



## **Animal Care and Management at the National Zoo: Final Report**

Committee on the Review of the Smithsonian Institution's National Zoological Park, National Research Council

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# **Animal Care and Management at the National Zoo: Final Report**

Committee on the Review of the Smithsonian Institution's National Zoological Park

Board on Agriculture and Natural Resources

Institute for Laboratory Animal Research

Division on Earth and Life Studies

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## Preface

The U.S. House of Representatives Committee on House Administration, chaired by U.S. Representative Robert W. Ney (Ohio-18th district), is responsible for oversight of the Smithsonian Institution, which administers the National Zoological Park (National Zoo) and the Conservation and Research Center (CRC). Following a hearing held by the Committee on March 5, 2003, in which House Representatives questioned the zoo director regarding concerns about animal care and management, Congress requested a science-based review of the quality and effectiveness of animal care and management at the zoo by the National Academies. In response to this request, the Board on Agriculture and Natural Resources and Institute for Laboratory Animal Research convened a committee to conduct the review. The detailed charge to the committee is as follows:

“A committee of experts will be appointed to assess the quality and effectiveness of animal management, husbandry, and care at the Smithsonian Institution's National Zoological Park in Washington, D.C. and the Conservation and Research Center in Front Royal, Virginia. The study will identify strengths, weaknesses, needs, and gaps in the current infrastructure and provide recommendations on changes needed to ensure effective management and care of the NZP's animal collection. The study will provide a description of the system currently in place, the elements and characteristics of that system, and the changing nature of concerns surrounding the system. The committee will examine the historic and recent problems with animal health and animal science practices at the zoo, including recent reports on zoo operations and a scientific examination of the causes of recent animal deaths. The committee will review the NZP within the context of the larger zoo community, identifying unique aspects of the environment in which the NZP operates. The committee will evaluate the communication and coordination of the various divisions of the zoo that impact animal care, analyze the use of resources, and outline attributes of an enhanced system to ensure the health and well-being of the animals at the NZP. In addition, the committee will evaluate recent and ongoing changes in zoo operations. An interim report identifying the most pressing issues in animal care and management and aspects of the system in need of immediate attention, will be delivered at the end of the initial 6 months of the study. A final report that provides a comprehensive assessment of the zoo, outlines attributes of an enhanced system to ensure the health and well-being of the animals, and includes the committee's final recommendations, will be delivered at the end of 12 months.”

In view of the complexity of the National Zoo, any review of it, even the current one, which is focused narrowly, requires a wide array of expertise. Accordingly, those recruited to form the Committee on the Review of the Smithsonian Institution's National Zoological Park included persons experienced in zoo management and operations, nutrition, veterinarian medicine, pathology, industrial management, leadership and group relations, toxicology, safety issues in the workplace, animal disease, zookeeping, animal welfare, and animal physiology. Dramatic changes have occurred in animal care and management at zoos over the last few decades as procedures have become more science-based and as deeper knowledge about the captive needs of individual species has

appeared in peer-reviewed, accessible literature. Accordingly, professional standards have changed, and the bar on accreditation has been raised substantially. More is demanded of staff in training and expertise. The design of exhibits is expected to be educational and humane and to be responsive to the needs of the captive animals they hold. Specific regulatory standards have been established by the Animal Welfare Act and are enforced by the US Department of Agriculture (USDA) Animal and Plant Health Inspection Service and by the requirements of the Public Health Service Policy on Humane Care and Use of Laboratory Animals. National Research Council reports provide science-based guidelines for all institutions that maintain animals, including industry, universities, and zoos on animal nutrition (the Animal Nutrition Series) and the care and use of animals used in research (Institute for Laboratory Animal Research publications). Additional standards and guidelines have been developed by professional organizations such as the American Zoo and Aquarium Association (AZA), American Association of Zoo Veterinarians, the Zoological Registrars Association, the American Veterinary Medical Association, and the Nutrition Advisory Group of the AZA. Many of those organizations have annual proceedings that contain new and revised opinions on how to care for zoo animals and manage them appropriately. The committee has reviewed much of that literature and has judiciously used various sources of information to formulate its findings.

In addition to its reliance on published information on how zoos should operate, valuable information was obtained from experts at two National Research Council-sponsored workshops and from previous evaluations of the NZP by AZA, USDA, and the Smithsonian Institution itself. Committee members visited the zoo's Rock Creek Park (Washington, DC) and Front Royal, VA, campuses to view the facilities and to meet staff members on all levels of management and animal keepers. The first visit to the Rock Creek Park campus was in August 2003 at the beginning of the committee's deliberations, the second in April 2004, a few weeks after the publication of its interim report. Some of the meetings were arranged and organized by the Research Council staff; others were informal and spontaneous and occurred as the result of chance encounters when committee members were walking through the grounds and buildings. Committee members had open access to the entire NZP operation and had the opportunity to inspect the facilities much as the public views them but also behind the scenes in areas that the public rarely visits. Many one-on-one interviews with NZP employees were conducted to gain insight into perceived weaknesses and strengths of the NZP operation. In addition to those interviews, NZP staff members were encouraged to submit information to the committee through Research Council staff in such a manner that their identities could be protected. Their impressions were discussed during the committee's deliberations, and lists of concerns were identified. As a result, several thousand pages of records and documents were requested from NZP management and were carefully reviewed. After its earliest deliberations in the late summer and fall of 2003, the committee decided which concerns were most pressing and described them, with a series of recommendations, in its interim report, *Animal Care and Management at the National Zoo: Interim Report*.

The final report of the committee details a more comprehensive evaluation of animal care and management at the zoo. This is an especially opportune time to explore the weaknesses and strengths of operations at the zoo, and the committee hopes that its final report will provide a balanced evaluation to provide a foundation on which the National Zoo can move forward with confidence to make it a first-rate institution. We believe that the report will also be of value to other zoos, many of which may have problems similar to those discussed in the interim and final reports.

R. Michael Roberts, Chair  
Committee on the Review of the Smithsonian Institution's  
National Zoological Park

## Acknowledgments

This report represents the integrated efforts of many people. The committee thanks all those who shared their insights and knowledge to bring the document to fruition. We also thank those who provided information at our public meetings and who otherwise participated in our public sessions.

During the course of the committee's deliberations, many people gave generously of their time to provide advice and information that were considered in its deliberations. The following deserve special thanks:

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**Thomas Wood**, George Mason University, Fairfax, Virginia

The committee is especially grateful to the staff members of the National Zoo who took time to speak with the committee about the zoo and its operations and who provided information essential for the committee's work. The staff's candid, timely, and thoughtful input greatly facilitated the committee's efforts. The committee also appreciates the National Academies staff members who worked diligently to maintain progress and quality in its work. The study and the resulting reports would not have been possible without the dedication and hard work of the two study directors, Jamie Jonker and Jennifer Obernier. A special acknowledgement is also due to Bill Kearney (director, Media Relations), who helped guide the committee through the challenges associated with a highly publicized subject.

The report has been reviewed in draft form by persons chosen for their diverse perspectives and technical expertise in accordance with procedures approved by the National Research Council's Report Review Committee. The purpose of this independent review is to provide candid and critical comments that will assist the institution in making its published report as sound as possible and to ensure that the report meets institutional standards of objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process. We wish to thank the following for their review of this report:

**Val Beasley**, University of Illinois, Urbana, Illinois  
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**Steven Thompson**, Lincoln Park Zoo, Chicago, Illinois

Although the reviewers listed above provided many constructive comments and suggestions, they were not asked to endorse the conclusions or recommendations, nor did they see the final draft of the report before its release. The review of this report was overseen by **John Dowling**, Harvard University, Cambridge, Massachusetts and **Harley Moon**, Iowa State University, Ames, Iowa. Appointed by the National Research Council, they were responsible for making certain that an independent examination of this report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of this report rests entirely with the author committee and the institution.

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## Executive Summary

After a series of publicized animal deaths at the Smithsonian Institution's National Zoological Park (National Zoo) in early 2003, Congress asked the National Academies to carry out a fast-track, science-based assessment of the quality and effectiveness of animal management and care at the National Zoo's Rock Creek Park facility in downtown Washington DC and Conservation Research Center (CRC) in Front Royal, Virginia. Congress specifically requested that the Academies' report be in two parts: an interim report to be completed within 6 months of the beginning of committee deliberations and a final report. The committee's interim report, released on February 25, 2004, focused on problems in need of immediate attention in the areas of animal care and management, recordkeeping, pest control, and strategic planning. This final report examines whether the institution is responding adequately to concerns raised in the interim report and addresses other aspects of its task, such as strategic planning, human resources, training, and occupational health and safety.

The National Zoo has been through a year of substantial upheaval as it attempts to reverse a decade-long decline in facilities, animal collection, and quality of animal programs. Over the last 12 months, the committee interviewed all levels of zoo staff, examined copious documentation and internal correspondence, received input from concerned members of the public and zoo community, and spent many hours observing operations at the zoo. The committee was presented with persuasive evidence that the zoo has many strengths, including the quality of its science programs and the dedication of its staff. The committee commends the staff of the zoo for the time, energy, and personal commitment that have resulted in an enormous number of positive changes in a short amount of time and thanks the staff for their efforts in fulfilling the committee's requests for documents, which required a substantial amount of staff time.

It is apparent to the committee that the zoo's deterioration evident in the fall of 2003 was the result of long-standing, systemic problems at the highest levels of the zoo's operations. Lack of overall vision, inattentiveness to American Zoo and Aquarium Association (AZA) and internal evaluations, and laxity in observing federal laws by the management of the zoo and Smithsonian Institution allowed for a system-wide breakdown in communications and responsibilities. This resulted in more than a decade of decline in almost every aspect of zoo operation, until a groundswell of change began in 2000. While some initial efforts at change may have faltered, continued efforts for change have gained momentum. The staff of the National Zoo must be applauded for their efforts that have resulted in noticeable improvement of zoo operations over the past year. Over the last 6 months, they have reorganized their preventive-medicine and nutrition programs and made substantial strides in developing an electronic keeper record system, centralizing their commissary, and establishing performance measures for all levels of the organization that are monitored by senior management. The committee encourages the staff of the National Zoo to continue in a positive direction towards regaining the National Zoo's preeminence in the zoo community.

However, several problems need attention if positive changes to ensure animal health and welfare are to continue. These problems include immediate needs identified in the interim report as well as the recommendations made in this final report. Most pressing of these recommendations is the establishment of rigorous animal-care staff training as well as a climate of accountability and personal responsibility. Of equal importance are the completion of renovation or construction of animal facilities and the development of a complete and comprehensive strategic plan.

Other recommendations that must be addressed are the establishment of clear standards of professional behavior at all levels; filling the head positions in the clinical nutrition and pathology departments with highly qualified individuals; and following through on efforts currently underway, such as establishing a comprehensive integrated pest management (IPM) effort, developing electronic recordkeeping systems, and completing and documenting diet evaluations. For the zoo to regain its preeminence in the zoo community, the leadership of the Smithsonian Institution and the zoo must ensure that resources and support continue to flow into the zoo so that it can address these major obstacles.

### **COMMITTEE'S TASK**

The National Academies was explicitly charged to focus narrowly, considering only those matters that related specifically and directly to animal management, husbandry, health, and welfare. Only those aspects of conservation, education, and science that affect animal care and management were within the scope of this review. For example, the committee was not asked to review the education programs, the scientific quality of the research carried out at the zoo, or the scope or effectiveness of its conservation programs. Evaluating the adequacy or inadequacy of funding to support the various zoo activities or making recommendations on personnel or leadership changes was not within the committee's charge.

It is beyond the scope of the committee's charge to dictate either specific remedies to address the recommendations of this report or specific time frames for effecting change, as there are many factors that will influence decision-making, such as the skills and workloads of individual staff and the availability of resources (human and capital), about which the committee lacks information. Instead, the committee identifies performance measures that the zoo has implemented to monitor the effectiveness and timeliness of recent changes, and comments on the adequacy of these measures, or notes where additional performance measures are needed. Ultimately, the zoo director and senior management must be held accountable for effectively correcting deficiencies in a timely manner.

In this final report, the findings deal primarily, but not exclusively, with issues not addressed in the interim report, such as the strategic plan, human resources, training, and occupational health and safety. This final report discusses whether the institution is responding adequately to concerns raised in the interim report and addresses three additional topics: a scientific evaluation of recent animal deaths, a review of CRC operations to determine whether the problems at the Rock Creek Park facility identified in the interim report were also evident at the CRC, and an assessment of whether practices and physical conditions at the zoo were improving.

### **PROGRESS AT THE NATIONAL ZOO SINCE RELEASE OF INTERIM REPORT**

Since the release of the interim report, which dealt almost exclusively with the Rock Creek Park facility, the zoo staff and management have expended enormous time and energy to enact positive changes at the zoo as quickly as possible. Some of the changes were in response to findings in the interim report; others, such as reviewing and documenting animal diets in a database, were started before the release of the interim report as a result of the zoo's own examination of its operations.

Over the last 6 months, the veterinary staff have eliminated the backlog of preventive-medicine procedures at the Rock Creek Park facility and staff at both the Rock Creek Park and CRC facilities have reviewed and updated their preventive-medicine protocols and established a monthly performance measure for tracking adherence to their protocols (currently, 100% of scheduled preventive-medicine procedures have been completed).

The zoo's nutrition staff have developed a schedule for implementing a centralized commissary at the Rock Creek Park facility and established performance measures to track progress. Collaboration between the research nutritionist and the clinical nutritionist was initiated quickly, and review of all animal diets and their entry into a database have progressed at a reasonable rate. Diet evaluation and documentation have been completed for mammals, birds, reptiles, and amphibians at the zoo; only the diets of invertebrates in the collection still need to be reviewed and entered into the database.

The zoo has made considerable progress in complying with federal statutes to ensure animal welfare. The composition of the zoo's institutional animal care and use committees (IACUCs) has been appropriately adjusted, semiannual inspections were performed in 2004, training for all IACUC members has been scheduled, and the appropriate documentation has been submitted to federal regulatory agencies.

## EXECUTIVE SUMMARY

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To address shortcomings in recordkeeping long-term, the zoo is contributing to the Web-based zoological information management system (ZIMS) that is being developed by the International Species Information System (ISIS). This system will not be available for several years, so the zoo has taken steps to deal with recordkeeping deficiencies in the interim. The zoo is developing and testing a standardized electronic keeper record system and is developing software to make the MedARKS medical-records system electronically accessible and compatible with current Web-based intranet hardware and software. Both developments were scheduled to be implemented by the end of 2004. In addition, in collaboration with the Smithsonian Institution, the zoo developed and implemented new standards for the filing and retention of records.

Finally, the pest-management program at the Rock Creek Park facility has made a number of facility improvements to control the rodent problem at the zoo.

Overall, the committee believes that the zoo has taken the committee's recommendations seriously and is making good-faith efforts to correct deficiencies noted in the interim report. Progress has been more impressive on some fronts than on others, and a number of weaknesses are still apparent, though the committee recognizes that additional improvements will have been made in the months since it last met. In order to build on the positive progress that has been made in the last 6 months, senior management at the zoo must ensure continued progress in the areas of animal care and management, recordkeeping, pest control, strategic planning that were addressed in the interim, as discussed in Chapter 7 of this report.

## LONG-TERM SUCCESS OF ANIMAL CARE AND MANAGEMENT AT THE NATIONAL ZOO

In the following sections, the committee presents its findings and recommendations on issues important for the long-term success of animal care and management at the zoo. The committee assessed the zoo's strategic plan; its management of communication, knowledge, and human resources; the animal care and management operations at the CRC; as well as a scientific examination of recent animal deaths.

### **Training and Development of Animal-Care Staff**

For the most part, the current cadre of keepers at the zoo had no prior experience in the care of zoo animals when they began as volunteers or employees of the zoo. Since at least 1992, training for keepers has been informal and has not followed a common protocol. Consequently, verbal descriptions of the goals and content of training initiatives of the zoo are inconsistent and vague and have resulted in husbandry training that is highly variable across the zoo. The zoo needs to develop effective mechanisms for ensuring that people who are directly responsible for the care and well-being of its animal collection are adequately prepared and competent. The zoo has no documentation outlining the content or goals of a training program for animal-care staff. This lack of formal training or well-structured informal training has been noted in every AZA accreditation report since 1992. There is an informal training system where new keepers follow veteran keepers for a period of a few days to 2 weeks, but there are no written requirements for the length of time that a new keeper should spend in training, what information and protocols new keepers should be taught, how to assess the quality of the training, or how well the training was assimilated.

In 2003, the zoo determined that all assistant curators in animal programs should receive management training through the AZA Management School; by the end of 2004, three of eight assistant curators will have taken this course. There is no documentation that additional training is offered to improve leadership and management skills of assistant curators at the zoo. This current state of training and professional development at the zoo does not foster the expectation that staff will assume responsibility to stay abreast of innovations and further their education and development in their respective fields. Keepers and assistant curators tend not to participate in continuing education opportunities because, they state, the animal program is understaffed. In fact, over the last 10 years, the keeper staff increased while the number of animals in the collection declined by 50%.

### ***Recommendations:***

- *The zoo should develop and implement an animal-care training program for its keeper staff immediately. This action requires establishing written husbandry protocols for each species at the zoo, standardizing the information to be passed to new keepers during training, designing a formal assessment of learned information, and instituting a formal system for documenting compliance with training requirements.*
- *The management team directly responsible for overseeing the day-to-day care of the animal collection (assistant curators) must undergo some form of management training.*

### **Adherence to Policies and Procedures**

In an effort to create a climate of accountability and responsibility, zoo management is undertaking the daunting task of updating and revising the Best Practices Manual. The zoo is holding all-supervisor meetings to make certain that supervisors are familiar with zoo policies and protocols. However, the zoo still needs to address how it plans to train all employees uniformly on zoo procedures. Also, it has not been adequately communicated that all supervisors, including senior management, are accountable for management failures that allow repeated lapses or poor performance in any aspect of zoo operations.

The zoo is updating and revising its zoo-wide policies with input from each unit, but protocols for husbandry, management, and enrichment have yet to be developed in many cases. The zoo has implemented a series of performance measures that set goals for supervisors in the veterinary and nutrition departments in particular, but performance measures to monitor the Department of Animal Programs and individual units have yet to be developed.

#### ***Recommendations:***

- *The zoo should develop performance measures to monitor the operations of the Department of Animal Programs and individual units as a mechanism for managerial accountability.*
- *The zoo must continue to clarify the roles and responsibilities of all staff. Inherent in this task is identifying who is accountable for decision-making and ensuring adherence to policies and procedures.*

### **Strategic Planning**

As described in the interim report, the zoo operated without a strategic plan or its equivalent since at least 1992. Thus, the zoo functioned for many years without a firm sense of direction, which might have contributed to the decline in the animal collection and facilities during the 1990s.

In May 2004, the zoo completed its strategic plan as part of a Smithsonian-wide process. The strategic plan is a good articulation of the mission and 10-year vision of the National Zoo and includes a bold proposal to integrate the CRC science programs with the Rock Creek exhibits and programs, thereby creating a unique niche in the larger zoo community that cannot be fulfilled by the Rock Creek Park facility alone.

The elements of the zoo's strategic plan include a mission statement, a description of core values, a 10-year vision statement, 1-year and 5-year goals, and six strategies for achieving the goals. The main 1-year and 5-year goals pertaining to animal management include goals to implement a comprehensive recordkeeping system; to clarify the roles, responsibilities, and decision-making processes related to animal care and management; to establish a collection and exhibit planning process that will guide decisions on acquisitions and animal relocations; and to continue to upgrade and improve the quality of the exhibits.

Although the 1-year and 5-year goals described in the strategic plan support the zoo's long-term vision in a general way, the strategic plan has several major weaknesses. The zoo did not engage in a situational analysis of its internal and external operational environment. That omission undermined efforts to develop a plan that builds on the strengths of the zoo and adequately anticipates the resource needs and obstacles that will arise as the zoo tries to attain its long-term vision over the next 10 years. The strategic plan also lacks a galvanizing operational plan for

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action and does not include any details on how the zoo intends to attain the 1-year and 5-year goals. The strategic plan also does not link the zoo's vision with the animal-acquisition plan, in that it is unclear how the zoo's vision will be expressed through the types of animals exhibited. Finally, the strategic plan does not take into account how the timeline for renovation and construction of animal exhibits should influence the animal-acquisition plan so that expansion of the animal collection will not tax facilities that are already failing.

### **Recommendations:**

- *The zoo should perform a situational analysis and use this analysis to reassess the goals and vision of the strategic plan. A detailed operational plan for attaining the 1-year and 5-year goals of the strategic plan should be developed. Appropriate performance measures should be identified to track the zoo's progress in attaining the goals of the strategic plan. These measures should be evaluated at least annually to determine whether those goals are being met and whether the strategic or operational plan requires modification.*
- *The strategic plan should directly link the plan for revitalizing the physical facilities with the animal acquisition plan to ensure that planned expansion of the zoo's animal collection can occur without taxing already failing facilities and compromising animal and staff safety.*

## Communication

As evidenced in its own strategic-planning process, the zoo recognizes that communication is critical for its own revitalization and for ensuring high-quality animal management and care. Effective communication has been a challenge because the zoo and its individual departments are organized hierarchically. Even within a single department, such as animal programs, units are largely isolated from one another; bottom-up communication is not well established; top-down communication has been inconsistent; and electronic communication has been utilized inconsistently. It is unclear whether written materials, such as policies and procedures, are read and assimilated by the animal-care staff and many employees do not feel that they have a voice within their unit or the organization.

Management recognizes that improvements in communication are critical for revitalizing the zoo and ensuring high-quality animal care and management, and is taking steps to remedy some of those long-standing deficiencies. Associate curators now visit their units regularly, interdepartmental meetings are more frequent, and work assists (moving employees to units others than their own to provide advice on particular issues) are more common. All employees had multiple opportunities to provide input to inform strategic planning process. Management holds regular "town hall" meetings at both campuses. There is also increasing use of electronic technology, especially two-way radios, in zoo operations.

### **Recommendations:**

- *The zoo should continue efforts to facilitate communication among and within departments and to improve communication between different organizational levels. There are many potential ways to achieve improvement: formalize regular interdepartmental meetings, expand the use of cross-functional assignments and cross-training, and formalize the use of available technological resources for enhancing communications within and across the various units of the zoo.*
- *Management at the zoo should be persistent in efforts to facilitate communication up and down the organization as a whole and in the chain of command in each unit.*
- *The zoo should develop a plan and process for monitoring adherence to and evaluating the outcome of standards, policies, procedures, special guidelines, and other aspects of communication. Staff training in communications is necessary to ensure that these policies have been assimilated and understood, and that there is accountability for adherence at all levels.*
- *The zoo must endeavor to build a sense of community for its employees and create professional relationships between various departments and individuals.*



### Knowledge Management

In the past, the zoo has lacked the ability and commitment to capture, archive, and retain existing institutional knowledge. There is no mechanism for capturing employees' knowledge so that it is not lost when they transfer between units or leave the organization. The zoo has a long history of deficiencies in continuing education and has relied heavily on an internal-development strategy: open positions are filled from within the zoo rather than by hiring from outside. This practice has limited the amount of new knowledge flowing into the institution. Not all departments in the zoo have used the computer network effectively to store information so that it is properly archived and accessible to others. As a result of those practices and the lack of a formal plan for the management of institutional knowledge, the zoo's knowledge base has stagnated.

The zoo until recently has not been diligent in promoting a learning environment where employees have a shared understanding of what the organization is trying to accomplish, employees are accountable for learning and their own performance, new ideas are valued and encouraged, and policies and practices support the effective use of training. The zoo relies heavily on an internal development strategy, which, coupled with a lack of continuing education opportunities, creates an insular culture and isolates the zoo from outside perspectives and innovations.

The zoo has recognized some of these problems and has made major improvements by updating standards, policies, and procedures; advertising open positions more broadly; using work assists; soliciting ideas and information from employees through the strategic-planning process and in efforts to update policy manuals; and holding "all-hands" meetings with the zoo director.

#### **Recommendations:**

- *The zoo should develop appropriate electronic storage of knowledge and enable employees to locate and access information in a just-in-time fashion.*
- *To improve the knowledge base among staff, the zoo should develop recruitment strategies to ensure an appropriate balance of staff recruited from outside and those transferred or promoted from within the organization.*
- *The zoo should develop additional strategies for capturing and retaining existing institutional knowledge that is being lost through the departure of experienced staff.*
- *The zoo should conduct an assessment of its learning environment to identify barriers to and opportunities for implementing initiatives for advancing the work culture as a learning environment.*

### Human-Resources Planning and Use

The zoo does not have its own human-resources plan, and the current strategic plan does not include projections of the staffing levels necessary to support the new strategic vision of the zoo. The centralized Smithsonian Office of Human Resources (OHR) makes most personnel decisions for the zoo, including employee selection and staff reductions. As a result, staffing decisions often lack a strategic focus. Staffing levels in most units of the zoo appear to be appropriate, but it is unclear how the specific needs of different units are weighed in determining how human resources should be allocated. Staff members have often been assigned to units where they had no taxonomic expertise. In addition, the Smithsonian is subject to the rules of federal employment processes, which can make decision-making cumbersome and protracted.

Improvements are evident. The zoo has been working with the Smithsonian OHR to streamline the hiring process by developing more detailed job announcements to reduce the number of applications from unqualified people that have to be processed. The electronic processing of applications and other human-resources administrative actions are under development.

**Recommendations:**

- *A more efficient hiring process in the zoo and the Smithsonian Institution would increase the likelihood of successfully recruiting top candidates for open positions at the zoo.*
- *The zoo should focus attention on developing a human-resources plan based on an analysis of the adequacy of its current staffing levels and projections of staffing necessary to achieve its strategic vision.*

**Review of Individual Animal Deaths at the National Zoo**

A scientific examination was conducted of recent animal deaths at the CRC and Rock Creek Park facilities. The committee examined medical records, keeper notes, pathology records, curatorial records, and internal memorandums and reports that were provided by the zoo. The committee reviewed 48 individual cases. This review included cases involving megavertebrates<sup>1</sup> and other species that were publicized through the media or written comments to the committee (23 cases from Rock Creek Park and 4 cases from the CRC), as well as a random sampling of megavertebrate deaths that occurred from 1999 to 2003 (10 cases from Rock Creek Park and 11 from the CRC). In total, the committee evaluated 74% of all megavertebrate deaths that occurred at the National Zoo from 1999 to 2003. The committee concluded that in a majority of cases, the animal received appropriate care throughout its lifetime. In particular, the committee's evaluation of randomly sampled megavertebrate deaths at the Rock Creek Park facility revealed few questions about the appropriateness of these animals' care, suggesting that the publicized animal deaths were not indicative of a wider, undiscovered problem with animal care at the Rock Creek Park facility.

The committee's evaluation of these cases did uncover recordkeeping deficiencies in 17 of the 48 cases. These lapses occurred at both the Rock Creek Park and CRC facilities and made it difficult to determine whether husbandry and veterinary procedures occurred but were not documented or whether the procedures were not performed. The committee's evaluation of randomly sampled megavertebrate deaths at the CRC facility revealed widespread veterinary recordkeeping deficiencies and potential problems with the preventive medicine program on a scale that is similar to the deficiencies in the preventive medicine program at the Rock Creek Park facility, which were detailed in the interim report.

Through its review of these cases, the committee identified a major organizational issue that created an environment where these human lapses could occur. The lack of open communication and collaboration among keepers, curators, veterinarians, nutritionists, and senior management was evident in almost every case where inadequate animal care was evident. The committee observed that the individual departments of the zoo seldom worked collaboratively, disrupting the system of checks and balances and allowing inadequate care to occur. When multiple people are actively involved in the care of each animal, it is less likely that a lapse in care will go unnoticed. A team approach to animal care is particularly important at the National Zoo, whose animal collection is generally geriatric and where a lapse in care may have a greater negative impact.

**Recommendations:**

- *The zoo must take immediate steps to clarify the actions, procedures, and observations that must be included in each type of record created by animal-care, veterinary, and nutrition staff.*
- *The apparent inadequate care caused by failures on the part of the veterinary, nutrition, and animal-care staff at the Rock Creek Park facility are being addressed by recent changes in policies and new*

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<sup>1</sup>Defined as elephant, hippopotamus, rhinoceros, zebra, bear, giant panda, lion, tiger, cheetah, gorilla, orangutan, camel, giraffe, sea lion, seal, Przewalski's horse, and oryx.

*initiatives by the zoo. The zoo should continue efforts to establish accountability for unprofessional actions that involved any level of staff.*

- *This evaluation of recent deaths at the CRC facility reveals widespread veterinary recordkeeping deficiencies, raising concerns about the adequacy of the preventive medicine program at the CRC. Senior management should evaluate whether the veterinary staff was adhering to the preventive medicine program from 1999 until recently and continue its current efforts to establish oversight and accountability for the veterinary staff at the CRC.*

### **Evaluation of the Conservation and Research Center**

The 3,200-acre CRC in Front Royal, Virginia, focuses on the conservation of biodiversity through scientific research, professional training, and education. The CRC Animal and Support Department consists of a Veterinary Division and an Animal Division that cares for a collection of mammals and birds. The animal collection at the CRC is small. As of January 2003, there were 97 mammals of nine, mostly endangered, species and 172 birds of 11 species. In addition to housing animals involved in research, the CRC serves as a holding site, usually temporary, for animals not currently needed for the Rock Creek Park exhibits.

The committee reviewed the CRC facility to determine whether there was effective management and care of its animal collection. It used criteria similar to those used in its evaluation of the Rock Creek Park facility, documented in the interim report.

#### Animal Care and Management at CRC

To assess the quality of past animal care at the center, the medical records of a random sample of animals representing about 5% of the collection were evaluated. Apparent incidents of inadequate preventive medical care were found for about 18% of the sample. However, the preventive medicine program at the CRC was recently updated, and the committee finds it appropriate for all the taxa maintained at the CRC. Senior management also instituted performance standards for the preventive-medicine programs at both the CRC and Rock Creek Park facilities in May 2004. From May to July 2004, the CRC veterinary staff completed 100% of its scheduled preventive-medicine procedures.

There were differences in the immunization protocols at the CRC and Rock Creek Park facilities for the same animal species without any apparent medical justification. Many species of animals are transferred between the two facilities, so it is important that vaccination protocols be developed in coordination to mitigate any infectious disease risk.

#### ***Recommendations:***

- *Senior management should continue to track completion of monthly scheduled preventive-medicine procedures at the CRC facility.*
- *The CRC and Rock Creek veterinary departments should collaborate to coordinate their preventive-medicine protocols as animals are transferred between the two facilities.*

#### Animal Welfare at CRC

The CRC IACUC, like that at Rock Creek Park, is responsible for ensuring the welfare of research and exhibit animals. A review of the CRC IACUC's activities for the last 5 years indicates that it actively reviewed all submitted animal research protocols. However, it failed to perform its other mandated activities, such as semiannual inspections. In addition, the IACUC's failure to investigate the death of a Grevy's zebra in 2000 indicates that it did not clearly understand its mandate to ensure the welfare of all animals in the CRC collection and not only animals used in research. The CRC IACUC has recently taken several steps to reorganize its program to clarify its role and

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responsibilities and to improve compliance with federal statutes, which includes submitting annual reports, performing semiannual reviews in 2004, and developing plans to provide training to IACUC members.

### ***Recommendations:***

- *The Smithsonian and the zoo should ensure that the CRC IACUC is fulfilling its stated responsibilities in a timely and complete manner. These responsibilities extend to the entire collection and not only to the animals involved in research.*

### Nutrition Program at CRC

At the CRC, the nutritionist, curator, and veterinarian collaborate to formulate diets. Many of the diets have been adapted from dietary formulations recommended by the Species Survival Plan (SSP) management group. In general, the nutrition program at the CRC appears to have been under appropriate control, and the feeding guidelines for all species at the CRC facility are appropriate. There is a standard procedure for altering diets. To avoid previous problems with hay quality, the CRC recently hired contractors to raise and harvest hay. However, problems remain with inadequate storage facilities to maintain hay quality.

### ***Recommendations:***

- *Adequate storage facilities for hay, on which the entire NZP depends, must be found, and quality control for the hay must be assured.*

### Recordkeeping at the CRC

The CRC, like the Rock Creek Park facility, uses a mixture of electronic and paper records. Except for CRC pathology records, the Rock Creek Park and CRC systems are not integrated. CRC keeper records are maintained on paper in the bird unit but are electronic in the mammal unit. Before the adoption of an electronic keeper record system by the mammal unit in 2001, the keeper records were maintained for only 1 year and then returned to the keepers.

There are numerous examples of failure to keep adequate medical records in the CRC veterinary hospital. It is unclear why these systematic lapses in documentation of medical observations, procedures, and vaccinations occurred, but it is clear that some veterinarians were simultaneously using hand-written records, some were using an electronic record system, and some were using MedARKS.

### ***Recommendations:***

- *Immediate steps must be taken to clarify to the CRC veterinary staff the actions, procedures, and observations that must be included in the medical record, and senior management must ensure compliance with these policies.*
- *The CRC should transition to new recordkeeping systems in parallel with the Rock Creek Park facility.*

### Pest Control at the CRC

The pest-control operation at the CRC facility has not experienced any difficulties. The unified system controlled by the new pest-control officer should minimize any future problems for the facility.

### **The National Zoo's Department of Pathology**

For many decades, the pathology department at the zoo has maintained an extraordinary reputation for excellence. However, a backlog of uncompleted pathology reports from 2000-2003 had accumulated, and annual morbidity and mortality assessments had not been completed. This backlog included approximately 21% of pathology cases from 2003. The department under the leadership of the acting supervisory pathologist has already eliminated the backlog from 2003, has plans to eliminate the remaining backlog by May 2005, and is scheduled to complete the 2003 morbidity and mortality assessment by the end of 2004.

#### ***Recommendations:***

- *Performance measures should be established for the pathology department to monitor operations and ensure that until a permanent supervisory pathologist is hired, the department has adequate staff to meet the pathology needs of the zoo and continue consulting with the larger zoo community.*

### **Occupational Health and Safety Programs**

The zoo's occupational health and safety (OHS) program is operating effectively, although it remains in a reactive mode. The safety officer is positioned appropriately by directly reporting into the director's office and is well qualified and knowledgeable regarding Smithsonian policies and procedures, OHS standards, and the principles for managing safety and health programs. The OHS program has a zoo-wide chemical-approval procedure, a comprehensive chemical-inventory database, and consistent safety procedures. In addition, escape drills have been held recently, and the OHS program offers safety-training classes. Those procedures and activities have helped the Safety Program move toward proactive, albeit still in many respects reactive, management of health and safety risks. However, there are still concerns regarding occupational health and safety at the zoo, one of which is the state of the Rock Creek Park health clinic. The health clinic is of inadequate size, floods occasionally, has only one exit, does not have the capability of providing complete health monitoring of workers, and is poorly equipped for emergency care.

Although the OHS program has written policies in place on good safety practices, there has been a lack of compliance with these policies in some areas of the zoo; for example, primate keepers feeding great apes without ready access to a two-way radio and failing to wear attire that conforms to safety policies. There is also a concern with the zoo's zoonosis program: testing and immunization requirements are not being determined by personnel trained and experienced in occupational health and infectious disease and as a result are inconsistent across the zoo.

#### ***Recommendations:***

- *The zoo's Safety Department should continue to shift its emphasis toward a more proactive, anticipatory role rather than reacting to events as they occur.*
- *Formal written policies pertaining to good safety practice should be enforced, and senior management should ensure inclusion of OHS training in a comprehensive training program for animal-care staff.*
- *Safety department staff trained in occupational health and infectious disease should determine the testing and immunization requirements for zoo employees based on a hazard and exposure assessment developed with input from unit supervisors.*
- *The Smithsonian Institution must correct the deficiencies in the health clinic facilities at the Rock Creek Park facility.*

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## Introduction

### ZOOS

Collections of wild and exotic animals have been maintained in menageries by the powerful and wealthy since the time of the pharaohs. However, the first known public collection of caged animals to be constructed in a park-like setting was in Vienna, Austria; it was inaugurated in 1752 (Reichenbach, 2002) and opened to the general public in 1779 (Vienna Zoo, 2004). The term *zoo* originated later, probably in the middle of the 19th century, as an abbreviation for the name of the Zoological Garden in Regent's Park, London. That zoo, which opened in 1828, and the earlier one created at Versailles, near Paris, around the beginning of the 18th century were intended as scientific laboratories for studying live animals (Croke, 1997; Hancock, 2001; Baratay and Hardouin-Fugier, 2002; Reichenbach, 2002). But, like similar zoos established later throughout urban Europe and North America, those institutions quickly became places of entertainment and relaxation for working people. The National Zoological Park (National Zoo) in Washington is a good example. Created in 1889 by an act of Congress, the National Zoo became part of the Smithsonian Institution in 1890. Its original mission was "the advancement of science and the instruction and recreation of the people" (NZZP, 2004). The National Zoo quickly became a crowd pleaser, attracting large numbers of visitors from the local populace (Croke, 1997).

