 5.00%
2003	1 or 11.11%	14 or 13.59%	4 or 13.33%	2 or 4.65%
26 to 50	8 or 12.12%	9 or 7.26%	6 or 9.52%	0 or 0.00%
2003	0 or 0.00%	7 or 6.79%	5 or 16.67%	1 or 2.32%
51 to 100	16 or 24.24%	2 or 1.61%	2 or 3.17%	2 or 10.00%
2003	0 or 0.00%	7 or 6.79%	2 or 6.67%	1 or 2.32%
101 to 250	10 or 15.15%	8 or 6.45%	10 or 15.87%	4 or 20.00%
2003	2 or 22.22%	8 or 7.77%	8 or 26.67%	3 or 6.97%
251 to 500	1 or 1.52%	0 or 0.00%	1 or 1.59%	0 or 0.00%
2003	0 or 0.00%	0 or 0.00%	1 or 3.33%	0 or 0.00%
501 or more	1 or 1.52%	2 or 1.61%	3 or 4.76%	0 or 0.00%
2003	0 or 0.00%	0 or 0.00%	0 or 0.00%	0 or 0.00%
Total Responses	66	124	63	20
2003	9	103	30	43
1 to 10	31.82%	69.35%	47.62%	70.00%
2003	66.66%	65.05%	33.33%	83.72%
11-501	68.18%	30.65%	52.38%	30.00%
2003	33.33%	34.95%	66.67%	16.28%

Note: 2002 data for Guthrie cave represents data gathered from January 24, 1998 through June 16, 2002.

The "number of caving trips the visitors have been on" category, as shown in Table 5, can help to provide a better understanding of the overall caving experience of the visitors.

Guthrie Cave had the highest numbers in this category in 2002. The 2003 figures are the reciprocal to the previous year. This is most likely due to the author taking five novice coworkers with him on a research visit in May of 2003. Guthrie Cave is difficult to find and its location is not well known by the general public compared with the other caves. A higher level of experience is expected for the visitors to this cave. Unavoidable passage through cold water probably keeps out some of the less experienced, and the more pristine state of the cave may still hold attraction for experienced cavers.

The easy access to Ava Cave coupled with the high number of youth groups has made this an often-used first time experience cave. More experienced cavers typically use this cave more for training and clean-up efforts than any other reason.

The figures for Equality Cave are a bit harder to evaluate, as it had a much more even distribution of experience in 2002, and a higher experience level in 2003. Regular clean-up efforts draw many experienced cavers, and the more experienced cavers seem to be more willing to fill out the registers. Equality is also somewhat geologically unique among southern Illinois caves, which may draw experienced cavers interested in this aspect of caving, despite the "trashed" appearance of the cave. It is also possible that the well-known location of this cave has led to many return trips by visitors who may only know the location of this one cave.

The figures for Rich's Cave indicate a much lower level of caving experience, and this is probably due to the increased number of youth groups signing the register. The

main passage of Rich's Cave, which many visitors stay in, is quite short in distance, and it has a large entrance quite visible from a good part of this passage. This probably leads to more casual curiosity-based visitation and not much challenge for the experienced caver. There is however, some challenge available to the visitor who is willing to crawl through very tight partially water filled passage. Most experienced cavers in the region go to bigger caves in neighboring states for this type of experience.

Table 6

When the caves are being visited

Cave	Guthrie	Ava	Equality	Rich's
Sunday	21 or 26.25%	24 or 13.04%	29 or 18.59%	5 or 13.89%
2003	1 or 4.55%	28 or 15.47%	21 or 18.26%	18 or 12.08%
Monday	5 or 6.25%	22 or 11.96%	17 or 10.90%	13 or 36.11%
2003	8 or 36.36%	37 or 20.44%	12 or 10.43%	6 or 4.03%
Tuesday	0 or 0.00%	0 or 0.00%	20 or 12.82%	4 or 11.11%
2003	0 or 0.00%	4 or 2.21%	5 or 4.34%	27 or 18.12%
Wednesday	4 or 5.00%	25 or 13.59%	1 or 0.64%	8 or 22.22%
2003	10 or 45.45%	4 or 2.21%	9 or 7.82%	38 or 25.50%
Thursday	20 or 25.00%	32 or 17.39%	12 or 7.69%	1 or 2.78%
2003	0 or 0.00%	46 or 25.41%	3 or 2.61%	10 or 6.71%
Friday	0 or 0.00%	43 or 23.37%	10 or 6.41%	3 or 8.30%
2003	3 or 13.63%	4 or 2.21%	5 or 4.34%	40 or 26.84%
Saturday	30 or 37.50%	38 or 20.65%	67 or 42.95%	2 or 5.56%
2003	0 or 0.00%	58 or 32.04%	60 or 52.17%	10 or 6.71%
Weekend visits	51 or 63.75%	62 or 33.70%	96 or 61.54%	7 or 19.44%
2003	1 or 4.55%	86 or 47.51%	81 or 70.43%	28 or 18.79%
Weekday visits	29 or 36.25%	122 or 66.30 %	60 or 38.46%	29 or 80.56%
2003	21 or 95.45%	95 or 52.49%	34 or 29.57%	121 or 81.21%
Time of day	15:01	14:16	13:28	15:54
2003	14:52	14:23	13:49	14:52

Note: 2002 data for Guthrie cave represents data gathered from January 24, 1998 through June 16, 2002.

The day of the week that visitors entered the caves was not asked for on the registers, but was deduced from the date listed, which was requested. Some of the most

reliable data came from this area, as the light monitors logged the exact date and time of the visits. The information is shown in Table 6.

One would think that caving, along with many other recreational activities, would traditionally be done more on weekends than during the week, due mostly to work schedules and available free time. Equality Cave visitations follow this pattern. The reverse was true for Guthrie and Rich's cave, with more than three-quarters of the visits to Rich's occurring on weekdays, and almost all of the visits to Guthrie on weekdays. Once again, the percentage for Guthrie was impacted by the author taking five novice coworkers into the cave on a research visit on Memorial Day (Monday) 2003, which represents more than 27% of the weekday visits. Also, IDNR personnel frequently make their research visits on weekdays, accounting for another 36%.

