Establishing a Keeper-Based Behavioral Monitoring Program: A Top-Down/Bottom-Up Approach

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Abstract

Brookfield Zoo is currently instituting a zoo-wide program of keeper-based baseline behavioral observation. Here, I describe the goals of the program, practical applications of the information gathered, challenges involved in incorporating such a program throughout a large institution, and methods for facilitating keeper participation. The goals of the monitoring program include establishing and maintaining a baseline of "normal," or typical behavior for individual animals. The baseline serves as a basis for comparison when social or environmental changes are implemented, and may also provide an early indication of impending medical or welfare issues that may require attention. The advantages and disadvantages of computer-based and paper-based data collection systems will be discussed. I will also focus on strategies for garnering support from senior managers as well as keeper staff in order to facilitate the implementation process. These include instituting necessary keeper training programs, as well as providing timely feedback and summaries of behavioral data to animal management staff. A review of the status of Brookfield Zoo's behavioral monitoring program and its application to animal management, particularly with respect to animal welfare, will be discussed.

Introduction

As a former keeper, and a current researcher and manager who has worked with keepers for a long time, I can assure you that no one becomes a keeper because they enjoy cleaning enclosures. We enter the profession because we are fascinated by the animals (usually their behavior) in our charge, we are concerned about their welfare, both at the individual and species level, and we want to make some small contribution towards education, conservation, the acquisition of knowledge. The reality of zookeeping however, is such that much of a keeper's time is devoted to meeting the basic physical needs of the animals: feeding, cleaning, medicating. Tim Sullivan and I, as co-managers of Brookfield Zoo's Behavioral Husbandry and Research Program, believe that attending to behavioral needs and issues can be just as critical for maintaining animal welfare as can the more accepted, routine husbandry tasks. We are in the process of gradually incorporating behavioral research, training, and enrichment into the daily routine of all keepers, not as an activity that is done when all basic husbandry is completed, but as a task of equal importance such that not a day goes by when keepers are not involved in the behavioral aspects of animal care. This paper describes the experiences that we've had in bringing about these changes at Brookfield Zoo, with respect to the initiation of the behavioral monitoring component of the program. This is a slow and ongoing process, but I hope that some of the things that we have learned along the way will be helpful for other institutions that are following similar paths.

What is behavioral monitoring?

The behavioral monitoring program at Brookfield Zoo, in its conception, was envisioned as providing a mechanism for establishing a baseline of normal behavior for individual animals in the collection. The idea was to take advantage of the fact that keepers spend some time (albeit it may be very brief) observing their animals every day. How this information gets communicated will vary from keeper to keeper and department to department. One keeper, for example, might note in the log that a particular animal was a bit lethargic today; another keeper may note this as less active than usual, and a third may not note this at all. So our first goal was to standardize and formalize the way in which information on animal behavior was recorded and communicated. By maintaining a high level of consistency and reliability in the way information is recorded, we have the ability to use this information to establish a

baseline of "normal" behavior. This baseline, in turn, can be used in several ways. First, it can improve our ability to detect slight changes in behavior quickly. Such changes may indicate a possible health problem, a change in reproductive state, or a sign of stress. Second, having a baseline improves our ability to document the effect that a change in physical or social environment is having on an animal. Such a change may be planned, like a move to new enclosure, a change in group composition, or addition of a new enrichment item, or unplanned, like the birth or death of an animal, or a sudden physical change in the environment. Third, it can allow us to identify long-term patterns of behavior (seasonal, annual) that might go unnoticed if the information is not recorded in a systematic, regular way.

Laying the Groundwork

The initiation of a program of this kind represents a fundamental change in the daily work routines of keepers. At Brookfield Zoo, as at most institutions, keeper time is at a premium. How were we to successfully integrate such a program without compromising keeper duties and with the support of supervisory staff? We chose to approach this at several levels. First, we developed standards and procedures for all 4 components of the behavioral husbandry and research program (monitoring, training, enrichment, and research). This policy was written by a team that included keepers and assistant curators. Discussions took place with both assistant curators and senior staff to insure that we were addressing concerns at all levels. The document is currently undergoing review by the senior staff. It's approval will put a formal policy in place stating that the tasks described in the document are deemed important, required work by the administration. This gives us support at the highest level to move forward with the program. Assistant curators conveyed this information to their supervisory keepers.