The popularity of zoos continues today. In 2000, over 134 million people visited zoos, aquariums, and wildlife parks accredited by the American Zoo and Aquarium Association (AZA)—more than the combined attendance at professional baseball, football, and basketball events (AZA, 2000a). The popularity of zoos is both a challenge to and a dilemma for modern zoo staffs, which must balance the entertainment value of the zoological park with other equally important and demanding zoo missions. Much has been written about the modern zoo and about how zoos are evolving to keep pace with public tastes, to deal with thorny ethical issues, and to establish and define their roles in conservation, education, and research (Tarpay, 1993; Hutchins and Conway, 1995; Kelly, 1997; Ebersole, 2001; Praded, 2002; Conway 2003; Hutchins, 2003; Hutchins and Smith, 2003; Knowles, 2003). The nation's outstanding zoos have transformed themselves over the last 30 years in response to a variety of external pressures and emerging viewpoints. The number of species in a zoo's collection no longer rates it as excellent or poor. Instead, it is how the exhibits are designed, how the animals are managed, the quality of the educational and scientific programs, and, most recently, the efforts to conserve species that determine the quality of an institution. Whether a zoo is successful in achieving and maintaining excellence by reforming its infrastructure and mission depends not only on the financial resources available to it but on focused and dedicated leadership and staff, short- and long-term vision and strategic planning, and organizational structure.

No longer can zoological parks be mere repositories of caged animals organized primarily for public viewing and for observation by a few resident staff scientists. Three related movements appear to have caused zoos to reinvent themselves in the last half century (Hutchins, 2003; Hutchins and Smith, 2003). First, beginning as early as the 1930s at such places as the Bronx Zoo, curators and the educated public became concerned about the physical and psychological well-being of captive animals and about the needs of many of the animals for more space and more hospitable, natural surroundings (Conway, 2003; Kirkwood, 2003; Sheperdson, 2003). What started as a small movement at a few top zoos to improve the lives of the animals has become all but a requirement at accredited institutions and has been limited less by a reluctance to change than by the availability of funds and space. Space is a particular problem for urban zoos, where a new or renovated exhibit can occupy several acres in a compact park setting.

Second, there is an increasing aversion to collecting animals from the wild (Hutchins et al., 1996; Hancocks, 2001). Not only has such a practice become expensive and politically charged, it has generally been perceived as counter to the conservation ideal except when a species was hovering on the brink of extinction and needing protection from ultimate destruction or when there was a need to broaden the genetic diversity of a captive species. Nearly 90% of the mammals and 70% of the birds in a modern zoo collection are now bred in captivity under careful management schemes that seek to avoid inbreeding (Hutchins et al., 1996)—a commendable improvement over past practice but one that can lead to surplus animals unless properly controlled (AZA, 2000b).

Third, it is recognized that species are becoming extinct at rates unprecedented since the end of the Cretaceous geologic period 65 million years ago, when the dinosaurs disappeared from the earth. The primary cause of this emerging tragedy is human activity with its accompanying destruction and fragmentation of habitat (Wilson, 1989; Reaka-Kudla et al., 1996). The concept of the “zoo ark” emerged as a way for zoos to rescue endangered species and possibly to reintroduce them into the wild (Beck et al., 1994; Stanley-Price and Soorae, 2003). Perhaps more important, zoos have positioned themselves, with the support of their members and visitors, as centers for conservation of wildlife (AZA, 1987; Tarcy, 1993; Hutchins and Conway, 1995; Kelly, 1997; Ebersole, 2001; Praded, 2002; Conway 2003; Hutchins, 2003; Hutchins and Smith, 2003; Knowles, 2003).

Each of those ideals—exhibits that cater to animal well-being and public education, captive breeding programs, and survival of species in their natural habitats—has become an essential aspect of the mission of most world-class zoos.

Thus, zoos continue to be popular places of entertainment but must continually make adjustments to have a meaningful role in modern society. At their best, they are organizations dedicated to conservation, education, and science, and they exhibit an array of species to reflect these ideals. At their worst, they are shameless indulgences. Exhibits in a world-class zoo are designed in a manner that is sensitive to the physical and psychologic needs of their animals. The best zoos employ expert veterinarians, pathologists, nutritionists, and other professionals dedicated to the animals they care for and to wildlife conservation. They are institutions of education and learning, providing both on-site and outside training opportunities for their staff and using state-of-the-art electronic communication to assist these efforts. Modern zoos have become responsive to the unprecedented declines in wildlife population and habitat destruction by promoting captive breeding programs, interinstitutional cooperation, and off-site conservation. Increasingly, they have to be concerned with their public image in the mass media, with raising funds, and with promoting cooperative interactions with other zoos to live up to their core missions. As a result of those activities and responsibilities, zoos have become complex structures that place great demands on leadership and on communication among management, staff, and the general public.

### **BASIS OF THE INTERIM AND FINAL REPORTS**

On March 5, 2003, the US House of Representatives Committee on House Administration held an oversight hearing on the Smithsonian Institution. During the hearing, questions were raised regarding animal care and management at the National Zoo. On the basis of questions raised during the hearing, Congress requested a science-based review by the National Academies on the quality and effectiveness of animal care and management at the zoo. In response to the request, the Board on Agriculture and Natural Resources and Institute for Laboratory Animal Research of the National Research Council convened the Committee on the Review of the Smithsonian Institution’s National Zoological Park to conduct the review. The detailed charge to the committee is as follows:

A committee of experts will be appointed to assess the quality and effectiveness of animal management, husbandry, and care at the Smithsonian Institution’s National Zoological Park in Washington, D.C. and the Conservation and Research Center in Front Royal, Virginia. The study will identify strengths, weaknesses, needs, and gaps in the current infrastructure and provide recommendations on changes needed to ensure effective management and care of the National Zoo’s animal collection. The study will provide a description of the system currently in place, the elements and characteristics of that system, and the changing nature of concerns surrounding the system. The committee will examine the historic and recent problems with animal health and animal science practices at the zoo, including recent reports on zoo operations and a scientific examination of the causes of recent animal deaths. The committee will review the NZP within the context of the larger zoo community, identifying unique aspects of the environment in which the NZP operates. The committee will evaluate the communication and coordination of the various divisions of the zoo that impact animal care, analyze the use of resources, and outline attributes of an enhanced system to ensure the health and well-being of the animals at the NZP. In addition, the committee will evaluate recent and ongoing changes in zoo operations. An interim report identifying the most pressing issues in animal care and management and aspects of the system in

need of immediate attention, will be delivered at the end of the initial 6 months of the study. A final report that provides a comprehensive assessment of the zoo, outlines attributes of an enhanced system to ensure the health and well-being of the animals, and includes the committee's final recommendations, will be delivered at the end of 12 months.

In view of the complexity of the National Zoo, any review of the institution that focuses narrowly requires a range of expertise. Accordingly, the assembled committee contains persons experienced in zoo management and operations, nutrition, veterinary practices and procedures, pathology, industrial management, leadership and group relations, toxicology, occupational safety and health, animal disease, zookeeping, animal welfare, and animal physiology.

### **Interim Report**

Because of Congress's concerns about animal care and management at the zoo and to allow progress at the zoo and prompt feedback on the zoo's actions, Congress requested an interim report on the committee's findings. The committee was charged to identify the "most pressing issues in animal care and management and aspects of the system in need of immediate attention." Congress requested that the committee develop a report that was intentionally narrowly focused on the concerns that the committee deemed the most important to the "health and well-being of the animals." To that end, the committee focused on the subjects that needed the most attention either because they were detrimental to the health and welfare of the animals or the staff or because they were crucial to the operational structure of the organization. The interim report focused on animal care and management, recordkeeping, pest management, and mission and strategic planning.

In the interim report, the committee noted that the zoo had several deficiencies that affected the care and management of the animal collection. The Rock Creek Park facility had a preventive-medicine program that was not fully implemented. The nutrition program had failed in a number of respects, including communication with keepers, standardization and evaluation of protocols, maintenance of adequate records, and implementation of a centralized commissary although there were adequate facilities. There was a lack of required documentation that the welfare of animals had been adequately considered during the development of research programs. Function of the institutional animal care and use committees (IACUCs) at both the Rock Creek Park and Conservation and Research Center (CRC) facilities was poor. There was a lack of familiarity with federal regulatory requirements despite provision of information to the Rock Creek Park IACUC chairman by the Smithsonian Institution's Office of Sponsored Projects outlining the information needed for compliance with the Public Health Service Policy on Humane Care and Use of Laboratory Animals (Smithsonian Institution, Foss memo, February 27, 2003; June 27, 2003). Finally, there had been poor adherence to the zoo's own policies and procedures for animal health and welfare, such as those for euthanasia and quarantine.

The other concerns addressed in the interim report included recordkeeping, pest management, and strategic planning. Records were found to be incomplete, hard to retrieve, inconsistent in format, and in some cases altered. Pest management, although improving, appeared to pose a threat to animals unless the best practices of integrated pest management were implemented. The committee also noted that the zoo had been operating without a strategic plan for over 10 years although development of one was recommended by the AZA accreditation report in 1992 and 1997 (AZA, 1992; 1997). That lack of planning jeopardized the long-term operation and the focusing of resources at the zoo at a time when there was a clear need for facility revitalization and renovation of the animal collection. The committee noted that the zoo had been in decline for many years and was beginning to show signs of improvement but that many critical weaknesses remained and needed to be addressed immediately.

### **Final Report**

This final report provides a comprehensive assessment of the zoo, including an evaluation of the CRC and an evaluation of how the zoo responded to the interim report. In addition to the concerns that were raised in the interim report, this report raises concerns that the committee felt deserved attention from the Smithsonian Institution and zoo staff but were not immediately detrimental to the animals or the staff, including training and human-resources concerns that could not be addressed by the zoo in the short term. The committee also conducted an



examination of the zoo's recent animal deaths and a random sample of medical records at both the Rock Creek Park and CRC facilities to determine the quality of care. The report also provides the zoo and Congress with the committee's final conclusions and recommendations on the most important changes needed to ensure high-quality care and management of the animals at the zoo.

### **THE NATIONAL ZOOLOGICAL PARK**

To appreciate the scope of the final report and of the interim report, it is necessary to consider briefly the history of the zoo, its budget, its operations, and its main missions. As noted above, the zoo was created by an act of Congress in 1889 for "the advancement of science and the instruction and recreation of the people"; in 1890, the zoo became part of the Smithsonian Institution (NZIP, 2004). The current mission of the zoo, "to celebrate, study, and protect the diversity of animals" (NRC, 2003b), is not much different from Congress's initial intent. In 1974, the CRC was founded, expanding the zoo's role in research (NRC, 2003b). The zoo is one of 16 museums in the Smithsonian complex, from which it receives most of its budget. On March 17, 2004, the zoo received a renewal of its AZA accreditation, which will last until September 2008. It is one of 213 zoos and aquariums accredited by AZA (AZA, 2003b). The CRC was also granted certification as an AZA-certified related facility in March 2003 (AZA, Healy letter, June 2, 2003); CRC certification is due to expire in March 2008.

#### **Budget**

In FY 2004, the federal appropriation in direct support of the zoo was approximately \$28.4 million of its total operating budget of approximately \$39.9 million (note that the total operating budget from Table 1-1 of the interim report erroneously included the operating budget of the Friends of the National Zoo (FONZ) – a nonprofit entity separate from the zoo). In FY 2003, the federal appropriation to the zoo was about \$24.3 million of a total operating budget of \$38.9 million, which includes business income, grants, gifts, and support from FONZ. The FY 2005 request for federal appropriations in direct support of the zoo is \$30.57 million of an estimated total operating budget of at least \$36 million; the operating budget estimate does not include an estimate of FONZ support of zoo programs (NZIP, Budget Overview, August 12, 2004).

The zoo received \$18.75 million for capital improvement from Congress in 2003, and \$28.22 million in 2004. The zoo has requested \$21.50 million in federal appropriations for capital improvement in 2005; estimates for revitalization at the zoo for 2006 through 2009 can be found in table 8-2. These figures represent updated budgetary information from the information presented in Tables 1-1 and 1-2 of the interim report. Unlike most other zoos that receive substantial public funding, the zoo does not charge admission for its estimated 2 million-plus annual visitors. Despite its quasigovernment status, the zoo is a complex business operation that depends on private, as well as federal, support for its operations.

#### **Locations**

The zoo consists of two campuses. The original site is on 166 acres of Rock Creek Park in northwest Washington, DC. It is open to the public 364 days a year and houses the majority of the present collection of over 2,500 animals of about 420 species. The second site is the 3,200-acre CRC at Front Royal, VA, about 65 miles from downtown Washington, DC. It is not generally open to the public except on special "open" days, when the center showcases its science. The CRC serves as a conservation facility and a laboratory for propagating a few rare species. It also trains wildlife biologists from the United States and abroad. A detailed critique of animal-care and management practices at the CRC is provided in Chapter 5 of this report. The two campuses participate as partners in conducting the three major missions of first-class modern zoos; education, research, and conservation.

### **Personnel**

Day-to-day operations of the zoo involve employees and volunteers within the organization, professionals in other parts of the Smithsonian, advisory boards, and others outside the zoo, including contractors, who work primarily to maintain the animals and physical plant. The organizational structure (NZIP, NZIP Organizational Structure, July 24, 2003) is shown in Figure 1-1 of the interim report. The structure is characterized by a hierarchic distribution of management authority and responsibility. At the apex of the structure is the zoo director, who interacts with three advisory bodies: FONZ, the National Zoo Advisory Board, and the CRC Foundation. The director is supported by a deputy director.

The zoo has eight departments, which operate essentially independently. Departments are led by assistant directors who report to the zoo director and deputy director. The Department of Animal Programs (Figure 1-2 of the interim report) has primary responsibility for the day-to-day care and management of the animal collections at the Rock Creek Park facility. Assistant curators report to associate curators (who in turn report to the general curator) and are generally people who have worked in the zoo for many years. The Department of Animal Health includes veterinary and nutrition staff (Figure 1-4, interim report). The Department of Pathology has primary responsibility for examining animal deaths and administers the pest-management program (Figure 1-5, interim report). The other four departments are Public Affairs and Communications, Administration and Technology, Exhibits and Outreach, and the Police. The CRC has primary responsibility for the day-to-day care and management of the animal collections at the Front Royal facility; its structure is presented in Chapter 5 of this report.

### **Animal Collection**

The status of the animal collection has been reviewed in detail in Chapter 1 of the interim report. The collection includes about 2,600 animals of just over 400 species but has undergone dramatic changes in the last 10 years. From 1993 to 2002, the size of the animal collection decreased by 54% for several reasons, including a decrease in acquisitions and an increase in removal of animals. The number of animals acquired annually by the zoo was fairly stable from 1993 through 1999, but starting in 2000 there was a decline in the number; annual acquisitions decreased by 67% from 1999 to 2002.

Even though annual acquisitions of animals remained relatively stable throughout the 1990s, the size of the animal collection continued to decline because the number of animals being removed from the collection each year through death or relocation to other institutions was greater than the number being acquired through birth or acquisition from other institutions. In particular, many animals were removed from the collection in 1995-1997 as a result of a deliberate reduction in the number of mammals held at the CRC and a large number of animal deaths, specifically of fish, amphibians, and invertebrates. The CRC also deliberately reduced the number of mammalian species in its inventory by about 40% during that period through relocation to other institutions. The decision to concentrate on only about 10 species that promised a high research return provided greater focus to the CRC research effort. In Chapter 4, the committee has attempted to provide a science-based objective assessment of mortality at the zoo and presents its findings on the recent animal deaths at the zoo.

### **The National Zoo as Part of the Larger Zoo Community**

The committee attempted to place the zoo in the context of the larger zoo community by using data from AZA-accredited zoos (AZA, 2003b) on vertebrate-animal collection sizes, total staff numbers, and annual budgets. The comparison was based on information that is publicly available from AZA and individual zoos' annual reports. The committee also attempted to gain information directly from individual zoos by asking for specific information on their collection sizes, budgets, personnel, veterinary care, nutrition, training, and communication. Because the committee received only five responses to its request, comparisons with other zoos were limited.

Using AZA data (AZA, 2003b), the committee excluded an institution from its analysis if it was an aquarium, if more than 70% of its vertebrate collection was fish, or if no staff and budget data were available. Those criteria yielded 155 AZA-accredited institutions with which the zoo could be compared. Annual budgets of those zoos were about \$60,000 to \$89 million, with an average of \$6.6 million (AZA, 2003b). The zoo budget was larger than those of 96% of the AZA-accredited zoos, and its staff size was in the 94th percentile. The vertebrate animal

collection size was at the 89th percentile, with 2,278 specimens. The zoo had a ratio of vertebrate animals to staff of 7.8:1, a value lower than those of 72% of the AZA-accredited institutions. The ratios include all staff (animal-care, animal-health, research, administrative, service, and so on) reported by the institutions. About 50% of the zoo staff is involved directly in animal care and management (the Department of Animal Programs, the Department of Animal Health, the Department of Pathology, and the CRC Animal and Support Department). According to a previous National Research Council report (NRC, 2003b), the CRC science programs, number of staff, and disciplines represented are comparable with those of other zoos of similar size and status. It has about 30 staff scientists in disciplines that include reproductive biology, veterinary medicine, conservation biology, species recovery, genetics and genome-resources banking, and GIS spatial analysis for conservation; the Brookfield Zoo has about 25 scientists, the Institute of Zoology at the London Zoo about 22, and the San Diego Zoo about 35 (NRC, 2003b).

The general conclusion that may be drawn from these introductory remarks is that the zoo ranks among the top 10% of zoos in the United States in annual funding, collection size, and staff. What the numbers do not show is that the zoo is also a major center of research and conservation science and that its direct federal support through Congress and its location in the nation's capital endow it with a special aura and prominence. However, according to a random nationwide survey of 1,987 adults done by the Roper Organization (1992), only 25% of people say that they know a lot about the zoo, compared with 60% who say that they know a lot about Sea World and 40% about Busch Gardens and the San Diego Zoo (Roper, 1992). Although some would argue that the zoo is the nation's zoo and that its well-being should be a matter of national and not just local concern, it may not yet be in the entire nation's consciousness.

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## Strategic Planning

### CHARACTERISTICS OF AN EFFECTIVE STRATEGIC PLAN

Strategic planning is critical to the success of any organization—large or small, public or private, for-profit or nonprofit. Strategic planning is a process whereby an organization charts its future; it may be initiated in response to various internal stimuli (such as a change in leadership or high turnover) or external stimuli (such as competition or changing regulations) (Steiner et al., 1994). The strategic-planning process provides an opportunity for an organization to clarify its fundamental mission or purpose. The mission can then be communicated to employees to create a shared understanding of what the organization is trying to accomplish. Strategic planning also involves setting short-term and long-term goals and generating a detailed operational plan that outlines how the goals will be attained. Clear goals and a concrete operational plan are essential for ensuring successful implementation of the strategic plan.

There are many models of strategic planning for nonprofit, for-profit, and government organizations (Bryson, 1988; Crittenden and Crittenden, 1997; Godet, 2000; Gummer, 1997; McNamara, 2003). Most involve six basic steps: assessing the current state of an organization (where we are now); identifying human, physical, and capital resources that are available to the organization (what we have to work with); creating a vision or deciding how the organization should be positioned in the future (where we want to be); formulating a detailed plan for achieving the vision (how will we get there); monitoring and evaluating progress (the extent to which we have implemented the strategic plan and achieved our goals); and revising and updating the strategic plan (to keep the strategic plan appropriate).

The act of creating a strategic plan facilitates organizational performance through several mechanisms. It forces an organization to take stock of its internal resources and capabilities, as well as the larger environment in which it is operating (Barry, 1986), a process known as situational analysis. An organization can use the resulting information to determine how to position itself in the future; thus, an organization's strategy should be designed to enable it to leverage its strengths and opportunities and to minimize or neutralize its weaknesses and threats (Gibbis et al., 2001). The strategic plan, when adequately communicated to employees, provides a road map for organizational success. The strategic-planning process identifies short-term and long-term goals and specifies, in detail, how and when the goals will be achieved; this information can guide individual, unit, and organizational actions and decision-making and can provide objective, quantifiable indicators by which to judge progress and success (McNamara, 2003).

Strategic planning can be performed by an internal facilitator or an external consultant. In many cases, the use of an external consultant is preferable. Nonprofit organizations that use a formal approach to strategic planning may achieve higher levels of performance than those with more informal procedures (Siciliano, 1997). An external consultant is less likely to hold preconceived ideas about the organization and can offer a fresh perspective on the organization's issues and ideas. An external consultant can also help to ensure that the organization develops all parts of its strategic plan and can offer an independent evaluation of whether the plan is being implemented properly and whether progress is being made.

Whether the strategic-planning process is overseen by an internal facilitator or an external consultant, it is critical to involve a broad array of stakeholders. The planning team should include top management so that employees see management buying-into the process (McNamara, 2003). Staff at various levels should also be part of the process. It is impossible to involve every employee on the planning team, but an effort should be made to collect information and reactions from as many employees as possible; this will not only ensure that all important issues are considered but also help to garner employee buy-in. Stakeholders (such as funders, trade association, potential collaborators, vendors and suppliers, customers, and volunteers) should also be included to ensure that those served by the organization have a voice in the process. (Crittenden and Crittenden, 1997).

A strategic plan should be implemented, evaluated, and periodically updated if it is to be valuable to the organization. In fact, failure to follow through on a strategic plan and show clear evidence of progress is likely to demoralize and frustrate employees who have contributed to the process. The strategic plan must contain clear goals and objectives that can be achieved with measurable results (Bonoma and Clark, 1990). Each of the major goals outlined in the strategic plan should be accompanied by an operational plan. Essentially, an operational plan details a

series of important steps that should be taken to achieve a major goal (Crittenden and Crittenden, 1997). For example, a major goal might be to repair necessary physical facilities, and the operational plan might prioritize the order of repairs, specify a schedule for completing the repairs, and identify additional funding and human resources that are needed. The strategic-planning process often involves setting goals for the next 5 years. Actions that the organization plans to take to achieve those goals in the short term (1-2 years) should be described in substantial detail in the operational plan. Those actions should have a detailed timeline and clear delineation of responsibility. The short-term elements of an operational plan should also be accompanied by specific evaluation criteria to assess effectiveness, efficiency, and cost. For example, the Perth (Australia) Zoo measures annual performance by effectiveness and efficiency indicators in three categories (Perth Zoo, 2003): wildlife conservation, customer awareness of conservation, and customer service. Other zoos have used a variety of objective, performance, and activity measures (City of Philadelphia, 1997; Metro, 2000; Auckland Regional Council, 2003; City of Topeka, 2003; Woodland Park Zoological Society, 2003). Actions that the organization plans to take in the long term (2-5 years), need not be as detailed initially but should be updated as time progresses. It is important to recognize that clear, objective goals and a detailed operational plan are essential if the strategic plan is to serve as the impetus for organizational change.

Not much has been written specifically on strategic planning in contemporary zoos, but there is little reason to expect the process to differ substantially from that in other contexts. For example, the elements listed below have been cited as important in the strategic-planning process for a zoo, and they were all cited earlier as key components of existing strategic-planning models (adapted from Pensacola Junior College, 2004):

- Defining the mission.
- Describing its organization.
- Outlining its vision for the future.
- Detailing primary strategies to address the main issues.
- Setting goals and implementation strategies.
- Stating specific expected results in support of the goals.
- Stating performance measures.

Obviously, however, the strategic planning process in zoos will need to focus on the specific challenges and issues that zoos face. For example, contemporary zoos are guided by five basic principles that should be considered in a strategic plan: conservation, education, science (research), animal welfare, and entertainment (Maple, 2003). In some cases, conservation goals may be inconsistent with animal-welfare concerns when captive breeding programs produce surplus animals that are not needed for exhibition or breeding (Cohn, 1992). Finally, captive animals often live longer (owing to improved medical care, animal husbandry, facilities, and social grouping), and consideration must be given to the care and management of geriatric animals (Maple, 2003).

The American Zoo and Aquarium Association (AZA) requires a strategic plan to be in place in all accredited institutions. However, the zoo has operated without a strategic plan or its equivalent for the last 10 years. That deficiency was stressed in the 1992 accreditation report by AZA, but Smithsonian leadership did not promote the initiation of such a plan until recently. Accordingly, the zoo had functioned for many years without a firm sense of direction. The lack of purpose probably contributed to the decline in the animal collection and facilities during the 1990s.

### **CURRENT STATE OF STRATEGIC PLANNING AT THE NATIONAL ZOO**

The final version of the strategic plan was provided to committee on May 28, 2004. It is a relatively short but ambitious document, written in the present tense and active voice. The elements of the plan are a mission statement, a description of core values of the zoo, a 10-year vision statement, 1-year and 5-year goals for achieving the mission and 10-year vision, and six strategies for achieving the goals.

The 1- and 5-year goals are in seven goal categories similar to those of the strategic planning process of other zoos:

- Animal management.

- Science.
- Education.
- Public impact.
- Financial strength.
- Staff and organization.
- Facilities.

The 1-year and 5-year goals in each category are accompanied by performance measures. The strategic-planning process is also described in some detail in a series of appendixes.

The committee evaluated the zoo's strategic plan on the basis of the literature describing an effective strategic-planning process, outlined in the previous section. The evaluation included assessment of the strategic planning process, the situational analysis, the statement of clear goals that can be achieved with measurable results, and the operational plan detailing actions for attaining each of the major goals identified in the strategic plan. These elements were the essentials of an effective strategic plan.

### **Strategic Planning Process**

Strategic planning for the zoo began in late 2003 as part of a Smithsonian-wide process. An outside consultant was recruited to work with the senior management team in assembling a strategic-planning team that represented the entire zoo organization and to coordinate and facilitate the strategic-planning process. The zoo's strategic-planning team consisted of 12 persons nominated by the zoo staff and included voluntary representation from both the CRC and the Rock Creek Park staff. The strategic-planning team was responsible for conducting site visits, collecting stakeholder input and feedback, and writing the strategic plan.

The strategic-planning team gathered extensive input from zoo staff and stakeholders. Staff had many opportunities to provide input through 4 different sessions held in November 2003. Staff was also offered the opportunity to provide feedback on drafts of the strategic plan through 12 different sessions held in February, March, and April, 2004. These sessions were facilitated using a system of wireless computers so staff could input their ideas anonymously and read all the input as it was generated. External stakeholders—including the US Department of Agriculture Animal and Plant Health Inspection Service, the Fish and Wildlife Service, AZA, Congress, and the general public—also had opportunities to provide input through 5 different stakeholder sessions in February 2004, although these entities have no direct representation on the strategic-planning team. After the strategic-planning team completed each section of the strategic plan, the strategic-planning team and the senior management team held a working session to finalize the plan.

### **Situational Analysis**

In its introduction, the strategic plan does note some internal weakness at the zoo, namely that facilities are old, financial investment has been deemed insufficient for several decades, and operating budgets are lean, resulting in a decline in the numbers of animals and in the lack of science and conservation activities reflected in the exhibits. However, these statements are a cursory examination of the operational environment and do not reflect that the zoo performed an in-depth situational analysis of its current internal and external operating environments. A clear understanding of the resources available to the zoo and the environment in which it operates would have provided a solid foundation upon which to build a strategic plan. The failure of the zoo to engage in a critical examination of its operations, its unique funding structure, and its position within the DC metropolitan area and the zoo community undermines the strategic-planning committee's efforts to develop a document that addresses the zoo's current and future situation.

Further, the strategic plan failed to incorporate the few weaknesses that were noted in the introduction. For example, the strategic plan notes that many of the zoo's facilities are declining, but the strategic plan does not analyze the current renovation plan and compare it to the animal collection plan to determine if the declining

facilities, and particularly facilities that are not scheduled for renovation for several years, can adequately house the current animal collection or the influx of animals that is planned over the next several years.

### **Mission, Long-Term Vision, and Core Values**

The zoo's current mission statement is as follows (NZZP, Strategic Plan, May 28, 2004):

We are the nation's zoo, providing leadership in conservation science. We connect people with wildlife through exceptional animal exhibits, explore solutions through science-based programs, build partnerships worldwide, and share our discoveries. We educate and inspire diverse communities to celebrate, study, and protect animals and their habitats.

The strategic plan is appropriately based on the five basic principles to which contemporary zoos are dedicated: conservation, education, science in the form of research, entertainment, and animal welfare (Maple, 2003). The core values, outlined in the strategic plan, included discussion of unity, conservation, staff, communication, excellence, and fun at the zoo. Those elements—a common vision, environmentally responsible practices, an excellent staff, effective communication, professional excellence, and a dedication to making the zoo fun to visit, are commendable, but presumably they are aspirations that all well-run zoos must espouse. The 10-year vision, which articulates long-term goals for achieving the mission of the zoo, is as follows:

As visitors enter our urban oasis, they will be inspired by state-of-the-art, innovative animal exhibits that reflect our commitment to animal care, science, and public engagement. Exhibits will connect visitors with the natural world and immerse them in our real-life stories of wildlife conservation. Our outstanding volunteer, education, and international outreach programs will enable people to learn more and take a personal role in the future of wildlife.

Our professional internships and training programs will be sought-after by highly motivated individuals, locally and internationally. Our apprentice programs will attract people from diverse backgrounds to learn the professions of a modern zoo. The National Zoo's facility in Front Royal, Virginia will be fully utilized as a center of excellence in science-based conservation. We will be renowned for developing leaders in the fields of zoo management, veterinary care, conservation science, and education.

The National Zoo will be known for its long-term commitment to capacity building and training. We will share science-based tools and information, empowering local communities to conserve habitats and animals.

Our staff will be respected as leaders and mentors in zoo and conservation sciences nationally and internationally.

The 10-year vision, which visualizes the Rock Creek Park site as an urban oasis and the Front Royal site as a national center of excellence in science-based conservation, appears to be achievable if the problems laid out in the committee's interim report, this final report, and in recent AZA evaluations (2003a, 2004) are properly addressed.

### **1-Year and 5-Year Goals**

The strategic plan lists a series of goals related to improvement in the categories of animal management, science, education, public impact, financial strength, staff and organization, and facilities. Of those, only animal management, staff and organization, and facilities come within the scope of the committee's charge, although all the goal categories will contribute to whether the zoo realizes its vision.

## **Animal Management**

The first of the 1-year goals for animal management is to prepare the zoo's existing animal data for transitioning to the new Zoological Information Management System (ZIMS), as a first step in moving to a comprehensive, integrated electronic recordkeeping system (the first 5-year goal). This will be an important step for the zoo, but progress will depend on how soon the ZIMS is available. The zoo has contributed considerable resources to the development of the ZIMS software and is expected to take full advantage of its investment. ZIMS is slated for initial release in 2006 (ZIMS, 2004).

A second 1-year goal is to clarify the roles, responsibilities, and decision-making processes related to animal care and management. If implemented properly, this change will reduce the chances of arbitrary decisions that threaten the welfare of the animals.

The final 1-year goal is to establish a collection and exhibit-planning process that will guide decisions on species acquisitions and animal relocations. The process has already been put into play with respect to the Asia Trail Project: a team of scientists, educators, and curatorial staff have collaborated to develop a matrix of species qualities—including availability, public appeal, status in the wild, taxonomic position, and scientific interest—to guide acquisitions for the exhibit. It is not apparent that a matrix-based approach will direct all acquisitions in the future or that this approach was used to develop the 2004 National Zoo animal-collection plan.

The first two of the 5-year goals for animal management are extensions of 1-year goals. One is to have a comprehensive recordkeeping system in place and the second is to integrate the main missions of the zoo around the animal collection. The third 5-year goal is to continue to upgrade and improve the quality of the exhibits. The fourth and fifth 5-year goals are related to staff development and training. The zoo will expand the training available to staff to improve expertise, encourage innovation, and improve management practices. The opportunities for residency and internship training will also be expanded. The achievement of those five goals will do much to correct problems in animal management, recordkeeping, communication, and training noted by the committee in this report and the interim report. Together they provide a road map for improvement.

The sixth 5-year goal relates to animal management and may do much to provide the zoo with a distinctive role in the zoo community. The goal states the zoo will capitalize on the Front Royal land and facilities to expand the zoo's collaboration in animal management and conservation with other organizations. Full use of the CRC's facility and human resources can provide a scientific resource for zoos nationwide. The complete scientific priorities for the zoo are covered in goal category 2 of the strategic plan. This topic is out of the purview of the committee, but it is worth noting that this goal, if it is achieved, will align the mission of the CRC more closely with zoo and Smithsonian priorities.

## **Staff and Coordination**

Within 1 year, the staff will be expected to be familiar with the core values of the zoo and be prepared to implement them. Human-resources practices are to be clearer and more efficient and incorporate best and most up-to-date practices. The 5-year goals expand on the 1-year goals. Managers will be expected to be effective leaders, and the core values will be practiced by the entire staff. All staff will have the opportunity to grow in their positions and to receive the training needed to achieve such professional growth. Administrative procedures will become more efficient and effective. Staff diversity will be increased by expanding recruitment practices nationwide, and in the local community. Staff zoowide will participate in recruitment for new positions. The final goal in relation to staff and organization is to align organizational structures and management systems and processes in such a way that staff are encouraged and presumably able to work cooperatively across departments. Those goals are commendable and, if achieved, will do much to break down the barriers and operational culture differences that operate to isolate departments from each other.

## **Facilities**

The strategic plan contains no 1-year goals for the facilities of the zoo. Rather, a series of 5-year goals is presented. First, "our master plan guides development of renewed facilities at Rock Creek and Front Royal. The plan is based on sound land use practices, addresses our infrastructure needs, and allows for flexibility in future growth." The strategic plan defines the master plan as the physical expression of the strategic plan; the process and document that describes future development of zoo land, facilities, and infrastructure (NZIP, Strategic Plan, May 28, 2004).



However, the strategic plan itself should describe the zoo's vision for future land development and priorities for facility and infrastructure development and renewal, not propose to develop this vision.

The other 5-year goals outlined in the facilities section are appropriate to the mission and vision of the zoo and, if implemented in the proposed 5-year span, will greatly improve the appeal and function of the zoo facilities.

### General Comments

When evaluating the 1-year and 5-year goals, which should detail the intermediate goals toward achieving the mission and 10-year goals of the strategic plan, the committee generally found these goals to be appropriate. But they often lack detail. For example, one of the 5-year goals in the category of animal management is, "Our animal collection is a dynamic expression of our conservation, science, animal management, and education priorities." That goal lacks any clear objective that can be achieved with measurable results. Does it imply that the zoo will focus its animal collection on wildlife species that are in danger of extinction? What are the animal-management priorities?

### Strategies to Attain the Strategic Plan Goals

Following the statement of the 1-year and 5-year goals, the strategic plan has a section entitled "Strategies". The strategies are "the basic approach to achieving the National Zoo's goals" – in essence an operational plan. Each of the major goals categories should have a corresponding section in the operational plan that details the specific actions that must be taken to achieve the 1- and 5- year goals. The "Strategies" section of the zoo's strategic plan is entirely composed of 6 strategies (NZZP, Strategic Plan, May 28, 2004):

Strategy #1: Master Planning. Develop and complete a visionary master plan that capitalizes on the uniqueness of the National Zoo's land and locations, and provides flexibility for future programs and exhibits. It is the physical expression of the strategic plan.

Strategy #2: Organizational Design. Examine and adjust as necessary the zoo's organizational design to align its diverse functions, improve coordination, minimize redundancy, and enhance collaboration. Clearly articulate roles and responsibilities and establish decision-making authority across units.

Strategy #3: Integrated Financial Planning. Develop a consolidated financial planning process for the zoo. Use this process to manage our federal and non-federal funds and address financial needs.

Strategy #4: Leadership and Management. Assess and enhance the leadership and management skills of zoo leaders, managers, and supervisors to increase their effectiveness.

Strategy #5: Core Values. Immediately implement a program that will promote the zoo-wide practice of core values.

Strategy #6: Visibility. Implement a comprehensive plan to maximize visibility of the zoo's successes and expertise to local, national, and international audiences.