The high Rich's number is most likely due to the large number of guided youth group visitations. Last year's high Rich's number can perhaps be attributed to people visiting the cave while on vacation and/or combining it with other activities, and the youth groups not signing the register. To get to Rich's Cave, one must park on the private landowner's property, and he operates an antique store and bed and breakfast there. It is also located just off of the Southern Illinois Wine Trail. Ava Cave's percentages are more balanced in 2003 than in the previous year, and perhaps more of the youth group visitation is going to Rich's Cave to reduce driving.

Visitation which is spread out more throughout the week may tend to have less impact on the wildlife within the cave. Illinois Caverns in Monroe County, Illinois, has such high visitation on the weekends that the cave has been officially closed on Mondays and Tuesdays, presumably to allow the wildlife a chance to recover. The Illinois Caverns

News Brief, 1999, states "Closure on these days would have little effect on the public and at the same time allow the cave system time to recover from the busy weekend." On certain days, the caves curiously had little or no visitation. In 2002, Guthrie and Ava both had no visitors on Tuesdays, Equality only had one on Wednesdays, and Rich's only had one on Thursdays. In 2003, Guthrie Cave had no visitors on Tuesdays, Thursdays, and Saturdays.

The average times for being in the caves were quite similar for all of them, being between 13:49 and 14:52 in 2003.

Table 7

Temperature

Cave	Guthrie	Ava	Equality	Rich's
Number of Readings	1743 (581 days)	2041 (680 days)	2024 (675 days)	2106 (702 days)
Average	52.43	53.50	50.09	52.60
Median	52.92	53.62	50.46	53.19
Mode	54.97	53.75	51.78	54.58
High 2002	56.49 (5/13/02)	54.06 (10/24/01)	52.70 (10/11/01)	58.52 (9/6/01)
2003	55.58 (6/16/02)	53.97 (10/10/02)	53.75 (10/10/02)	61.61 (8/4/03)
Low 2002	48.02 (1/4/02)	52.97 (3/25/02)	47.49 (3/5/02)	44.69 (1/4/02)
2003	44.56 (1/24/03)	52.70 (3/10/03)	45.60 (2/28/03)	34.88 (1/24/03)
Range 2002	8.47	1.09	5.21	13.83
2003	11.02	1.27	8.15	26.73

Note: All temperatures are in degrees Fahrenheit.

Graphs of the temperatures for the study periods listed can be viewed in Appendix D for Guthrie Cave, Appendix E for Ava Cave, Appendix F for Equality Cave, and Appendix G for Rich's Cave. Please note that all information concerning temperature covers from the initial installation of the temperature monitors in 2001 through the final data downloads in FY 2003, unless otherwise noted. The average daily surface temperature at Paducha, Kentucky, is also provided in the graphs for comparison with the caves.

One of the objectives of this study was to measure the temperature within the caves and try to determine if increased human visitation altered this temperature. This

was done by comparing the dates and times of rises in temperature with visits logged in the registers and on the light monitors. Also, the dates of group visits with high numbers of visitors were matched with the temperature data for that particular day, and if possible time. All temperatures used in this report, unless otherwise noted, will be in degrees Fahrenheit. Temperature information is shown in Table 7. Graphs of the temperatures for the study period are in Appendices D-G.

Ava Cave had the most constant temperature, varying by only 1.09 degrees in 2002, and only 1.27 degrees the following year. Researcher handling of the monitors raised the temperature reading slightly, if it logged it shortly after handling. For instance, on one research visit the temperature was 53.01 degrees at 07:21 in the morning. At 15:21 it registered 54.14 degrees, a rise of 1.13 degrees. The monitor had been handled for data retrieval only five minutes before this reading. This temperature rise due to handling, as well as others, was not included with the high/low temperature data as it was inconsistent with the rest of the data. Ava Cave also had the highest average temperature and median temperature of the four caves. The largest temperature variations occurred on days (0.44 and 0.13 degrees) when there were no visitors registered or logged. There were a few occasions in which large group visits corresponded with slight rises in temperature (10 visitors/0.05 degree rise, 18 visitors/0.05 degree rise, 16 visitors/0.04 degree rise, and 18 visitors/0.09 degree rise). There was one unregistered visit logged on the light monitor with a rise of 0.05 degrees. On the next research visit the refuse of several tea lights (small candles) was found approximately 20 feet from the temperature monitor, and this may have been the cause of the temperature increase. P. Borsari

(personal communication, August 6, 2002) of the Onset Corporation states the accuracy of the temperature monitors as being plus or minus 0.33 degrees at 70 degrees Fahrenheit.

Equality Cave had the lowest average, median, and mode temperatures. This cave fits the profile of a Cold-air-trap cave.

R. Buecher (1995) states:

> Cold-air-trap caves selectively capture and hold cold air. Typically these caves have entrances and initial passages which slope downward from the entrance. Usually there is only a single entrance and the cave volume is relatively small. At night or during the winter months, air that is colder or of greater density will flow into the cave, filling the areas lower than the entrance with cold air. During the warmer months of the year, a pool of colder dense air remains. The volume of cold air stored must be large enough to keep the area cool for several months (p. 43).