At the keeper level, we realized that we might face some challenges, the biggest one being lack of time. Because keepers' time budgets are so tight, if we are to add a task to their day, we must find a way to free up some equivalent amount of time to compensate. We depended on supervisory staff to help keepers re-prioritize their activities. As part of the zoo's Keeper Development Program, we provided keepers with an overview of behavioral observation methods (and operant conditioning techniques, for the training component). This training is repeated twice a year for new keepers, keepers who have missed prior training programs, or those who wish a review. This served both to provide keepers with the tools they would need to conduct basic systematic observations, and to motivate and excite keepers about the upcoming behavioral monitoring. We endeavored to involve keepers in the development of the monitoring programs in their areas, so that could foster support and personal ownership of the program.

Once keeper staff had received this basic training, we then met with keeper work groups individually to discuss the monitoring program, how it would work, and how it would impact their time. Involving keepers in the decision-making has helped to empower them throughout this process. The particular behaviors that were scored, the frequency and time of data collection, all were developed with the keepers to best serve their needs. We made every effort to insure that the information that we were collecting would be beneficial to the keepers and managers.

Data collection options

We investigated a number of computer-based data-recording possibilities. Our ultimate goal was for the program to be as easy and self-maintaining as possible. Although keepers are accustomed to basic checksheet observations and data collection, we wanted to avoid the inevitable delays that emerge when data need to be entered onto computer, proofed, and analyzed. We considered both palm-top computers (Psion, Hewlett-Packard) and Palm Pilots™ as data collection tools. Valuable advice from Sue DuBois at Disney's Animal Kingdom helped convince us that Palm™ devices would be the easiest, most cost-effective way to go. Palm Pilots™ are available at a wide range of prices, and small grants can go a long way towards provisioning a significant number of keeper staff with a palm. We are currently using the Palm IIIxe™.

We envisioned a system in which keepers would access a series of drop-down menus on the Palm™; that would allow them to select an animal, it's behavior, it's location and, if appropriate, it's nearest neighbor. The software we settled on was Satellite Forms, by Pumatech Services. This allowed us to develop a menu-driven system that was compatible with an Access database. Developing the applications was, of course, not as easy as we had hoped. However, we currently have a fairly flexible system that allows us to gradually add areas to the database as data collection begins in specific sections of the zoo (see figure 1).