The "Strategies" section lacks any specifics for attaining the 1-year and 5-year goals pertaining to animal management, staff and organization, and facilities sections. The strategic plan actually states that "the strategies are the basic approach to achieving the zoo's goals. Rather than develop strategies for every goal, the plan includes a small set of strategies, each of which addresses multiple goals; the limited number of strategies is intended to keep the strategic plan tightly focused." The first three strategies are in reality the processes that should have occurred during the strategic-planning process to develop an operational plan. Instead the difficult task of developing an operational plan has been deferred to a later date.

In addition to the lack of specific actions for attaining each 1-year and 5-year goals, the strategies outlined to achieve the goals of the strategic plan lack any details regarding the timeline for developing the master plan and organizational design and who is responsible for developing these plans. Furthermore, the strategic plan appears to pass responsibility for developing the master plan and organizational design on to the individual units of the zoo. In

the section “Next Steps: Implementing the Plan,” the strategic plan states that “by the end of 2004, each ‘unit’ within the zoo will complete unit strategic plans and performance measures, based on the goals and strategies outlined in the overarching Plan. These unit plans will guide staff performance plans, encourage cross-unit activities, and support the newly identified Core Values.”

Because the zoo strategic plan did not include an operational plan, it will be impossible for the zoo to evaluate its progress in achieving its goals (particularly its long-term goals). That could lead to frustration and disenfranchisement of the people who undertook the strategic-planning process and the employees and stakeholders who contributed information and advice.

### Performance Measures

An effective strategic plan includes specific criteria to evaluate the progress on and effectiveness of the operational plan in achieving the goals of the strategic plan. The zoo’s strategic plan states that “the performance measures are the indicators used to determine if progress is being made toward the zoo’s vision; these are the benchmarks that will be used during the first year of implementation of the plan. At the end of one year, the measures will be assessed based upon the starting point and the degree to which they drive change and reflect accomplishments.”

Each goal category (animal management, staff and organization, and facilities) includes a list of performance standards, but describe methods for analysis and are not actually standards. For example, a performance measure for the short-term animal management goals is “percentage of decisions about animal moves and species acquisition made based upon collection plan that reflects integration of science, education, exhibit and facility priorities.” Who has responsibility for deciding whether a decision about animal moves and acquisitions was based upon the collection plan? What percentage should the zoo be striving to achieve—50%, 80%, 95%?

Another example of a vague and unuseful performance standard is in the facilities section of the strategic plan: “Number of significant finds (problems) identified by RCM (Reliability Centered Maintenance).” This performance measure does not identify a goal to be achieved but implies that the zoo has not yet identified all the problems with its facilities. Facility problems should have been identified at the start of the strategic-planning process as part of the situational analysis. Because the strategic plan did not include an operational plan for achieving the 1-year and 5-year goals, performance measures were impossible to develop appropriately.

## FINDINGS AND RECOMMENDATIONS

### *Findings:*

- *The strategic plan is a good articulation of the mission and 10-year vision of the zoo and includes a bold proposal to integrate the CRC science programs with the Rock Creek Park exhibits and programs, thereby creating a unique niche in the larger zoo community that cannot be fulfilled by the Rock Creek Park facility alone.*
- *The strategic plan’s lack of a situational analysis to examine the zoo’s internal and external operational environments brings into question the appropriateness and completeness of the strategic plan’s 1-year and 5-year goals for achieving the zoo’s long-term vision.*
- *The strategic plan lacks an operational plan that details how the zoo plans to attain its 1- and 5-year goals. Without an operational plan, the strategic plan is a statement of vision and not a road map for change at the zoo.*

There were many failures that occurred during the zoo’s strategic-planning process that in the committee’s opinion undermined efforts to produce a useful document. The strategic planning committee failed to perform a situational analysis that would have created a clear understanding of the resources available to the zoo to attain its goals, as well as the threats that need to be counteracted in order for the zoo to achieve its goals. Even more importantly, the strategic plan lacked an operational plan that details how the zoo plans to attain its strategic goals. Though the committee felt the goals identified in the strategic plan were vague, it is impossible to attain any goal of a strategic plan if the operational plan is not in place.

Several other factors undermined the strategic planning effort; for instance, the lack of involvement of senior management in the deliberative stages of the strategic-planning process. The strategic-planning team was responsible for gathering feedback and developing each section of the strategic plan. The senior-management team was involved only after each section was substantially completed by the strategic-planning team. As compared to the members of the strategic-planning team, the senior management team has a wider view of the zoo's administration, financial situation, and outside pressures and an understanding of the staff, budgetary, and organizational efforts needed to achieve the goals of the strategic plan. The failure to include senior management in the entire strategic-planning process undoubtedly had an adverse effect on the process.

Another factor that undermined the strategic-planning process was the limited scope of the strategic-planning process. An effective strategic plan for the zoo should have included a master plan to provide orderly, comprehensive development of the Rock Creek Park and Front Royal sites and a detailed operational plan for the 1-year and 5-year goals. Rather than clearly defining expectations for the strategic-planning process and properly composing the committee to include senior management and technical experts (such as an architect or engineer) so that a comprehensive, effective strategic plan could be developed; the Smithsonian Institution and the zoo permitted extensive staff time and resources to be used to develop a handful of visionary statements.

Before the final draft of the zoo's strategic plan had been completed in May 2004, the Smithsonian Institution and the zoo initiated a process to hire an external consulting firm to develop the master plan. The firm, which will be selected from respondents to an advertised description of the task (Smithsonian Institution, Federal Business Opportunities Announcement for Master Planning Support, May 13, 2004), will be expected to have had experience in zoo planning and to provide a master plan consistent with current standards and guidelines for animal care while maintaining the zoo's historical character. The advertisement required applicants to provide answers to a series of questions highly relevant to the strategic planning. Perhaps the most interesting requirement was to respond to the question, "What are the opportunities to distinguish the National Zoo (including its 3,200-acre facility in Front Royal, VA) from all other zoos?" Those opportunities should have been identified at the beginning of the strategic-planning process as part of the situational analysis, and the answer to the question should have helped the strategic-planning team to define the mission of the zoo. It is apparent that the hard work and dedication of the strategic-planning team has been undermined, as basic questions about the zoo's future identity have yet to be answered.

**Recommendations:**

- *The zoo should perform a situational analysis and use this analysis to reassess the goals and vision of the strategic plan. A detailed operational plan for attaining the 1-year and 5-year goals of the strategic plan should be developed. Appropriate performance measures should be identified to track the zoo's progress in attaining the goals of the strategic plan. These measures should be evaluated at least annually to determine whether those goals are being met and whether the strategic or operational plan requires modification.*
- *The strategic plan should directly link the plan for revitalizing the physical facilities with the animal-acquisition plan to ensure that planned expansion of the zoo's animal collection can occur without taxing already failing facilities and compromising animal and staff safety.*

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## Communication, Knowledge Management, and Human-Resources Management

The zoo is a complex organization of highly differentiated operational units with a hierarchic management structure (Figures 1-1 to 1-5, interim report). At the apex of this structure is the zoo director, whose responsibilities involve contact with three advisory bodies: Friends of the National Zoo, the National Zoo Advisory Board, and the CRC Foundation Board. A deputy director is responsible for day-to-day operations of the zoo and, in the absence of the director, serves as its chief executive.

At the next level are managers of the zoo's eight operations units. They report individually to the deputy director. They also report to the director as a group during regularly scheduled meetings of the Executive Committee. They are the associate director for public affairs and communications, the general curator of the Department of Animal Programs, the associate director for the Conservation and Research Center; the associate director for administration and technology, the associate director for exhibits and outreach, the head veterinary medical officer for animal health, the supervisor of the Department of Pathology; and the chief of the Police Department. Within each operational unit are associates, assistants, supervisors, or heads for subdivisions of the units. At the bottom of the hierarchy are staff that have day-to-day hands-on responsibility for the various tasks that determine the effectiveness of those above them.

Concerns regarding the hierarchy for the care and welfare of animals prompted the committee to give special attention to the Animal Programs Department, which is run by a management team consisting of the general curator, two associate curators, and eight assistant curators. This team oversees about 70 employees (NZIP, Organizational Chart for Department of Animal Programs, 2003) who have direct responsibility for animal care and management at the Rock Creek Park facility. It is important to note that the general curator has primary responsibility for the day-to-day care and management of the animal collection at the Rock Creek Park facility, which amounts to almost 90% of the entire collection of about 2,600 animals. The rest of the zoo collection is housed at the CRC, in Front Royal, VA.

During the first phase of its review, the committee noted that management's efforts to address problems related to animal deaths at the zoo focused on the organization and management structure. Accordingly, several important changes had occurred, and others were in progress. The changes included appointments to critical managerial positions, redistribution of some core responsibilities, and other measures to strengthen the chain of command. Examples are the appointment of a deputy director for day-to-day operations; a new general curator of the Department of Animal Programs, who would also assume responsibility for the Registrar's Office and for animal care and exhibitions; and a head veterinarian to assume full authority over animal health. In addition, responsibility for the use of pesticides in exhibit areas was reassigned to a member of the executive staff (the head of the Department of Pathology). Policies and standard operating procedures had been reviewed and revised, and performance objectives and measures for FY 2003 were published. The animal deaths brought to the fore a wide array of problems at the zoo of long duration, which, in the face of unfavorable press and public sentiment, created an environment racked by turbulence and uncertainty. No doubt, the management strategy employed by the zoo as a result of this scrutiny—which clarified roles, relationships, lines of authority, rules, and procedures—was essential to enable the zoo to rise above these circumstances and move forward.

The committee was encouraged by the initial changes, but it became clear that the zoo was aware of its organizational and management deficiencies over a decade ago and failed to act upon them. In 1993, a needs analysis of training and services required to improve the zoo's management and supervisory capabilities was completed (NZIP, Robinson memo, March 18, 1993). The principal finding of the analysis, referred to as the Alexander report, was that zoo managers, supervisors, and employees were stuck in habitual ways of interacting, which had resulted in a sense of mistrust of management and generated increased complaints of sex and racial bias, increased miscommunication, and general displeasure in working with one another. The Alexander report made seven principal recommendations (as indicated in Robinson memo, March 18, 1993) to address the needs including:

- Provide training for management on communication and human relations skills.

- Provide all supervisors with basic training in making fair employment decisions and understanding the dynamics of a diverse workforce.
- Emphasize performance and conduct management, and teach constructive feedback.

Those recommendations so closely match the recommendations detailed in this chapter that it is clear that deficiencies identified by the committee, such as lack of accountability at all levels and poor adherence to the zoo's own policies, were identified as major deficiencies at the zoo over 10 years ago. It is not apparent that any of the recommendations to address the deficiencies were acted on. In the committee's opinion, firm action by the leadership of the zoo and the Smithsonian Institution to address the concerns raised by the Alexander report most likely would have averted some of the decade-long decline at the zoo.

For this final report, the committee focused on management in the Department of Animal Programs because this department has primary responsibility for the day-to-day care and management of the animal collections at the zoo. However, we also considered more wide-sweeping management problems at the zoo when there was a clear connection to animal-care and management concerns. On the basis of discussions with zoo and Smithsonian staff, personal observations, and analysis of various documents, four primary management problems were identified: communication, knowledge management, human-resources planning and use, and human-resources development and training. The following sections discuss those topics in detail.

It is important to note that communication, knowledge development and transfer, and human-resources planning and development are mutually dependent and determine in large part the quality of performance and productivity of staff in any organization. It might be predicted, therefore, that advances in the care and welfare of the animal collection at the zoo and in the viability of the whole enterprise will be proportional to progress in addressing challenges in a systematic and systemwide fashion.

## COMMUNICATION

Communication is a critical determinant of individual, team, and organizational performance. Communication enables information exchange and supports organizational learning. Social interaction facilitates resource exchange among employees and business units, which can lead to the generation of new ideas and enhanced organizational performance (Tsai and Ghoshal, 1998). The same is true within teams, where communication leads to the exchange of task-related information, establishment of intrateam interaction patterns, and the development of team solutions to problems (Kozlowski and Bell, 2003). Both internal communication frequency (e.g., Waller, 1999) and external communication frequency (e.g., Ancona and Caldwell, 1992) have been linked to team performance. Communication is also critical for conveying an organization's mission to employees and establishing a desired organizational culture. For example, safety-related communication from managers has been shown to increase safe work behaviors and lead to substantial reductions in workplace injuries and accidents (Hofmann and Morgenson, 1999; Zohar, 2002). Open communication is also an important determinant of employees' trust in their manager and their willingness to engage in desired organizational behaviors (Korsgaard et al., 2002).

### Current State of Communication

The zoo recognizes that communication is critical for its revitalization and for ensuring high-quality animal management and care. Several factors pose challenges to effective communication within the zoo. The size and complexity of the zoo make effective communication difficult. The zoo has a hierarchic structure with multiple layers of management. Decision-making authority resides at the top of the organizational chart as opposed to being distributed throughout lower levels. As the number of layers of management increases, communication between the upper and lower levels of the organization becomes more difficult (Tesluk et al., 2002). In addition, the zoo is functionally departmentalized. Different functions within the zoo—animal programs, pathology, maintenance, exhibits, and so on—are divided into distinct units, and the animal-programs unit is further organized by animal type. Functional departmentalization may be the most logical division of work within the zoo, but it is important to recognize that it creates challenges to organizationwide communication and vision.

The magnitude of the communication challenges is especially apparent in the Department of Animal Programs, where the scope of responsibility is wide, large numbers of personnel are involved, and multiple layers of

management extend the department's chain of command. Communication is difficult at best. Linkages for vertical integration, coordination, and control are not adequate to ensure effective channels of communication down the line. That has been a source of serious concern because important communications from top management have been channeled inconsistently or inaccurately to lower levels of the hierarchy. For instance, many employees never received information regarding policies and staff actions that might have contributed to recent animal deaths, nor was information passed on about subsequent changes made by senior management to prevent a similar incident in the future.

Furthermore, the lack of horizontal linkages has led to gaps in communication between the department and the various other functional units. Yet, the Department of Animal Programs depends heavily on all other units to carry out its defined functions. Alternative devices for enhancing communication and strengthening the capacity for knowledge development and transfer—within this department and between this department and other units of the zoo—are essential to ensure that the care and welfare of animals are of the highest quality possible. During the final phase of the committee review, its deliberations revealed encouraging findings in both areas.

The zoo is developing devices to overcome structural barriers to effective communication within and among the major units of the zoo. For example:

- The newly hired associate curators now communicate with staff down the line during daily visits to their respective units.
- Regularly scheduled meetings with structured discussions have been established, which bring together all members of the curatorial staff.
- Interdepartmental meetings are increasingly being held to facilitate communication among units and keepers are invited to attend these meetings so that they can share information from the meetings with all employees.
- The zoo has recently distributed updated best-practices manuals and communication plans throughout the organization
- New walkie-talkies and other communication tools have been purchased and distributed to select staff.

### Findings and Recommendations

The January 2003 American Zoo and Aquarium Association (AZA) Accreditation Report for the zoo called attention to various gaps in communication and highlighted the need for a mechanism to ensure that staff—at keeper and management levels—share information through appropriate channels. That assessment was confirmed by findings from interviews and observations of this committee, which highlighted several conditions that impose barriers to effective communication throughout the zoo.

#### *Findings:*

- *Different units are structurally isolated from one another and linkages across unit boundaries are not apparent. The zoo has taken some initial actions to overcome these obstacles to communication by holding interdepartmental meetings and regularly scheduled, structured meetings with all of the curatorial staff.*
- *Bottom-up communication at lower levels of the organization is lacking, communication channels between staff and management are not well established, and many employees do not feel that they have a voice within their units or the organization. In an effort to address this concern, the newly hired associate curators communicate with down-the-line staff during daily visits to each unit under their management.*
- *Information obtained or generated at the upper levels of the organization is not consistently transmitted to employees at lower levels.*
- *All told, the nature and effectiveness of communication throughout the organization determine in large part the quality of animal care and management and the viability and success of the zoo.*

- *Managers recognize that improvements in communication are critical for revitalizing the zoo and ensuring high-quality animal care and management, but the organizational complexity of the zoo is a barrier that must be surmounted.*
- *The zoo recognizes the importance of communications and acknowledges the associated problems and the urgency to remedy them, and it has taken several steps to do so. respect and the urgency to remedy them, and it has taken several steps have been taken to do so.*

Many of the recent actions taken by the zoo comprise positive steps, and collectively they have helped to improve communication within the zoo. The committee hopes that the momentum apparent at the zoo will be sustained and progress accelerated in the days ahead.

#### **Recommendations:**

- *The zoo should continue efforts to facilitate communication among and within departments and to improve communication between different organizational levels. There are many potential ways to achieve improvement: formalize regular interdepartmental meetings, expand the use of cross-functional assignments and cross-training, and formalize the use of available technological resources for enhancing communications within and across the various units of the zoo.*
- *Management at the zoo should be persistent in efforts to facilitate communication up and down the organization as a whole and in the chain of command in each unit.*
- *The zoo should develop a plan and process for monitoring adherence to and evaluating the outcome of standards, policies, procedures, special guidelines, and other aspects of communication. Staff training in communications is necessary to ensure that these policies have been assimilated and understood, and that there is accountability for adherence at all levels.*
- *The zoo must endeavor to build a sense of community for its employees and create professional relationships between various departments and individuals.*

## **KNOWLEDGE MANAGEMENT**

The development, management, and transfer of knowledge are critical for organizational success (Noe et al., 2003). Knowledge management involves generating new knowledge, for example, through training and development activities or by selecting employees who have desired knowledge and skills (DeNisi et al., 2003). Those activities help to ensure that employees have the most up-to-date knowledge in their fields and can help to facilitate organizational learning. However, knowledge management goes beyond the generation and acquisition of knowledge. It also includes the management and sharing of information. Many knowledge-management efforts emphasize using technology to collect and maintain data, experiences, and lessons (Pfeffer and Sutton, 1999). And, it creates social systems that facilitate interaction and information exchange among employees in an organization.

In the zoo setting, knowledge management has many potentially important implications. It is critical for ensuring that employees have the most current knowledge and skills in animal care and management. A focus on knowledge sharing can help to ensure that advances in animal care and management practices generated in one part of the zoo are transferred to other parts. Managing institutional knowledge can also prevent the loss of knowledge that typically occurs when people leave an organization and thereby to make sure that animal care and safety are not compromised by staff turnover. Knowledge is essential for providing high-quality animal care and management; therefore, zoos, like any other organization, must take steps to manage their institutional knowledge.

### **Current State of Knowledge Management**

Previous reports and data collected during the committee's review revealed three primary areas of knowledge-management problems at the zoo: knowledge-sharing, generation of new knowledge, and retaining and

archiving knowledge. It is important to note that steps have recently been taken to address those problems and that progress has been made. Each of the concerns is outlined below to identify not only existing challenges but also progress.

The zoo does not have a formal plan in place for the management of institutional knowledge, and knowledge-sharing among units is lacking. In part, that is due to the communication problems outlined above. For example, personnel have developed innovative and apparently effective work practices in their own units, but these successful work practices have not been transferred to other units. It is expected that as additional steps are taken to enhance interdepartment communication, knowledge-sharing in the zoo will increase as well.

The use of technology for knowledge-sharing is inadequate (for details on the use of technology at the zoo, refer to Chapter 3 of the interim report). For example, e-mail use in the zoo is sporadic and therefore does not serve as a reliable means of communication. In some units, the zoo's computer network has been used as a place to store valuable information so that it can be easily accessed by all members of the unit; but this practice is not widespread. The zoo needs to identify how technology can be used to enhance communication and information-sharing and then adopt zoo-wide practices that encourage better use of technologic resources.

The second concern is the generation of new knowledge in the zoo. Continuing education is critical for introducing new knowledge into an organization. As discussed in further detail later in this chapter, the zoo has a long history of deficiencies in continuing education, which have limited the amount of new knowledge flowing into the zoo over the last 10 years. Recognizing the lack of continuing education, the associate curators have taken steps to provide more educational opportunities to staff in the Department of Animal Programs in the last year. It is also important for management to have access to continuing education. The zoo has begun to use management and executive training opportunities offered by the US Department of Agriculture, the Smithsonian Institution, and several private firms. That is a favorable step and should be continued. However, time and money have been a constant challenge in providing such opportunities to staff.

The generation of new knowledge in the zoo, however, goes beyond the continuous development of existing zoo staff and involves hiring employees with different knowledge, skills, and perspectives. Historically, the zoo has relied on internal development: open positions are filled from within the zoo rather than by hiring from outside. For example, nearly 80% of new keeper positions are filled by volunteers, and most upper-level positions have been filled by people who have worked their way up through the ranks. The zoo should be commended for bringing new employees into the zoological profession and providing staff with opportunities for upward mobility. However, relying solely on internal development can create a insular culture and isolate the zoo from outside perspectives and innovations. The zoo's ability to recruit outside talent is limited, in part, by its location in the Washington, DC, metropolitan area, and it has been deemed difficult to recruit people from other zoos to the area, particularly for low-paying positions, because of the high cost of living. However, zoo management has recently engaged in efforts, such as broader advertising of open positions, trying to attract people from outside. Those efforts should continue with the goal of achieving a better balance of filling positions inside and outside the organization.

The third knowledge-management concern is the zoo's ability to capture, archive, and retain existing institutional knowledge. That is a critical problem in the zoo, given the high level of turnover in recent years. If there is no mechanism to capture employees' knowledge, their tacit knowledge is lost when they leave the organization. Research has shown that turnover has less effect when structures and processes are well defined and explicit (Argote et al., 2001). Thus, the zoo's recent efforts to update and standardize policies and procedures should help to retain valuable institutional knowledge. However, additional efforts should be made to try to capture organizational knowledge. For example, information technologies can be used to store knowledge and to enable employees to locate and access information in a just-in-time fashion (DeNisi et al., 2003). The zoo may benefit from appointing a Chief Information Officer – a single individual who would be responsible for creating and maintaining systems to capture, retain, and manage new and old information for the zoo.

As the zoo moves forward, it will be important for it to become more of a learning organization. The zoo has a long history of being a leader in the generation of new knowledge, but in the last 5-10 years the focus on learning has been overshadowed by other issues. Reinvigorating the learning climate in the zoo will help it not only to overcome current problems but also to position itself for the future. Research by Tannenbaum (1997) identified the following characteristics in learning organizations:

- People are aware of the “big picture” and have a shared understanding of what the organization is trying to accomplish and how their job are related to others in the organization.



- People are accountable for learning, and performance expectations are high enough to necessitate continued personal growth.
- Situational constraints on learning and performance are identified and minimized.
- New ideas are valued and encouraged.
- Supervisors and co-workers provide support, allowing people to learn and attempt to implement new ideas.
- Policies and practices support the effective use of training.

Some efforts have been undertaken, and there are signs of progress. But overall there are substantial lags in the kinds of efforts that would foster the acquisition of new knowledge and the appropriate use of technologies for capturing, storing, and transmitting existing knowledge and data throughout the zoo. These signs of progress:

- Standards, policies, and procedures were recently updated; this is helpful in efforts to capture and retain institutional knowledge and important information.
- Work assists—moving employees from one unit into another to provide advice on particular issues—are being used to promote the sharing of knowledge and information between units.
- A process for soliciting ideas and information from employees at all levels is being used in the zoo’s strategic-planning process.
- The “all-hands” meetings, initiated by the zoo director before the committee’s review, were originally used to disseminate important information to a zoowide audience. Now, the format is more like that of a town-hall meeting, which serves as a forum not only for the dissemination of information by top management but also for members of the zoowide audience to share concerns, ideas, and information.

### Findings and Recommendations

#### *Findings:*

- *The use of technology for knowledge-sharing is limited. Email use is sporadic and the use of the zoo’s intranet to store and share knowledge within units is not widespread.*
- *In the past, the zoo has lacked the ability and commitment to capture, archive, and retain existing institutional knowledge. Recent efforts to update and standardize policies and procedures should help retain valuable institutional knowledge; additional efforts could complement this initial work.*
- *The zoo relies heavily on an internal development strategy, which coupled with a lack of continuing-education opportunities, creates an insular culture and isolates the zoo from outside perspectives and innovations.*

#### *Recommendations:*

- *The zoo should develop appropriate electronic storage of knowledge and enable employees to locate and access information in a just-in-time fashion.*
- *To improve the knowledge base among staff, the zoo should develop recruitment strategies to ensure an appropriate balance of staff recruited from outside and those transferred or promoted from within the organization.*
- *The zoo should develop additional strategies for capturing and retaining existing institutional knowledge that is being lost through the departure of experienced staff.*

- *The zoo should conduct an assessment of its learning environment to identify barriers to and opportunities for implementing initiatives for advancing the work culture as a learning organization.*

### HUMAN-RESOURCES PLANNING AND USE

There are several keys to using an organization's human resources effectively (Noe et al., 2000). First, an organization must understand its current human-resources configuration. It must understand the strengths and weaknesses of its employee population and take steps to leverage the strengths and neutralize the weaknesses. In a zoo environment, high-quality animal care and management depends on having employees with the knowledge, skills, and motivation to perform at the highest levels. Second, an organization must have a plan for where it is headed and understand how its current human resources are related to the plan. If there are gaps between the current human-resources configuration and the configuration needed for implementation of the organization's plan, efforts (such as selection and training) must be taken to close them. In a zoo, human-resources planning can help the organization to meet its long-term goals, such as being a leader in animal care and husbandry or conservation.

#### Current State of Human-Resources Planning and Use

The National Zoo Personnel Office is relatively small and must focus much of its energy on handling personnel-related administrative tasks, such as job postings. Most of the human-resources systems in the zoo are developed by the centralized Smithsonian Office of Human Resources (OHR), and major personnel decisions, such as staff reductions, are made at this level. The OHR also administers many of the human-resources systems, such as employee selection. However, responsibility for human-resources activities has increasingly fallen to managers. Managers now spend substantial time in such activities as selection, training, and performance management, and they receive minimal assistance in these activities.

Human-resources planning and use are examined by AZA during the accreditation process. The January 2003 AZA Accreditation Report commented on the following concerns:

- Although annual appropriations increases have been given to the National Zoo, they have been insufficient to cover mandatory federal employee wage increases. Over the last 10 years, that has led to severe staffing problems at the curatorial level.
- The team has concerns about how long it takes to hire staff. The Smithsonian OHR was affected by a recent early retirement offer; whatever the cause, the turnaround time for keeper positions is very long.
- Assistant curators have repeatedly been assigned to areas in which they had no taxonomic expertise.

All those concerns point to weaknesses related to human-resources planning and use in the zoo. The first involves staffing levels. From 1993 to 2000, the number of full-time equivalents (FTEs) allocated to the zoo steadily declined by about 14%, from 370 to 317 FTEs (NZIP, FTE Use, August 9, 2004); this trend was reversed in 2001, and the zoo currently is allocated 346 FTEs. However, there was no net change in the number of keeper staff from 1993 to 2000 (NZIP, Staff Gain/loss Statement 1993-2003, September 24, 2003), even though the size of the zoo's animal collection declined by about 38% (NZIP Status of the Collection Reports, 1993-2002). In fact, as the size of the collection decreased after 2000 to less than 50% of its 1993 size, the zoo actually added six keepers to the Animal Programs staff (NZIP Staff Gain/Loss Statement 1993-2003, September 24, 2003). The zoo now has 74 permanent keeper positions and only one is unfilled (Tanner Memo of July 19, 2004). On the basis of those statistics and staff interviews, the committee concludes that keeper staffing levels at the zoo are more than adequate to care for the current animal collection appropriately and any increase that might happen over the next few years.

A second, more troubling concern is the speed at which open positions are filled. The hiring process is long, and this has created problems for hiring staff at all levels. There is an immediate need for a more efficient hiring process in the zoo to increase the likelihood of successfully recruiting top candidates for open positions.

A third concern involves the effective use of human resources. Resource-allocation decisions are often ambiguous and appear to lack a strategic focus. The AZA report noted that people are sometimes assigned to work

for which they lack the necessary expertise. Furthermore, the specific needs of different units do not appear always to be considered in determining how human resources should be allocated.

Of more recent concern to the committee is the lack of attention paid to human resources in the newly written strategic plan. The strategic plan should have projected the staffing needs necessary to accomplish its 1-year, 5-year, and 10-year goals so that human-resources decisions could support the strategic vision for the zoo. However, as noted in Chapter 2, a situational analysis was not performed as part of the strategic planning process; such an analysis would have included an assessment of the adequacy of current staffing and provided the basis for accurate projections of staffing needs.

It is important to recognize that steps have recently been taken to address some of those concerns. For example, zoo management has begun working with the OHR to streamline the hiring process, such as developing more-specific job announcements to reduce the number of unqualified applicants who must be processed. In addition, the Smithsonian is in the process of developing an enterprise resource planning system that will enable many administrative human-resources actions (such as requests for personnel actions, tracking of training instances, and application receipts) to be processed electronically (NZIP, Tanner memo, May 14, 2004). It is hoped that the system will increase the efficiency of human-resources actions in the zoo and free up staff of the zoo personnel office to focus on other tasks related to human resources.

### Findings and Recommendations

#### **Findings:**

- *The zoo does not have a human-resources plan, and the current strategic plan does not include projections of the staffing necessary to support the new strategic vision of the zoo.*
- *Human-resources allocation decisions have often lacked a strategic focus. Staffing levels in most units of the zoo appear to be appropriate, but it is unclear how the specific needs of different units are weighed in determining how human resources should be allocated.*
- *There is a clear need for a more efficient hiring process in the zoo to increase the likelihood of successfully recruiting top candidates for open positions in a timely manner.*

Several solutions might be employed in addition to these current actions. One solution to address human-resources problems is to restructure the human-resources management function. The centralization of human-resources services in the Smithsonian OHR has created inefficiencies, such as those noted above in staffing. It would be beneficial to enhance the size and scope of the zoo personnel office, perhaps by placing one of the Smithsonian OHR staff on-site at the zoo as a liaison that could champion the needs of the zoo. This liaison could work closely with zoo management to develop a human-resources strategy that will support the larger goals and mission of the zoo. The zoo should still have their own Personnel staff to assume responsibility for human-resources practices in the zoo and provide support to management on human-resources issues, such as forecasting and planning, staffing, performance management, and training. Clearly, this recommendation is feasible only if resources (such as staff) that are now centralized in the Smithsonian OHR are decentralized to individual units such as the zoo.

A second recommendation is that attention be focused on maximizing the use of human resources in the organization. For example, many units have ceased engaging in cross-training, because they are unable to “loan” employees to other units. That is unfortunate because cross-training can enhance both individual and team performance and can provide organizations with some flexibility when staffing levels are low (e.g., Blickensderfer et al., 1998).

There is also some confusion and conflict regarding employees’ roles and responsibilities in the zoo. For example, the performance plan for assistant curators lists supervision as a noncritical job responsibility (NZIP, Performance Plan, Assistant Curator), although this is an important element of their job. In addition, some assistant curators are required to develop research programs and seek funding, and others are not, depending on their grade level (GS-12 vs GS-13). It is important to define and communicate employees’ roles and responsibilities, and to evaluate employees on how well they are fulfilling their responsibilities.

Finally, it will be important to make sure that the work environment facilitates effective employee performance. Both associate curators have given high priority to addressing the smaller, nagging concerns that reduce employees’ motivation on the job. For example, attention has been paid to ensuring that employees have the

tools necessary to perform their jobs. It will be important to continue to focus on ways to maximize the use of human resources in the zoo.

**Recommendations:**

- *A more efficient hiring process in the zoo and the Smithsonian Institution would increase the likelihood of successfully recruiting top candidates for open positions at the zoo.*
- *The zoo should focus attention on developing a human-resources plan based on an analysis of the adequacy of its current staffing levels and projections of staffing necessary to achieve its strategic vision*

**TRAINING AND DEVELOPMENT OF ANIMAL-CARE STAFF**

Three elements characterize successful organizational training and development systems. First, a good training program is systematic, in that it is intentionally designed and implemented to address specific needs that have been identified through a comprehensive training-needs assessment (Goldstein and Ford, 2002).

Second, training is aligned with other components of the larger organizational system. There is an underlying assumption that training interacts with and is directly affected by a larger system that involves organizational policies and practices (such as management philosophy and employee staffing) (Tannenbaum, 2002). When alignment is high, the various human-resources management (HRM) subsystems (such as selection, training, and performance management) work together harmoniously and are mutually reinforcing; as a result, the effectiveness of each component is enhanced, as is the overall HRM system and its ability to support an organization's goals and mission (Becker et al., 2001).

Third, a successful organizational training and development system focuses not only on developing employee skills but also on generating and managing institutional knowledge. It does that by implementing systems and structures that create new knowledge, archive existing knowledge, and facilitate knowledge-sharing across the organization (DeNisi et al., 2003). Numerous mechanisms can be used to manage and leverage institutional knowledge. The most common involves social systems in the organization that enable knowledge-sharing within and between organizational units (DeNisi et al., 2003). Information technologies can be used to store valuable knowledge and to enable employees to locate and access information in a just-in-time fashion. Although the specific mechanisms may vary, it is essential for an organization to manage its intellectual capital.

The Department of Animal Programs at the zoo—which includes keepers, assistant curators, associate curators, and the general curator—has the most direct and frequent contact with zoo animals, so specific training with their charges is of the utmost importance. Traditionally, zoos have used informal training methods (such as mentoring and apprenticeship) to teach new staff about the daily routines of feeding, cleaning, and observing the animals in their care. New keepers might be given a few days to several weeks to learn how to perform the routine duties in their assigned area before performing them without assistance. Unusual circumstances—such as responding to animal escapes, assisting with medical procedures, or responding to animals that are behaving aggressively—were learned on the job as situations arose. Managers, such as the curator staff, learned how to train and motivate employees through trial and error.

Most contemporary zoos have established in-house training programs that provide all keepers with a foundation in animal care, and most zoos also use AZA's courses for training management staff. Although zoos continue to use veteran keepers or area supervisors to train new keepers to perform daily routine tasks, many zoo administrators have discovered the benefits of providing formal, universal training to all keeper staff, regardless of their specialties. Upper management staff—including curators, nutritionists, and veterinarians—share their expertise with keeper staff, teaching them about animal behavior, general nutrition, animal restraint, the administration of medications, the importance of enrichment and appropriate cage furniture, and how to respond to animal escapes.

A formal training program is not meant to replace the training that keepers receive from their fellow keepers; it is meant to supplement it. It provides keepers with a foundation for understanding nutrition, veterinary care, and animal behavior, so that they are better prepared for working with their animals and are properly equipped to respond to animal emergencies throughout the zoo.

The Indianapolis Zoo Society (IZS) uses both formal and informal training. In the Collections Department at this zoo, which includes keepers and curators, each new employee is given a document titled *Core Training Components* (IZS, 2004) during orientation. It outlines basic training requirements, the zoo's expectation for collection employee performance, and standard operating procedures, such as:

- Animal escape.
- Lock protocols and policy.
- Communication.
- Keepers' role in animal health.
- Keeper health and safety.
- Preventing animal injuries.
- Observation and recordkeeping.
- Husbandry protocols.
- Performance expectation.
- Regulatory oversight.

On review and understanding of the basic rules, both employee and curator must sign off, acknowledging full comprehension of all rules. The employee must also pass a test on the rules before continuing in the training process. *Core Training Components* includes timeframes for completion of training, skills assessments, and the protocol for documenting training.

Training for keepers continues through a mentoring process and through coursework and certifications by organizations outside IZS. During the mentoring process, a new keeper is paired with an experienced staff member and is trained in area-specific skills. This mentoring is guided by animal-husbandry protocols to ensure acquisition of a common skill set and provision of at least minimal quality of animal care. An animal-husbandry protocol includes the following information:

- Taxon name.
- Record identifier.
- Date approved.
- General curator and curator signatures.
- Exhibit or species.
- Environmental measures.
- Diet and feeding schedules.
- Daily routines.
- Weekly routines.
- Seasonal routines.
- Safety concerns.
- Reproduction.
- Behavioral-enrichment procedures.

Using a written document, such as an IZS animal husbandry protocol, to guide an informal training process provides standardization of training, allows for regular skills assessment, and provides a clear performance expectation.

Mentored training is also acknowledged in writing by the new keeper and curator and is documented in the employee's permanent training file. Both parties (curator and new keeper) are responsible for keeping the file up to date. The permanent training file allows each employee to understand fully what is expected of him or her and allows all parties involved to know what further training is required.

### **Current State of Training and Development of Animal-Care Staff**

Of utmost importance to the committee is the necessity for the zoo to develop effective mechanisms for ensuring that people who are directly responsible for the care and well-being of the zoo's animal collection are adequately prepared and competent to assume their responsibilities. But the committee was unable to obtain any documents from the zoo that describe the essential knowledge and skills or training that people who have the most frequent and the closest day-to-day contact with animals receive.