The temperature in Equality Cave dropped below 50 degrees on 12/27/01 and did not rise above 50 degrees until 5/6/02 in 2002, and did likewise from 12/24/02 through 5/20/03. Dunlap (1995), from his research in caves of southern Indiana, states that the endangered Indiana Bat (Myotis sodalis) prefers colder temperatures for its hibernation areas, typically between 5-10 degrees Celsius (41-50 degrees Fahrenheit). Harvey (1992) notes a slightly lower temperature of 38-43 degrees Fahrenheit. Dunlap also states (as cited in Brack, Tyrell, & Dunlap, 1995) that these bats are very selective and "While there are tens of thousands of caves in this species' known hibernation range, only about 135 caves have been documented as being used by these bats with only a dozen or so caves containing substantial populations" (Dunlap, 1995, p. 76-77). Equality Cave could

have the potential to be an Indiana Bat hibernaculum temperature-wise, but the high degree of visitation and impact to the cave may prove to be a deterrent for the sensitive creatures. There were eight occasions when visits corresponded with slight temperature rises ranging from 0.04 to 0.09 degrees, and one light monitor log with a rise of 0.31 degrees. A research visit on March 19, 2002, found Equality Cave partially flooded, and very cold water had pooled in the bottom of the cave. This water was waste deep near the temperature monitor, and was draining to lower levels, but not fast enough to keep it from pooling. This cave is not frequently known to flood, as it is located high on a hill. Some of the coldest temperatures correspond with times of extremely heavy surface precipitation. Perhaps large amounts of very cold water may cause a lowering of temperature in this type of cave.

A communication failure occurred when retrieving data in Equality Cave on September 22, 2002, and the temperature monitor was removed for a period of one week. The battery was replaced and it was reinstalled. Upon review of the data, major irregularities were discovered. There were four separate occasions representing 44 readings (approximately 15 days) during the period of July 22 and August 17, 2002, in which the temperature readings were well below zero. These readings were deleted from all calculations, and were attributed to a battery malfunction. These deletions can be seen on the graph in Appendix F as small gaps. Slightly lower than normal temperature readings for this time of year can also be noticed on this graph during the same time period, but were within a couple of degrees of normal and were retained.

Guthrie, and especially Rich's Cave, had the highest variations of temperature, with the highs and lows being somewhat consistent with variations in surface

temperature. These caves fall into the chimney cave classification. R. Buecher (1995) states:

> Chimney caves are caves with two or more entrances which lie at different elevations. During the year two patterns of steady airflow can develop due to the differences in air density between the two entrances and the air in the cave. The greater the elevation difference the more pronounced the air flow will be.
>
> During the winter, cool air entering the lower entrance is warmed and rises to the top of the cave and exits as a plume of warm air at the upper entrance. During the summer, the air inside the cave is cooler and more dense than outside air and it flows out the lower entrance (p. 43).

Rich's Cave has two entrances at higher elevations than the large main entrance, one of them being quite large, allowing for increased air flow. The annual temperature range was 26.73 degrees, more than double that of Guthrie Cave, which had the next highest temperature range. This is almost double the range of the previous year, and the winter of 2003 had some much colder daily averages than the previous year. Moving the temperature monitor deeper into the Rich's Cave would most likely narrow this range a bit.

Andy West (personal communication, October 21, 2002) states that Guthrie Cave has a small second entrance located on adjacent private property, and he is only aware of a couple of people actually being able to get through it. The temperature monitor is a good ways inside the cave; this, in conjunction with a smaller upper entrance probably cause Guthrie Cave to have a narrower temperature range than Rich's.

Rich's Cave had no temperature changes that could be attributed to visitation. Guthrie Cave had three rises in temperature (1.05, 0.04, and 0.17 degrees) corresponding with light monitor logs. The last rise corresponded with a research visit and was logged three minutes before the temperature monitor data was downloaded. There were six visitors in close proximity to the monitor. A very big rise and fall of temperature recorded in Rich's Cave on October 7-8, 2001, was due to the temperature monitor being removed for replacement, and the changes during this time period were actually outside surface temperature readings. This data was deleted from all calculations as well as from the graph in Appendix G.

SUMMARY

A great deal of information has been gathered through this study. Ava and Equality Caves have had excessive amounts of visitation and show it. Due to fiscal year and initial start-up time restraints, data is missing from this research for some summer months of 2001 and 2003. Summer is traditionally a time of increased recreation, and one has to believe that this would mean increased visitation to the caves. It would not be unreasonable to estimate 300 or more visitations to Ava Cave, and 400 or more visits to Equality Cave annually. The amount of visitation to Rich's Cave showed a huge increase from the previous year. This is most likely due to the large youth groups using the cave and signing in, when they previously did not. When people see that others are filling out the register, they may be more inclined to do so themselves.

The state of abuse to Equality Cave requires serious attention. Its reputation as a "party cave" in the local community has led to serious damage and degradation. Many people write this cave off as a lost cause, but many others do not feel this way. Clean-up efforts have made great progress, but something needs to be done to mitigate future illicit use of and damage to this cave. Taylor and Webb (1998) state "The public knows very little about caves and the organisms that inhibit them" (pp. 3). Perhaps an educational effort could be effective in helping to prevent future damage. Clean-up efforts help a great deal in this area, as visitors happening upon a cave clean up get a chance to see stewardship in action. Foster (1989) feels that making the public aware of the need to protect caves will help on a long-term basis. Perhaps a small sturdy sign inside the cave entrance could help to make vandals aware that they are breaking the law, and could also provide conservation information as well. A sign outside this cave would probably be

very short-lived. A law enforcement effort leading to prosecution may have a strong mitigation effect as well. Gating the cave and restricting use may be the most effective solution. Roughly two-thirds of the visits to Equality Cave were on weekends, most notably Saturdays. An educational effort during these busy times could have a great effect in converting potential vandals into stewards.