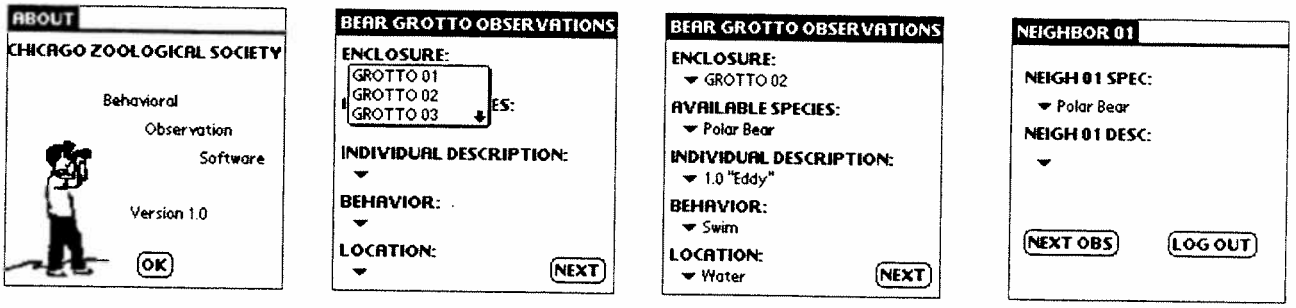
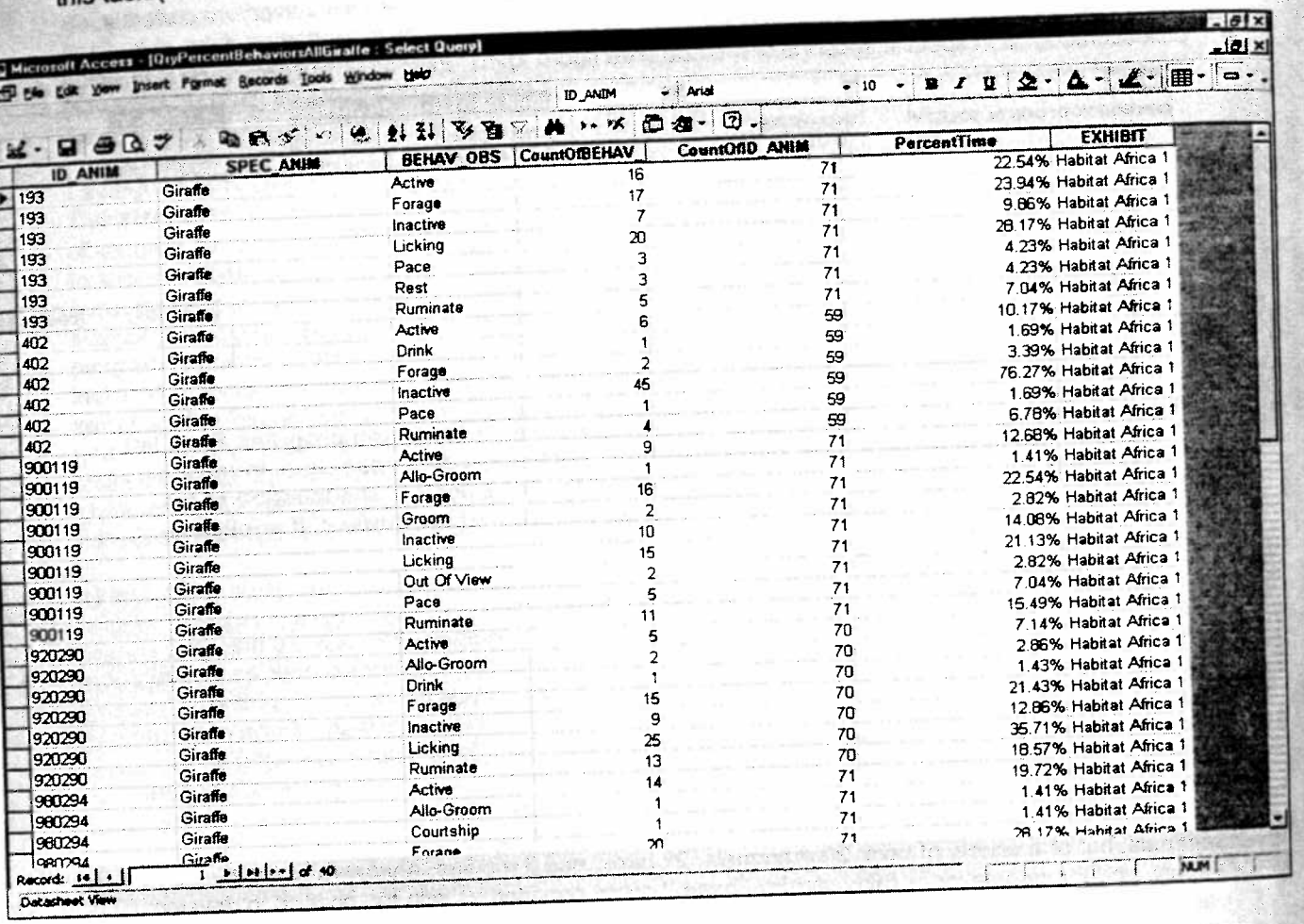


Figure 1. Selected screens illustrating the Palm-Pilot™ data collection program. From left to right: opening screen; selecting a particular enclosure; data collection, involving identifying the individual animal and recording the behavior and the location of the subject; identifying and recording the nearest neighbor of the subject, if applicable.