Employees of the zoo participated in a total of 487 training courses and other developmental activities (such as conferences) in 2001-2002 (NZIP, FY01 Training, October 16, 2003; NZP, FY02 Training, October 16, 2003). Training in the areas of compliance (such as sexual harassment and safety) and basic skills (for example, computer software applications) accounted for about 80% of all training opportunities (NZP, FY01 Training, October 16, 2003; NZP, FY02 Training, October 16, 2003). Little training was offered in other critical subjects, such as management skills and animal care.

### **Keepers, Museum Specialists, and Biologists**

The zoo has no documentation outlining the content or goals of any training program for animal-care staff in the Department of Animal Programs. There is an informal training program for keepers, but there are no written requirements for the length of time that a new keeper should spend in training, what information and protocols new keepers should be taught, how to assess the quality of the training or how well the training was assimilated.

The lack of formal training or well-structured informal training has been noted in the AZA accreditation reports since 1992 (AZA, 1992). In 1992, the American Association of Zoological Parks and Aquariums, now AZA, noted in its report, "that the keeper training program as described seems weak and it was not clear to us how employee development was encouraged except through general self-improvement courses of the Smithsonian." The 1997 AZA accreditation report echoes the same concerns:

There is a significant amount of required federal government training given to each employee, i.e., HIV/AIDS Introduction and Policy, Sexual Harassment, etc. Other training appears to be somewhat random. We were told that keepers and others may attend a session, 'Pathology Rounds,' every Tuesday at 1:00 p.m., where all animal deaths are reviewed by the Department of Pathology. Senior staff stated that about 50% of the staff attends at least one conference or training session. There is currently a system where keepers are provided an opportunity to cross-train in other areas of the zoo. Twenty-two keepers cross trained last year. Several keepers stated that they felt that training opportunities were limited.

The 2003 AZA accreditation report also mentions the problem of insufficient keeper training:

There is no formal keeper training program. Overall, there is a severe lack of training/professional development in the area of animal husbandry, both at the keeper and assistant curator level. Professional development opportunities and training programs at both the keeper and curatorial level appeared inadequate for an institution of National Zoo's size and caliber.

Because of the lack of documentation of the zoo's current informal keeper training, committee members questioned keepers and curators at the zoo to evaluate the program. The interviews indicated that new keepers follow veteran keepers for a few days to 2 weeks to learn how to perform their routines and that the informal training methods described in the previous section are the standard operating procedure at the zoo. In general, permanent keepers are provided with a longer training period than temporary keepers. Management of animal behavior, nutrition, and enrichment is learned on the job, and keepers learn how to respond to animal emergencies by reading a manual and by accessing the standard operating procedures for each area.

Some attempt to address the lack of documentation of animal-care staff training was made when the *Best Practices Manual* was updated in July 2003 (NZIP, AZA Accreditation Progress Report, 2004). The manual lists the administrative, compliance, and animal-management training courses that each employee is required to attend:

Core Training Requirements

Prevention of Sexual Harassment  
Safety Orientation  
Computer Security Awareness Training

Supervisor Requirements

Equal Employment Opportunity for Supervisors  
Basic Supervisory Training  
Safety Training for Supervisors

Animal Programs Staff Requirements

Proper handling and use of Smithsonian Institution travel Cards  
Travel Manager  
PeopleSoft  
FarSight  
AZA Management School (curators)  
All pertinent AZA offered training  
Elephant Manager Training  
General computer operation  
SSP and other population management participation/training

As shown in Table 2-1 of the 2004 AZA accreditation report, the number of keepers who participated in required training courses increased from one to four. In 2004, none of the 56 keepers at the Rock Creek Park facility are scheduled to participate in training courses required by the *Best Practices Manual* (NZIP, Best Practices Manual, 2003).

Beyond the list of courses shown above, there is no mention of training in the *Best Practices Manual*. That may be in part because written husbandry standard operating procedures (SOPs) have not existed in all units at the zoo. The zoo has made strides in documenting husbandry SOPs in the last year, but it is not apparent that husbandry SOPs have been established for each species at the zoo.

Employees are required to acknowledge, by signature, familiarity with the zoo's *Best Practices Manual*. However, it is unclear whether any assessment of understanding is carried out. Furthermore, although assistant curators are responsible for ensuring that "supervisees are cognizant of and adhere to all National Zoo, SI and other policies and procedures" (NZIP, Performance Plan, Assistant Curator), the committee was shown no evidence that individual assistant curators have developed or implemented plans for what information should be conveyed to keepers during training or for how (if at all) knowledge will be assessed to ensure the adequacy of the training.

**TABLE 2-1.** Training and continuing education of animal care staff in the Department of Animal Programs at the Rock Creek Park facility from 2001-2004.

**Training and Continuing Education of Curators, 2001-2004**  
 (including assistant, associate, and general curators)

	2001	2002	2003	2004 <sup>c</sup>
<b>Curators that Participated in Required Training<sup>b</sup></b> (Number of Classes Attended)	1(1)	1(1)	3(4) <sup>a</sup>	4(4)
<b>Curators that Participated in Continuing Education<sup>c</sup></b> (Number of Classes Attended)	1(1)	8(14) <sup>a</sup>	11(20) <sup>a</sup>	8(12) <sup>a</sup>
<b>Total</b>	2(2)	8 <sup>d</sup> (15)	11 <sup>d</sup> (24)	10 <sup>d</sup> (16)

**Training and Continuing Education of Keepers, 2001-2004**  
 (including keepers, museum specialists, and biologists)

	2001	2002	2003	2004 <sup>c</sup>
<b>Keepers that Participated in Required Training<sup>b</sup></b> (Number of Classes Attended)	1(1)	3(3)	4(4)	0(0)
<b>Keepers that Participated in Continuing Education<sup>c</sup></b> (Number of Classes Attended)	3(4) <sup>a</sup>	12(14) <sup>a</sup>	20(27) <sup>a</sup>	21(24) <sup>a</sup>
<b>Total</b>	3 <sup>d</sup> (5)	15(17)	21 <sup>d</sup> (31)	21(24)

<sup>a</sup>Some employees attended more than one training/continuing education event during the year.

<sup>b</sup>Required Training includes training classes outlined in the NZP Best Practices Manual (2003).

<sup>c</sup>Continuing education includes all non-required training, workshops, conferences, etc.

<sup>d</sup>Total does not equal the sum of the columns because employees who participated in both training and continuing education during that year were counted.

<sup>e</sup>Includes training and continuing education events planned for 2004.

Source: NZP, AZA Accreditation Progress Report, 2004; NZP, FY 01 Training, October 16, 2003; NZP, FY 02 Training, October 16, 2003.



Continuing education for keepers, defined as all training and professional-development events other than courses identified in the *Best Practices Manual*, has also been lacking at the National Zoo. In 2001, only three keepers from the Rock Creek Park facility participated in continuing-education events (Table 2-1). In 2004, 21 keepers are scheduled to participate in continuing-education events. The committee was particularly encouraged by the renewed presence of the zoo's animal-care staff at the AZA national meeting, an event at which they can make contacts and mingle with the leaders in their fields.

### Curators

Requirements for training of supervisors at all Smithsonian Institution facilities are stated in National Zoo's Best Practices Manual and include courses in equal employment opportunity for supervisors, basic supervisory training, and safety training for supervisors. In 2003, the zoo determined that all assistant curators in the Department of Animal Programs should receive management training through the AZA Management School (NZIP, Department of Animal Programs - Best Practices, 2003); by the end of 2004, three of the eight assistant curators will have taken this course. However, there appears to be little additional training offered to improve leadership and management skills specifically of assistant curators at the zoo (NZIP, FY 01 Training, October 16, 2003; NZIP, FY 02 Training, October 16, 2003). Over the last 10 years, most assistant curators at the zoo were hired from the zoo's keeper staff. There is no evidence to suggest that assistant curators promoted from keeper to curator participated in or were required to receive any type of leadership or management training peculiar to zoo operation. As a result, the management team most directly responsible for the care and well-being of the animal collection consists of people who have not received any well-structured formal training during their employment with the zoo.

The zoo is, however, making some moves in continuing education of its curatorial staff. In 2001, only one curator participated in a continuing-education event (Table 2-1); in 2004, eight of the 11 curators are slated to participate in continuing-education events.

### Future Assessments of Training Needs

In May 2004, the National Zoo established a goal of "including individual development plans in the performance plans of National Zoo employees in the 2005 performance cycle." (NZIP, Tanner memo, June 2004). To determine whether gaps exist in the training of current employees, zoo management has developed a training-assessment instrument. The instrument will be distributed in September 2004 and will be collected in October, November, and December 2004. A training plan will be developed by staff on the basis of results of the survey.

### Findings and Recommendations

The result of the training system described above is that the quality of training and the ability of new personnel to address important organizational needs are highly variable in the zoo. As a result, the zoo's expectations of its animal-care staff are unclear, performance at both curator and keeper levels is not assessed in a standard way (if at all), and there is no written guidance or formal policy regarding the information that should be imparted during training. When information to be conveyed during training is clearly documented and an employee is tested to assess learning of the material, it creates an environment of accountability in which expectations for employee performance are clearly stated and employee performance is assessed in an unbiased manner.

The committee observed isolated cases at the zoo in which a keeper or group of keepers has taken the initiative to stay abreast of innovations in the care and management of the species they manage. Generally speaking, however, the lack of a well-structured training program has resulted in an animal-care staff that is functioning with animal-husbandry knowledge from the early 1990s that has been passed down by word of mouth from keeper to keeper. Regular participation by the animal-care staff in continuing education events could have provided a conduit, though relatively minor, for updated knowledge into the zoo; however, the failure of the zoo staff to participate in continuing-education events over the last 10 years indicates a lack of commitment of senior management to provide the animal-care staff with the support and knowledge they require to adequately perform their jobs.

The current state of the keeper training program creates no expectations for keepers and assistant curators to be responsible for staying abreast of innovations and furthering their education in their field. Keepers and assistant curators tend not to participate in continuing-education opportunities, because, they state, the animal program is understaffed. However, there was no net change in the number of keeper staff from 1993 to 2000 (NZIP,

Staff Gain/loss Statement 1993–2003, September 24, 2003), even though the size of the zoo’s animal collection declined by about 38% (NZIP, Status of the Collection Reports, 1993–2002). In fact, as the size of the collection continued to decrease after 2000 to less than 50% of its 1993 size, the zoo actually added six keepers to their animal programs staff (NZIP Staff Gain/Loss Statement 1993–2003, September 24, 2003). The zoo now has 74 permanent keeper positions (NZIP, Tanner memo, July 19, 2004). On the basis of those statistics, staff interviews, and the committee’s observations, keeper staffing levels are more than adequate to allow basic husbandry training, continuing education, and cross-training on some scale within the zoo. The committee also expects that when the central commissary begins operations, this will free up a significant portion of the time the keeper staff spends on food preparation. In the committee’s opinion, the general perception that the animal-care staff is understaffed and the negative culture that developed as a result is a direct result of senior management’s lack of commitment through the 1990s to support the animal-care staff with the resources, training, and leadership necessary for them to perform their duties in an effective manner.

The following list of findings was developed by the committee on the basis of its observations of the Rock Creek Park facility, interviews with keepers and curators (assistant, associate, and general), and relevant documents provided by the zoo.

**Findings:**

- *For the most part, the current cadre of keepers at the zoo had no prior experience in the care of zoo animals when they began as volunteers or employees of the zoo. Since at least 1992, training for keepers has been informal and has not followed a common protocol. Consequently, verbal descriptions of the goals and content of training initiatives of the zoo are inconsistent and vague and have resulted in husbandry training that is highly variable across the zoo.*
- *The lack of formal training or well-structured informal training has been noted in every American Zoo and Aquarium Association (AZA) accreditation report since 1992.*
- *New keepers follow veteran keepers for a period of a few days to 2 weeks. It appears that this is the standard operating procedure and is intended to help new keepers learn how to perform their routines. Training times differ, and are longer for permanent keepers than for those being appointed to temporary positions.*
- *In 2003, the zoo determined that all assistant curators in animal programs should receive management training through the AZA Management School; by the end of 2004, three of eight assistant curators will have taken this course. There is no documentation that additional training is offered to improve leadership and management skills of assistant curators at the zoo.*
- *The current state of training and professional development at the zoo does not foster the expectation that staff will assume responsibility to stay abreast of innovations and further their education and development in their fields.*
- *Keepers and assistant curators tend not to participate in continuing education opportunities because, they state, the animal program is understaffed. In fact, over the last 10 years, the keeper staff increased while the number of animals in the collection declined by 50%.*
- *Management of animal behavior, nutrition, and enrichment is learned on the job. Keepers learn how to respond to animal emergencies by reading a manual and by accessing the standard operating procedures that exist for each area.*

**Recommendations:**

- *The zoo should develop and implement an animal-care training program for its keeper staff immediately. This action requires establishing written husbandry protocols for each species at the zoo, standardizing the information to be passed to new keepers during training, designing a formal assessment of learned information, and instituting a formal system for documenting compliance with training requirements. The management team directly responsible for overseeing the day-to-day care of the animal collection (assistant curators) must undergo some form of management training.*

Developing a training program can be a long and complex process, consuming time and resources that the zoo may not have in abundance. However, many other large zoos in the United States, such as the Indianapolis Zoo, have expended considerable energy to develop strong keeper-training programs. The committee strongly suggests that the zoo consider implementing a keeper-training program that has already been developed at another zoo, bypassing the need to develop a completely new program, and use its resources to tailor this program to the zoo and move its keepers through as rapidly as possible. It may be worthwhile for the zoo to consider hiring an experienced training and development specialist to oversee the development of a rigorous training program and corresponding set of measures to ensure follow through. Central to the success of any program implemented at the zoo is a common understanding and acceptance that training in animal husbandry will benefit the work performance of every keeper at the zoo, including those who that have been with the zoo for many years.

Senior management at the zoo must ensure that any training program implemented include more than animal husbandry training for the particular species of animal that an animal care staff member manages. All animal care staff must be indoctrinated in the general principles of animal husbandry, welfare, and behavior, as well as the preventive health, nutrition, pest management, occupational health and safety, and sanitation programs. As noted in Chapter 7, a lack of zoo-wide support for integrated pest management, has led to a paralysis of the IPM program and a failure to implement zoo-wide, sustainable programs necessary for long-term control of pests. Senior management must ensure comprehensive training of animal care staff, so the staff understands that these other programs require their active support to function and benefit the animal collection and improve their own work environment. Standardized training in the general principles of animal husbandry, welfare, and behavior at both the Rock Creek Park and CRC facilities will also benefit the animal collection by widening the knowledge base at the zoo; allowing keepers to assist in other areas, creating more flexibility in coordinating human resources; and providing harmonized management of animals that move between the two facilities.

Comprehensive and rigorous training for all animal care staff, if appropriately developed and implemented, can also begin addressing the general perception that the animal program is understaffed. This perception is used by all levels of management at the zoo to justify the failure of animal care staff to participate in professional development and to stay abreast of the latest advances in animal enrichment and husbandry, whether through formal training events or self-education. Training can help establish effective time management skills, identify attainable daily goals for the animal care staff, and introduce long-overdue efficiencies.

It is also essential that any new training program (for keepers or curators) at the zoo instill a sense of personal responsibility for the continued professional development of the staff. In that way, the zoo can become a “learning organization” as described in the knowledge-management section of this chapter and once again become the premier institution where people come to learn about cutting-edge zoologic research and husbandry.

The Department of Herpetology at the Dallas Zoo is an excellent example of a department that has successfully used high expectations to foster the intellectual and professional development of its keeper staff. In that department, once new keepers complete their initial training, they are given material for a self-taught course in herpetology similar to a university-level herpetology course. The keepers are expected to pass a test on the material within 6 months to move beyond a probationary period. All keepers are expected to achieve that goal, regardless of previous education or professional experience (Dallas Zoo, Department of Herpetology Manual).

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## Review of Individual Animal Deaths at the National Zoo

Part of the charge to the committee was to examine scientifically the causes of recent animal deaths at the zoo. The committee evaluated available documentation on the care provided to 33 animals at the Rock Creek Park facility and to 15 animals that were housed at the Conservation and Research Center (CRC). Those cases included the recently publicized animal deaths referred to in the statement of task and a random sample of animals in the megavertebrate collection that had died from 1998 to 2003. The committee evaluated available written records in each case; e.g., medical records, pathology reports, curator reports, keeper reports, Specimen Records, euthanasia-request forms, and internal zoo memoranda and reports. In each case the committee based its evaluation on published guidelines and literature and federal statutes. If guidance was not available from these sources, the committee relied on professional judgment as noted in the text.

Rather than focusing solely on the events directly associated with the animal's death, the committee reviewed the care each animal received throughout its life. The committee chose this approach for several reasons, foremost being the many instances where the written records pertaining to the events surrounding the animal's death seemed incomplete.

The committee found recordkeeping deficiencies in 17 of the 48 cases reviewed (see Tables 4-1 and 4-2); the majority of deficiencies involved medical records. However, since most of the records evaluated by the committee were medical and pathology records, this evaluation should not be considered a systematic examination of keeper, curator, or nutrition records. In some cases, the recordkeeping deficiencies involved the events immediately surrounding the animal's death; in other cases, the deficiencies occurred over many years preceding the animal's death and raise a question of whether a long-standing lack of attention to the animal's general health contributed to the animal's death. Because of the incompleteness of the records, the committee was unable to determine whether husbandry and veterinary procedures were performed but were not documented, or whether the procedures were not performed. This ambiguity left the committee without the information needed to make a definitive statement as to the factors that caused or contributed to the animal's death.

Another factor in the committee's decision to include a more comprehensive evaluation of each animal's care was several cases where inadequate care was evident but did not appear to contribute to the animal's death, and would not have been noted in an assessment of the causes of animal deaths at the zoo. Finally, it should also be noted that many of the animal deaths that were reviewed by the committee involved geriatric animals with multiple terminal conditions. In these cases, it is impossible to determine retrospectively whether each animal's death was caused by a specific instance of inadequate care, the animal's many medical problems, or a combination of both.

Due to these many confounding factors, the committee summarized the pertinent details of each animal's history at the zoo, highlighting instances of inadequate care that were evident from the available records as well as recordkeeping deficiencies that raise unanswerable questions about the factors that caused or contributed to an animal's death.

### EVALUATION OF ANIMAL HUSBANDRY, MANAGEMENT, AND VETERINARY CARE PROVIDED ANIMALS AT THE ROCK CREEK PARK FACILITY

In evaluating the causes of recent animal deaths at the zoo, the committee initially examined the available records for 23 animals that had recently died at the Rock Creek Park facility (Table 4-1). The public was aware of these animals, which included megavertebrates and other species, from reports in the media and written comments that were submitted to the committee. The committee found that in the majority of these cases, the care provided the animal appeared to be appropriate based on the written records available to the committee. In a minority of cases, the committee found evidence of apparent inadequacy of husbandry, management, and/or veterinary care.

The committee chose to evaluate an additional group of animals whose deaths were not publicized (Table 4-1). These animals were selected by random sampling of previously unevaluated megavertebrate<sup>1</sup> deaths that

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<sup>1</sup> Defined as elephant, hippopotamus, rhinoceros, zebra, bear, giant panda, lion, tiger, cheetah, gorilla, orangutan, camel, giraffe, sea lion, seal, Przewalski's horse, and oryx.

**Table 4-1.** Recordkeeping deficiencies noted in the records of animals that died at the Rock Creek Park facility.

Animal	Accession Number	Recordkeeping deficiencies evident
<b>Recent animal deaths covered by the media or identified to the committee in public comments</b>		
East African Bush Elephant	26223	
Orangutan	100797	X
Bobcat	103175	X
Masai Giraffe	104081	X
Celebes Macaque	104111	X
Grey Seal	104161	
Two-toed Sloth	105802	
Bengal Tiger	106098	
Masai Giraffe	106318	
Masai Giraffe	106649	
Bacterian Camel	107662	
Barbary Lion	107851	
Barbary Lion	108413	
Vietnamese Pot-bellied Pig	109080	
Cusimanse	110332	
Bongo Antelope	110565	X
Pygmy Hippopotamus	110963	
Red Panda	111967	
Red Panda	113194	
White-fronted Marmoset	113220	X
Grevy's Zebra	113393	X
Bald Eagle	207549	
Kingfisher	214083	
<b><u>Animal deaths selected by random sampling</u></b>		
Pygmy Hippopotamus	29218	
Giant Panda	100357	
Kodiak Bear	101108	
California Sea Lion	102584	
California Sea Lion	102590	
Orangutan hybrid	105170	
Gorilla	107566	
Cheetah	110842	X
Cheetah	113355	
Sumatran Tiger	113442	

occurred at the Rock Creek Park facility from 1999 to 2003 (NZIP, Megavertebrate Pathology Log 1999-2003, March 2004). In these 10 randomly sampled cases, the committee found few problems with either the care or recordkeeping. The only evident problems involved the lack of a euthanasia form and a question of why an animal that had a history of injuries caused by cagemates was not relocated to a less adverse environment.

In total, the committee evaluated 90% of all megavertebrate deaths that occurred at the zoo from 1999 to 2003, based on a list of megavertebrate deaths provided by the zoo (NZIP, Megavertebrate Pathology Log 1999-2003, March 2004). The committee concluded that for the majority of deaths reviewed, animal care was appropriate based on the written records available to the committee.

#### EVALUATION OF ANIMAL HUSBANDRY, MANAGEMENT, AND VETERINARY CARE PROVIDED ANIMALS AT CRC

The committee was aware of only a few animal deaths at the CRC, specifically those of a Grevy's zebra, a Persian onager, and two Burmese Brow-antlered deer (Eld's deer). Therefore, the committee also evaluated 11 randomly selected megavertebrate deaths that occurred at the CRC from 1998 to 2003 (NZIP, Megavertebrate Pathology Log 1999-2003, March 2004).

Evaluation of these 15 animal deaths at the CRC, which included megavertebrates and other species, revealed many deficiencies in veterinary recordkeeping (Table 4-2). Because it is unclear whether veterinary procedures were performed but not documented or were not performed, the committee was unable to determine whether appropriate preventive and follow-up care was provided to the animals. These recordkeeping deficiencies are discussed in further detail in Chapter 5; the use of multiple recordkeeping systems by veterinary staff members at the CRC contributed to this problem.

In total, the committee evaluated 57% of the megavertebrate deaths that occurred at the CRC from 1999 to 2003, based on a list of megavertebrate deaths provided by the zoo (NZIP, Megavertebrate Pathology Log 1999-2003, March 2004). The committee concludes from its evaluation of animal deaths at the CRC that there are widespread and previously undocumented problems with veterinary recordkeeping at the CRC. As a result, there is much ambiguity surrounding the preventive and follow-up veterinary care that was provided to the animals. It may be that the appropriate veterinary procedures were performed but not documented, but that determination is impossible for the committee to make based on the available records.

#### INDIVIDUAL CASE REVIEWS

##### **East African Bush Elephant** - Accession #26223

Between 1997 and her death in 2000, this animal had been diagnosed with osteoarthritis and osteomyelitis, and suffered from multiple episodes of abdominal edema, skin lesions, and mastitis. In summer 1997 and fall 1998, the animal was tested for tuberculosis with trunk washes. However, from October 1998 until the animal's death, the veterinary staff failed to test the animal for tuberculosis according to the records available to the committee. The animal's medical record contains an entry from February 6, 1999, stating that "tuberculosis or other granulomatous disease can not be ruled out" as the cause of clinical symptoms.

The animal began to lose weight, and her condition became resistant to treatment. In the month before the animal's death, her condition deteriorated, and apparent discomfort worsened as she began to refuse food and medication (NZIP, Medical Record, Accession #26223). On August 22, 2000, the animal was euthanized because of advanced age, severity of clinical symptoms, and poor prognosis. Necropsy revealed extensive pneumonia involving 60% of the lungs. The pneumonia was caused by a mycobacterial bovine infection, a type of tuberculosis (NZIP, Pathology Report, Accession #26223).

It is the judgment of this committee that the veterinary staff should have performed tuberculosis testing in accordance with federal regulation, but that the euthanasia of this animal was appropriate and warranted because of its deteriorating condition. However, it is not possible for the committee to form a judgment as to whether euthanasia would have been necessary if the tuberculosis infection had been discovered. The animal had a number of medical problems unrelated to the tuberculosis infection, and it is impossible to determine retrospectively whether its deterioration was caused by the tuberculosis infection or by the unrelated medical problems (such as osteomyelitis and osteoarthritis).

**Table 4-2.** Recordkeeping deficiencies noted in the records of animals that died at the CRC facility.

Animal	Accession Number	Recordkeeping deficiencies evident
<b><u>Recent animal deaths covered by the media or identified to the committee in public comments</u></b>		
Persian Onager	104834	X
Grevy's Zebra	110719	X
Burmese Brow-antlered Deer	111413	X
Burmese Brow-antlered Deer	113296	
<b><u>Animal deaths selected by random sampling</u></b>		
Scimitar-horned Oryx	104710	
Przewalski's Horse	105791	
Przewalski's Horse	106006	X
Oryx Dammah	106054	X
Oryx Leucoryx	107973	X
Oryx Leucoryx	108300	X
Oryx Leucoryx	109698	X
Scimitar-horned Oryx	110177	
Scimitar-horned Oryx	110612	
Przewalski's Horse	110627	
Arabian Oryx	111021	X

**Orangutan** - Accession #100797

This 33-year-old orangutan with a suspected intestinal obstruction underwent surgery on January 28, 2000 (NZIP, Medical Record, Accession #100797). A 7-cm tumor and 30-cm section of the small intestine were removed with nearby lymph nodes. Examination of the tumor and lymph nodes revealed that the tumor was a malignant adenocarcinoma that had metastasized to the local lymph nodes. This type of tumor and its spread to local lymph nodes suggested a poor prognosis (NZP, Pathology Report, Accession #100797). Postsurgical recovery was uneventful. In March, an old wound on the animal's neck reopened, and the animal was treated with a round of antibiotics. In early May, the orangutan had a 2-week bout of intermittently loose stools and was treated with two rounds of antibiotics. On June 18, the animal was started on a 7-day course of antibiotics, although there is no notation of whether it was to treat a recurrence of diarrhea or a reopening of the neck wound. On July 25, it is noted in the medical record that the animal was lethargic and had a distended abdomen. The animal apparently had diarrhea throughout July; five fecal screens were performed, and each fecal screening record notes diarrhea (NZP, Clinical Laboratory Report, Clinical Lab No. 2000-1949; 2000-2050; 2000-2133; 2000-2178; 2000-2194). The screenings on July 21 and July 24 (NZP, Clinical Laboratory Report, Clinical Lab No. 2000-2178; 2000-2194) both indicated gram-negative bacterial overgrowth. The animal developed progressive anorexia and vomiting (NZP, Medical Record, Accession #100797). Euthanasia was performed because of the animal's deteriorating quality of life and poor prognosis due to metastatic intestinal cancer (NZP, Request for Specimen Euthanasia, Accession #100797; NZP, Medical Record, Accession #100797). Necropsy revealed persistent diarrhea attributed to subacute inflammation of the intestine; *Salmonella arizonae* was cultured from the colon (NZP, Pathology Report, Accession #100797).

In the committee's judgment, the veterinary care provided this animal was acceptable, and the euthanasia was appropriate. The failure to diagnose the *Salmonella* infection might be viewed negatively, but in the committee's judgment the veterinary staff was warranted in attributing the animal's diarrhea to complications from intestinal resection and intestinal tumors. In addition, the committee could find no fault with the decision to euthanize. However, the euthanasia-request form for this animal (NZP, Request for Euthanasia, Accession #100797)

was incomplete in that the curator's signature was missing, and the signature of the representative of the Department of Animal Health was dated March 2001, 9 months after euthanasia. In addition, the form indicated that the National Zoo director disapproved the euthanasia.

Allegations have been made that the decision to euthanize was based on an ultrasonogram that was misread by the veterinary staff as indicating metastatic liver tumors (Nichols letter to the authors, November 11, 2003). There is no indication in the medical record, pathology record, or euthanasia form that ultrasonography was performed. The committee was charged with performing a science-based evaluation of recent animal deaths, and it is not within its purview to ascertain the validity of that claim. On the basis of the clearly documented diagnosis of metastatic adenocarcinoma of the small intestine, a recurrent history of diarrhea, and declining quality of life, it is the committee's judgment that veterinary care and diagnostics performed on this animal were acceptable and that the euthanasia was justified. However, the incompleteness of the Request for Euthanasia form is unacceptable.

#### **Bobcat** – Accession #103175

The 23-year old bobcat had a 5-year history of chronic renal disease and osteoarthritis leading to progressive inactivity. The curatorial staff, keepers, and veterinarians agreed that euthanasia was the best option for the animal and that additional procedures requiring anesthesia, such as trimming the overgrown claws, were not indicated because of the advanced renal failure and a prolonged recovery after the last anesthesia procedure (NZIP, Medical Record, Accession #103175).

At necropsy, overgrown claws were observed on both front paws that had grown into the adjacent footpads (NZIP, Pathology Report, Accession #103175). A benign tumor was found in the adrenal cortex and a malignant tumor in the thyroid gland at necropsy that may have contributed to the bobcat's clinical signs (NZIP, Pathology Report, Accession #103175). Microscopically, there were multifocal glomerulosclerosis and tubular mineralization that resulted in the impairment of renal function. There was histologic evidence of renal secondary hyperparathyroidism resulting in fibrous osteodystrophy in the skeleton that contributed to the physical inactivity, most likely because of bone pain (NZIP, Pathology Report, Accession #103175).

In the committee's judgment, based on macroscopic photographs (submitted to NAS, 12-19-2003) of the front paws that revealed a lack of local inflammation or infection, the overgrown claws appeared to be a minor component of the animal's deteriorating body condition. The veterinary care provided this animal was acceptable, and euthanasia was appropriate and warranted. However, the medical recordkeeping was unacceptable: two different sets of medical records were supplied to the committee.

#### **Masai Giraffe** - Accession #104081

The animal was first reported for front leg tenderness in May 1996 and diagnosed with overgrowth of the front medial claws in June 1997. This older male giraffe was affected by severe arthritis in his rear limbs and as a result developed severe hoof overgrowth. He was treated with several courses of phenylbutazone. At this time, planning was begun for hoof trim and radiography in the fall or winter. Anesthesia and immobilization of giraffes result in high mortality because of the giraffe's unique physiology, and anesthesia and immobilization require construction of special restraint facilities and behavioral training of the animal (Bush, 1993). An attempt to anesthetize and immobilize the animal was made on December 11, 1997, but was unsuccessful because the animal would not cooperate and because of the physical limitations of the facility (NZIP, Medical Record, Accession #104081).

A second attempt to anesthetize and immobilize the animal was made on April 30, 1998; during this attempt, the animal collapsed and died (NZIP, Pathology Report, Accession #104081). There are no medical records for this animal after March 9, 1998, even though the record reflects that the animal was removed from the collection on April 30, 1998 (NZIP, Medical Record, Accession #104081). Necropsy revealed that the giraffe regurgitated and aspirated rumen contents while recovering from an aborted anesthetic induction (NZIP, Pathology Report, Accession #104081)—one of the possible complications of anesthesia and immobilization of giraffes (Bush et al., 2002).

Chronic arthritis and lameness are common causes of morbidity in zoo-maintained giraffes. The veterinary staff adequately managed the orthopedic problem for 2 years, and anesthesia was used as a last resort because of the high mortality of giraffes under anesthesia. The committee is unable to evaluate the veterinary actions of April 30, 1998, because there are no entries in the medical record after March 9, 1998, except for a note on April 30 that the animal was removed from the collection.

#### **Celebes Macaque** - Accession #104111

This female Celebes macaque was first presented for examination on May 21, 1998, because of weight loss and being "not quite herself." A "very large" firm spherical caudal abdominal mass was detected on physical



examination on June 9; after a complete workup, the decision was made to perform an exploratory abdominal examination the next day (NZIP, Medical Record, Accession #104111), which resulted in an ovariohysterectomy due to periuterine endometriosis (NZIP, Pathology Report, Accession #104111). No clinical record entries were made from June 11 to 13, and it is unclear whether postoperative observation of the animal occurred. On June 14, the macaque was immobilized because of poor appetite and failure to produce urine. Testing revealed urine in the abdominal cavity, and the animal was appropriately euthanized as a result (NZIP, Medical Record, Accession #104111). Necropsy revealed a number of pathologic changes, the most important of which was that “during the surgical procedure . . . , a perforation was accidentally induced in the right ureter and the left ureter was inadvertently transected” (NZIP, Pathology Report, Accession #104111).

In the committee’s judgment, removal of an abdominal mass is a very difficult surgical procedure, and consideration should have been given to bringing in a surgical specialist to assist. No entries were made in the medical record made available to the committee for the 3 days immediately after the surgical procedure; so it is unclear whether the animal was observed postoperatively. Although the outcome of this case if the surgery had been successful will never be known, the immediate cause of death was damage to the ureters at the time of surgical resection of the abdominal mass.

#### **Grey Seal – Accession #104161**

This geriatric animal was anorexic and lethargic on August 31, 2002, with a twitch in the neck and face. These clinical symptoms were evident the next day; the animal was given antibiotics, and blood was drawn to test for West Nile virus. The animal continued to deteriorate, had difficulty breathing, and displayed neurologic signs, including twitching and involuntary eye movements. Additional testing (radiography, ultrasonography, electrocardiography, and so on) was performed on September 2, and the results suggested the animal had encephalitis; steroids and further antibiotics were administered. The animal experienced seizures that night and died (NZIP, Medical Record, Accession #104161). Necropsy revealed underlying heart disease, an ovarian tumor, and an inflammation of the brain caused by the West Nile virus. The cause of death was heart failure. The animal’s advanced age, the presence of heart disease, and an ovarian tumor probably predisposed this animal to inflammation of the brain after it was infected by the West Nile virus (NZIP, Pathology Report, Accession #104161). It is the committee’s judgment that the veterinary care provided this animal was acceptable.

#### **Two-toed Sloth - Accession #105802**

On routine physical examination in September 1999, the sloth was first noted to have increased blood values suggestive of chronic renal disease (NZIP, Pathology Report, Accession #105802). There were no followup annual examinations, and the animal was found dead in July 2001.

The cause of death was acute septicemia that led to cardiac and liver failure due to acute necrotizing typhlitis and metritis. *Arcanobacter pyogenes* was cultured from the heart, and multiple microorganisms from the uterus. Chronic renal fibrosis evident at necropsy contributed to but was not the cause of death (NZIP Pathology Report, Accession #105802).

Medical records from 1987 until death were reviewed. The veterinary care provided this animal was acceptable until 1999 (NZIP, Medical Record, Accession #105802). After 1999, there was an apparent failure to perform appropriate routine veterinary care and follow-up diagnostics to monitor the animal’s condition. However, this animal died from septicemia, and morbidity and death from septicemia can occur within days or even hours. It is plausible that there were no outward abnormal clinical signs from this animal until 24 hours before death.

#### **Bengal Tiger - Accession #106098**

This geriatric animal developed hindleg weakness in 1998 because of spondylosis. The animal was treated for the next 4 years with steroids and later nonsteroidal anti-inflammatory drugs (NSAIDs). The spondylosis progressed and became severe. The animal became ataxic on September 30, 2002. The animal was euthanized on October 2, 2002, because of deteriorating clinical condition and poor quality of life (NZIP, Medical Record, Accession #106098). The veterinary care provided this animal was acceptable and euthanasia warranted in the judgment of this committee.

#### **Masai Giraffe - Accession #106318**

This 19-year-old female giraffe had rapid onset of anorexia, difficult mastication of food with escape of ingesta from her mouth during chewing, and bloating. The course was rapidly progressive (5 days) from onset of illness to natural death (NZIP, Medical Record, Accession #106318). Necropsy revealed poor body condition with widespread serous atrophy of body fat. The teeth were markedly worn to near the gingival line with extensive food

impacted in the interdental spaces and associated periodontitis and suppurative gingivitis. In addition, there was acute suppurative gastritis of the forestomachs caused by gram-negative filamentous bacteria suggestive of *Fusobacterium* spp. A terminal blood sample revealed profound hypoglycemia and renal dysfunction indicated by high blood urea nitrogen and hyperphosphatemia (NZP, Pathology Report, Accession #106318). A similar “clinical syndrome” has been reported in captive giraffes associated either with feeding diets insufficient in protein but too high in fiber (Fowler, 1993) or with chronic energy malnutrition and hypoglycemia (Ball, 2000). It is apparent that consumption of large amounts of bamboo as browse by giraffes at the National Zoo caused serious dental wear and gingival infections that later interfered with the animals’ ability to consume adequate nutrients for normal energy balance and to prevent progressive inanition.\* In the wild, giraffes browse on soft small leaves of acacia and other trees and are not accustomed to diets with large amounts of roughage.