The state of abuse in Ava Cave is much less, and over the years clean-up efforts have helped to reduce the amount of vandalism a great deal. People spray painting arrows to find their way does seem to be a recurring problem, as these arrows are periodically scrubbed off and then reappear. Tom Clifton of the Meremac Valley Grotto (personal communication, July 2001, 2002, and 2003) has spearheaded annual clean-up efforts at Ava Cave, and he suggested mounting small reflective arrows in strategic locations to help with this problem and even provided a prototype. Accidental damage seems to be the biggest problem in this cave due to the large numbers of visitors. Trout (1998) suggests impact mapping as a way to keep track of cave damage. Setting up a permitting system in this cave may be the best solution for limiting use. Anita Arends of the Shawnee National Forest (SNF) (personal communication, March 2002) states that they are in the process of establishing guidelines for permits for guided cave visitation for the Forest, as it is not covered under their recent Decision Memo concerning Commercial Outfitting and Guide Services (Foot Travel). The main entrance of Ava Cave's close proximity to the road would make an outside sign prohibitive, as it would attract even more visitors. A small sturdy sign just inside the cave entrance would probably be helpful. Having three entrances, the gating of Ava Cave would be problematic. Its close

proximity to the road would also enable vandals more of an opportunity to use heavier equipment to destroy a gate on the main entrance.

Guthrie and Rich's caves simply do not have the abuse problems suffered by the other caves. Their somewhat remote locations are probably the main reason for this. Keeping public knowledge of their locations to an absolute minimum should be the priority to help keep them from becoming abused. The sign in front of Rich's Cave has been pretty effective in keeping people out during the bat closure time period. Seven of the seventeen cave visits during FY 2002 occurred during the closure, but there were no visits between October 11, 2001, and March 27, 2002, a really critical time period when the bats should not be disturbed. There were eleven visits to Rich's Cave during the closure for FY 2003, with two of them during the critical period (These two visits were by IDNR personnel, and they were probably surveying the bat population.).

Guthrie Cave has a large sign, and it would be helpful to provide information on this sign addressing conservation, information on safe caving techniques and equipment, and maybe even State legal information concerning caves and Nature Preserves. Guthrie Cave has a sizeable bat population, and may benefit from a seasonal bat closure. An inventory of wildlife would be helpful in determining the need for this.

One of the most beneficial findings of this study concerned the effectiveness of the light monitors for measuring visitation. Properly placed, they worked quite well for detecting group visits, but were not accurate in determining group size. The brighter the light, the better they worked. Some large groups using l.e.d. lights did not log at all, due to the soft nature of these lights. Proper positioning and camouflage were critical with these monitors. Placing more than one in a cave (especially Equality Cave) could increase

the accuracy of visitation measurement, and their relatively low cost ($ 59.95) is not prohibitive.

Most of the temperature changes possibly attributable to human visitation were so negligible and few that it is probably safe to say that there was no noticeable effect on temperature due to normal human cave visitation. The accuracy of the monitors compared with the small temperature changes also led to the same conclusion. The collection of the data will still be beneficial though, as it will be continued, and as Dunlap (1995) states, temperature data covering many years will no doubt be beneficial to future research.

In conclusion, the NSS and its Grottos, as well as other cave organizations (State Speleological Societies, Karst Conservancies) and stewards, are a great asset to land managers. The volunteer efforts, and the wealth of knowledge, experience, and information often available from these groups and individuals is invaluable. Conversely, the information, assistance, and support land managers can provide cavers is invaluable as well. Continued partnerships on future projects and decisions concerning caves are in the best interest of all parties concerned.

Additionally, the NSS and its grottos maintain call out lists of cavers who are willing to volunteer their time, experience, and often vast knowledge of local cave resources to assist with cave rescues.

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APPENDICIES

CAVE REGISTER
and
QUESTIONNAIRE

Cave _____

County _____ State _____

This register is maintained by the _____

Person who placed register in cave _____ Date placed _____

Person who recovered register from cave _____ Date removed _____

INSTRUCTIONS and HOW TO SAVE TIME

1. **Every person in each group should fill out a questionnaire on each trip into the cave.**

2. Please assist in advancing the understanding of caves and caving by filling out the next available questionnaire in this cave register book. Most questions are self explanatory and designed to be answered quickly. You do not need to spend time recalling your past caving to obtain exact answers.

3. If there are two or more register books available, you may save time by having some of your group fill out questionnaires in one book while other group members fill out questionnaires in another book at the same time.

4. If you have filled out a cave register questionnaire like this one in this county before, **you may save time by answering only the questions marked with an "*".** Also, please answer those questions in which your responses have changed since your last recording in a cave register. Cavers who often fill out registers should completely answer a questionnaire at least once a year as some registers are not returned.

5. The key words in each question are printed in **"bold"** to assist you in quickly identifying the main point(s) of the question.
6. Please do not over tighten the lid of the register container. It is not intended to be watertight.

Published: January 1991, Version 6.01 Code: NoDRD _____, NoMS _____, S ___, Standard ___, L ___, X-L ___, C ___, Other ___.

Name_____ Age_____ Male_____ Female_____

Address_____ Today's date_____

City_____ State_____ Zip_____

Main purposes of this cave trip: Education or training___, Conservation or cleanup___,Mapping___, Exploration_____, Photography____, Recreation/sightseeing____, Scientific_____, Other_____.

How long do you plan to stay in the cave, in hours?_____. # of people in your group on this trip?_____. Are you an NSS member? Yes____No____, Number_____.

Check types of equipment you are using: Hardhat_____, Carbidelamp____,Electric____,Flashlight____,Other light source____. Year you first entered a non-commercial cave:____.

How did you find this cave? Friends___ Book/periodical____,Club____,Other____. Name the organizations, clubs or grottos you usually cave with:_____.