Pilot-testing the Program

Brookfield Zoo has over 3000 individual animals and over 100 keepers. We realized that the ultimate goal of having all keepers collecting routine behavioral data on their animals, was a truly long-term one. We decided to start by piloting the program in 2 areas of the zoo, the Perching Bird house and Habitat Africa/Kopje. Perching bird has over 100 individual birds. Some of these birds live in a large, multi-species walk-through aviary; others are in off-exhibit breeding areas and may be moved from one enclosure to another as the breeding season progresses. Keepers in this area have long been involved in research, and were comfortable with technology, having used palm-top computers for other research projects. Habitat Africa has far fewer individual animals, but of a variety of taxa: 20 mammals, 22 birds, and 3 reptiles. Animal moves occur rarely, and the population is fairly stable. These 2 areas provided us with the chance to develop applications for areas with vastly different types of animals, different histories with respect to research and technology, and different constraints on their time. We met with the keepers as needed to modify the application to suit their needs. Modifications included adding or removing behaviors from the list of choices based on the animals, identifying locations that are relevant for a particular exhibit, or adding individual descriptions along with ISIS numbers. Since each area had several runs, we brought 1 run at a time on-line. We asked that an observation be done once a day. The length of the observation depended on the number of individual animals on the run, and the ease with which the animals could be found (for example, locating 4 giraffes was quite trivial, but finding the 26 individual birds in the perching bird free-flight area was not). Our hope was that observations could be completed in 15 minutes or less. In an effort to balance observations across the day, we divided the day into 3 time blocks. Generally, these were before 11, 11-2 and after 2. We asked that data collection be distributed as evenly as possible across those 3 time blocks. As more runs were added, fewer observations per run were made each week. An area with 3 runs, for example, would collect data twice a week for each run. Although we ultimately hope that daily data can be collected on each run, we felt that we were better off incorporating the task gradually. As keepers get accustomed to the system, they will get more proficient. When a keeper is able to complete the data collection in 5 minutes, rather than 15, then we can ask for daily observations on each run. It is generally the lead keeper's responsibility to assign responsibility for collecting the data.

Approximately once each week, data are transferred from the Palm™ to a Microsoft Access database on a desktop computer. Ultimately, we hope to train keepers to accomplish this file transfer task. However, until computer accessibility is improved we are currently responsible for this task (see figure 2).



Microsoft Access - [QryPercentBehaviorsAllGiraffe : Select Query]

ID_ANIM	SPEC_ANIM	BEHAV_OBS	CountOfBEHAV_	CountOfID_ANIM	PercentTime	EXHIBIT
193	Giraffe	Active	16	71	22.54%	Habitat Africa 1
193	Giraffe	Forage	17	71	23.94%	Habitat Africa 1
193	Giraffe	Inactive	7	71	9.86%	Habitat Africa 1
193	Giraffe	Licking	20	71	28.17%	Habitat Africa 1
193	Giraffe	Pace	3	71	4.23%	Habitat Africa 1
193	Giraffe	Rest	3	71	4.23%	Habitat Africa 1
193	Giraffe	Ruminate	5	71	7.04%	Habitat Africa 1
193	Giraffe	Active	6	59	10.17%	Habitat Africa 1
402	Giraffe	Drink	1	59	1.69%	Habitat Africa 1
402	Giraffe	Forage	2	59	3.39%	Habitat Africa 1
402	Giraffe	Inactive	45	59	76.27%	Habitat Africa 1
402	Giraffe	Pace	1	59	1.69%	Habitat Africa 1
402	Giraffe	Ruminate	4	59	6.78%	Habitat Africa 1
402	Giraffe	Active	9	71	12.68%	Habitat Africa 1
900119	Giraffe	Allo-Groom	1	71	1.41%	Habitat Africa 1
900119	Giraffe	Forage	16	71	22.54%	Habitat Africa 1
900119	Giraffe	Groom	2	71	2.82%	Habitat Africa 1
900119	Giraffe	Inactive	10	71	14.08%	Habitat Africa 1
900119	Giraffe	Licking	15	71	21.13%	Habitat Africa 1
900119	Giraffe	Out Of View	2	71	2.82%	Habitat Africa 1
900119	Giraffe	Pace	5	71	7.04%	Habitat Africa 1
900119	Giraffe	Ruminate	11	71	15.49%	Habitat Africa 1
900119	Giraffe	Active	5	70	7.14%	Habitat Africa 1
920290	Giraffe	Allo-Groom	2	70	2.86%	Habitat Africa 1
920290	Giraffe	Drink	1	70	1.43%	Habitat Africa 1
920290	Giraffe	Forage	15	70	21.43%	Habitat Africa 1
920290	Giraffe	Inactive	9	70	12.86%	Habitat Africa 1
920290	Giraffe	Licking	25	70	35.71%	Habitat Africa 1
920290	Giraffe	Ruminate	13	71	18.57%	Habitat Africa 1
920290	Giraffe	Active	14	71	19.72%	Habitat Africa 1
980294	Giraffe	Allo-Groom	1	71	1.41%	Habitat Africa 1
980294	Giraffe	Courtship	1	71	1.41%	Habitat Africa 1
980294	Giraffe	Forage	20	71	28.17%	Habitat Africa 1