In the committee’s judgment, the veterinary care provided this animal was acceptable. Because of the lack of peer-reviewed literature on the cause of the animal’s clinical syndrome, it is not possible for the committee to determine whether the feeding of bamboo browse contributed to the animal’s death. However, the diet and medical records for this animal indicate that the animal care staff failed to manage this animal’s diet appropriately. A diet change request form for this animal, submitted on February 14, 2002, and signed by the nutritionist on March 1, 2002, states that all bamboo is to be discontinued until further notice (NZP, Diet Specification and Diet Change Request Form, Accession #106318). Yet, on April 28, 2002, this animal was examined by the veterinary staff for lameness in the right front leg. The clinical note indicates this animal climbs the moat in its exhibit to gain access to bamboo, and this climbing may have led to the injury (NZP, Medical Record, Accession #106318).

#### **Masai Giraffe** - Accession #106649

This 16-year-old male giraffe had a chronic history of intermittent lameness, especially in both front legs, and periodic overgrowth of the foot wall with abscess formation. In early January 2002, the animal had abnormal regurgitations and began to have “sour” breath that persisted for several months. The giraffe preferred bamboo to its regular diet of hay during its illness. The animal’s condition continued to deteriorate until he was found in sternal recumbency with extreme weakness and abdominal distention. Important clinical laboratory findings included hypoglycemia, hypocalcemia, hyperphosphatemia, and mild anemia. The giraffe died of natural causes although the Zoo staff had decided to proceed with euthanasia because of its deteriorating condition (NZP, Medical Record, Accession #106649). At necropsy, the giraffe was found to be in poor nutritional condition as indicated by reduced amounts of subcutaneous and body fat and by pericardial and abdominal serous atrophy of fat. There were focal erosions of joint cartilage of the radius, femur, and humerus. The gingiva between the molars was receded, and the interdental spaces were packed with fibrous plant material. That condition was associated with marked proliferative gingivitis that was probably related to the animal’s preference for bamboo to hay. The necrotizing suppurative frontal sinusitis probably was related to the abnormal regurgitations. The animal appeared to have died from a clinical syndrome that develops in captive giraffes fed a low-protein and high-fiber diet and has been reported in the literature (Fowler, 1993). The high-fiber diet fed to this giraffe also resulted in blunting and fusion of villae in the small intestine, which may have resulted in malabsorption of some nutrients (NZP, Pathology Report, Accession #106649).

In the committee’s judgment, the veterinary care provided this animal was acceptable. Owing to the lack of peer-reviewed literature regarding the cause of this animal’s clinical syndrome, it is not possible for the committee to determine whether the feeding of bamboo browse contributed to the animal’s death.

#### **Bactrian Camel**- Accession #107662

This camel was euthanized in January 2004 after at least 6 years of chronic forelimb lameness, which responded intermittently to a succession of treatments. She was housed with a male camel beginning in 1990, and copulation was noted on several occasions. She had one unborn calf in her lifetime and often had minor skin scrapes, abrasions, bite wounds, and hair loss caused by interactions with the male. A left front swollen fetlock was first noted on August 29, 1990; however, the problem resolved. In August 1997, she developed a left front lameness that continued intermittently in various degrees of severity until death. In October, she was examined with radiography while under standing anesthesia; however, no evidence was found to explain the lameness. She was treated with antibiotics for a foot abscess and later with NSAIDs for pain as the limping continued intermittently. Radiography was repeated twice in 1999, and chronic signs of arthritic changes were noted in left front joints. In March 2000, she was suffering from pelvic pain attributed to interaction with the male while in rut. Attempts to diagnose this problem

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\*This sentence was edited after release of the prepublication draft to clarify the committee’s views on the consumption of large amounts of bamboo by giraffes.

definitively were unsuccessful, as radiography of her neck and distal limbs were normal. However, the zoo did not have the imaging equipment necessary to obtain spinal radiographs. The animal could not be transferred to a large-animal clinic for evaluation because she had a chronic diagnosis of subclinical cryptosporidiosis that treatment options had failed to resolve. The keeper and curator continued to assess her quality of life as it varied over the years. There were indications of “click,” “cracking,” and “popping” noises heard by the keeper from the left and right forelimbs beginning in 2001. In April and August 2002, the camel experienced episodes when it could not rise and had trembling in the limbs. In September 2002, there were several entries in the clinical notes regarding the consideration of euthanasia. Throughout 2003, the camel received a variety of treatments to address her lameness, including a glucosamine supplement that provided some relief. Also the animal was separated from the male while he was in rut, but she was not voluntarily consuming all medications placed in the feed. Late in 2003, her left front leg was progressively bowing with the knee being a few inches lateral to the foot. In January 2004, the animal’s quality of life deteriorated progressively, and the decision to euthanize was made by the curatorial, keeper, and veterinary staff (NZIP, Medical Record, Accession #107662).

The medical records reviewed were from June 1987 until the euthanasia of the animal on January 17, 2004. The animal received a physical examination with blood work about every 1 to 2 years. The camel had chronic left front lameness since August 30, 1997, which progressed to degenerative joint disease. Veterinary care was appropriate, with at least bimonthly checks beginning in January 2001. Complete diagnostics on the animal included radiography, joint taps, blood work, and consultations with outside experts. Treatment included multiple series of NSAIDs and chondroprotectants (NZIP, Medical Record, Accession #107662). Despite appropriate veterinary care to manage the joint deterioration and pain, the camel was experiencing poor quality of life and was appropriately euthanized.

#### **Barbary Lion - Accession #107851**

Starting in March 2000, this animal was reported to have difficulty in moving due to spondylosis; in April, she developed intermittent anorexia. Dysphagia became chronic and progressive despite therapies. Multiple veterinary workups failed to yield a diagnosis. The animal also developed stranguria and urine scalding. The animal was euthanized on December 4, 2000, because of severe dysphagia and deteriorating condition (NZIP, Medical Record, Accession #107851). Necropsy revealed a malignant tumor that metastasized throughout the abdominal cavity and affected multiple organs. Tumor impingement on the bladder caused the stranguria, and the animal’s difficulty in chewing and swallowing was the result of abnormal nerve function caused by the presence of multiple tumors. The pathology report also noted that the ovariohysterectomy performed in November 1995 was incomplete; about 15 cm of one uterine horn was found on autopsy (NZIP, Pathology Report, Accession #107851).

The veterinary care provided this animal was adequate. It is the committee’s judgment that the inability to diagnose the malignant tumor was not due to a failure on the part of the veterinary team.

#### **Barbary Lion - Accession #108413**

This 14-year-old lion was found dead after an x-ray procedure for chronic lameness. Several anesthetics were injected (xylazine, ketamine, and midazolam), and isoflurane was administered for 2 hours with an inhalation tube. Two immunizations were performed while the lion was under anesthesia (NZIP, Medical Record, Accession #108413). He was found dead the next morning with pulmonary edema of unexplained pathogenesis. The xylazine concentration in the kidney was found to be “high”; however, appropriate control tissue (such as kidney tissue from an animal given a similar amount of anesthetic that had recovered normally) was not assayed for xylazine (NZIP, Pathology Report, Accession #108413).

It is not appropriate to conclude that inadequate veterinary care, such as a possible excessive dose of anesthetic, was responsible for the death of the lion because it is appropriate veterinary medical practice to administer additional doses of an anesthetic to a dangerous animal undergoing a surgical procedure when the initial dose fails to provide the desired anesthesia. Tissue concentrations of anesthetics in different animal species after death are not available in the published literature, so it is impossible to draw conclusions from the xylazine concentration in the kidney. In the committee’s opinion, the veterinary care provided this animal was acceptable.

#### **Vietnamese Pot-bellied Pig - Accession #109080**

This geriatric Vietnamese pot-bellied pig was first examined on June 17, 2002, for possible ascites (accumulation of fluid in the abdomen) because of keeper reports of the animal’s “pendulous abdomen and short gait on rear legs.” A full clinical workup was performed with ultrasonography and revealed an enlarged heart, spondylosis, and a right-sided hydronephrosis, all attributed to clinical signs of aging, but no signs of free fluid in the abdomen. From June 17 to October 17, clinical signs in the animal varied from normal to partial anorexia; on

October 9, keepers reported further enlargement of the abdomen. The veterinarian offered to pursue a more intensive workup; however, the medical record reflects “that keepers prefer not to work up further at this time” (NZIP, Medical Record, Accession #109080, Clinical Note, October 9, 2002). On October 17, keepers reported that the animal “is worsening and is having difficulty standing.” The pattern of intermittent anorexia continued until October 24, when the pig was anesthetized and a full workup performed. Radiographs and ultrasonography revealed “a round 10 cm mass noted in caudal, ventral abdomen.” On October 25, “keepers elected euthanasia,” which was humanely performed on October 28 (NZIP, Medical Record, Accession #109080, Clinical Note, October 9, 2002). At necropsy, an adenocarcinoma of the uterus, a leiomyoma of the uterus, and a leiomyoma of the cervix were found (NZIP, Pathology Report, Accession #109080).

It is the committee’s judgment that appropriate diagnostic steps were taken to arrive at the cause of the animal’s clinical signs, and appropriate veterinary care was given. However, the medical records indicate that the animal keepers, not the veterinary medical staff, were making the medical decisions, including when to euthanize the animal (NZIP, Medical Record, Accession #109080). It is imperative that trained, competent veterinarians have the final authority and accept responsibility for all medical decisions involving animal patients at the National Zoo.

#### **Cusimanse** - Accession #110332

A routine physical examination with blood work on January 10, 2001, revealed blood values suggestive of kidney disease (NZIP, Medical Record, Accession #110332). Keepers in the unit monitored the animal closely for clinical signs of renal insufficiency, such as excessive drinking and urination. Increased water consumption was first noted on May 9 with normal urination, defecation, and appetite (NZIP, Office of Animal Programs Daily Report, Accession #110332). The kidney disease was not followed up in this animal with more frequent veterinary examinations. The keeper reported lethargy and an unkempt appearance on Saturday, February 16, 2002. The animal was moved to the veterinary hospital for close observation of appetite, drinking, urination, defecation, and attitude. Blood work was not performed when the animal was moved to the veterinary hospital because the clinical pathology laboratory is not available on weekends. Blood work also was not performed after the laboratory opened on Monday. The cusimanse was found dead in its hospital cage on February 20 (NZIP, Medical Record, Accession #110332). The pathology report confirmed nephrosclerosis with uremia as the cause of death (NZIP Pathology Report, Accession #110332).

The medical records from birth to death were reviewed. The veterinary care provided this animal before its admittance to the hospital on February 16, 2002, was acceptable. However, the veterinary staff did not recognize that the animal was critically ill while in their care. The animal was evaluated each day by the attending clinician, and it appeared to be bright, alert, and actively avoiding the presence of humans. However, it is the judgment of the committee that blood work should have been done on the first day that the pathology laboratory was available (Monday). The animal received less than ideal care because of a failure to perform diagnostics in a timely manner; however, it is uncertain whether this failure contributed to the death of the animal, inasmuch as it had a long history of renal failure.

#### **Bongo Antelope** – Accession #110565

This female bongo antelope was first seen on November 11, 2000, for “fur loss and sore on the neck.” On December 19, the animal was put under general anesthesia for physical examination, vaccinations, and tuberculosis testing. The tuberculosis test site was observed over the next several days (December 20-25,) and was found swollen and somewhat enlarged. On January 26, 2001, the keeper reported soft stools and a reduced appetite. On January 29, the animal was reported to have watery diarrhea and depression. A physical examination was performed under anesthesia, and the animal was treated with a variety of antibiotics over the next few weeks. On May 26, the animal was seen for “weight loss with thin appearance with unclear food consumption history.” On May 28 and 29, she was reported to have “explosive watery diarrhea.” Over the next 10 days, the animal was examined by a veterinarian several times for continued loose stools and chronic weight loss, and a full workup was to be scheduled for the following week. On June 15, the animal was found to be “ataxic, with legs trembling” and was anesthetized for examination. The medical record indicates that radiographs were taken of the thorax and that a blood sample was collected. The next entry in the medical record, on June 16, indicates treatment with flunixin meglumine until further notice (NZIP, Medical Record, Accession #110565). The animal was apparently euthanized on June 19 because of a poor prognosis (NZIP, Pathology Report, Accession #110565). However, there are no clinical entries in the medical record after the physical examination conducted on June 15. Necropsy revealed that the animal had a leiomyoma of the uterus, which compressed the adjacent large intestine, and this condition led to the diarrhea noted in the weeks before death (NZIP, Pathology Report, Accession #110565).

The medical records are incomplete; no entries indicate the decision to euthanize the animal. It is unclear from the medical record why radiography or ultrasonography was not performed on the abdominal cavity to explore the possible cause of the chronic diarrhea. Euthanasia of the animal on the basis of the clinical observations noted in the pathology report was appropriate in the committee's judgment; however, it is impossible to determine whether early detection of the tumor would have influenced the outcome of the case.

**Pygmy Hippopotamus** - Accession #110963

This 9-year-old animal was found dead on January 27, 2003. The animal failed to eat all of her feed on the previous afternoon, but no clinical symptoms were evident. Necropsy revealed lesions on the brain and spinal cord and changes in the liver suggestive of acute shock caused by a viral infection of the central nervous system. This condition compromised the animal's respiratory and cardiovascular functioning and resulted in fluid accumulation in the lungs and death. Tests for West Nile virus, equine encephalitis (western, eastern, and Venezuelan), and rabies were negative. In addition, extensive screening for toxic substances was negative, and analysis of the water quality in the animal's pool revealed nothing unusual (NZIP, Pathology Report, Accession #110963). It is the committee's judgment that the veterinary care provided this animal was acceptable.

**Red Pandas** - Accession #113194 and Accession #111967

On January 11, 2003, two red pandas were found dead. Necropsy revealed that both animals died from accidental exposure to aluminum phosphide, which had been used as a rodenticide in their enclosure (NZIP, Pathology Report, Accession #113194; NZP, Pathology Report, Accession #111967). At the time of the animals' deaths, pest management was the responsibility of the safety manager. It is the judgment of the committee that the veterinary care provided these animals was acceptable. The deaths of the animals were due to a lack of proper procedures, including the lack of a formal use plan for the fumigant, no approval system prior to application, and no pesticide use policy (see interim report for further discussion).

**White-fronted (Geoffrey's) Marmoset** - Accession #113220

This female marmoset was first seen on August 28, 1997, for a routine physical examination, vaccinations, and tuberculosis testing. She was given routine physical examinations, vaccinations, and tuberculosis testing on July 15, 1998, and all findings were normal. At her annual physical examination on July 22, 1999, an abdominal mass was detected and thought to be a gravid uterus. As a result of the suspected pregnancy, tuberculosis testing was not done and no vaccinations were administered. The next entry in the medical record is from June 1, 2002, when the animal was given a dose of ivermectin. On August 19, the marmoset was taken to the veterinary hospital because of weight loss. A clinical workup was postponed until August 26 because of other emergencies. At that time, a "firm round mass" was located with abdominal palpation and radiographic examination. The mass (diagnosis uncertain) was surgically removed, and the animal made an uneventful recovery. There are no other medical record entries for August 26. On August 28, the animal was examined because "the abdominal incision had opened and the entire gastrointestinal tract was exposed." In a second operation, a large section of the small intestine was removed. There are no medical record entries for the first postoperative day, August 29. The animal was observed, and entries were made in the medical record for August 30 and 31 and September 1. No entries are in the medical record for September 2-3. On September 4, the marmoset was anesthetized and examined because "she appeared painful and her bowel was distended." A third operation was performed. Because of postsurgical adhesions and intestinal perforations, the animal was euthanized (NZIP, Medical Record, Accession #113220).

The clinical management of this case raises several questions:

- Either the medical record is incomplete or no annual physical examinations were performed in 2000 and 2001, despite the detection of an abdominal mass on July 22, 1999. There also is no record that tuberculosis testing and vaccinations were done in 2000 and 2001.
- The marmoset was seen at the hospital on August 19, 2002, and surgery was performed on August 26. There is no documentation in the medical record that this animal was observed postoperatively until August 28, when the medical record notes wound dehiscence and evisceration of the intestinal tract.
- After the second surgery on August 28, 2002, there is no indication in the medical record that the animal was observed on August 29.
- There is no documentation in the medical record of how euthanasia was performed.

**Grevy's Zebra** - Accession #113393

On May 17, 1999, this animal was examined by the veterinary staff because keepers reported that it had a distended abdomen. According to the animal's medical record, the diet was cut from 2 lb of pellets and 2 flakes of hay to 1 lb of pellets and 2 flakes of hay (NZIP, Medical Record, Accession #113393). National Zoo documents (Wells, 2000b) indicated that at some time during summer 1999, the animal's diet was increased to 5 lb of pellets per day and later reduced to 4 lb of pellets and 4 flakes of hay, which is presumably the diet that the animal was receiving in fall 1999. However, those changes were not noted in the medical records, and no nutritionist records could be produced for the animal. On November 8, the keeper logs indicated that the animal's diet was to be reduced to 2 lb of pellets and hay would be reduced by half, but there is no indication of what the hay consumption was previously or what measurable amount it would then be (NZIP, Keeper's Log, Accession #113417 and 113392). The change was not noted in the medical record, although the keeper logs indicated that the veterinary staff was aware of the diet change; other zoo documents also indicated the change was at the behest of the veterinary staff (NZIP, Nichols and Stevens memo, undated; Wells, 2000a). Zoo documents further indicated that the diet was reduced for 3 or 4 weeks and then returned to about 4 lb of pellets and 3 flakes of hay per day (NZIP, Nichols and Stevens memo, undated)(Nichols and Stevens; Wells, 2000b). However, the change is not noted in the keeper logs, veterinary medical records, or curator report.

On the afternoon of January 31, 2000, the animal was seen by the veterinary staff after keeper staff saw him lying on the stall floor. The animal was sedated for examination, and intravenous fluids and other medications were administered. The animal recovered from sedation and was then locked into his stall for the night. The veterinary staff's examination of the animal and the two other zebras it was housed with led to the veterinary staff further reducing the zebras diets (NZIP, Keepers Log, Accession #113417 and #113392), though the pathology report and nutritionists examination subsequently determined that all animals were underweight (NZIP, Keepers Log, Accession #113417 and #113392; NZP, Pathology Report, Accession #113393).

The animal died the night of January 31, 2000, because of hypothermia with inanition as a contributing factor (NZIP, Pathology Report, Accession #113393). Various internal zoo documents (NZIP, Nichols and Stevens memo, undated; Wells 2000a and 2000b) generated after the animal's death indicated that the zoo keepers, the curator, and the veterinary staff were apparently aware of the two diet changes that occurred in November and December, although the changes were not documented in the available records in a complete fashion, if at all. It is unclear to what extent the nutritionist was involved in the decisions, because no nutritionist records could be produced for the animal, although there are indications that diet-request forms were submitted to the nutritionist (Wells, 2000a). Some keeper logs pertaining to the animal were not archived, and others were improperly archived. In addition, it is apparent that substantial changes were made in the medical record of this animal, as detailed in the committee's interim report.

In the judgment of the committee, the apparent inadequacies of care contributed to the animal's death, including the failure of the nutritionist to be involved in decisions regarding the animal's diet, failures by all staff involved to document changes to the animal's diet clearly, and failure of the veterinary staff to assess the animal's body condition properly. In addition, the failure of the veterinary staff to note changes in diet that were prescribed by the veterinary staff is unacceptable, as is the incompleteness of the medical record and subsequent changes made to the medical record.

Allegations have been made that attempts were made by the animal care staff to have the veterinary staff reevaluate the animal in December and January and that the curatorial staff, although aware of the lack of adequate heat in the building, had failed to act. There is no documentation in the keeper or curatorial records to indicate that the veterinary staff were contacted, nor was documentation available to indicate that the curatorial staff had been informed of the problems with the heating system in the building. The committee was charged with performing a science-based evaluation of recent animal deaths, and it is not within its purview to ascertain the validity of these claims.

**Bald Eagle** - Accession #207549

On July 3, 2003, at about 7:15 a.m., the bald eagle was found seriously injured on the ground in the center area of its outdoor flight cage. No health problems had been reported. The bird was treated for shock and tissue trauma with antibiotics, an anti-inflammatory drug, pain medications, and fluid therapy at the veterinary hospital. Blood values were normal except for a highly increased creatine phosphokinase due to muscle and tissue damage. On July 4, the bird was anesthetized again for wound management, but it suffered cardiac arrest at 10:14 a.m. A

catheter was placed and cardiopulmonary resuscitation with appropriate drugs was initiated, but death was called at 10:25 a.m. The cause of death was cardiac arrest (NZIP, Medical Record, Accession #207549).

There was no evidence cited in the pathology report to suspect any underlying disease or condition that would make this animal particularly vulnerable to a predator attack. The eagle was probably attacked by a fox, given evidence at the exhibit and the nature its wounds (NZIP Pathology Report, Accession #207549). The most likely scenario is that the fox entered the cage to consume food left for the eagle, the fox was attacked by the bird, and the eagle fared badly in the resulting conflict. It is the committee's judgment that the veterinary care provided this animal was appropriate, though it may be that failure to inspect the cage or perform necessary maintenance made it possible for the fox to penetrate the eagle's flight cage.

#### **Kingfisher** - Accession #214083

This kingfisher had been successfully treated for pulmonary aspergillosis in March and April 2002, which involved 8 weeks of intensive care at the veterinary hospital (NZIP, Medical Record, Accession #214083). On August 14, 2002, the animal was taken to the Veterinary Hospital for treatment of aspergillosis, including nebulization, administration of fluids, and force-feeding of a nude mouse containing steroid medication (NZIP, Pathology Report, Accession #214083). On August 15, the kingfisher was found dead at the Veterinary Hospital; the pathology report indicated that the animal was found with his head caught in a plant on August 10 and was monitored over the next 2 days. Other than a prescription for itraconazole and clotrimazole, there are no clinical notes in the medical record from June 6, 2002, to August 15, 2002, when a note indicated that the animal was removed from the collection (NZIP, Medical Record, Accession #214083). Necropsy revealed that the animal died from necrotizing myocarditis caused by the West Nile virus. The heart, spleen, kidney, and brain were found to be positive for West Nile virus (NZIP, Pathology Report, Accession #214083).

The medical records and laboratory work were reviewed from 1998 with the pathology report. This animal died from cardiac lesions caused by the West Nile virus. The nude mouse body found lodged in the anterior esophagus of the animal was not noted as a cause of death in the pathology report (NZIP, Pathology Report, Accession #214083). The force-feeding of mouse pups is considered an appropriate procedure for delivery of medication to a kingfisher in the judgment of the committee.

#### **Pygmy Hippopotamus** - Accession #29218

This geriatric animal had a year-long history of stiff gait and intermittent anorexia. An examination done under anesthesia on October 1, 1999, revealed severe renal failure, and the animal was euthanized (NZIP, Medical Record, Accession #29218). Necropsy revealed polycystic kidney disease. The animal was the sixth pygmy hippopotamus to die with polycystic kidney disease; five of the six were related, and further investigative work was initiated to understand this disease in pygmy hippopotamuses better (NZIP, Pathology Report, Accession #29218). It is the committee's judgment that the veterinary care provided this animal was appropriate and euthanasia warranted.

#### **Giant Panda** - Accession #100357

This giant panda, 28 years 7 months old, had a long history of chronic renal failure, bridging spondylosis of the thoracolumbar vertebrae with mineralization of intervertebral disks, and degenerative osteoarthritis of the left elbow and carpus. Chronic epistaxis, decreased exercise tolerance, and keratitis with corneal ulceration had reduced the quality of this animal's life until zoo keepers and veterinary staff agreed on euthanasia (NZIP, Medical Record, Accession #100357). At necropsy, there was severe nephrosclerosis with focal interstitial nephritis, cardiomegaly with myocardial fibrosis, degenerative osteoarthritis involving multiple joints, and thrombosis of ecstatic vessels of the nasal turbinates (NZIP, Pathology Report, Accession #100357). This geriatric giant panda had a number of age-related diseases that were diagnosed and treated in an acceptable manner before it was appropriately euthanized.

#### **Kodiak Bear** - Accession #101108

This 27-year-old animal was euthanized on May 10, 2002, because of electroretinographically proven blindness (no electric activity when tested under anesthesia on September 24, 2001), skin wounds, and liver cancer (NZIP, Medical Record, Accession #101108). At autopsy, a hepatocellular carcinoma with wide metastatic disease was found, in addition to the eye lesions and multiple other geriatric and complicating illnesses (NZIP, Pathology Report, Accession #101108). It is the judgment of this committee that the veterinary care provided this terminally ill animal was acceptable, and euthanasia appropriate and warranted.

#### **California Sea Lion** - Accession #102584

This geriatric animal had suffered from cough for 2 months and was treated with a variety of drugs to combat suspected bacterial and fungal infections but continued to decline and have difficulty in breathing (NZIP, Medical Record, Accession #102584). Euthanasia was performed on November 14, 2003, because of worsening of chronic respiratory distress despite prolonged treatment (NZIP, Request for Specimen Euthanasia, Accession #102584). Necropsy suggested that laryngeal dysfunction caused the animal's respiratory distress (NZIP, Pathology Report, Accession #102584). It is the judgment of this committee that the veterinary care provided this animal was acceptable, and that euthanasia was appropriate and warranted for this geriatric animal because of the clinical findings.

**California Sea Lion** - Accession #102590

This female sea lion was euthanized on February 2, 2001, because of severe liver disease. At autopsy, severe cholestasis, jaundice, renal bile casts, and a variety of unsuspected other abnormalities were found; the animal was also geriatric (NZIP, Pathology Report, Accession #102590). It had become acutely anorexic. Diagnostics revealed severe hyperbilirubinemia, pointing to a major hepatic problem (NZIP, Medical Record, Accession #102590). It is the judgment of this committee that the veterinary care provided this geriatric animal was acceptable, and euthanasia was appropriate and warranted.

**Orangutan hybrid** - Accession #105170

This male orangutan was euthanized at the age of 14 years on October 18, 1999, because of recurrent severe air sacculitis (*Pseudomonas*) that had existed for 2.5 years. The animal was born in 1983, and numerous clinical-chemistry and hematology findings are recorded, but several anesthesia records are not included. On May 22, 1995, he was noted to have wounds on the neck and arm that healed well. Digital wounds were cast, but he was bitten again by Azy (another male) on July 31 and sustained severe local tissue damage. Antibiotics and other medications were given, and many immobilizations followed the injuries. Annual examinations, tuberculosis tests, and vaccinations are all well recorded. In 1996, a cough was noted, and air sacculitis was suspected. *Pseudomonas* was cultured and antibiotics were administered. In March 1997, bronchoscopy revealed much suppurative exudate in the airways. Medications were poorly accepted. Many antibiotics were administered, and nebulization was tried to get drugs to the air sacs, but all failed to stop progression of the bacterial air sacculitis. There was extensive documentation of veterinary care, and the keeper records are abundant (NZIP, Medical Record, Accession #10170). Despite extensive therapeutic attempts to resolve the lung and air sac problems caused by *Pseudomonas*, the animal's condition deteriorated, and euthanasia was performed (NZIP, Request for Specimen Euthanasia, Accession #105170). At necropsy, the clinical diagnosis was confirmed as bronchopneumonia, and a pulmonary abscess was found (NZIP, Pathology Report, Accession #105170).

It is the committee's judgment that the veterinary care provided this animal was acceptable, and the euthanasia appropriate and warranted. There is an issue with the husbandry provided this animal. The animal received multiple injuries from other hostile orangutans, and it is unclear to the committee why the animal continued to be exposed to them.

**Gorilla** - Accession #107566

This animal was obtained from another institution and was in the care of the National Zoo for 13 years. Recurrent problems were periodontal disease, minor wounds and abscesses as a result of fighting among cagemates, otitis externa, arthritis, and overweight. Wounds were treated as needed, and she received regular dental treatments. The arthritis was treated chronically with NSAIDs and chondroprotectants. In 1998, variable intermittent changes in weight, appetite, and mobility were noted. An examination on February 24, 1999, indicated increased liver enzymes and an abnormal liver structure on ultrasonography. A liver biopsy was not done, because of the inability to check clotting times and the risk of blood loss in case of increased vascularity. The changes in the liver of this animal were considered chronic although the animal's liver enzymes were normal 4 months earlier (NZIP, Medical Record, Accession #107566).

An examination on February 25, 2000, indicated severe periodontal disease, increased heart size with a soft murmur, spondylosis, abnormal liver structure, and two large fluid-filled structures in the abdomen on ultrasonography. In late March 2000, the animal was observed to have periods of lying down more often and to be less responsive or more depressed, and she was reported to be weak with noticeable tremors and increased respiratory rate on some days. Tachypnea, possible ascites, and occasional light-colored stools were reported on April 5, 2000. On April 9, the animal was recumbent with dyspnea and a distended abdomen and was unable or unwilling to rise. Physical examination revealed a loud systolic murmur, fever, and possible pulmonary edema, ascites, and hepatomegaly. Blood work revealed anemia, increased white-cell count, and increased bilirubin.



Regurgitation of gastric contents revealed a large amount of blood. She appeared to improve until April 13, 2000, when she fell, cut her leg, was unable to rise, and appeared disoriented. The decision was made to euthanize the animal because of her moribund condition associated with advanced hepatic disease and right-sided heart failure (NZIP, Medical Record, Accession #107566).

Necropsy revealed a cholangiocarcinoma that had metastasized to regional lymph nodes, had irritated the pancreas resulting in a chronic focal pancreatitis, and had caused a chronic mild cholecystitis (NZIP, Pathology Report, Accession #107566). Medical records and that pathology report were reviewed from April 3, 1987. Several outside experts (DVM, MD, and DDS) were consulted on numerous occasions in the latter years of this animal's life. It is the judgment of the committee that the veterinary care provided this animal was acceptable and that euthanasia was warranted.

**Cheetah** - Accession #110842

This animal was euthanized on June 28, 1999, because of deteriorating condition and a poor prognosis after a 12-month history of renal failure (NZIP, Pathology Report, Accession #110842; NZP, Medical Record, Accession #110842). It is the committee's judgment that the veterinary care and husbandry provided to this animal were appropriate. However, no euthanasia-request form could be produced, although it was noted in the animal's file that the curator failed to produce the form after repeated requests from the registrar (NZIP, Murphy memo, July 25, 2001).

**Cheetah** - Accession #113355

On November 27, 2002, this animal was reported as depressed and as having partial anorexia. Blood work revealed renal failure (NZIP, Medical Record, Accession #113355). The animal's condition worsened, and it was euthanized on December 5 because of deteriorating condition and poor quality of life (NZIP, Request for Specimen Euthanasia, Accession #113355). Necropsy revealed chronic interstitial nephritis, which caused the renal failure (NZIP, Pathology Report, Accession #113355). It is the committee's judgment that the veterinary care provided this animal was acceptable, and euthanasia was appropriate and warranted.

**Sumatran Tiger** - Accession #113442

This neonatal Sumatran tiger died on June 24, 1999, because of aspiration of amniotic fluid during a difficult delivery (NZIP, Pathology Report, Accession #113442). It is the judgment of this committee that the veterinary care provided to this animal was appropriate.

**Persian Onager** - Accession #104834

On July 16, 2000, this animal was reported to be drinking excessively and had passed blood by rectum, but it looked fine and was in good body condition. The animal was found dead on July 17 (NZIP, Medical Record, Accession #104834). Necropsy revealed that the animal died from salmonellosis (to which equids are particularly susceptible). The necropsy report suggests (in a handwritten note at the bottom of a page) that the animal may have been infected by *Salmonella* that earlier had caused the death of a scimitar-horned oryx at the zoo, inasmuch as the onager had been transported in the same trailer as the oryx. The exhibit area had been sterilized, but the trailer had not been sterilized. However, no documentation that the trailer had failed to be sterilized was available other than the handwritten note in the necropsy report and the same allegation in a clinical note (NZIP, Medical Record and Pathology Report, Accession #104834).

It is the judgment of this committee that the veterinary care provided this animal was acceptable. Owing to a lack of adequate records, the committee could not ascertain whether the onager acquired *Salmonella* as a result of a failure of the husbandry staff to sterilize the trailer before the onager was transported.

**Grevy's Zebra** - Accession #110719

This animal was found dead on January 22, 2000. Necropsy revealed that the animal died from inanition and hypothermia (NZIP, Pathology Report, Accession #110719). The failures of the keepers to provide hay ad libitum in accordance with established procedure, to post the diet of the animal, to report problems with heat lamps, and to bed the animal heavily and lock it into its stall (NZIP, memo to CRC Union Steward, May 25, 2000; NZP, memo to CRC keeper, March 29, 2000a; NZP, memo to CRC keeper, March 29, 2000b; NZP, memo to Deputy Director, December 7, 2000; NZP, memo to CRC keeper, February 9, 2001) all contributed to the death of the animal.

Although veterinary care did not contribute to the death of this zebra in the committee's judgment, the medical record raises concern as to whether the animal received adequate attention from the veterinary staff at the

CRC. The animal was born in 1989 and arrived at the Rock Creek Park facility from the St. Louis Zoo in July 1992. During its stay at the Rock Creek Park facility, it had a history of chronic recurring laminitis and lameness that required repeated prednisone and diuretic treatment. During its stay there, it was vaccinated on a regular schedule for rabies, tetanus, and encephalitis. The final clinical entry in the medical record before the animal was transferred to the CRC was, "Annual hoof trim and dental should be adequate" (NZIP, Medical Record, Accession #110719).

After the animal's transfer to the CRC, there are a series of clinical notes in the medical record from January 30 to February 21, 1998, to treat the animal with a steroid and diuretic for lameness and leg edema. Other than parasite screens in 1999, there are no additional medical entries for this animal until a notation on January 22, 2000, that the animal was found dead in its stall. There is no evidence in the medical record that the animal received annual vaccinations, hoof trims, or dental examinations. Further complicating the issue, at the time of this animal's death, its medical record was being simultaneously maintained in three record systems. Some time after the animal's death, the MedARKS record was updated by the addition of the clinical notes from January and February 1998, as evidenced by the differences in the animal's MedARKS record between a printing on March 30, 2000, and on June 23, 2003.

**Burmese Brow-antlered (Eld's) deer** - Accession #111413

On March 10, 2001, this animal was attacked by a pack of dogs and suffered lameness in the front and rear legs. The lameness in the left rear leg failed to resolve, and the animal was examined twice under anesthesia—March 19, 2001, when annual vaccinations were also administered, and March 29, 2001. A ruptured ligament was suspected, and surgery was performed April 20, 2001. The clinical-note entry for that date indicates that during intubation, the animal had a strong laryngeal reflex and chewing movements that severed the intubation tube. A tracheotomy was performed to retrieve the intubation tube from the trachea. The clinical note indicates that the animal was reintubated and surgery continued. However, in the rest of the clinical note, there is no mention of what surgical procedure was performed; in fact, the rest of the clinical note is identical to the clinical note of March 19, which details a physical examination, radiographs, and vaccinations that were performed. Therefore, it is unclear what, if any, surgical procedure was performed on the animal's left rear leg (NZIP, Medical Record, Accession #111413).

After the surgery on April 20, 2001, there are no clinical notes until May 2, 2001, when the animal was anesthetized for an examination and radiography. The animal had surgery again on May 10, 2001, to repair the anterior cruciate ligament. The clinical note suggests that the animal's joint had been clamped with nylon strands during the previous surgery on April 20, 2001, and that the radiographs on May 2, 2001 showed misalignment of the clamps. However, neither the April 20, 2001 nor the May 2, 2001 clinical entry reflects this information. During the surgery on May 10, 2001, the clamping on the joint was modified, and it was noted that the posterior cruciate ligament was ruptured. Screws were used to attach a tendon graft taken from the patella to the cruciate attachment of the femur. External fixation of the joint was placed with the use of pins placed in the femur and the tibia. After the surgery, there are no clinical entries from May 11, 2001 to May 17, 2001 (NZIP, Medical Record, Accession #111413).

On May 18, 2001, the animal was observed with one of the external fixation pins removed from the leg and bent. The animal was anesthetized to replace the external fixation pins, and radiographs were taken to confirm that the patellar graft and joint clamping were sound. After the surgery, there are no clinical entries from May 19, 2001 to May 28, 2001 (NZIP, Medical Record, Accession #111413).