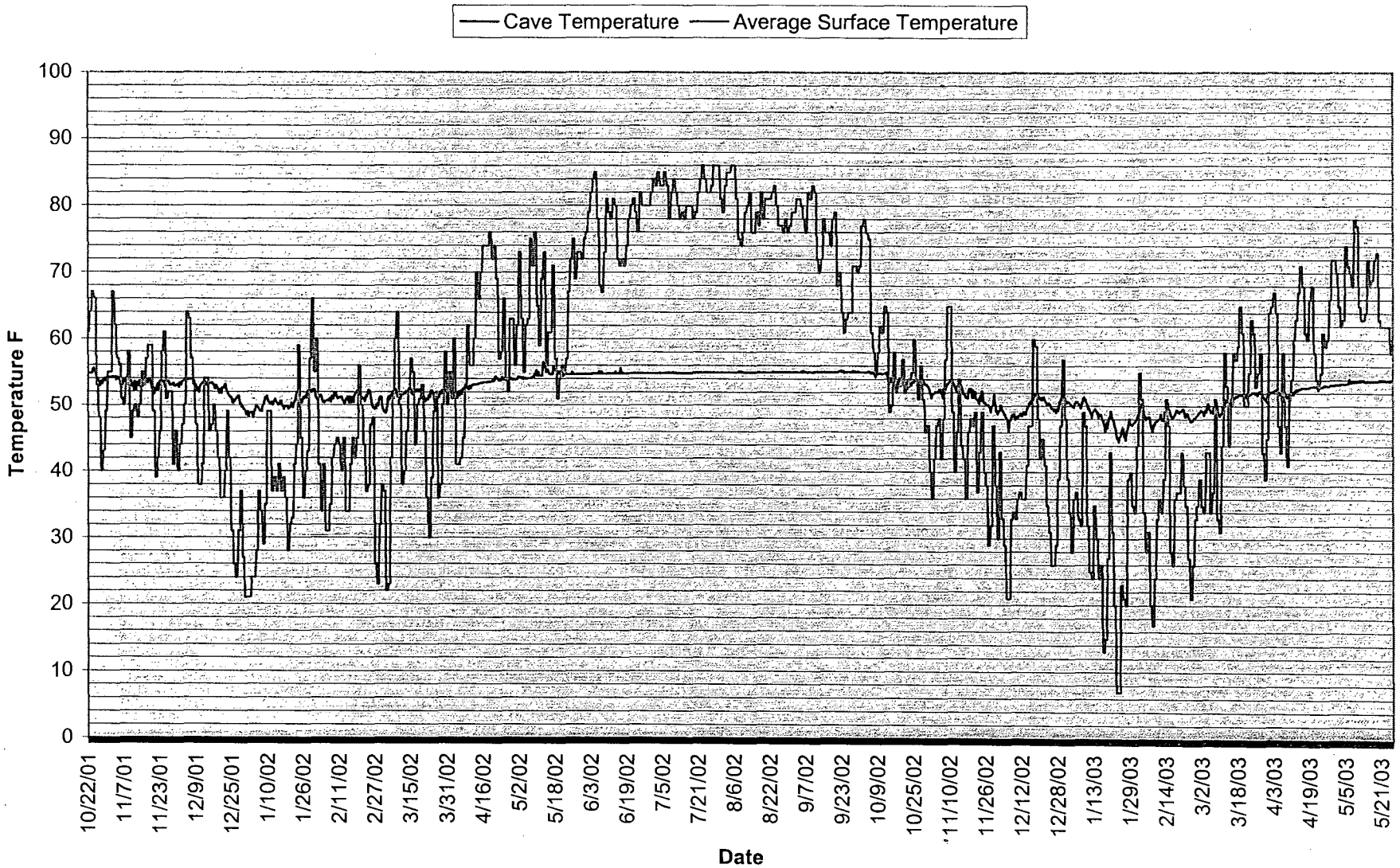
Circle approximate number of cave trips you have been on. (Count multiple trips into the same cave separately.) 1 2 3 4 5-10 11-25 26-50 51-100 101-250 251-500 501 or more