Record: 1 of 40

Datasheet View

Figure 2. Sample data from database generated by behavioral monitoring. Data from the Palm™ are transferred into Microsoft Access, where the permanent database is stored. Once transfer is complete, data can be safely removed from the Palm™.

Feedback

All too often, keepers are asked to collect data for one project or another, or for one researcher or another. Only rarely however, do they see the results of that research. One of our main concerns with the behavioral monitoring program was that the information be converted into an easily-interpretable and easily-accessible form as quickly as possible. We wanted keepers and managers to be able to access and use the information that they had been collecting. After the initial programming effort to simply develop a functional application, we turned our attention to the enormous task of managing the growing data base, and converting raw data into time budgets and other useful forms in a timely manner. We used Access to facilitate this. At present, we are able to produce (virtually immediately) cumulative time budget graphs for each animal that is being observed (figures 3 and 4). Recently, we developed a procedure that allows us to view changes in the frequencies of behavior over time (figures 5 and 6). Although we are still modifying this graphing option, we feel that it best illustrates the uses of behavioral monitoring. Changes in behavior over time can be readily detected from these graphs.

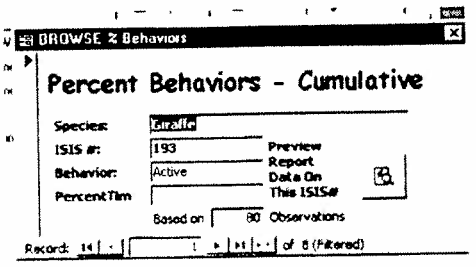


Figure 3. Menu for selecting subject for cumulative time budget graph.