On May 29, 2001, the clinical entry reflects that the animal did not want to get up on May 28, 2001. The animal did stand on May 29, 2001, but swelling was noted in the leg, and palpation revealed a fracture. The animal was anesthetized, and the bone was set and stabilized with pins. The next clinical entry, on June 1, 2001, notes that drug therapy was continued and that food consumption was minimal. An entry on June 6 indicated that the drug regimen was modified, and an entry on June 10, 2001 indicated that the pins had broken through the skin and were exposed about 0.5 inches; the wound was cleaned and the medications were to be continued. On June 12, 2001, the animal was unable to rise owing to a refracture of the femur. Euthanasia was performed (NZIP, Medical Record, Accession #111413).

This animal was euthanized because of multiple leg injuries that resulted from the attack by a pack of dogs, and it is the committee's judgment that euthanasia was medically justified. However, the medical record raises concern because there were no clinical entries in the medical record after each surgical procedure until the next clinical problem arose, so it is not clear whether the animal was observed postoperatively. In addition, the medical entry that was made on April 20, 2001, is unacceptable, in that it fails to document the surgical procedure that was performed and indicates that the animal received vaccinations that had already been administered in the previous month.

**Burmese Brow-antlered (Eld's) Deer** - Accession #113296

A 12-year-old Eld's deer was found dead, due to an apparent dog attack on March 10, 2001 (NZIP, Pathology Report and CRC Veterinary Clinician's Pathology Questionnaire, Accession #113296). The medical record was reviewed from April 1998 until the animal's death. It is the judgment of this committee that the veterinary care provided this animal was acceptable.

**Scimitar-horned Oryx** - Accession #104710

This animal was euthanized on April 21, 1999, due to advanced age, chronic lameness, and poor prognosis (NZIP, Request for Specimen Euthanasia, Accession #104710). It is the committee's judgment that the veterinary care provided this animal was acceptable, and euthanasia was appropriate and warranted.

**Przewalski's Horse** - Accession #105791

This horse was first noted to have a nasal discharge and poor body condition on December 14, 1999, and it was extensively worked up and treated over the next 8 months, including multiple endoscopy of the trachea, rhinoscopies of the nasal cavities, and radiography of the head. The animal was diagnosed with an intestinal parasite (treated with antihelmintics) and rhinitis and sinusitis (treated with multiple antibiotics through the middle of June 2000). The infection in the nasal cavity improved intermittently but was not resolved. On August 31, 1999, the animal was noted to have audible upper respiratory noises and continued poor body condition. The animal was started on antibiotics again but was not consuming all of its medicated feed. On September 5, the animal was observed to have a ruptured mass on the left maxilla. A physical examination under anesthesia and consultation with a local equine practitioner were planned for the next day, but the horse was found dead the next morning (NZIP, Medical Record, Accession #105791). Necropsy determined that the animal died of sepsis (an infection and toxins spread via the blood) caused by a chronic *Streptococcus zooepidemicus* infection of the left guttural pouch. *S. zooepidemicus* was also cultured from the lung and heart (NZIP, Pathology Report, Accession #105791).

Medical records were reviewed for January 1, 1984, to death. A guttural pouch endoscopy was considered twice in January 1999 to rule out infection, but it was not performed because the animal's sinuses and guttural pouches appeared normal on radiographs. In the committee's judgment, the decision not to perform a guttural pouch endoscopy was acceptable based on the diagnostics performed.

**Przewalski's Horse** - Accession #106006

This animal was treated for lameness in May and June 1995. In August and September 1999, the animal was treated again for lameness with multiple drug therapies and corrective shoeing. In September 1999, radiographs showed severe laminitis (inflammation of lamella covering the last digital bone in the hoof). The prognosis was poor, and euthanasia was elected (NZIP, Animal Health Patient Records, Accession #106006; NZIP, Pathology Report, Accession #106006).

Medical records were reviewed for June 28, 1995, to death. The medical record appears to be complete; there is a continuous record from 1984 until the animal's death. However, numerous entries in the specimen record (NZIP, Specimen Record, Accession #106006) of medical observations and vaccinations do not appear in the medical record. Evaluation of the specimen record and medical record in conjunction makes it appear that preventive medicine and veterinary care were acceptable in the committee's judgment. However, the incompleteness of the medical record is unacceptable.

**Oryx Dammah** - Accession #106054

This animal was anesthetized on September 13, 2002, for a general examination, blood work, and radiography of the left stifle, pelvis, femur, and sacral vertebrae because of difficulty in standing. The suspected hindquarter injury was a ruptured femoral head ligament. After good recovery from anesthesia, the oryx was housed in a bedded and padded stall and was later noted to be standing and interested in food. The medical record notes that the animal charged and hit the door with its head and the base of its horns; however, the animal's condition after hitting the door is unclear. The animal was found dead on September 14 (NZIP, Medical Record, Accession #106054). The necropsy was unable to identify the cause of death (NZIP, Pathology Report, Accession #106054).

The medical records were reviewed for August 4, 1984, to death. There is a continuous medical record from 1984 until the animal's death with no obvious gaps; however, numerous entries in the specimen record (NZIP, Specimen Record, Accession #106054) of medical observations and vaccinations do not appear in the medical record. Evaluation of the specimen record and medical record in conjunction makes it appear that the veterinary care

provided the animal was acceptable in the committee's judgment. However, the incompleteness of the medical record is unacceptable.

**Oryx Leucoryx** - Accession #107973

This animal was euthanized on July 15, 1999, after a 3-month history of severe lameness in the left hind leg. The animal had an ossifying hematoma on the left stifle (the joint roughly equivalent to the human knee), which impaired walking. The animal was in poor body condition and lagged behind the herd (NZIP, Medical Record, Accession #107973). The stifle lesion was most likely the result of an injury that had not healed normally because of the constant motion in the joint (NZIP, Pathology Report, Accession #107973).

The Specimen Record was reviewed from the animal's arrival at the National Zoo on February 18, 1988, until it was euthanized in July 1999. Medical records were provided by the zoo only from June 10, 1999 to the date of euthanasia. It is the committee's judgment that the veterinary care provided this animal during this short period was acceptable. However, there is no indication in the medical record or Specimen Record that the animal received any veterinary care, physical examinations, or preventive medicine between February 28, 1988, and June 10, 1999. The animal was appropriately euthanized because of her deteriorating quality of life; however, it is unclear, owing to the failure to keep appropriate medical records, that she was receiving appropriate husbandry or medical care before June 1999. Because of the incompleteness of the medical record, the committee was not able to assess whether inadequate veterinary care contributed to the animal's death.

**Oryx Leucoryx** - Accession #108300

On July 15, 2001, this oryx was housed with a female herdmate, and both were fasted for a preshipping examination the next day (NZIP, Pathology Report, Accession #108300). Overnight, the oryx was gored in the left side several times by the herdmate (NZIP, Medical Record, Accession #108300). During anesthesia induction for transport to the veterinary hospital, the animal thrashed several times, a substantial amount of dirt lodged in its mouth. Attempts to clean the mouth of dirt were unsuccessful before intubation was necessary. The animal's wounds were cleaned, and drains were placed to promote wound drainage. The animal was maintained at the hospital on antibiotic therapy for 3 days. On July 19, 2001, the oryx had an increased respiratory rate and appeared depressed and unsteady when standing. She was anesthetized the next day for the drain removal. During anesthesia, xrays were taken and showed that the animal had pneumonia. The animal suffered cardiac arrest and died while under anesthesia (NZIP, Medical Record, Accession # 108300). The pathology report determined the cause of death to be cardiac arrest while under anesthesia complicated by aspiration pneumonia and glomerulonephritis (NZIP, Pathology Report, Accession #108300).

The medical records for May 10, 2000, to death were reviewed. Preventive vaccinations and husbandry care appear to have been adequate in the period reviewed. The zoo did not provide medical records prior to May 2000, and the specimen record (NZIP, Specimen Record, Accession #108300) reflects only one medical observation and no vaccinations from the time the animal was released from quarantine on arrival in fall 1988 until May 10, 2000. Therefore, the committee was unable to assess the veterinary care and preventive medicine provided the animal during this 12-year period. The pathology report indicated that the animal had been azotemic since May 2001; however, the medical record available to the committee contains no record of blood work or mention of this condition. In the committee's judgment, the aspiration of dirt during the sedation of the animal was not caused by failure of the veterinary staff to administer anesthesia properly; sedation of wild animals can be difficult even for well-trained and experienced veterinarians. However, the committee was unable to assess veterinary care before the incident because of recordkeeping deficiencies.

**Oryx Leucoryx** - Accession #109698

This animal was euthanized on July 24, 2001, after a 6-day history of lameness. The timeline of events for this animal is unclear in that the entries in the medical record contradict one another. Clinical notes entered in the medical record indicate that an examination was performed under anesthesia on July 16, 2001; that the animal developed an abnormal gait on July 19, 2001; and that it was found down and unable to get up on July 20, 2001, at which time steroids and the NSAID Ketofan were administered. However, the July 20, 2001 clinical entry contains a comment that the animal was anesthetized on July 15, 2001, displayed an abnormal gait on July 16, 2001, and was found down and unable to stand on July 17, 2001. The comment further states that steroid therapy was initiated for 36 hours but that the animal showed no improvement. No prescription for steroid therapy is entered into the medical record until July 20 (NZIP, Medical Record, Accession #109698). Further complicating the events, the Specimen Record indicates that the animal was anesthetized on July 16, 2001, was observed lame on July 17, 2001, and was unable to stand and had steroids and Ketofan administered on July 18, 2001 (NZIP, Specimen Record, Accession

#109698). Over the next 3 days, the animal was still unable to stand and because of its deteriorating condition was euthanized on July 24, 2001 (NZIP, Medical Record, Accession #109698).

The medical record contained no entries from December 1990 (5 months after birth) to May 2000 (14 months before death). However, the specimen record (which is compiled from input from the veterinary and nutritionist staff as well as input from the assistant curators regarding behavioral observations and husbandry procedures performed by keepers) documents that the animal was treated by veterinary staff in March and September 1991, but that no further interaction with the veterinary staff occurred until May 2000. The specimen record entries in March and September 1991 reveal deficiencies in the veterinary record and indicate to the committee that the specimen record does reflect the care provided to this animal.

In the committee's judgment, veterinary care provided the animal from 1992 to 2000 was unacceptable owing to the lack of veterinary observation or vaccination. However, the animal was appropriately euthanized, inasmuch as its condition was deteriorating because of the inability to rise. The cause of the animal's clinical symptoms is unknown to the committee because the pathology report provided by the zoo was incomplete and did not contain final diagnoses or a cause of death (NZIP, Medical Record, Accession #109698).

#### **Scimitar-horned Oryx** - Accession #110177

This animal was found dead on November 23, 2001, owing to multiple liver abscesses (NZIP, Pathology Report, Accession #110177). A slight lameness had been reported that resolved about 4 months before the animal was found dead. The animal was weighed at that time, and no weight loss was evident (NZIP, Medical Record, Accession #110177). The pathology report states the animal was in good nutritional condition (NZIP, Pathology Report, Accession #110177). It is the judgment of this committee that the veterinary care provided this animal was appropriate.

#### **Scimitar-horned Oryx** - Accession #110612

This female scimitar-horned oryx was known to be pregnant and approaching her delivery date. She separated from the herd on July 17, 1999, and was observed to be straining on July 20, 1999. When checked at 8:00 p.m. on July 20, the oryx was reported "up moving around, didn't appear to be in too much discomfort." Blood was observed on her rear legs. She was found dead the next morning (NZIP, Pathology Report, Accession #110612). The pathology report indicated that death was due to dystocia caused by a malpositioned large male fetus. Dystocia resulted in a uterine rupture and extensive hemorrhage "suggestive of a prolonged dystocia event" (NZIP, Pathology Report, Accession #110612).

In the committee's judgment, this animal, which is extinct in the wild and was part of an artificial-insemination project, should have been observed throughout the night or until a successful delivery had been achieved. However, the committee acknowledges that even with observation, this animal may not have survived. The veterinary and animal care staff at the zoo should have an established protocol for pregnant females as their delivery date approaches and the first stages of labor are observed.

#### **Przewalski's Horse** - Accession #110627

This animal was found dead on July 23, 2000, owing to a lightning strike (NZIP, Pathology Report, Accession #110627). The medical record was reviewed for May 1992 to death. In the committee's judgment, the veterinary care provided this animal was acceptable.

#### **Arabian Oryx** - Accession #111021

In February 2000, this animal was treated for a gore wound and was noted to have a poor body condition. Over the next 17 months, the animal continued to lose weight and developed chronic parasitism that was unresponsive to treatment. It eventually developed persistent high fibrinogen and low serum calcium (NZIP, Medical Record, Accession #111021). The animal was euthanized on July 16, 2001, because of deteriorating condition and poor quality of life (NZIP, Request for Specimen Euthanasia, Accession #111021). Necropsy revealed chronic renal failure and renal secondary hyperparathyroidism (NZIP, Pathology Report, Accession #111021).

It is the committee's judgment that the veterinary care provided this animal before euthanasia was acceptable. However, the medical record contains no entries from August 1996 until it was gored in February 2000. However, the specimen record (which is compiled from input from the veterinary and nutritionist staff as well as input from the assistant curators regarding behavioral observations and husbandry procedures performed by keepers) documents that a routine fecal check was performed in 1999. The specimen record entry in 1999 indicates to the committee that the specimen record does reflect the care provided to this animal.

In the committee's judgment, veterinary care provided the animal from 1992-2000 was unacceptable owing to the lack of veterinary observation or vaccination, but that failures in veterinary care did not contribute to this death. In addition, the euthanasia form was incomplete.

### SUMMARY

After evaluating the care provided 48 animals that died since 1999 at the Rock Creek Park or CRC facility, the committee concludes that in the majority of cases, the animals received appropriate care throughout their life at the National Zoo. In a minority of cases, the committee found evidence of apparent inadequate care or recordkeeping deficiencies. The recordkeeping deficiencies made it difficult to determine whether husbandry and veterinary procedures occurred but were not documented or whether the procedures were not performed. Due to this ambiguity, the committee could not definitively identify the factors that caused or contributed to an animal's death.

In reviewing the many publicized animal deaths at the Rock Creek Park facility, the committee found some instances of inadequate care; however, the committee's evaluation of randomly selected, unpublicized megavertebrate deaths at the Rock Creek Park facility revealed the animals were generally well cared for and their care was documented, suggesting that the publicized animal deaths were not indicative of a wider, undiscovered problem with animal care at the Rock Creek Park facility. At the CRC facility, few animal deaths reached the public's attention; however, the committee's evaluation of animal deaths revealed problems with veterinary recordkeeping and potential problems with the preventive medicine program on a scale that is similar to those previously documented at the Rock Creek Park facility.

In reviewing all of the failures identified in its review of recent animal deaths at the National Zoo, the committee identified a single organizational issue that created an environment where these events could occur. The lack of open communication and collaboration among keepers, curators, veterinarians, nutritionists, and senior management was evident in almost every case where inadequate animal care was evident. This deficiency is more obvious in some instances, such as the death of the Grevy's zebra at the Rock Creek Park facility, where the animal's diet was changed multiple times without the involvement of the nutritionist. However, even in the cases where failures occurred within a single department, such as the widespread failures of the veterinary staff to provide adequate preventive medical care to the animal collection, it is unclear why the keeper and curator staff did not object when animals in their care failed to receive the appropriate preventive medical care, and why senior management did not act to bring in temporary or permanent staff to address the staffing problems in the veterinary department that contributed to this problem. The committee observed that the individual departments of the zoo, even though they are all supporting the same animal collection, seldom worked collaboratively. This practice disrupts the system of checks and balances, allowing failures in animal care to occur repeatedly. Regular communication and collaboration on all aspects of animal management can mitigate human errors, which are bound to occur within any organization. Because multiple people are actively involved in the care of each animal, it is less likely that inadequate care will go unnoticed. Developing a team approach to animal care is particularly important at a facility like the National Zoo, whose animal collection as a whole is geriatric and requires additional consideration.

While effective collaboration and communication among keepers, curators, and veterinary nutrition staff is essential, it is important that the veterinary staff understand they have the ultimate responsibility for medical decisions regarding the animal collection. Senior management must ensure that the veterinary staff has the authority to ensure the provision of adequate veterinary care to both the exhibit and the research animals and to oversee the adequacy of other aspects of animal care and use, as required by the Animal Welfare Act (9CFR 2.33 and 2.40).

Considering the long-standing nature of the communication problems at the zoo and the protective mindset and defensive environment this situation has created, it will take time and much effort to reverse completely the closed and negative organizational culture that currently exists at the zoo. It is important that the activities and operations of the National Zoo remain open to the zoo community and the public through the publication of papers by zoo scientists, unannounced inspections by the US Department of Agriculture, and collaborative projects with other zoos, as this will provide an external pressure on the zoo to continue in the direction of positive change.

### FINDINGS AND RECOMMENDATIONS

#### *Findings:*

- *A scientific evaluation of the care provided 48 animals that died since 1999 at the Rock Creek Park or CRC facility reveals that in the majority of cases, the animals received appropriate care throughout*

*their life at the National Zoo. In a minority of cases, the committee found evidence of inadequate care or lapses in recordkeeping. The lapses in recordkeeping made it difficult to determine whether husbandry and veterinary procedures occurred but were not documented or whether the procedures were not performed.*

**Recommendations:**

- *The zoo must take immediate steps to clarify the actions, procedures, and observations that must be included in each type of record created by animal-care, veterinary, and nutrition staff.*
- *The apparent inadequate care caused by failures on the part of the veterinary, nutrition, and animal-care staff at the Rock Creek Park facility are being addressed by recent changes in policies and new initiatives by the zoo. The zoo should continue efforts to establish accountability for unprofessional actions that involved any level of staff.*
- *This evaluation of recent deaths at the CRC facility reveals widespread veterinary recordkeeping deficiencies, raising concerns about the adequacy of the preventive medicine program at the CRC. Senior management should evaluate whether the veterinary staff was adhering to the preventive medicine program from 1999 until recently and continue its current efforts to establish oversight and accountability for the veterinary staff at the CRC.*

## Evaluation of the Conservation and Research Center

The Conservation and Research Center (CRC) is a directorate, or program, of the Smithsonian's National Zoo; it has been a part of the zoo for almost 30 years. It has one of the world's most extensive and renowned programs in conservation-biology research. The CRC and its research programs distinguish the National Zoo from most other metropolitan zoos in the United States and provide the zoo with unique opportunities to participate in conservation, education, and training efforts. The campus of the CRC is a 3,200-acre facility in the foothills of the Blue Ridge Mountains in Front Royal, Virginia, about 65 miles west of the Rock Creek Park campus in northwest Washington, DC, a distance sufficient to make travel between the two campuses difficult and to require duplication of some resources and services.

### **Mission**

The mission of the CRC as described on the CRC Web site (<http://nationalzoo.si.edu/ConservationAndScience/CRC/>) is the conservation of biodiversity through scientific research, professional training, and education. Three primary goals are associated with the research: saving wild life, saving habitat, and restoring species to the wild. The CRC is heavily involved in promoting international training in conservation leadership through courses on site and, more recently, abroad. At least 2,700 people have taken these courses, and many of their graduates are implementing conservation programs abroad in isolated areas. CRC scientists and educators make up a major component of the zoo's educational and outreach programs and have a major role in developing exhibits at the Rock Creek Park campus (personal communication, Lynn Dolnick, May 14, 2004).

### **Facilities**

About 700 of the 3,200 acres at the CRC facility is enclosed, requiring 300 miles of fencing whose integrity must be maintained to protect the collection, particularly from dogs and white-tailed deer (which pose a threat of parasitic diseases to exotic ungulates). Although many of the buildings—including the convention center, dormitories, staff housing, main offices, laboratories, and some animal enclosures—are concentrated close to the main entrance to the site, some of the animal quarters and barns, including the ones for the Przewalski's horses and the Grevy's zebra (which died in January 2000), are on hilly terrain far from the administrative center of the campus. There are 20 miles of gravel roads and jeep trails on the property to serve outlying facilities and research sites. Although many of the structures on the site are old, they are well maintained and functional.

### **Staff**

The CRC program has a total of about 90 scientific, animal-caretaker, administrative, and maintenance staff, of whom about two-thirds are assigned to the Front Royal site, and the remainder to the Rock Creek Park site.



In addition to the regular scientific staff, about 35 postdoctoral, predoctoral, and visiting scientists are employed on “soft” money, mainly derived from federal grants, foundations and other non-Smithsonian sources.

There is an acting associate director for science, and CRC is seeking a permanent associate director. The Animal Support Department of CRC consists of a Veterinary Division, an Animal Division focused entirely on mammals, and a Bird Unit. There are two research departments: the Department of Reproductive Sciences and the Department of Conservation Biology.

### **Science Programs**

The science programs associated with CRC are focused on the conservation and management of wild animal populations. A species-recovery program is dedicated to preventing extinctions and aimed at reintroducing species to the wild and more general research on a variety of other endangered species. Among the mammalian species studied at the Front Royal campus are the maned wolf, the black-footed ferret, and the Eld’s deer. CRC has an extensive and highly respected program in reproductive physiology, with an emphasis on reproduction of cats (especially cheetahs), elephants, and pandas. It also has a repository of frozen gametes, embryos, and tissues aimed at preserving genetic diversity. The ecology research emphasizes the processes that govern the distribution and abundance of wild populations, including migratory birds. Except where they were relevant to animal-care and management problems, the committee was not asked to evaluate the science programs at the zoo, which have received highly favorable evaluations in two recent reports, one external (NRC, 2003) and one internal (Smithsonian Institution, 2003a). Recently, CRC scientists have been directed to focus their Smithsonian-funded research more closely on the mission of CRC (personal communication, David Evans, November 2003; personal communications, CRC scientists, October 2003; NZP, Strategic Plan, May 2004).

### **Budget**

In 2001 and 2002, the total CRC budget exceeded \$10 million. Of that, about \$2.5 million came from external grants and \$0.5 million from grants from the Smithsonian Institution and Friends of the National Zoo. Administrative (about \$0.460 million), facilities (\$1.7 million), collection (about \$1.2 million), and research (\$3.8 million) expenditures, largely from Smithsonian—hence, federal sources, accounted for the remainder of the budget. From 1992 to 2002, when most other federal research agencies showed substantial budget growth, the zoo experienced a steady erosion of base support for research and a loss of 5% of its scientists (Smithsonian Institution, 2003a).

### **Animal Collection**

As of January 2003, the collection had 97 mammals of nine species, most of them endangered (NZP, Status of Mammalia Inventory, December 2003). A few “surrogate species” are kept as models of their rarer counterparts. At the same time, 172 birds of 11 species, again mostly endangered, were kept on the site (NZP, Status of Aves Inventory, December 2003). Those numbers have declined over the last decade, most probably for strategic reasons related to focusing of the research effort on a smaller number of species (personal communication, Linwood Williamson, November 2003). However, the Front Royal facility can also serve as a holding site, usually temporary, for animals not wanted at the Rock Creek Park exhibits or at other zoos.

## **CURRENT STATE OF CRC**

The committee’s evaluation of the CRC facility was conducted by assessing the same aspects of animal management and welfare that were assessed at the Rock Creek Park facility, as detailed in the interim report, including: animal care and management, animal welfare, animal nutrition, recordkeeping, and pest control.

### **Animal Care and Management**

A head veterinarian and a veterinary technician provide primary veterinary care at CRC (NZP, -CRC written response on 4/12/04 to NRC committee members’ queries). The CRC research veterinarian or a Rock Creek Park

veterinarian detailed temporarily to CRC provides care in the absence of the head veterinarian. Animal keepers assist the veterinarian and technician in medical treatment and clinical procedures and are responsible for the husbandry and care of animals being held for treatment or quarantine. In weekly meetings, the veterinary, curator, and keeper staffs discuss the husbandry and care of animals in the collection at the CRC facility (NZIP, Response to the NAS committee on requested items, April 12, 2004). The pathology needs of CRC are performed at the Rock Creek Park facility.

Preventive medicine is the responsibility of the CRC head veterinarian. The updated 2004 preventive-medicine protocols (NZIP, CRC Preventive Medicine Protocol, 2004) are detailed for all the taxa maintained at the facility and generally are in accordance with published guidelines (AZA, 2003c; AAZV, 1999). However, there are differences in the preventive-medicine protocols between the Rock Creek Park facility and the CRC facility. For example, kangaroos at the Rock Creek Park facility receive annual rabies and tetanus vaccinations, but the kangaroos at the CRC facility do not receive any vaccinations; all birds at the Rock Creek Park facility receive an annual vaccination against West Nile virus, and waterfowl also receive an annual botulism vaccination, but birds at the CRC facility do not receive any vaccinations. It is important that the preventive-medicine protocols at the CRC and Rock Creek Park facilities be developed in coordination or that quarantine practices for transferred animals be established, as animals (such as tree kangaroos) are transferred between the two facilities. The transfer of animals between the two facilities without regard for potential infectious disease risks places both collections in jeopardy.

To assess the quality of animal care at CRC, the committee evaluated a random sample of 16 medical records, representing about 5% of the collection, to determine whether they were complete (Table 5-1), that is, continuous from the birth or receipt of the animal until its death or shipment to another facility, and to assess whether preventive medicine had been performed regularly and according to the available CRC protocols (Table 5-2).

**Table 5-1.** Animals in the CRC collection for which medical records were incomplete

<b>Animal</b>	<b>Accession Number</b>	<b>Lapse in Medical Records</b>
Przewalski horse	105408	Medical records for 1994 and 1997 missing
Tufted deer	113295	Medical records for 1999 missing
Tree kangaroo	110930	Medical records for March 1999-July 2002 missing; animal was transferred from CRC to Rock Creek Park in March 1999 and transferred back to CRC in July 2002
Przewalski horse	108778	Medical records for 1994 and 1997 missing
Micronesian kingfisher	212388	Medical records for 1993-1997 missing
Scimitar horned oryx	113204	Medical records for 1998 missing

In general, the clinical notes on the mammals (horses, deer, oryx, wolf, and black-footed ferrets) were sufficiently informative and detailed to provide a clear picture of the veterinary care provided each specimen. The major weakness was the lack of continuity in some of the records, which appears to be because two electronic medical-records systems (one of which was the Medical Animal Records Keeping System, or MedARKS, used at the Rock Creek Park facility and discussed extensively in the interim report) and a paper system existed at CRC during the same period. For example, for the Przewalski horse (NZIP, Medical Record, Accession #108778), the medical entries for 1989–1993 appear in one medical-record system, medical entries for 1995 and 1996 appear in MedARKS, medical entries for the years 1998–1999 appear in the first system, and medical entries for 2000 and later appear in MedARKS. In general, the records could be pieced together without problem, but in at least six cases (Table 5-1) some records are presumed to be missing, although in the case of the tree kangaroo (NZIP, Medical Record, Accession #110930) the gap in the records occurred when the animal was transferred to the Rock Creek Park facility for 2 years. A similar problem with lapses in the medical records was also apparent in the committee’s review of medical records for recent animal deaths at the CRC (see Chapter 4). In some cases, the medical record lacks any entries for up to 12 years. An alternative explanation of the absence of records is that no veterinary care was provided to the animals during the times for which records are missing. One other minor point is the entry of dates by the veterinarians. There are inconsistencies in use of the American style and the British style. Usually, interpretation is trivial when the records are continuous, but the different practices can cause confusion. For example, is “06/10/99” the sixth of October or the 10th of June?

The records for the birds in the CRC collection are rather less detailed, but there was adequate adherence to written protocols. The biggest weakness with the medical record keeping for birds is lack of documentation on the disposition of the animals. It is sometimes unclear whether a bird was shipped out or died. Outcomes should be entered properly into the records.

**Table 5-2.** Apparent Inadequate Preventive Medical Care at CRC in 1998-2003<sup>a</sup>.

	<b>AAZV/AZA Vaccination and Testing Guidelines<sup>b</sup></b>	<b>National Zoo Preventive Medicine Program<sup>c</sup></b>	<b>Apparent Inadequate Preventive Medical Care at the CRC<sup>d</sup></b>
<b>Deer, oryx</b>	Rabies and tetanus vaccination as warranted	Rabies and tetanus vaccination annually	<p><b>Accession #113204 Scimitar horned oryx</b> Failed to receive rabies and tetanus vaccination in 1998 and 2001</p> <p><b>Accession #113295 - Western tufted deer</b> Failed to receive rabies vaccination in 1998, failed to receive rabies and tetanus vaccination in 1999, 2001, 2003</p> <p><b>Accession #113603 – Bermese brow-antlered deer</b> Failed to receive rabies and tetanus vaccination in 2001</p>

<sup>a</sup>This table presents vaccination and infectious disease test schedules as recommended by the American Association of Zoo Veterinarians (AAZV, 1999) and the American Zoo and Aquarium Association (AZA, 2003c), and as outlined in CRC’s written preventive-medicine program (2004). Table includes information on most routinely administered vaccinations and is not inclusive of all requirements of preventive medicine program.

<sup>b</sup>AAZV, 1999; AZA, 2003c.

<sup>c</sup>Adapted from CRC preventive medicine protocol, 2004.

<sup>d</sup>A random sample of 16 animal records were examined for adherence to CRC’s preventive medicine program (2004).

In reviewing the medical records of 16 animals in the CRC collection, the committee found apparent inadequate preventive medical care in three cases. It is possible that veterinary decisions were made not to vaccinate

some animals on the basis of their medical status; however, if those decisions were made, they were not documented in the medical records, as should have been done. Although these incidents of apparent inadequate care were not nearly as widespread as the preventive medicine lapses documented for the Rock Creek Park animal collection in the interim report, they are still unacceptable. Senior management has established completion of scheduled preventive-medicine procedures as a monthly performance measure for the department (NAS Action Plan Performance, July 2004). From May through July 2004, the CRC veterinary-services department has achieved 100% completion of its scheduled preventive-medicine procedures.

The committee also reviewed the medical records (NZIP, Medical Record, Accession #110719), curatorial record (NZIP, Curatorial Daily Report from Hoofstock, November 1999-January 2000), pathology report (NZIP, Pathology Report, Accession #110719), Specimen Record (NZIP, Specimen Record, Accession #110719), and internal memos (NZIP, memo to CRC Union Steward, May 25, 2000; NZP, memo to CRC keeper, March 29, 2000a; NZP, memo to CRC keeper, March 29, 2000b; NZP, memo to Deputy Director, December 7, 2000; NZP, memo to CRC keeper, February 9, 2001) associated with the Grevy's zebra that died in January 2000 at the CRC facility (keeper records for this animal were unavailable; see the recordkeeping section later in this chapter for further discussion). On the basis of those records and interviews with the staff at CRC, it is clear that several errors on the part of the keepers resulted in this animal's death. The failures of the keepers to provide hay ad libitum in accordance with established procedure, to post the animal's diet, to report problems with heat lamps, and to heavily bed and lock it in its stall (NZP, memo to CRC Union Steward, May 25, 2000; NZP, memo to CRC keeper, March 29, 2000a; memo to CRC keeper, March 29, 2000b; NZP, memo to Deputy Director, December 7, 2000; NZP, memo to CRC keeper, February 9, 2001) contributed to the death of the animal from inanition and hypothermia (NZP, Pathology Report, Accession #110719).

Although failures in veterinary care did not contribute to the death of the zebra, the committee's examination of the medical record raises concern as to whether the animal received adequate attention from the veterinary staff at CRC. This animal, which was born in 1989, arrived at the Rock Creek Park facility from the St. Louis Zoo in July 1992. During its stay at the Rock Creek Park facility, it had a history of chronic recurring laminitis and lameness that required repeated prednisone and diuretic treatment. While there, it was vaccinated on a regular schedule for rabies, tetanus, and encephalitis. The final clinical entry in the medical record before the animal was transferred to CRC (November 20, 1997 clinical note) was, "Annual hooftrim and dental should be adequate" (NZP, Medical Record, Accession #110719).

Following the animal's transfer to CRC, a series of clinical notes were placed into the medical record from January 30, 1998, to February 21, 1998, to treat the animal with a steroid and a diuretic for lameness and leg edema. Other than parasite screens in 1999, there were no further medical entries for this animal until a notation on January 22, 2000, that the animal was found dead in its stall. There is no evidence in the medical record that the animal received annual vaccinations, hooftrims, or dental examinations. A complicating matter is that at the time of the animal's death, its medical record was being simultaneously maintained in three record systems: an electronic medical-records database (1992-1994 and 1999), MedARKS (1995-1997, and 1999, and 2000), and a paper medical record (1998 and 2000). The zoo moved from an electronic medical-records database to MedARKS in 1995; this explains why the record was maintained in the electronic system from 1992 to 1994 and then in MedARKS from 1995 to 1997. It is unclear why CRC veterinary staff would choose to maintain this animal's medical record from 1998 through 2000 in three systems and in particular would record almost all this animal's medical record on paper rather than using one of the two electronic systems. After the animal's death, the MedARKS record was updated by the addition of the clinical notes from January and February 1998, as evidenced by the differences in the MedARKS record between a printing on March 30, 2000, and on June 23, 2003.

## Findings and Recommendations

### *Findings:*

- *The preventive medicine program currently in place for the animal collection at CRC is appropriate.*
- *In a random review of medical records from the CRC, as well as the review of recent animal deaths at the CRC, there was evidence that veterinary staff at the CRC have not been adhering to a preventive-medicine program. However, recently established performance measures indicate that since May 2004, the CRC veterinary program has been completing 100% of the monthly, scheduled preventive-medicine procedures.*

- *There are significant differences in the preventive- medicine protocols at the CRC and Rock Creek Park facilities.*

**Recommendations:**

- *Senior management should continue to track completion of monthly scheduled preventive-medicine procedures at the CRC facility.*
- *The CRC and Rock Creek Park veterinary departments should collaborate to coordinate their preventive-medicine protocols, as animals are transferred between the two facilities.*

**Animal Welfare**

The zoo has two institutional animal care and use committees (IACUCs): one at Rock Creek Park and the other at Front Royal. The Animal Welfare Act and Public Health Service Policy on the Humane Care and Use of Laboratory Animals are federal laws that mandate the IACUC at the CRC ensure adherence to federal standards of care for research animals. The Animal Welfare Act also mandates standards for exhibit animals and states that adherence to the standards for exhibitors is the responsibility of the exhibitor organization, although the formation of an IACUC to oversee the welfare of exhibit animals is not required. In addition, the roles of the National Zoo IACUCs, the USDA, and the Smithsonian for overseeing the care and use of animal on exhibit or used for breeding were not clearly defined. However, as detailed below, certain responsibilities for ensuring the welfare of exhibit animals was delegated to the IACUCs.

Since the 1970s, the zoo had a committee located at the CRC to review research proposals using animals at the zoo (Smithsonian Institution, Foss memo, August 17, 1993). In response to federal legislation, this research review committee became the CRC IACUC in 1994 (NZIP, Derrickson memo, June 20, 1994). In 1985, an Animal Welfare Committee located at the Rock Creek Park facility was established to address concerns with animals housed at the Rock Creek Park facility (NZIP, Marcellini memo, November 16, 1994). In 1994, it appears this Animal Welfare Committee became the Rock Creek Park IACUC.

From documentation provided the committee, it is apparent that the two IACUCs understanding of their mandates was very different. A memorandum from the zoo director in 1993 indicates that the Rock Creek Park IACUC's (then known as the NZIP Animal Welfare Committee) mandate was "to review all [research] proposals" (NZIP, Robinson memo, April 13, 1993). A memorandum from the chair of the IACUC to IACUC members indicates the chair's view that the IACUC was subject to the Animal Welfare Act and PHS Policy and that the IACUC "reviews all proposed research to be done at the zoo," "tries to inspect all zoo animal facilities at least twice a year," and "investigation of welfare concerns" (NZIP, Marcellini memo, November 16, 1994). This documentation also suggests that at least some members of the IACUC considered the IACUC responsible for "ensuring that animal welfare standards are followed in husbandry, exhibition and research . . ." (NZIP, Anonymous memo to Marcellini, October 27, 1994). The available documentation from the mid 1990s suggests that the Rock Creek Park IACUC generally was complying with their stated mandate, though the Smithsonian Institution failed to submitted annual reports to the USDA and OLAW to document compliance. However, as documented in the interim report, since the late 1990s, the Rock Creek Park IACUC has not consistently fulfilled its responsibilities as required by PHS Policy IV.E. regarding recordkeeping, and failed to document its delegated oversight (NZIP, Marcellini memo, November 16, 1994) of the welfare of exhibit animals and research animals not covered by PHS Policy or the AWA.