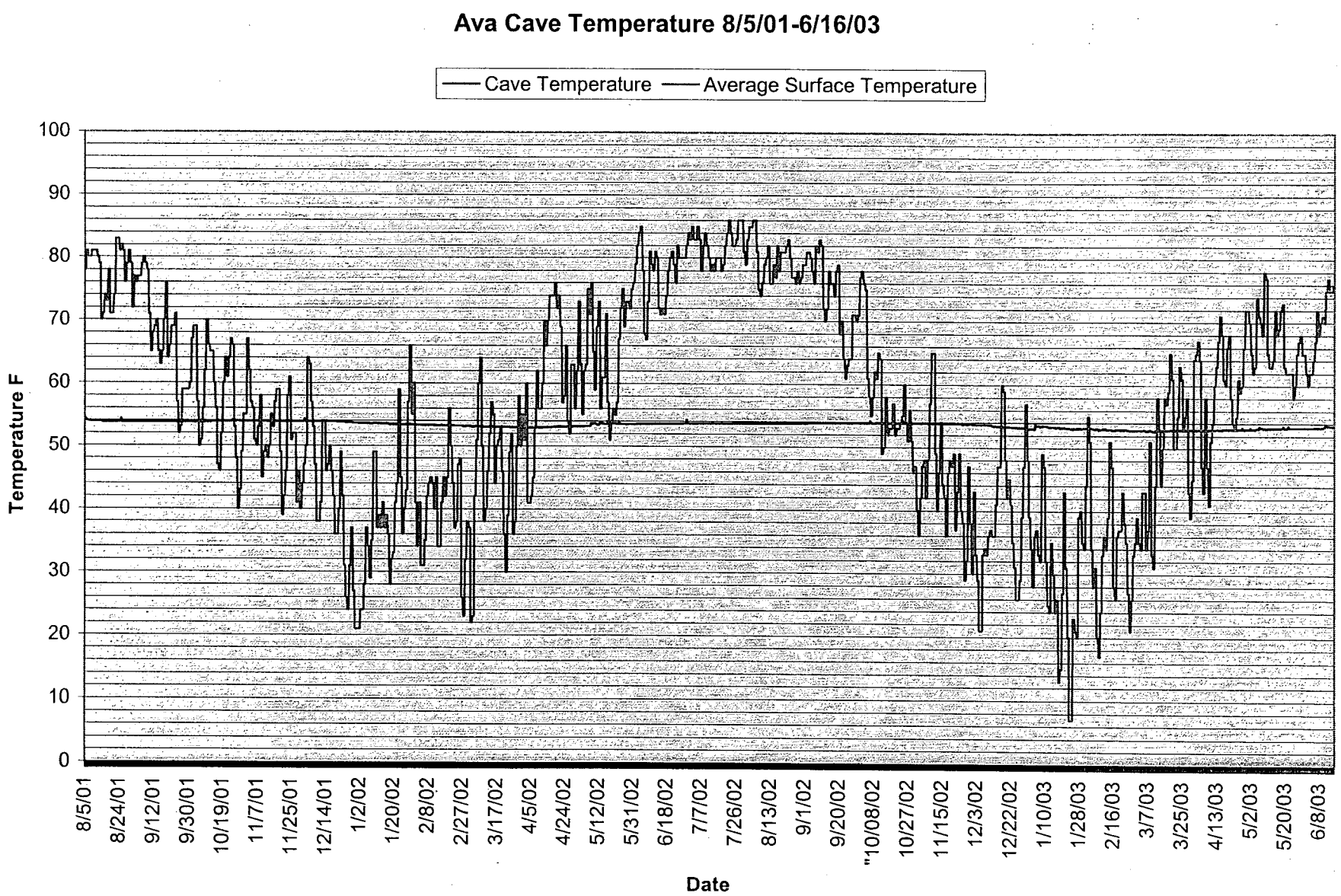
Comments_____

SHAWNEE CAVES CAVE USE STUDY
CAVE MONITORING EQUIPMENT

This equipment is meant to be concealed. Please do not move or tamper with it. If it has been moved or affected in any way, please call (618) 453-1121 ext. 239 and leave a message stating the name of cave and the problem encountered. Thank you for your assistance with this very important research project.

Guthrie Cave Temperature 10/22/01-5/26/03




Ava Cave Temperature 8/5/01-6/16/03
Cave Temperature
Average Surface Temperature
Temperature F
100
90
80
70
60
50
40
30
20
10
0
8/5/01
8/24/01
9/12/01
9/30/01
10/19/01
11/7/01
11/25/01
12/14/01
1/2/02
1/20/02
2/8/02
2/27/02
3/17/02
4/5/02
4/24/02
5/12/02
5/31/02
6/18/02
7/7/02
7/26/02
8/13/02
9/1/02
9/20/02
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11/15/02
12/3/02
12/22/02
1/10/03
1/28/03
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3/7/03
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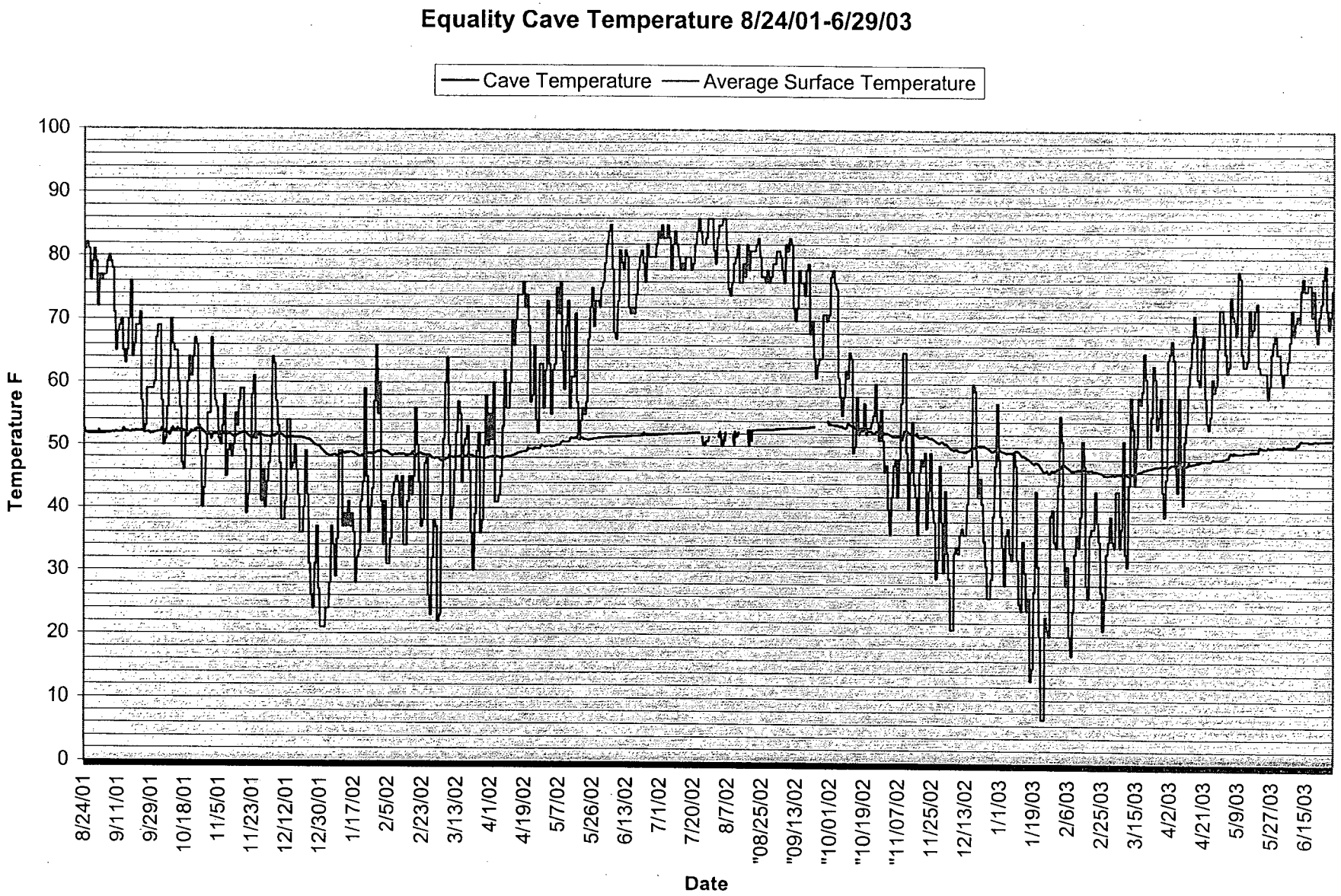
4/13/03
5/2/03
5/20/03
6/8/03
Date