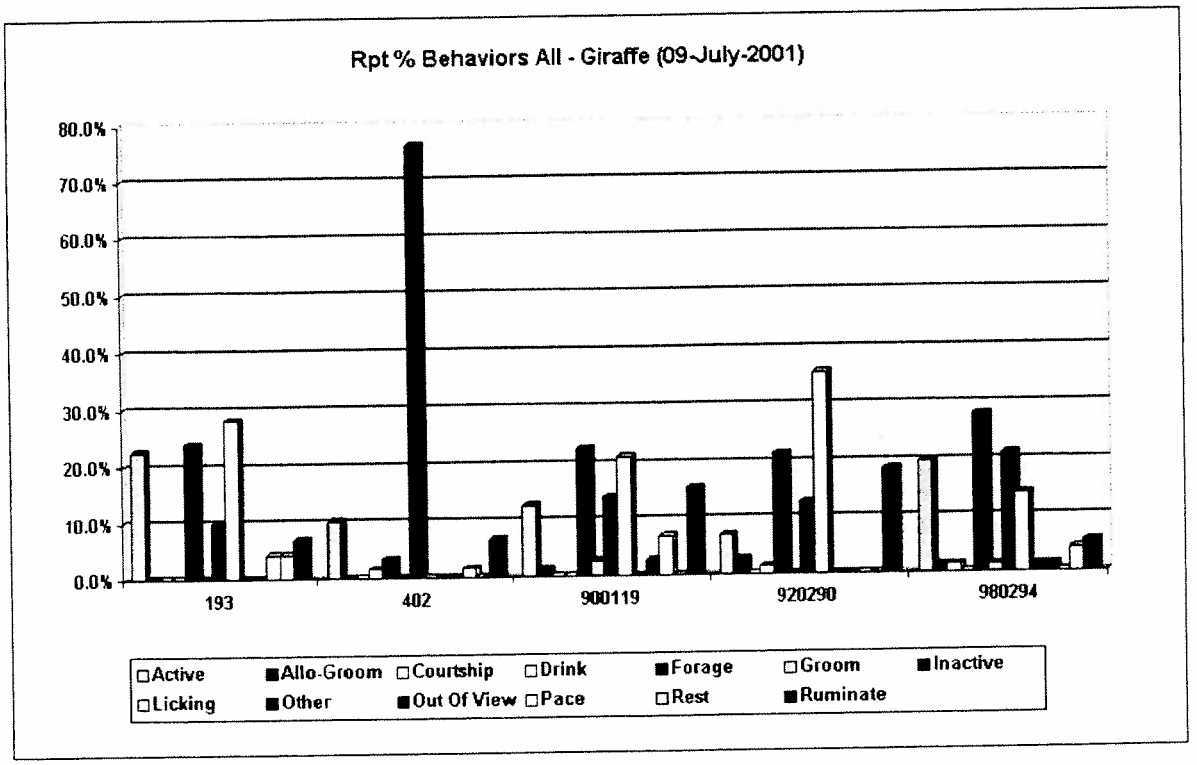


Figure 4. Sample time budget graph for giraffes. This graph represents cumulative time budget data collected over a period of several months.

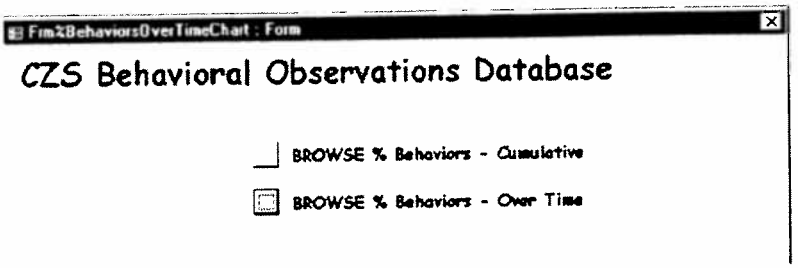


Figure 5. User interface for selecting the option of examining changes in behavior over time. The user selects the "browse % behaviors over time" option.