The only documentation available regarding the mandate of the CRC IACUC indicates that it was responsible for review of research protocols in accordance with PHS Policy (NZIP, Derrickson memo, June 20, 1994). However, the CRC IACUC also did not consistently fulfill the recordkeeping requirements mandated by PHS Policy IV.E.; it also failed to perform semiannual program evaluations and inspections of facilities from 2000 to 2002 (Smithsonian Institution, Evans letter to Potkay, March 31, 2004).

The Smithsonian Institution, as the institution on record with the Public Health Service and USDA, is legally responsible for ensuring compliance with PHS Policy (PHS Policy II) and the AWA (9 CFR Part 1.1), as applicable, and was responsible for submitting annual reports to OLAW (PHS Policy IV.F) and to the USDA in connection with the use of live animals in research, tests, experiments, or for teaching (9 CFR Section 2.36). If these reports had been prepared annually, the committee considers it likely that the designated Institutional Official at the Smithsonian would have recognized that the zoo's IACUCs were not consistently fulfilling their

responsibilities as detailed in the applicable provisions of the PHS Policy and the Animal Welfare Act. Since the release of the interim report, internal Smithsonian memoranda were submitted to the committee, which reflect recognition by certain staff members that “the Smithsonian Institution is subject to the Animal Welfare Act for all research involving vertebrate animals and is subject to the Public Health Service Policies for PHS-funded research” (Smithsonian Institution, Steiner memo; July 23, 1993). Another memorandum from 1993 documents that “the Smithsonian is not exempt from the [Animal Welfare] Act” and the belief by certain Zoo staff members at the time that “the Smithsonian is currently not in full compliance with those requirements” (Smithsonian Institution, Foss memo, August 17, 1993). The memo recommends specific actions to ensure compliance; however, the records made available to the committee did not indicate that any of these recommended actions were implemented.

The revamped IACUC programs are outlined in the zoo’s General Memorandum 15 (NZIP, Best Practices Manual, August 8, 2003; September, 2003) clearly defines the responsibilities of each IACUC as:

- Inspecting all animal areas and supporting facilities twice a year and submitting inspection reports;
- Investigating and resolving concerns and complaints brought to their attention;
- Reviewing proposals for research
- Recommending to the zoo director changes to NZIP practices and procedures to correct deficiencies;
- Recommending to the zoo director the suspension of any activity not being conducted in a manner consistent with current policy and procedures.

The revised General Memorandum, the submission of an assurance to the National Institutes of Health by the Smithsonian Institution, recent documented semiannual inspections (Smithsonian Institution, Evans letter to Potkay, March 31, 2004), and efforts to provide the appropriate training to IACUC members (NZIP, Roberts memo, April 27, 2004; NZIP response to the NAS committee on requested items, May 5, 2004), are all indicators that matters are improving and that conditions are more favorable for ensuring the welfare of the animals.

## Findings and Recommendations

### *Findings:*

- *The CRC IACUC failed to adhere to policies meant to ensure animal welfare at CRC, such as conducting semiannual inspections and performing an investigation into the death of a Grevy’s zebra in 2000.*
- *The CRC IACUC has reorganized to clarify its role and responsibilities and to improve compliance with federal statutes. In addition, plans have been made to provide training for all IACUC members.*

### *Recommendation:*

- *The Smithsonian and the zoo should ensure that the CRC IACUC is fulfilling its stated responsibilities in a timely and complete manner. Those responsibilities extend to the entire collection and not only to the animals involved in research.*

## Animal Nutrition

At CRC, the curator, veterinarian, and nutritionist formulate diets. For many species that are managed cooperatively under the AZA Species Survival Plan (SSP), CRC had adopted dietary formulations recommended by the SSP management group. The committee was given an extensive list of feeding guidelines for all the specimens at the CRC facility, including hoofstock (Attachment 3, Academies requested information submitted April 16, 2004). The general guides for the ruminants (sable antelope, Eld’s deer, Pere David’s deer, scimitar oryx, Arabian oryx,

Chinese tufted deer, and kudu) and the nonruminant herbivore (Przewalski's horse) seem reasonable on the basis of comparisons with feed intakes suggested for maintenance of cattle (NRC, 1989a) and horses (NRC, 1989b). Amounts of pellets and hay to offer are calculated as a percentage of body weight. It is essential that the body condition of all animals be monitored closely to evaluate the feeding program. Monthly body weights would be very useful, but if they are not practical, body-condition scores should be used. Environmental conditions influence energy needs. In herd feeding situations, timid animals may not get their share of the feed. It remains unclear how similar the revised protocols are to those used earlier.

CRC has a standard procedure for altering diets. Diet changes may be proposed by keepers, curators, the veterinary staff, or the zoo nutritionist with a diet-change request form. The zoo nutritionist, CRC head veterinarian, and curator must approve a change before the diet is altered. Approved paper request records are filed. The only exceptions to this approval procedure are temporary diet modification related to current medical care (recommended by the head veterinarian and approved by the curator) and changes in SSP-recommended diets in response to specimen weight change in the case of black-footed ferrets. In cases of experimental alteration of diets, as in the case of cystinuria in maned wolves, the experimental diets and procedures must be reviewed and approved by the IACUC, the zoo nutritionist, the CRC veterinarian, and the responsible curator. Diet-formulation records are maintained on food cards or boards in food-preparation areas or in hoofstock barns. Those records, keepers' daily logs, and ARKS specimen records are updated when diets are changed.

The Rock Creek Park facility commissary is responsible for acquisition of all routine and specialty food items for approved diets for the CRC collection except for hay (alfalfa, timothy, and orchard grass), bamboo, and suckling laboratory mice, which are raised at CRC. The bird and mammal units place weekly orders with the commissary, and the orders are delivered by the Rock Creek Park commissary truck on the following Thursday morning.

CRC has centralized storage for hay, bamboo, and commercially prepared feeds, and it has large walk-in freezers and coolers for storage or perishable bulk foods. Short-term storage of hay, bamboo, and pelleted diets is in the hoofstock barns and bird yards. Live suckling mice are collected daily from the breeding colony and are either fed immediately or euthanized and then frozen. Fruits and vegetables are transported from the freezers or coolers to smaller kitchens in the animal-collection buildings for immediate feeding or for short-term storage.

Hay crops previously were raised and harvested by CRC personnel; however, this led to the crops being sprayed, fertilized, and harvested at suboptimal times because of staffing constraints, negatively affecting the quality of the hay. Starting in the summer of 2004, contractors have taken over responsibility for the hay crops. The contractors can work 7 days per week and more than 8 hours per day, so hay spraying, fertilizing, and harvesting can be accomplished at optimal times, avoiding hay-quality problems of the past. Hay use at both the Rock Creek Park and CRC facilities will be monitored by the CRC assistant director and the zoo nutritionist. Soil analysis, fertilization, and reseeded will be the responsibility of the Office of Facilities Engineering and Operations manager. Harvested hay will be sampled by the CRC mammal curator and nutritional analysis done by the zoo nutritionist. There are also problems with inadequate storage facilities to maintain hay quality. The Office of Facilities Engineering and Operations (OFEO) and zoo staff are investigating alternatives. Specific hay-production protocols will be developed before cutting in 2004.

Among the circumstances associated with the death of the Grevy's zebra, one in particular was related to the nutrition program. The zebra was not provided with *ad libitum* hay during a cold part of the year, and the appropriate protocol was not posted at the zebra's barn. Accordingly, the information was not available to others who had occasional responsibility for the animal.

## Findings and Recommendations

### *Findings:*

- *In general, the nutrition program at CRC appears to have been under appropriate control, and the feeding guidelines for all species at the CRC facility are appropriate.*
- *The CRC has hired contractors to raise and harvest hay at the CRC, to avoid previous problems with hay quality. However, available storage facilities are inadequate for maintaining hay quality.*

**Recommendation:**

- *Adequate storage facilities for hay, on which the entire NZP depends, must be found, and quality control for the hay must be assured.*

**Recordkeeping**

As with the Rock Creek Park facility, CRC uses MedARKS. The CRC MedARKS records are backed up on the local server and copied onto CDs that are stored offsite by the veterinary technician. Paper records that back up the electronic MedARKS records are now stored in fireproof file cabinets in the CRC veterinary hospital as a result of a recent US Department of Agriculture Animal and Plant Health Inspection Service inspection. The Rock Creek Park facility and the CRC facility MedARKS systems are not integrated but are expected to become so when the Zoological Information Management System is adopted. Unless animals are transferred between the Rock Creek Park facility and CRC, medical records are not shared. CRC pathology records, however, are integrated into the Department of Pathology database.

As documented in Chapter 4 and Appendix B, there are numerous examples of failures to keep adequate medical records at the CRC veterinary hospital. It is unclear why those failures in documented medical observations, procedures, and vaccination occurred, but it is clear that some veterinarians were using handwritten records, some were using an electronic record system, and some were using MedARKS.

Keepers record daily events in their logs in accordance with the zoo's *Best Practices Manual* (NZP, Best Practice Manual, July 2003). Before 2001, keepers kept daily written records; these were maintained by the curator for a year and then returned to the keepers and apparently disposed of. However, in response to the death of the Grevy's zebra housed at CRC in 2000, an electronic keeper-record system was implemented for mammal keepers at CRC (NZP, Tanner memo, November 10, 2003). Individual keepers in the mammal unit keep standard electronic records daily in accordance with the format issued by their supervisor. The electronic records are sent to the unit and the subunit (small-mammal or hoofstock) co-workers and keeper leader. The individual reports are consolidated into a unit report and forwarded electronically to the mammal supervisor, the curator (the unit's record keeper, the veterinarian and veterinary technician, and research staff members who request them. The individual daily reports and unit reports are reviewed by the curator, corrected or amended if necessary, and then archived on the curator's computer and on the CRC server. The records are accessible to the zoo registrar through shared folder access. The recordkeeper uses information in the reports to update specimen records in the International Species Information System ARKS database, which is maintained on the recordkeeper's computer and backed up on CDs that are maintained offsite. Backup paper copies are filed in fireproof file cabinets on site. This system appears to capture essential information and facilitates timely information flow to supervisors and others who need to know what changes are occurring for individual animals and in the unit as a whole.

The bird unit uses an entirely different record system. Keepers enter their daily reports of activities and pertinent specimen information in writing in ink on consecutive pages of hardbound notebooks maintained in the office. Additional sheets involving large numbers of birds may be stapled onto the notebook sheets. Logbook entries are photocopied at the end of each workday and sent to the curator, who reviews them on the following morning, making corrections or additions in ink that are initialed. Pertinent information determined by the curator and the zoo registrar is entered weekly in the ISIS database from the logbooks by the recordkeeper. ISIS ARKS specimen records are maintained on the recordkeeper's computer, the CRC server, and on backup CDs stored off site by the recordkeeper. Paper copies of ARKS specimen records, inventory reports, and auxiliary information records are kept in fireproof file cabinets. It is unclear why the bird unit did not change to the electronic keeper-record system in parallel with the mammal unit, especially given the small numbers of animals and care staff at CRC.

Nutritional records are kept manually on food cards or boards, and changes are noted in keepers' logs. That system appears to work well, given the relatively small numbers of animals being fed. The current nutritional-record system, although functional, will undergo a radical change when it becomes electronic. Integration with the Rock Creek Park system should facilitate ordering, shipment, and storage of feed and bedding materials.



## Findings and Recommendations

### *Finding:*

- *Numerous incidents of inadequate medical recordkeeping were evident in reviews of medical records at the CRC facility.*

### *Recommendations:*

- *Immediate steps must be taken to clarify to the CRC veterinary staff the actions, procedures, and observations that must be included in the medical record, and senior management must ensure compliance with these policies.*
- *The CRC should transition to new recordkeeping systems in parallel with the Rock Creek Park facility.*

## Pest Control

The zoo pest-control officer is responsible for pest control at both the Rock Creek Park facility and CRC under the supervision of the head of the Pathology Department of the zoo but with the head veterinarian having local responsibility. The same protocols are used for rodent control at CRC as at the Rock Creek Park facility (NZIP, NZIP-CRC Rodent Control Protocol, April 16, 2004). CRC has relatively few reported pest problems. Keepers are responsible for monitoring their assigned areas for problems and reporting evidence of pest problems to the head veterinarian. They are then given the responsibility of deploying bait, assessing its effects, and reporting outcomes to the head veterinarian. Contracept, an anticoagulant poison, is used in the small-mammal and wolf buildings because its effects are reversible. Bird areas use Quintox rat and mouse bait. Control for raccoons and white-tailed deer is undertaken according to protocols approved by the Virginia Department of Game and Inland Fisheries. Protocols for pesticides are under review. Completion of review and updating of pest-control protocols is expected in 2004. The pest-control officer will obtain a Virginia pest-control license.

## Findings and Recommendations

### *Finding:*

- *The pest-control operation at the CRC facility has not experienced any difficulties. The unified system controlled by the new pest-control officer should minimize future problems for the facility.*

## 6

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# Occupational Health and Safety Programs

Organizations are obliged to provide a healthy and safe environment for their workforce and, when public facilities are involved, for visitors. There are many valid ways for an institution to fulfill its commitment to provide a healthy and safe environment. However, the key elements required for developing and sustaining an effective occupational health and safety (OHS) program are a clear directive and consistent guidance from senior staff (NRC, 1997). And a truly successful program depends ultimately on the participation of all employees whose work might affect OHS and visitor safety.

### REQUIREMENTS FOR OCCUPATIONAL HEALTH AND SAFETY

The benefits of an effective worker safety and health program are clear. In general, effective management of such programs have been shown (OSHA, 1989):

- To reduce the extent and severity of work-related illness and injury.
- To improve employee morale and productivity.
- To reduce worker-compensation costs.

That is particularly true in the unique setting of a zoo environment. The risks posed by the absence of a comprehensive and effective health and safety program are unacceptable.

Evaluations of effective organizations find that exemplary workplaces have common characteristics and similar approaches to OHS programs, including the use of organized and systematic methods (OSHA, 1989):

- To assign responsibility to managers, supervisors, and employees.
- To inspect regularly for and control hazards.
- To orient and train all employees to eliminate or avoid hazards.
- To identify, evaluate, prevent, and control hazards.
- To go beyond specific legal requirements.
- To include a written program describing responsibilities.

Consistency is essential to the success of an OHS program, including rules, enforcement, and application to all workers. A lack of consistency can undermine a program. For instance, if higher-level personnel do not adhere to

rules, it sets a bad example. Rules that are too rigid, misunderstood, or considered unreasonable by employees can undermine the credibility of a program (NRC, 1997). Developing programs and policies and then subsequently failing to implement them only fosters cynicism among employees and results in poor adherence to health and safety policies.

It is important for management to articulate a clear worksite safety and health policy that:

- Establishes and communicates clear goals for the OHS.
- Provides visible top-management involvement in implementing the program.
- Encourages employee involvement in inspection, hazard analysis, work rules, training, and accident investigation.
- Provides adequate authority and resources to responsible parties.
- Holds managers, supervisors, and other employees accountable.
- Includes periodic program reviews.

The following is a brief review of the program elements that must be encompassed in an OHS program at a major zoo (AIHA, 1997; NRC, 1997; OSHA, 1989). It is important to recognize that resources and expertise, in addition to management and employee commitment, are necessary to accomplish these elements.

The first element is *worksite analysis*, which focuses on identifying hazards and anticipating conditions and operations that may lead to harmful occurrences (AIHA, 1997; OSHA, 1989). This process includes

- Comprehensive baseline and periodic safety and health surveys.
- Analysis of planned and new facilities, processes, materials, and equipment.
- Routine job-hazard analyses and site safety and health inspections.
- Employee notification of management about safety and health concerns without fear of reprisal, and receive timely and appropriate responses to such notifications.
- Investigation of all accidents and near accidents.
- Analysis of injury and illness trends (recordkeeping).

The second element, hazard prevention and control, includes establishing procedures for the correction and control of hazards by using the hierarchy or control principle (for example, elimination of hazards and engineering controls as a first consideration) and determining the proper use of personal protective equipment. This element also encompasses maintenance, planning and preparing for emergencies, and establishment of an occupational medical program.

The third element is safety and health training. Employees must understand the hazards that they will be exposed to and how to prevent harm to themselves. They must also be made aware of what to do in an emergency and how to deal with a potentially harmful exposure. Training should include the responsibilities of all personnel (hourly and salaried), and it is usually most effective if incorporated into other training. It is important for managers to understand their responsibilities and that there is accountability among supervisory staff for carrying out safety and health responsibilities.

The occupational health part of a zoo's OHS program has three purposes:

- To protect the health of employees and the public.
- To protect the health of the animal collection.
- To comply with legal and ethical institutional standards.

A number of potentially occupational zoonoses occur in a zoo setting. It is crucial that zoo employees be aware of those risks, know how to protect themselves and to recognize when an exposure has occurred, and have

rapid access to a knowledgeable infectious-disease physician. In a zoo setting, the primary concerns are animal bites and scratches, with injuries associated with cages or other objects, and the resulting risks of such infections as cercopithecine herpesvirus 1 (B-virus) from macaques, Q-fever, toxoplasmosis, tetanus, and rabies. Contact with venomous animals might require emergency access to antivenin. Medical surveillance, serum banking (not currently recommended as a standard component of an OHS program; NRC, 1997), immunizations, worker compensation, hearing conservation, and physical examinations (for example, for respiratory protection programs) are other subjects that should be addressed by a zoo's occupational health program.

A zoo's OHS program must also deal with animal-escape and animal-restraint issues, including policies, procedures, and exercises; therefore, OHS department personnel are often members of a facility's institutional animal care and use committee.

Visitor safety is an issue that involves the NZP Police Department to a large degree and must be considered and evaluated during all facility modifications and exhibit changes.

## CURRENT STATE OF OCCUPATIONAL HEALTH AND SAFETY AT THE NATIONAL ZOO

### Safety Program

The zoo safety program is administered by a safety officer and two safety committees that are responsible for safety support of about 450 employees (both the National Zoo and Friends of the National Zoo), the Center for Research and Conservation, and the public (personal communication, J. Hilton, August 28, 2003). The safety committees (one at the Rock Creek Park facility and one at the Front Royal facility) assist the safety officer in coordinating and administering the safety program. The current safety manager appears to be well qualified and knowledgeable regarding Smithsonian policies and procedures, OHS standards, and the principles of managing safety and health programs. He seems to have achieved credibility with employees and management. However, he is not supported by an administrative staff or safety technician.

Organizationally, the safety department appears to be positioned appropriately within the management structure as the safety officer reports to the assistant zoo director and attends weekly senior management staff meetings held by the zoo's director. The Smithsonian Office of Environmental Safety and Health provides audit and oversight functions for the zoo's safety program through periodic inspections of the zoo's safety program and procedures. Given appropriate resources and senior management follow through to incorporate training on OHS into a comprehensive training program for animal care staff there is reason for optimism that a comprehensive and effective OHS program will be attained at the zoo.

Before the red panda deaths on January 11, 2003, responsibility for pest-control contracts and plans rested with the safety officer, who reported to the facilities department. After the deaths, responsibility for pest control was reassigned to the Department of Pathology. The safety officer currently is responsible for the administration of the safety programs at Rock Creek and Front Royal, safety training, and investigation of accidents. The members of the safety committees are responsible for communicating with the safety officer, holding safety discussions with workers in their area, and conducting routine inspections and training within their function unit. The safety program utilizes training videos and other information, including procedures for animal captures that are available for loan to the various units. Each safety committee has at least one representative from each organizational unit (NZP, General Memorandum No. 100, August 9, 2003).

A zoo-wide chemical approval procedure to ensure that all chemicals (including pesticides) are reviewed and approved prior to use was presented to all zoo staff on October 1, 2003 (NZP, General Memorandum No. 125, September, 24, 2003) and has now been fully implemented. In collaboration with the Facility Manager, a form was created that requires approval from multiple persons in order to authorize the application of chemicals anywhere in the zoo complex (NZP, Chemical Approval Form, September 24, 2003). In addition, a chemical inventory database now exists that identifies the location of an application, volume of the application, approval secured, location of a material safety data sheet (MSDS), and the purpose of the chemical (e.g., maintenance, horticulture, pesticide, laboratory, hospital, janitorial). The one component that should be included in the new chemical approval procedure is a purchasing policy requiring that all purchases of chemicals must be made by the Purchasing Department; currently any department can purchase any chemical. In this way the use of chemicals throughout the zoo can be monitored and potential problems with the inappropriate use of a chemical can be mitigated. In addition to chemical control, this policy would help ensure compliance with the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Initially, the safety program staff was operating in a reactive mode rather than proactive mode and daily activities entailed responding to events, emergencies, issues, routine regulatory requirements, etc., as opposed to focusing on the development or enhancement of sustainable programs (personal communication, J. Hilton, August 28, 2003). The safety program has now been able to achieve a better balance between a crisis-management operation of responding to day-to-day issues and a more proactive program-oriented approach. The implementation of the chemical inventory and approval program, hazard communication program, development of policies and procedures, and training of NZP staff was a significant step toward this improvement (personal communication, J. Hilton, March 17). Two animal escape drills have been held, and safety training classes are routinely offered for employees (AZA, 2004; NZP, Spelman letter, February 13, 2004). When specialized expertise is needed on, for example, industrial hygiene monitoring, environmental issues, and safety engineering, the Smithsonian Office of Environmental Safety and Health can provide resources (personal communication, J. Hilton, August 28, 2003). One example of this is the recent Washington DC issue concerning lead in potable water (there are about 6 lead-lined tanks in NZP that were taken out of service and a zoo-wide testing program was implemented), NZP safety staff relied on the Smithsonian Industrial Hygiene and Environmental group as the lead for responding to this concern.

The zoo has a formal policy on keeper safety (NZP, General Memorandum No. 11, August 8, 2003), which like many policies was revised in April 2003. Although a 2003 AZA Accreditation Report (AZA, 2003a) noted that documentation of safety procedures was inconsistent within the zoo, a follow-up inspection conducted in February, 2004 found that "significant improvements in these areas have been made" (AZA, 2004). However, the committee continued to observe failures in compliance with written good safety practices. For example, in the primate area, workers were observed feeding the great apes without ready access to a two-way radio (for use in an emergency), because radios were insufficient for all personnel. Also, workers in the primate area do not always conform to professional attire, wearing, for example, open-toe shoes. These behaviors are problematic from a health and safety standpoint and are not in accordance with zoo policy (NZP, General Memorandum No. 11, August 8, 2003).

In summary, the safety officer appears to be well accepted by employees and has developed a good working relationship with management from all functional areas. Progress has been made in establishing the necessary programs for ensuring a comprehensive employee and public safety program; however, there are still problems with enforcement of safety policies within some areas of the zoo.

### **Occupational Health Program**

The zoo operates a health clinic that supports the zoo staff; although not specifically designed for visitors, the clinic also serves the public as necessary (personal communication, S. Striker, August 28, 2003). The clinic is organizationally a component of the Smithsonian Institution, and clinic staff do not report to the zoo administration. It is managed by a registered nurse (a certified occupational health nurse) who reports to the Smithsonian Office of Safety and Environmental Management (personal communication, S. Striker, August 28, 2003). A physician under contract with the Smithsonian is also available to assist with the zoonosis program and with the hearing-protection and respiratory-protection programs. The physician visits the zoo clinic weekly to review records and the status of the programs. Clinic staff track worker accidents and injuries, administer first aid as necessary, support the medical monitoring program, and manage the worker-compensation program.

The health clinic is adjacent to the zoo police station. It is below grade and often floods, and there is no patient-bed area or occupational-screening capability (such as audiometry booth or spirometry). Previous access problems (stairs only) have for the most part been addressed by the addition of an elevator that allows nonambulatory patients to get to the clinic (personal communication, S. Striker, March 17, 2004, personal observation); when construction is complete, there should be adequate facilities for disabled, infirm, or injured patients to reach the clinic. The clinic itself is of inadequate size, has only one exit, and is poorly equipped for emergency care (eyewash, shower, and so on). About 100 employees are sent to off-site clinics for spirometry and audiometry exams each year. The current system is both resource-intensive and a disincentive to employees to participate (personal communication, T. Lawford and S. Striker, October 1, 2003). The zoo has considered relocating the Safety and Health Department to the clinic area as part of their long-term planning effort; this would be consistent with modern industrial OHS programs and allow better use of resources, ready access to accident and illness data, trend analysis, medical monitoring programs, and training. However, due to the poor state of the current clinic facilities, other options should be considered.

All workers are instructed to notify and report to health services if they experience fever or illness (NZP, General Memorandum No. 105, August 8, 2003). Infectious-disease physicians at Georgetown Medical Center are available for consultation if necessary (personal communication, S. Striker, August 28, 2003). Antivenin is stored

where there are venomous snakes because zoo policy states that if someone is bitten, antivenin is carried with them to the hospital via ambulance (NZIP, General Memorandum No. 506, August 8, 2003), as it requires a physician to administer intravenously. Recent "Code Green Drills" for staff and visitor safety were being prepared with snakebite and a macaque bite (B-virus exposure) as themes (personal communication, S. Striker and J. Hilton, March 17, 2004).

### Zoonosis Program

The Zoonosis Program is operated by the Smithsonian and overseen by the Smithsonian Institution occupational physician. It consists of two components, the first of which is the identification and prevention of disease in the zoo's animals. That is accomplished by using veterinarians, curatorial staff, and animal keepers to examine and immunize animals, quarantine new arrivals, and communicate findings about animal health to the health unit (NZIP, General Memorandum No. 500, August 8, 2003). The second component focuses on the prevention of diseases that can be transmitted from zoo animals to people. Zoo employees are screened for infectious diseases, trained on how to avoid infection, and given protection, immunizations, and tests (NZIP, General Memorandum No. 500, August 8, 2003).

The second component of the Zoonosis Program is the testing and immunization of employees for infectious diseases. There are some formal policies at the zoo on testing and immunization for specific employees (for instance, tuberculosis tests and tetanus shots are mandatory for primate workers) (NZIP, General Memorandum No. 500, August 9, 2003). However, the curator of each unit is deciding if an employee should be included in the zoonosis program. This practice runs counter to published texts on occupational health and safety for animal care employees (NRC, 1997; 2003c). The responsibility for performing hazard and exposure assessments for individuals or groups of employees lies with the Safety Department, and with a staff member trained in occupational health and infectious disease, although input from area supervisors is essential. These assessments should identify employees at high risk and identify personal protection equipment vaccinations, and testing that should be provided to each individual to mitigate risk (NRC, 1997; 2003).

## FINDINGS AND RECOMMENDATIONS

### Findings:

- *The zoo's occupational health and safety (OHS) program is operating effectively, although it remains in a reactive mode. Although the OHS program has written policies in place on good safety practices, there has been a lack of compliance with these policies in some areas of the zoo.*
- *Testing and immunization requirements of the zoo's zoonosis program are being determined by unit supervisors rather than by a member of the safety department trained in occupational health and infectious disease. This practice has resulted in inconsistencies in the zoonosis program across zoo units and could lead to some at-risk employees being excluded from the program while other employees are included unnecessarily.*
- *The health clinic at the Rock Creek Park facility is not adequate to support the activities of the institution.*

### Recommendations:

- *The zoo's Safety Department should continue to shift its emphasis toward a more proactive, anticipatory role rather than reacting to events as they occur.*
- *Formal written policies pertaining to good safety practice should be enforced and senior management should ensure inclusion of OHS training in a comprehensive training program for animal care staff.*

- *Safety department staff trained in occupational health and infectious disease should determine the testing and immunization requirements for zoo employees based on a hazard and exposure assessment developed with input from unit supervisors..*
- *The Smithsonian Institution must correct the deficiencies in the health clinic facilities at the Rock Creek Park facility.*

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## Recent National Zoo Actions in Response to the Interim Report

The National Zoo is in a period of transition. In response to the committee's interim report (NRC, 2004a), the zoo has been engaged in evaluation of the interim report findings and immediate needs and in formulation of necessary actions. Indeed, the zoo has been moving forward in those respects not only since the interim report was issued but consistently since the beginning of the committee's study, in response to reports from the American Zoo and Aquarium Association (AZA) and the US Department of Agriculture (USDA).

This chapter examines the zoo's progress in response to the seven findings and immediate needs in the interim report. The committee has considered in its analysis progress that has already been demonstrated, stated plans of action, and responses to its interim report and other recent reports on the zoo. Specifically, the committee has considered these questions:

- Has documentation of the improvements been sufficient?
- Have actions taken been appropriate?
- If a proposed action plan includes a timeline, is the timeline appropriate, and has the zoo maintained the schedule so far?
- Are there measures in place for self-evaluation?

### NATIONAL ZOO ACTION PLAN

In the wake of the interim report released in February 2004, the zoo developed an action plan to address the concerns raised by the committee. The action plan included specific monthly or annual goals to be attained in animal care, nutrition, animal welfare, facilities, administration, recordkeeping, pest control, and strategic planning, which are submitted to and monitored by senior management. Table 7-1 summarizes the performance measures and minimal acceptable standards. The zoo provided the committee with performance measures for May, June, and July 2004.

Of the 15 performance measures identified by the action plan, the zoo met the acceptable standards for 11 in May, June, and July 2004. The performance measure for recordkeeping will not be instituted until new standards are completed in September 2004; no information was given by the zoo on tracking the cost growth of the Asia Trail.

For three performance measures—percentage of maintenance work orders completed, percentage of performance reviews completed, and percentage of integrated pest management (IPM) work orders completed—the zoo fell below the acceptable standard. However, for IPM work-orders and performance reviews, the zoo displayed progress over the 3-month period and attained 100% completion in July.

For only one performance measure, completion of maintenance work orders, has the zoo failed to attain an acceptable standard; in fact, the percentage of work orders completed each month has declined, from 74% in May to only 47% in July. The zoo noted that because of funding limitations the facility staff is 28% below authorized levels



(NZIP, NAS Action Plan Performance, July 2004). The zoo has many failing facilities, and completing less than 50% of maintenance orders monthly is unacceptable. That will inevitably lead to the failure of more facilities and to unsafe conditions for the animals, staff, and visitors. It also provides a pointed example of the importance of human-resources planning to avoid situations in which a lack of staff jeopardizes the functioning of an organization.

One performance measure, completion of diet reviews, raises a special concern in the committee. The zoo has attained its monthly goal through July, but the acting clinical nutritionist is resigning effective September 30, 2004. As of the end of July, 31% of the diets still need to be reviewed and entered into the database. Given the resignation of the clinical nutritionist, and the length of time that it typically takes the Smithsonian to hire a replacement, it seems unlikely that the zoo will attain the goal of completing the diet reviews by the end of 2004. However, as the research nutritionist and clinical nutritionist have been collaborating on the review of diets for the animal collection, work on the review and entry of the diets into the database could be continued by the research nutritionist during the interim, so that the momentum gained over the last year in this arena is not lost.

**Table 7-1.** National Zoo Performance Standards to Track Improvements Made in Response to National Research Council Interim Report

<b>Performance Measure</b>	<b>Minimal Standard to Maintain Green (Acceptable) Status</b>
<i>High-Quality Animal Care</i> % of scheduled preventive medicine examinations performed Number of staff participating in AZA programs	91% completed monthly 75 staff trained annually
<i>Diet Review and Progress toward Centralized Commissary</i> % of diets reviewed and entered into database % of monthly schedule completed	8% reviewed monthly/ 100% by December 31, 2004 100% of monthly schedule completed
<i>Animal Welfare</i> Number of animal-welfare findings not corrected within 12 months	Fewer than 5 findings
<i>Renew Facilities</i> Number of renewed and new exhibits completed % of time growth for major construction (currently Asia Trail) % of cost growth for major construction (currently Asia Trail)	Improve and open one exhibit every 2 months 0-10% time growth of schedule 1-5% cost growth of budget
<i>Improve Maintenance</i> % of work orders completed	90% completed monthly
<i>Improved Human Resources and Administration</i> % of supervisors trained % of performance reviews completed by deadline (April 30 and August 30)	25% of supervisors trained quarterly, 100% annually 100% completed by deadline
<i>Improved Organization of Animal-Care Records</i> % of records filed and retained according to new Smithsonian standards (standards instituted in July 2004)	25% increase in number of records properly stored 100% properly stored by November 2004.
<i>Improved Pest Management</i> % of IPM work orders completed Number of meetings held between contract and zoo IPM specialist	90% completed monthly Two meetings per month
<i>Strategic Plan Implementation</i> % of targets met for strategic plan implementation	100% of monthly implementation schedule completed

Source: Summarized from NZP National Academy of Sciences Action Plan Performance.

## VETERINARY CARE

**Interim Report Findings:** *“The current preventive medicine program at the National Zoo is not being fully implemented, and since 1998, veterinary staff members have not been adhering to this program in terms of providing annual exams, vaccinations, and infectious-disease testing. Although efforts have been made in the past year to improve implementation, there is still a backlog of animals that have not received examinations, vaccinations, or tests as prescribed by the preventive medicine program.”*

**Interim Report Immediate Needs:** *“The Department of Animal Health should promptly eliminate the backlog of animals that should receive preventive care and document its current and future plan for preventive medicine activities. The National Zoo administration should take responsibility for ensuring that the Department of Animal Health has the resources and oversight necessary to adhere to the program.”*

### National Zoo’s Actions in Response to Interim Report

#### Department of Animal Health at the Rock Creek Park Facility

After the release of the interim report, the Department of Animal Health at the Rock Creek Park facility immediately worked to eliminate the backlog of preventive-medicine procedures. As of spring 2004, the backlog had been eliminated (NZIP, Preventive Health Schedule, May 3, 2004; NZP, Great Ape Exams, undated; NZP, Small Mammal House/Propagation Primates, undated). The veterinary staff reviewed and updated its preventive-medicine protocols in March 2004 (NZP Preventive Health Program, March 2004) and established a monthly schedule for preventive-medicine examinations, tests, and vaccinations (NZP Preventive Health Schedule, March 2004.) A performance measure for the preventive-medicine program was established whereby the percentage of scheduled preventive-medicine procedures is tracked on a monthly basis by senior management. From the establishment of this performance measure in May 2004 until July 2004, the Department of Animal Health at the Rock Creek Park facility completed 100% of its scheduled preventive-medicine procedures (NZP, NAS Action Plan Performance, July 2004). The committee encourages the Department of Animal Health and senior management to continue to use completion of preventive-medicine procedures as a monthly performance measure to ensure that systematic lapses in preventive medicine do not happen in the future. The committee applauds the professionalism and actions of the veterinary staff in enacting the changes and recognizes the enormous effort that it took to make the changes in such an expeditious manner.

#### Department of Pathology

For the last several decades, the zoo has maintained an extraordinary department of veterinary pathology. For example, the department was the first to identify a fungal skin disease in frogs, which turned out to be a major factor in the global decline of amphibians (NRC, 2003b). However, there is evidence that the zoo’s department of pathology was not functioning effectively, particularly in 2003. As of February of 2004, a backlog of uncompleted pathology reports had accumulated and the 2003 annual morbidity and mortality assessment had not been developed (NZP, NAS Action Plan, May 2004). This backlog included 60 incomplete pathology reports from 2003 (approximately 21% of the caseload) and 59 incomplete pathology reports from the years 2000-2002 (approximately 4% of the total caseload). Documentation of this backlog was submitted to the committee following its request in March 2004 for a large number of pathology reports (NZP, NAS Action Plan, April 13, 2004).

Though the committee’s review of recent animal deaths (Chapter 4) revealed only one case where a Pathology Report had not been issued, it is possible that any future backlog in pathology reports or the annual morbidity and mortality assessments could prevent the zoo from properly assessing the population health of the collection and mitigating health risks. No specific performance measure has been established to monitor the operations of the pathology department, but such a measure would allow senior management to recognize and mitigate any incident or staffing issue that would negatively impact on the department’s ability to manage its caseload in a timely fashion.

Since February 2004, the Department of Pathology has eliminated the backlog of 60 pathology cases from 2003 (NZIP, Viner memo, April 29, 2004). The zoo has also set a target date of May, 2005 (NZIP, NAS Action Plan, December 2004) for completion of the backlog of cases from 2000-2002. In addition, the 2003 morbidity and mortality assessment is scheduled to be completed by December 2004 (NZIP, NAS Action Plan, May 2004). The zoo advertised an open position vacancy for a supervisory pathologist in June 2004 (Smithsonian Institution, Vacancy Announcement, 04SP-1198). However, after interviewing candidates, the zoo has deferred hiring from this announcement and has appointed the acting supervisory pathologist to a term appointment (NZIP, Tanner memo, December 6, 2004).