Equality Cave Temperature 8/24/01-6/29/03
Cave Temperature
Average Surface Temperature
Temperature F
100
90
80
70
60
50
40
30
20
10
0
8/24/01
9/11/01
9/29/01
10/18/01
11/5/01
11/23/01
12/12/01
12/30/01
1/17/02
2/5/02
2/23/02
3/13/02
4/1/02
4/19/02
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7/1/02
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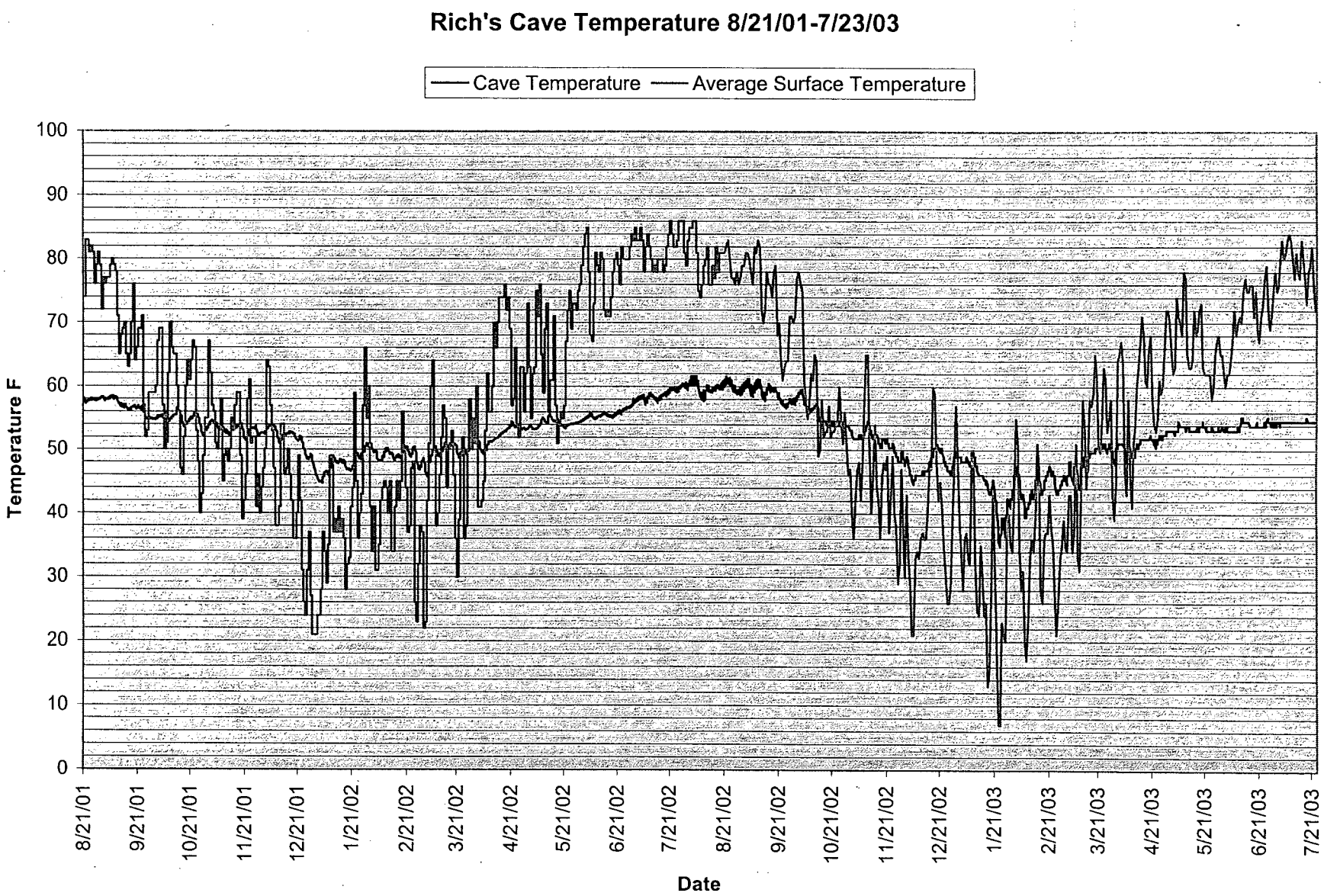
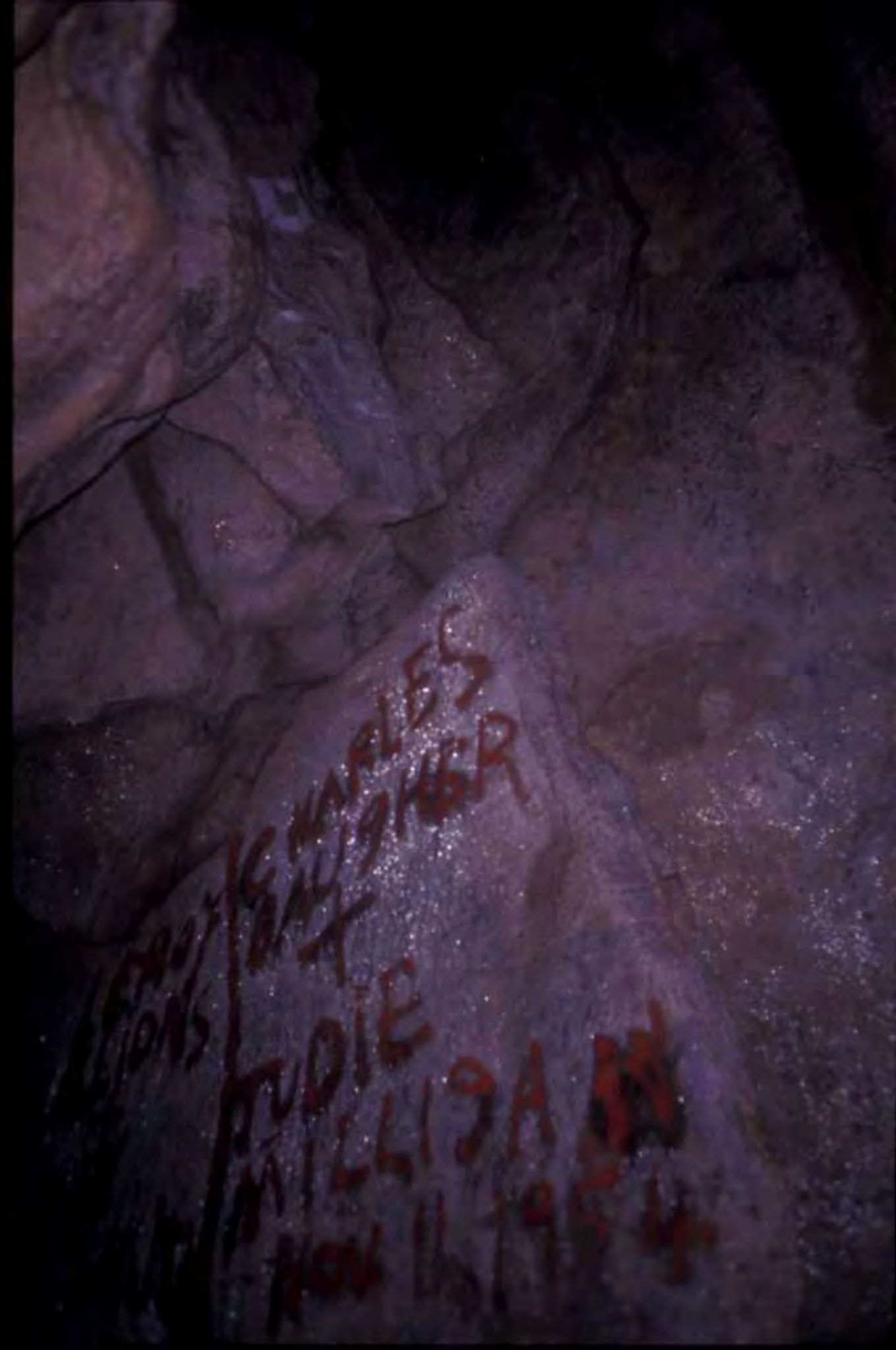
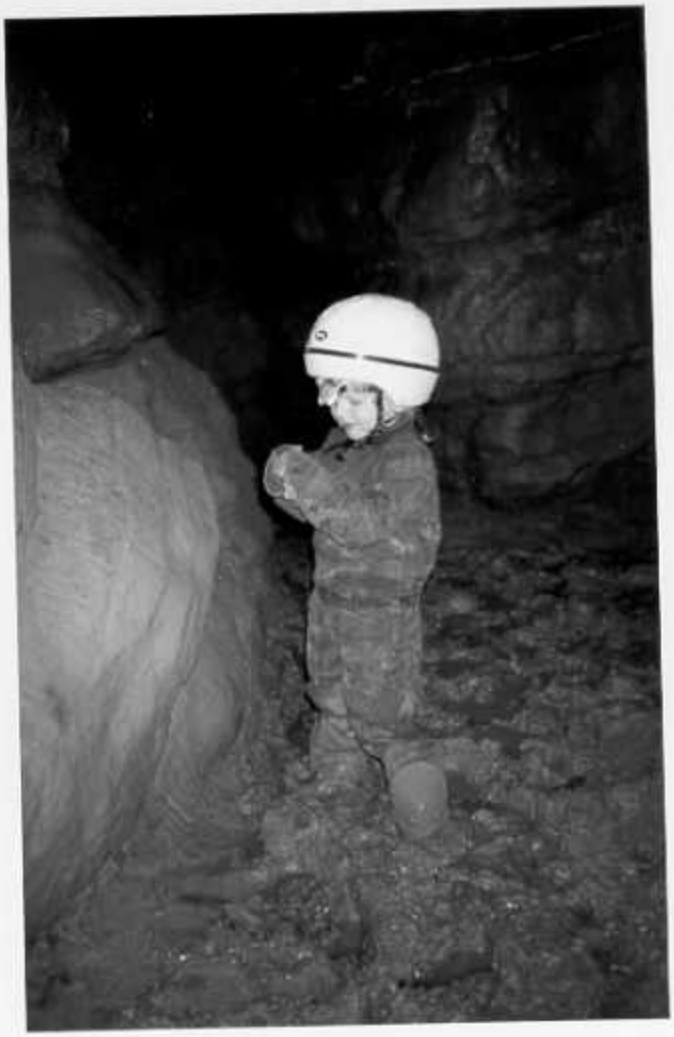
12/13/02
1/1/03
1/19/03
2/6/03
2/25/03
3/15/03
4/2/03
4/21/03
5/9/03
5/27/03
6/15/03
Date


Rich's Cave Temperature 8/21/01-7/23/03
Cave Temperature
Average Surface Temperature
Temperature F
100
90
80
70
60
50
40
30
20
10
0
8/21/01
9/21/01
10/21/01
11/21/01
12/21/01
1/21/02
2/21/02
3/21/02
4/21/02
5/21/02
6/21/02
7/21/02
8/21/02
9/21/02
10/21/02
11/21/02
12/21/02
1/21/03
2/21/03
3/21/03
4/21/03
5/21/03
6/21/03
7/21/03
Date

ATTENTION!
DO NOT ENTER THIS
CAVE BETWEEN
SEPTEMBER 1 AND
APRIL 30.
This land is a
REGISTERED ILLINOIS
NATURAL HERITAGE LANDMARK

PLEASE COMPLETE
THE SHORT QUESTIONNAIRE
IN THIS ENCLOSURE


CHARLES
GAGNIER
PIE
MELISA
NOV 11 1924

CHILD CARRIER