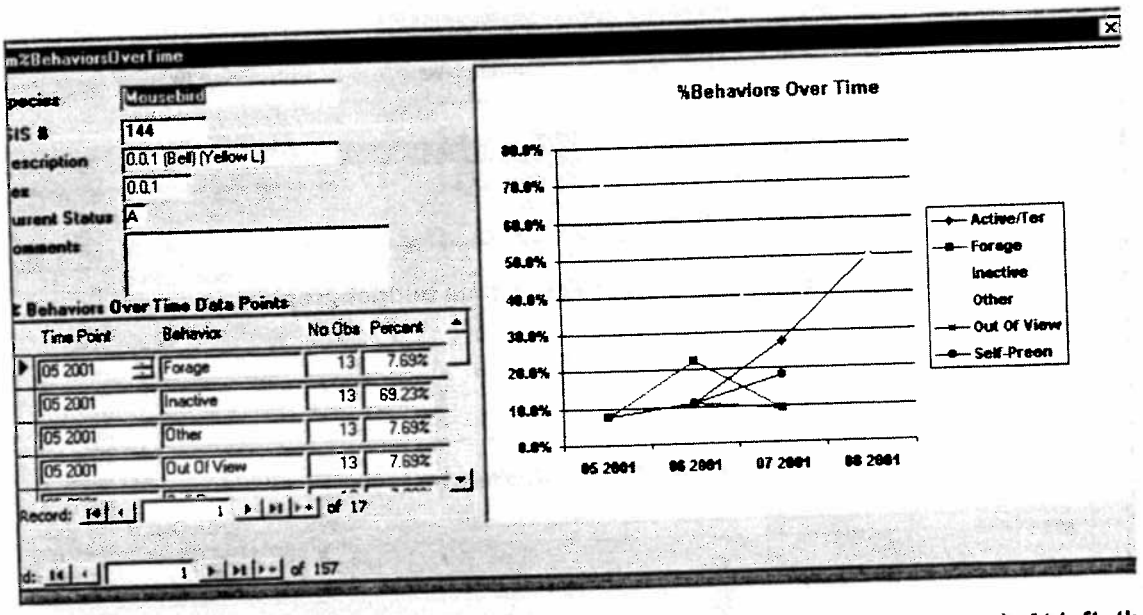


Figure 6. The user can select an individual animal (by species and/or ISIS number). At left, the number of observations and percent occurrence for each behavior observed by month. At right, the graph showing changes in behavior over time.

Uses of Behavioral Monitoring Data

We have only been formally collecting the behavioral monitoring data for several months, thus we cannot yet truly assess the use of the data. However, we have in the past few years used behavioral monitoring techniques, to address specific behavioral issues using a keeper-based behavioral monitoring approach. Although these were done largely the old-fashioned way—with check sheet and pen—the process was the same. Keepers incorporated some brief but systematic observations into their run in an effort to monitor behavioral changes over time. For example, we were able to identify a highly seasonal stereotypic swimming pattern in one of our Alaskan brown bears through keeper behavioral monitoring. Throughout the day, the bear keepers would often walk by the bear grottos. We asked them to note the behavior and location of the bear at this time, and record it on a data sheet when they returned to the building. On a typical day, the keepers would monitor behavior in this way approximately once every hour. This form of monitoring was done weekly, until we detected the onset of the behavior pattern. At this time, we increased observation frequency to 3 times per week. Because of this data collection, we have been able to accurately characterize the behavior and identify the highly seasonal nature of the pattern (figure 7). We likely would not have been able to do this, or at least not as easily or convincingly, if we were basing our analyses on notes in the keeper log. This process was relatively easy for the keepers to do, and provided them with the feedback they needed to interpret the behavior.

As another example, and one in which we are in fact using a palm-pilot application, the pachyderm keepers are monitoring the behavior of one particular rhino who has periodic loose stool problems. At intervals throughout the day, the keepers note the rhino's behavior, and the social and physical environment at that time (animals in neighboring enclosures, disturbance caused by other animals or visitors, weather, etc.). This information, collected over a period of time (like the data on the brown bears), should allow us to identify relationships among behavior, environment, and stool quality. Ultimately, the uses of this type of behavioral data are enormous. By simply systematizing and quantifying observation, we improve our ability to reliably and objectively interpret behavior.

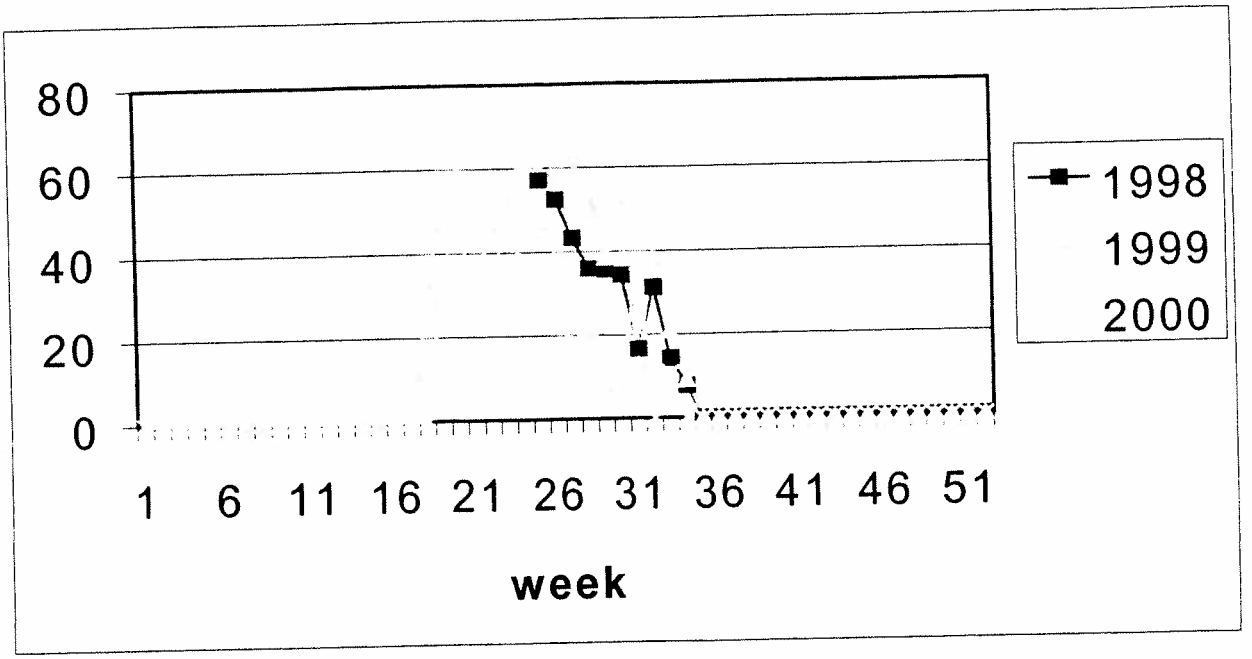


Figure 7. Graph illustrating the percent time spent in stereotypic swimming by week for a brown bear. Data were collected over a three year period. Data were collected by keepers during their daily routine. Data collection was done one day per week when no stereotypic swimming was observed, and increased to 3 days per week once stereotypic swimming was detected.

Challenges

Technology has proven to be both an asset and a liability as we move forward with the implementation of behavioral monitoring program. Not all animal areas have computers, and of those that do have computers, only a small proportion are networked with the zoo server. At present, keepers must bring their Palm Pilot™ to the research office in order to upload their data. Although this takes only a few minutes, it is often difficult to accomplish. Research staff must often go to the animal area and retrieve the Palm™. Without ready access to computers, keepers cannot readily access the results of the data collection. Furthermore, few keepers (and in fact, few zoo staff at any level) are comfortable with Microsoft Access. The flexibility of the behavioral monitoring system is compromised by these shortcomings. We hope to remedy this in several ways. First, as a short-term solution, we can provide hard-copy graphs of any information that a keeper or manager requests. Second, we are attempting to install a snapshot viewer on computers in animal areas such that keepers can at least view the graphs (using a floppy or, where applicable, the network) without actually constructing them. Finally, we hope to develop a report system such that keepers can simply choose the animal for whom they would like to see data, select the time period, and the behaviors and generate the graph themselves. This will again require considerable training in the use of the software.

Another challenge involves encouraging staff to actually use the information that is being collected. It is difficult to see the value of random bits of behavioral information, however as the database grows, it will, we hope, become more evident how this information can be used. How do behaviors change seasonally? Are changes in particular behaviors associated with medical problems? How effective are our enrichment programs, or enclosure modifications? Although we hope that keepers will take the initiative in exploring these relationships, this too will take time. Managers may need to take the lead in this process for the immediate future.

All of these improvements are a moot point if the computer infrastructure is not improved. This is certainly not a trivial matter, but as technology advances so too, will the potential to network areas without digging up concrete and installing underground cabling. These problems are in no way unique to Brookfield Zoo, but rather represent the problems that zoos must face when trying to retro-fit programs and facilities for new and innovative uses. Whether these changes involve replacing or updating equipment or shifting work responsibilities or job descriptions, the transformation will take time. At Brookfield, we view this as a five-year plan: we hope to see behavioral monitoring being done routinely throughout the zoo in 5 years. We will no doubt experience setbacks and bumps in the road, but the potential benefits far outweigh these possible problems.

Behavior serves as a visible, immediate indicator of an animal's internal state and well-being. Consequently, regular and systematic monitoring of behavior can provide a valuable management tool. As AZA moves forward with animal welfare standards, we encourage institutions to begin systematically recording behavioral information to provide this tool. Whether computer-based data collection, paper and pen check-sheets, or simply standardizing the terms used in keeper logs to describe behaviors, we will greatly improve our ability to monitor and interpret changes in behavior. This in turn, can help us to make management decisions for the improved welfare of the animals in our care.

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