### Findings and Recommendations

#### Findings:

- *The Department of Animal Health at the Rock Creek Park facility has addressed the findings and immediate needs of the interim report by eliminating the backlog of preventive-medicine procedures; reviewing and updating preventive-medicine protocols; establishing a monthly schedule for preventive-medicine examinations, tests, and vaccinations; and establishing and tracking a monthly performance measure for the preventive-medicine program.*
- *The Department of Pathology developed a backlog of pathology cases from 2000 to 2003 and had failed to develop an annual morbidity and mortality assessment. The backlog of pathology cases from 2003 was eliminated in early 2004, the rest of the cases are slated for completion by May 2005, and the 2003 morbidity and mortality assessment is slated for completion by the end of 2004.*

#### Recommendations:

- *Performance measures should be established for the pathology department to monitor operations and ensure that until a permanent supervisory pathologist is hired, the department has adequate staff to meet the pathology needs of the zoo and continue consulting with the larger zoo community.*

### ANIMAL NUTRITION

**Interim Report Findings:** *“Shortcomings exist in the animal nutrition program. There has been inadequate communication between the nutrition keeper, and veterinary staffs; poor consultation between the research nutritionist and the acting head of clinical nutrition; and a lack of standardization and regular evaluation of animal diets. Nutrition records are not currently integrated with other record-keeping systems and, despite having adequate facilities for over a decade, the National Zoo is only now beginning to move toward a centralized commissary.”*

**Interim Report Immediate Needs:** *“The National Zoo should immediately use its existing expertise by increasing coordination and collaboration between the acting head of clinical nutrition and the research nutritionist to address nutritional issues of the animal collection, including diet review, evaluation, and modification. The zoo also should seek a permanent (rather than temporary), qualified experienced person for the role of clinical nutritionist. Centralization of standard diet formulation records and integration of those records with other record-keeping systems for animal care and management at the National Zoo should be completed. An annual schedule for evaluation of diet formulations for each animal or animal group should be developed and implemented. The National Zoo should finalize its draft plan to centralize the commissary and implement it in 2004.”*

### National Zoo's Actions in Response to Interim Report

The zoo reports that its research nutritionist and its acting clinical nutritionist were having biweekly meetings to discuss diet review, evaluation, and modification prior to the departure of the clinical nutritionist. A protocol has been developed and implemented to improve communication among veterinarians, the clinical nutritionist, and curators. The protocol requires that all three sign off on any dietary changes. It must be noted that

sign off by the curator, nutritionist, and veterinary staff has been a stated requirement on diet change request forms since at least 1998 (NZIP, Diet Specification and Diet Change Request Form, Accession # 106318). Zoo management indicates that that will encourage increased and continued collaboration between clinical and research nutrition staff through revisions in annual performance plans (NZIP, Response to Interim Report, March 17, 2004). Interviews with zoo staff indicate that interaction between the clinical nutritionist and keepers has apparently increased in the last several months and that the clinical nutritionist has been responsive to keeper needs and questions.

The committee recommends continued efforts to improve the communication and collaboration among keepers, curators, veterinary staff, and nutrition staff. Senior management must establish accountability for the appropriate sign off on dietary changes so that failures in the nutritional management of the collection do not continue to occur.

### **Diet Documentation**

As of July 2004, 69% of all diets for species at the zoo have been reviewed and entered into the diet database (NZIP, NAS Action Plan Performance, July 2004). This includes the diets for all species of mammal, bird, reptile, and amphibian (NZIP, NAS Action Plan Performance, July 2004); only diets for invertebrates are unfinished.

The database consists of individual Microsoft Word documents that are organized and stored in the zoo's intranet system so they are accessible to all staff. While the committee applauds the zoo's recent efforts to document the diets of the entire animal collection, the current databasing system (a collection of Microsoft Word files) does not have the capability for additional functions, such as electronic analysis of diets and automating commissary ordering and budgetary management. Nutrition software that incorporates all of some or all of these additional functions are being utilized by other zoological parks in the US, and the zoo is urged to investigate these options and determine if such a software package, if properly adapted, could enhance the functioning of the nutrition program and department at the zoo.

The zoo's stated goal is to have all diets reviewed and entered into the database by December 31, 2004; however, the nutritionist is scheduled to resign effective September 30, 2004, and the zoo expects progress in reviewing and documenting the remaining diets to slow (NZIP, NAS Action Plan Performance, July 2004). The zoo has developed or revised protocols for animal-diet determination, analysis and changes, hay management, quality control, enrichment guidelines, and hospital diets (NZIP, DAH Procedures on Nutrition and Commissary Operating Protocols, September 15, 2003). The committee applauds the efforts of the zoo in quickly and effectively addressing the substantial deficiencies in diet documentation outlined in the interim report.

There remain recent examples of conflicting staff knowledge and inadequate documentation of animal diets. There are conflicting reports from staff and no documentation regarding the browse provided gorillas as enrichment. The assistant curator of primates states that browse is fed daily to primates and that in the winter months the variety of browse is limited to two or three species, whereas during the summer months many more species of browse are available. The nutritionist states that the zoo does not maintain a 12-month browse program and that browse is available on a limited basis during the spring and summer months (NZIP, Responses to NAS on Nutrition Requests, May 12, 2004). Diets should be nutritionally complete without food items fed as enrichment; however, it is still important to document the type of browse being offered, the nutritional content of the browse, and a general understanding of consumption patterns. These factors must be known to ensure that the consumption of browse does not cause an imbalance in the diet that can negatively affect the health of the animal.

Diet records should reflect any nutrient intake in browse or other food items fed as enrichment. At a minimum, the browse, even if used only as enrichment, should be recorded as a component of the diet, and weights of the browse should be recorded before and after feeding on a regular basis. Browse should be analyzed to help to estimate nutrient intake in the future.

### **Diet Formulation**

The committee's interim report discussed several examples of possible concerns with diet formulation. For example, a report by USDA (2004) states that the feeding of baked fish and beef to apes at the zoo is inappropriate. A review of the orangutan diet (NZIP, Animal Diet, Accession #103874) indicates that meat and fish provide 5% of dietary dry matter. A review of several gorilla diets provided to the committee (NZIP, Submission of Animal Diets, January 8, 2004) indicates that meat provides 4-6% of dry-matter intake.

Opinions as to the value of animal products in ape diets vary among zoos; however, scientific reports suggest that these products are not part of apes' natural diet and may be inappropriate (Popovich and Dierenfeld, 1997; NRC, 2003). Popovich and Dierenfeld (1997) conducted a survey of 37 zoos. Meat was fed daily at one zoo and one to two times per week at five zoos. Eggs were fed at 19 zoos: daily at three, one to two times per week at six, and one to two times per month at 10. Popovich and Dierenfeld conclude that "there appears to be little need to feed gorillas any type of animal products including eggs (except of course, nursing young)." They also suggest that animal products could increase serum cholesterol in apes and thus increase the potential for cardiovascular disease. Rothman (2004) reports that gorillas in the wild do not eat vertebrate parts do eat some insects.

In addition to formulation, the form of the diet is important. An example of where a link to the form of diet, its nutritional adequacy, and potential enrichment are key is the cheetah diet (NZIP, Animal Diet, Accession #113866). Feeding 1.8 kg of a commercial carnivore diet would provide adequate concentrations of nutrients as listed by the National Research Council for cats (NRC, 2004b), but the form of this diet (soft, meat-based) could lead to dental problems (Bond and Lindburg, 1990). The clinical nutritionist reports that the enrichment program for cats includes bones and whole rabbits, which can help to prevent such dental problems as the buildup of tartar and also provide nutrients. To the extent that these items are fed or consumed, they should be recorded as dietary components and considered in formulation of the diet.

The interim report provided analyses of diets for several primate species and three Grevy's zebras at the zoo. These analyses were based on the NRC publications Nutrient Requirement of Nonhuman Primates (2003a) and Nutrient Requirements of Horses (1989b). The NRC nutrient requirements are "guidelines" that are extrapolated largely from studies of animals in controlled laboratory settings. For this reason, an appropriate analysis of diets at the National Zoo using the NRC nutrient recommendations should include consideration of variables such as health status and age and how to properly extrapolate dietary requirements developed for nonzoological animals under controlled laboratory conditions to zoological animals. The analyses of diets presented in Tables 2-4 and 2-5 of the interim report did not include consideration of these points. Further, the diets analyzed in the interim report reflected the food items offered to the animal and not the food items actually consumed by the animal. The composition of the diet actually consumed can vary considerably from the composition of the diet offered as animals may consume only preferred components of the diet. In the absence of this information on consumption, the documented diets may not reflect the actual nutrition consumed by the animal. For these reasons, the analyses of diets presented in Tables 2-4 and 2-5 of the interim report were unnecessarily subjective and should be disregarded.\*

### **Food Analyses**

Steps have been taken to improve the efficiency of food-composition analyses. The research-nutrition unit has drafted a memorandum of understanding with the clinical-nutrition unit for nutrition laboratory services (NZP, NAS Action Plan, May 3, 2004). Under the agreement, a working relationship between the units will be solidified whereby the research-nutrition laboratory provides assistance to the clinical-nutrition staff with the analyses of zoo food items. The committee recommends that the agreement and the effectiveness of the working relationship be evaluated annually by senior management and that collaboration be encouraged through revisions in annual performance plans.

### **Hiring of Permanent Clinical Nutritionist**

A job description for a supervisory research nutritionist was written in fall 2003. However, according to the zoo action plan (NZP, NAS Action Plan, May 3, 2004), the zoo plans to hire a supervisory clinical nutritionist (GS-14) and realign the reporting structure of the commissary and the clinical nutrition unit by October 1, 2004. In addition, the supervisory clinical nutritionist is resigning effective September 30, 2004; the zoo planned to hire a new supervisory clinical nutritionist in September or October 2004 (NZP, NAS Action Plan Performance, July 2004). However, the zoo reopened the vacancy announcement for a supervisory clinical nutritionist in October 2004. This announcement states as the basic requirement for qualification, (A) a bachelor's degree in biological sciences, agriculture, natural resource management, chemistry, or related disciplines or (B) courses equivalent to a major, as

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\*This paragraph was edited after release of the prepublication draft to clarify the committee's views on the analyses presented in Tables 2-4 and 2-5 of the committee's interim report.

shown in A, plus appropriate experience or additional education (Smithsonian Institution, Vacancy Announcement 04SP-1371).

The committee recommends that the zoo seek a qualified, experienced nutritionist with an advanced degree (PhD) in animal nutrition or an equivalent number of years of experience in management, design, and implementation of a zoo-animal nutrition program. The committee bases this recommendation on several factors: the diversity and stature of the zoo's animal collection; the continued shortcomings noted in the composition, formulation, and evaluation of animal diets; and the close collaboration with the PhD research nutritionist that is expected to continue with the hiring of the next clinical nutritionist.

The committee strongly recommends that in the short-term, the zoo utilize the current research nutritionist to continue the progress that has already been made in reviewing and documenting diets for the animal collection. The committee recognizes that the research nutritionist cannot juggle both positions for any significant length of time and urges the zoo to make every effort necessary to locate and hire an appropriately qualified and experienced clinical nutritionist. However, once the clinical nutritionist position has been filled, it is important for the research nutritionist to remain involved in the clinical nutrition program to move advances made in the research community into the decision-making process for clinical diets.

### **Record Integration**

Individual animal units maintained historical diet records before 2002. Current zoo diets are posted in individual animal units to facilitate diet preparation. Procedures for posting diets are managed by curators or biologists in individual animal areas. The nutritionist is working with all animal areas to standardize diet records used in each unit.

Computerized documentation of animal diets is under way. Currently, the clinical nutritionist maintains computerized diet records and diet-record approvals. Those records are maintained only in the nutritionist's office; however, there has been collaboration with the Information Technology Division to create suitable space on the zoo's server for computerized diet-record storage. Access of all pertinent animal-care staff to the diet database via an intranet server should be available by November 2004 (NZIP, Responses to NAS on Nutrition Requests, May 12, 2004).

### **Centralized Commissary**

The zoo plans to centralize animal nutrition to improve oversight of daily feedings and diets, reduce rodent infestations associated with overfeeding, and decrease animal food expenses. A commissary task force has been organized to develop and oversee a centralization plan. A contractor was selected, and the contractor has met with the animal programs and commissary staff, visited all food-preparation areas (23 buildings), and documented all current activities. The contractor has made initial recommendations and prepared a questionnaire to be used in two site visits to other zoos (NZIP, NAS Action Plan Performance, July 2004). In April 2004, a preliminary budget estimate and staffing needs were submitted to the under secretary of science for the FY 2006 budget.

The zoo has also drafted an organizational timeline (January 2004-August 2005) to implement a centralized commissary. The move to a central commissary will be gradual, and this appears to be a reasonable approach. Conversion to a centralized commissary system at the San Diego Zoo and the Fort Worth Zoo took 3-4 years. A trial run of the centralized commissary system for pilot area 1 (possibly Bird House) is proposed for January 2005. Additional training of animal-program and veterinary staff on nutrition with site visits to facilities that have centralized commissaries is planned for August and September 2004.

A new commissary manager who has an extensive background in warehousing has been hired. He also has training and practical experience in animal science, nutrition, and general agriculture, all of which will be helpful in dealing with commissary operations.

Since May 2003, the zoo has developed or revised protocols for monitoring food orders and deliveries, commissary inventory, and assessing food quality. A record system to track food shipments to each exhibit food unit has been developed and will help with inventory, ordering, and flagging diet changes. A program for commissary budgetary management and cost analysis is under development.

### Findings and Recommendations

#### **Findings:**

- *Notwithstanding the urgent need to complete science-based evaluations of all animal diets, considerable improvements in the nutrition program have been implemented, and they appear to be occurring at a reasonable rate. Collaboration between the research nutritionist and the acting clinical nutritionist was initiated quickly and has benefited the zoo's nutrition program.*
- *The acting clinical nutritionist has made improvements in dietary documentation since fall 2003 and has improved communication and cooperation with keepers, which ultimately results in improved animal care.*
- *Although long overdue, progress has been made in the last year to improve commissary operations and management, increase attention paid to the food budget, and implement a centralized commissary.*

#### **Recommendations:**

- *The committee strongly recommends continued efforts in improving communication and collaboration among keepers, curators, and DAH veterinary and clinical nutrition staffs so that all the zoo diets can be accurately described and quantified regularly.*
- *On the basis of the committee's diet analyses, nutritional problems remain with primate diets that contain food items that are not appropriate for particular species. In addition, key components of the diet (such as browse) are not documented for use in evaluation. Nutritional evaluations of these and all diets of animals in the collection should be performed as soon as possible and appropriate modifications made.*
- *The committee recommends that the effectiveness of the working relationship between the research nutrition and clinical nutrition units to evaluate the zoo's animal diets be reviewed annually, and that collaboration be encouraged through revisions of annual performance plans.*
- *The committee recommends that the zoo finish developing a full schedule for centralization of its commissary so that it can continue monitoring progress toward a centralized commissary within a reasonable period.*

### ANIMAL WELFARE

**Interim Report Findings:** *"There is a lack of documentation that the welfare of animals has been appropriately considered during the development and implementation of research programs and that complaints regarding the welfare of animals on exhibit were appropriately investigated. There also has been a lack of understanding within the National Zoo and the Smithsonian Institution of the requirements of federal regulations and Public Health Service Policy and how to maintain compliance."*

**Interim Report Immediate Needs:** *"The National Zoo and the Smithsonian Institution should ensure compliance with all elements of the Animal Welfare Act and the Public Health Service Policy. The National Zoo and the Smithsonian Institution should seek outside training and assistance to achieve compliance with regulations and implement procedures meant to ensure the welfare of research and exhibit animals at the National Zoo."*

#### **National Zoo's Actions in Response to Interim Report**

The committee has documentation that the Smithsonian has provided NIH with the appropriate assurance that it will comply with the PHS Policy (Smithsonian Institution, Evans letter to Potkay, March 31, 2004; April 5, 2004; April 30, 2004). The documentation that the Smithsonian submitted to the OLAW regarding compliance with the PHS Policy (Smithsonian Institution, Evans letter to Potkay, March 31, 2004) indicated that both the Rock Creek



Park and Conservation and Research Center facilities did not comply with the requirement to perform semiannual program evaluations and inspections of facilities from 2000 to 2002. Furthermore, the Smithsonian indicated that annual reports for 2000, 2001, and 2003 were not submitted to NIH; these reports were included in the March 2004 submission to NIH.

In spite of those past failures, the zoo has made considerable progress since February 2004 in response to the animal welfare findings in the committee's interim report. In addition to the Smithsonian submission of an assurance to OLAW, the Smithsonian and USDA have entered into a memorandum of understanding establishing USDA's authority to conduct announced and unannounced inspections of the zoo for the purposes of ensuring compliance with the Animal Welfare Act (Smithsonian Institution, Memorandum of Understanding Between Smithsonian Institution and The United States Department of Agriculture, March 31, 2004). A recent USDA inspection of the zoo indicates that the noncompliance items cited in the February 12, 2004, USDA inspection report were resolved (USDA, USDA Inspection Report, September 9, 2004).

In meetings with the two IACUC chairmen and with documentation noted below, the committee was able to establish that the makeup of the IACUC is appropriate, and the zoo is taking steps to provide the IACUC members with the training required to understand and perform their roles so that appropriate standards are being followed and documented to ensure the welfare of animals at the two zoo facilities. The zoo is accumulating available information for the members of the IACUCs and is working to arrange for an outside organization to provide training. In the meantime, it will make use of published material (such as the NRC Guide, 1996) and on-line training opportunities (OLAW-sponsored on-line training courses: "Essentials for ACUC Members" and "Working with the ACUC") (NZIP, Roberts memo, April 27, 2004; NZIP, Response to the NAS committee on requested items, May 5, 2004).

This is a major favorable shift at the zoo regarding the function of its IACUCs, and it will be important for this progress to continue its momentum. If the zoo's inconsistent approach to animal welfare is going to change, it will require the IACUCs to follow through on the plans they have developed to come into compliance with appropriate structure, function, and documentation of their activities (see for example, NZIP, Roberts memo, May 12, 2004). The semiannual inspections and follow-through on needed remediation, and minutes of meetings to review protocols and evaluate concerns and complaints sent to the IACUCs for their consideration will be a critical continuing measure of compliance and effectiveness. The Smithsonian Institution's written assurance to OLAW indicates that the Under Secretary of Science has been designated the Institutional Official for Animal Welfare Compliance. According to both PHS Policy (Section III) and the Animal Welfare Act (9CFR1.1) is the official who has the legal authority to make a commitment on behalf of the institution that the requirements of PHS Policy and the Animal Welfare Act are being met, and ultimately is the individual held responsible for ensuring institutional compliance. Appointment of an Institutional Official at the Smithsonian Institution will help ensure that the IACUCs are conducting and documenting facility inspections, program reviews, and meetings properly, as well as, appropriately following up on areas of concern noted in the semiannual inspections or through staff complaints.

Continued progress in animal welfare will help to bring the zoo into line with animal-welfare practices evolving at other zoos (Goodrowe, 2003; AVMA, 2003). It will be critical to link animal-welfare progress to the full spectrum of activities and practices (NZIP, Enrichment and Training Programs at the National Zoo, May 3, 2004). Animal welfare cannot be divorced from the many other deficiencies identified at the zoo. Strategic planning, staff training, data management, and nutrition all played a role in compromising the welfare of the zoo's animals. Progress in those and other aspects will be needed to fulfill the zoo's obligations to protect animal welfare.

## Findings and Recommendations

### ***Finding:***

- *The zoo and the Smithsonian Institution have made considerable progress in complying with the relevant federal statutes.*

### ***Recommendation:***

- *The committee recommends that the zoo establish and monitor performance measures to ensure that its IACUC conduct semiannual inspections and program reviews, follow through on needed remediation, and document meetings to review protocols and evaluate concerns and complaints sent*

*to the committees for their consideration. Continuing evaluation of those performance measures will document the continued effectiveness of the IACUCs in ensuring animal welfare.*

### ADHERENCE TO POLICIES AND PROCEDURES

**Interim Report Finding:** *“There has been poor adherence to the National Zoo’s own policies and procedures for animal health and welfare.”*

**Interim Report Immediate Needs:** *“All levels of management should be held accountable for ensuring that National Zoo policies and procedures are followed. All zoo staff should take personal responsibility for educating themselves and adhering with the policies and procedures that pertain to their position and duties.”*

### National Zoo’s Actions in Response to Interim Report

According to the zoo’s stated plan of action, one of the primary objectives of the all-supervisor meetings is to make certain that supervisors are familiar with zoo policies and protocols with the intention that consistent interpretation of and adherence to procedures by all employees will follow. Although there is no documentation to verify that the objectives of the all-supervisor meetings are being met, the intention seems appropriate and the meetings seek to address the concerns of the interim report. However, it is not apparent to the committee that the zoo has adequately communicated that all supervisors, including senior management, are accountable for management failures that allow repeated lapses or poor performance in any aspect of zoo operations. The zoo has implemented a series of performance measures that set goals for supervisors in the veterinary and nutrition departments in particular, but performance measures to monitor the Department of Animal Programs and individual units have yet to be developed.

Another step that the zoo’s management staff is taking to ensure that employees are familiar with procedures and policies is to update and revise their *Best Practices Manual*, and they are requesting that each unit provide input. By December of 2004 the zoo staff expects to have the *Best Practices Manual* updated. The *Best Practices Manual* addresses zoo-wide policies, but it does not contain any specific protocols for husbandry, management, or enrichment. For the safety and well-being of the keepers and the animal collection, those protocols also need to be revised, updated, and distributed to the animal care staff. Although the committee believes the timeline is appropriate for zoo-wide policies, there should be a timeline for updating, revising, and distributing specific animal care and enrichment protocols to staff as well. In addition, as discussed in Chapter 3, the zoo needs to develop a training program to make sure that all employees are familiar with procedures and are consistently following them.

In an interview with committee members, the zoo upper management staff conceded that it was too soon (May 5) to tell how effective their efforts to improve adherence to procedures had been. However, the zoo has established some monthly performance measures that can be used to track compliance with policies.

As AZA noted, the zoo is in a state of flux, and the committee recognizes that it may take time for all policies and procedures to be followed consistently throughout all parts of the zoo. For example, in March 2004, when the AZA accreditation team reviewed the documentation process for euthanasia, it discovered that “it appears that some of the paperwork documenting the process has not been recorded or maintained in accordance with the zoo’s own internal policy” (AZA, 2004). Although the team concluded that there was evidence that the decision to perform euthanasia was made thoughtfully and that “no untimely or inhumane euthanasias have resulted from the lapses in internal paperwork” (AZA, 2004), staff should be adhering to procedures to avoid controversy and confusion.

### Findings and Recommendations

#### **Findings:**

- *The two most important omissions in plans for ensuring adherence to policies and procedures are training and accountability.*

- *Although zoo management is undertaking the daunting task of updating and revising the Best Practices Manual, it still needs to address how it plans to train all employees uniformly on zoo procedures.*
- *The zoo has implemented performance measures for the veterinary and nutrition departments, which provides a mechanism for managerial accountability. However, the Department of Animal Programs and individual units have no performance measures that allow senior management to monitor the operations that most directly affect the welfare of the animal collection.*

**Recommendations:**

- *The zoo should develop performance measures to monitor the operations of the Department of Animal Programs and individual units as a mechanism for managerial accountability.*
- *The zoo must continue to clarify the roles and responsibilities of all staff. Inherent in this task is identifying who is accountable for decision-making and ensuring adherence to policies and procedures.*

**RECORDKEEPING**

**Interim Report Finding:** *“The National Zoological Park lacks a comprehensive information management system for animal husbandry and management records, which results in inconsistent record keeping and practices of alteration in medical records weeks or years after events.”*

**Interim Report Immediate Need:** *“The National Zoo should implement an information management system that insures complete documentation of animal husbandry and management and reasonable accessibility to the records by all units and departments. This does not necessarily mean that the entire system needs to be computerized immediately but rather that consistent practices be put in place, that a system be developed to make records reasonably accessible and that an appropriately experienced individual be given responsibility for system oversight.”*

**National Zoo’s Actions in Response to Interim Report**

The zoo recognizes that a well-integrated information-management system is necessary to avoid many of the recordkeeping, retrieval, and archiving problems that the zoo has had in the recent past (NZP, Schoop Report to the Smithsonian Institution Office of Government Relations, May 4, 2004; personal communication, M. Murphy, March 19, 2004). The new Zoological Information Management System (ZIMS), to which the zoo has been contributing considerable resources, is expected to fill the zoo’s needs for an integrated-management system and the zoo is expected to take full advantage of its investment. However, the ZIMS system is not slated for initial release until 2006 (ZIMS, 2004).

While awaiting the development and implementation of ZIMS, the zoo has developed standardized approaches and policies for archiving records so that information contained in them can be easily retrieved; this should avoid the loss and inaccessibility of records that have occurred in some instances. Record storage and retention were reviewed by the Smithsonian Institution and changes were incorporated (NZP, NAS Action Plan, February 13, 2004).

The zoo has also begun to develop additional software for electronic keeper records and increasing the integration of the MedARKS records. New software for the electronic keeper logs has been developed and is being tested in several units. When the pilot tests have been completed and necessary changes made, the system will be implemented by all units and departments in the zoo; the target date is summer 2004 (personal communication, P. Schoop). Keeper training is planned when implementation expands (NZP, Best Practice Manual, 2003). This system will avoid the loss of records and facilitate information transfer when staff turnover occurs.

Software is being developed in 2004 to make the Medical Animal Record Keeping System (MedARKS) electronically accessible and compatible with current zoo Web-based intranet hardware and software (personal communication, P. Schoop). The nutritional database has been placed on the zoo’s intranet (NZP, NAS Action Plan, February 13, 2004). It is important that recordkeeping, archiving, and retrieval in the interim information-management system should be unaffected by staff illness, absence, or turnover. The acting registrar recognizes that

her job will evolve into one of information management rather than just data entry (personal communication, M. Murphy, March 19, 2004). The zoo administration needs to communicate to all personnel that the registrar has the responsibility and authority to manage all aspects of the information system.

Several units have augmented the keeper log records by developing their own forms to track specific aspects of animal husbandry. One unit, the Beaver Valley exhibit, has developed an extensive set of forms to ensure consistent documentation of information and facilitate communications between shifts and departments. Daily cage-check sheets indicate what tasks were performed in the morning and in the afternoon with the animals (such as training, enrichment, recording of appearance and stool condition, and weighing) and their pens (cleaning and rebedding). Weekly training records are kept for species that are being taught specific behaviors that will reduce the need for chemical or physical restraint. Morning and afternoon task lists and keeper chore assignments ensure occasional tasks are not forgotten and allow monitoring of unit operations. A daily history sheet is used to record intensive monitoring of individual animals that have medical problems to document behavior, physical observations, and medications, facilitating information transfer between shifts and to the zoo veterinary staff. This unit has also developed a standardized classification system to describe the behaviors and symptoms of ill animals; this facilitates accurate telephone communication between the keeper, curator, and veterinary staff.

### Finding and Recommendations

#### **Finding:**

- *The zoo needs an overall information-management system and has been taking steps in that direction. The expectation is that the Web-based ZIMS being developed by the International Species Information System in collaboration with the AZA and other professional associations will be that system when it is completed.*

#### **Recommendations:**

- *The zoo administration and staff recognize the need for a zoowide information system and have been moving in that direction with commendable speed. It is important that this initiative continue to advance as swiftly as possible.*
- *Recordkeeping innovations developed within units should be shared and evaluated for use in other units of the zoo.*
- *Employee training to ensure adequate recording and archiving and appropriate oversight to ensure compliance with recording and archiving standards.*
- *Performance standards should be developed by the registrar and system users for the interim system and for ZIMS when it becomes available.*

### PEST MANAGEMENT

**Interim Report Findings:** *“Even though the pest management program has been reorganized and is showing signs of improvement, pest management remains inadequate and poses a potential threat to the animal collection, employees, and visitors to the National Zoo.”*

**Interim Report Immediate Needs:** *“A comprehensive IPM plan should be developed: (1) in the short term to bring current populations of pests down to acceptable levels and (2) in the long term to maintain those levels using modern IPM techniques.”*

### National Zoo’s Actions in Response to Interim Report

Observations and findings indicate that considerable progress has been made since the issuance of the interim report. Many of the obvious deficiencies noted have been addressed, and aesthetic improvements and

enhancements were observed by committee members in many areas. For example, what had previously appeared to be long-term endemic housekeeping problems (improper trash receptacles, poor upkeep of foliage, improper sanitation, and rodentproof mesh in poor repair or missing) showed signs of improvement. Many workers were observed repairing, painting, sweeping, and so on, and rodentproof trash receptacles were being installed. Although it did appear that signs of rodent infestation had been corrected to some degree (for example, outside greater ape house), there are still problems with rodents in several areas, and continued diligence is necessary (AZA, 2004).

An experienced entomologist from the National Park Service was hired in November 2003 to lead the IPM effort at the zoo. However, initial efforts to implement IPM (and discontinue reliance on the use of chemical control as an option for rodents) and to rely solely on trapping and other controls has met with resistance from curators and other staff and has not been completely successful. It appears that the rat infestation had become extreme and that chemical control would be necessary before nonchemical techniques could successfully control the rodent population (NZIP, Spelman Letter, March 17, 2004). Recently, a decision was made to use rodenticides, and discussions have begun about which types and toxicity levels of chemicals should be tolerated. The chemical-approval program has been successfully implemented by the safety director, and this ensures that any new pesticide will receive appropriate scrutiny before use. Other improvements include the hiring of a qualified pest-control firm on a short-term contract that has helped with the rodent and cockroach program (NZIP, Spelman Letter, March 17, 2004).

There have been a number of facility improvements, including installation of door sweeps, underground wire, pea gravel, and proper trash containers and increased trash pickups throughout the zoo. Other actions taken to improve pest management at the zoo include initiation of a public-education program for the use of IPM. In cooperation with the zoo, the University of the District of Columbia held an IPM training class at the zoo on March 18. The class was held for recertification training for licensed pest-control operators. Speakers covered such topics as IPM methods for urban environments, including rodent and cockroach control, and state and federal regulations for the safe handling and use of pesticides.

The director of pathology who hired the IPM manager has left the zoo, and the current certified pesticide applicator will retire soon. On the basis of interviews, the IPM manager does not appear to have sufficient support to implement the policies necessary for a successful pest-management program. For example, she sets numerous traps for mice and rats and determines whether rats have been localized to particular areas on the basis of nighttime infrared surveys. Efforts to train staff or develop an IPM team have met with mixed results. Attendance at IPM training classes is sparse, and routine attempts to meet with curators to review IPM goals are of limited success.

### Findings and Recommendation

#### **Findings:**

- *There have been a number of improvements and progress, but a true IPM team effort (for example, in which each functional area has a designee that ensures that concepts and principles are followed) has not been established. Written procedures for the use of rodenticides (such as a policy on highly toxic vs moderately or slightly toxic materials) or a general IPM policy has not been developed. A formal functioning and effective IPM team has not yet been established.*
- *Although progress in the short term has been made, because of lack of zoowide support the IPM manager and her director appear to be focusing on the details of individual problems, and the policy and zoowide sustainable programs necessary for long-term success have yet to be addressed.*

#### **Recommendation:**

- *IPM policies and procedures should be developed, and there should be proper documentation and senior management support of these policies. An IPM team should be formed with representation from all departments. A containment strategy should be developed for the dumpster and ancillary area.*

## 8

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# Assessment of Overall Directions in Animal Care and Management

An important part of the charge to the committee was to provide a comprehensive evaluation of the overall directions that the National Zoo has taken over the years and to comment on changes that have recently been made in the zoo's system of animal care and management. As part of this evaluation, the committee reviewed changes that reportedly have been implemented since its interim report was published. More important, this final report provides an assessment of the overall directions that the zoo has taken in the last 10 years with regard to animal care and management. In an evaluation of available information, several trends became apparent. Those trends are identified as short-term, long-standing, favorable, and unfavorable. Where appropriate, priorities for change are identified, and recommendations for continued work in specific directions are made.

### Facilities

The Rock Creek Park zoo facility consists of 22 major buildings with a combined total area of about 600,000 ft<sup>2</sup> (Smithsonian Institution, 2003b). The Smithsonian Institution secretary and the zoo director testified to Congress in 2003 that “over half of the zoo buildings have seriously compromised structural, mechanical, electrical and fire and life safety systems” (Smithsonian Institution, 2003b). A Smithsonian Institution Facility Management Integration Task Force recommended organizational changes to integrate facility maintenance, management, and operations (Smithsonian Institution, 2003b). The task force stated that “the living collection at the zoo necessitates vigilance by facility professionals with respect to code compliance for animal care and containment facilities. These unique circumstances pose critical concerns due to the vastly decayed structures and building systems at the zoo.” The most recent American Zoo and Aquarium Association (AZA) accreditation report (2003a) also noted a great amount of deferred maintenance. Several buildings have been demolished because of their poor condition. The most seriously deteriorated facilities today include the Bird House, the Invertebrate Area, the Elephant House, the Small Mammals House, Beaver Valley, the Seals and Sea Lions Area, the Bears Area, the Sloth Bears Area, and the Reptiles Area (Table 8-1 and Figure 8-1).

A recovery plan that has been developed will require at least \$250 million over the next decade to implement. The plan requires tripling the maintenance and repair budget of the zoo to \$12 million per year (Smithsonian Institution, 2003b). In March 2003, AZA gave the zoo 1 year to fix its most obvious structural deficiencies and various other shortcomings or potentially lose its accreditation (AZA, 2003a). The prior accreditation report (AZA, 1997) had noted multiple areas of the zoo that were poorly maintained, whereas the 1992 report (AZA, 1992) failed to note any major deficiencies in facilities or in their maintenance. Together, those data strongly suggest a serious decline in the infrastructure of the zoo over the last decade and a failure to meet accepted standards for AZA-accredited institutions.

Since the release of the committee's interim report (NRC, 2004a), AZA announced that the zoo had regained full 5-year accreditation. The FY 2005 budget request submitted by the Smithsonian Institution to the US Office of Management and Budget (OMB) provides further evidence of a commitment to a major revitalization of the zoo facilities (Table 8-2).

**Table 8-1.** Current Status and Plans for Animal Exhibit Areas

Area	Condition of Facilities as of Feb 2004 <sup>b</sup>	Construction, Repair, and Demolition Planned for 2004 <sup>c</sup>
Deer/Tapir Area	Failing	Scheduled for demolition in spring 2004 to allow for construction of Asia Trail I and II.
Bird House	Failing	Bird House screen and misting head repair completed. Owl exhibit renovation to be completed in 2004 New shed and heated water for Kori Bustard Yard to be completed in 2004 Heat for wetland ponds planned for 2004 General painting for Bird House Areas planned for 2004 Crane yard fence to be extended in 2004 Winter bird holding construction to be completed in September 2004 Upgrade of emergency generators is being planned
Invertebrates	Failing	Lids ECT to be completed in 2004 Repairs to soil table and large beetle tank planned for 2004
Pandas	Good	Railing modification, unknown completion time.
Prairie Trail	Good	Prairie Dog exhibit is being planned
Cheetah Conservation Station	Fair	Railing modification, unknown completion time.
Kangaroo Area	Good	—

<sup>a</sup> Facility condition as indicated by NZP Failure Map (NZP, 2004 Progress Report Appendix)

<sup>b</sup> Renewal and maintenance projects for 2004 as indicated by NZP List of Active OFEO Projects for Maintenance and Major Renewal (NZP, 2004 Progress Report Appendix).

**Table 8-1.** Continued

Area	Condition of Facilities as of Feb 2004	Construction, Repair, and Demolition Planned for 2004
Elephant House	Failing	Male elephant yard work and hydraulic gate work completed in January 2004 Renovation of Elephant House as part of Asia Trail II slated to start in September 2005 and be completed in 2007; male elephant pen upgrade is being planned
Beaver Valley	Failing	Upper Beaver Valley demolition complete Beaver/Otter exhibit repairs to be completed in May 2004
Seals/Sea Lions	Failing	Emergency rock repair to be completed February 2004 Seal/Sea Lion Chiller and Roof Replacement to be completed March 2004
Bears	Failing	Escape hatch maintenance planned for 2004
Small Mammals	Failing	Miscellaneous repairs completed Roof/skylight repair to be completed in 2004 Black-footed Ferret exhibit being planned
Great Apes	Fair	Removal of deteriorated and rusted shelving in quarantine area planned for 2004
Gibbons	Fair	New exhaust fan and dehumidifier planned for 2004
Sloth Bears	Failing	
Reptiles	Failing	Radiant heat installation planned for 2004. Slate feeding pad installed in Giant Tortoise Yard planned for 2004. Giant Salamander exhibit is being planned.

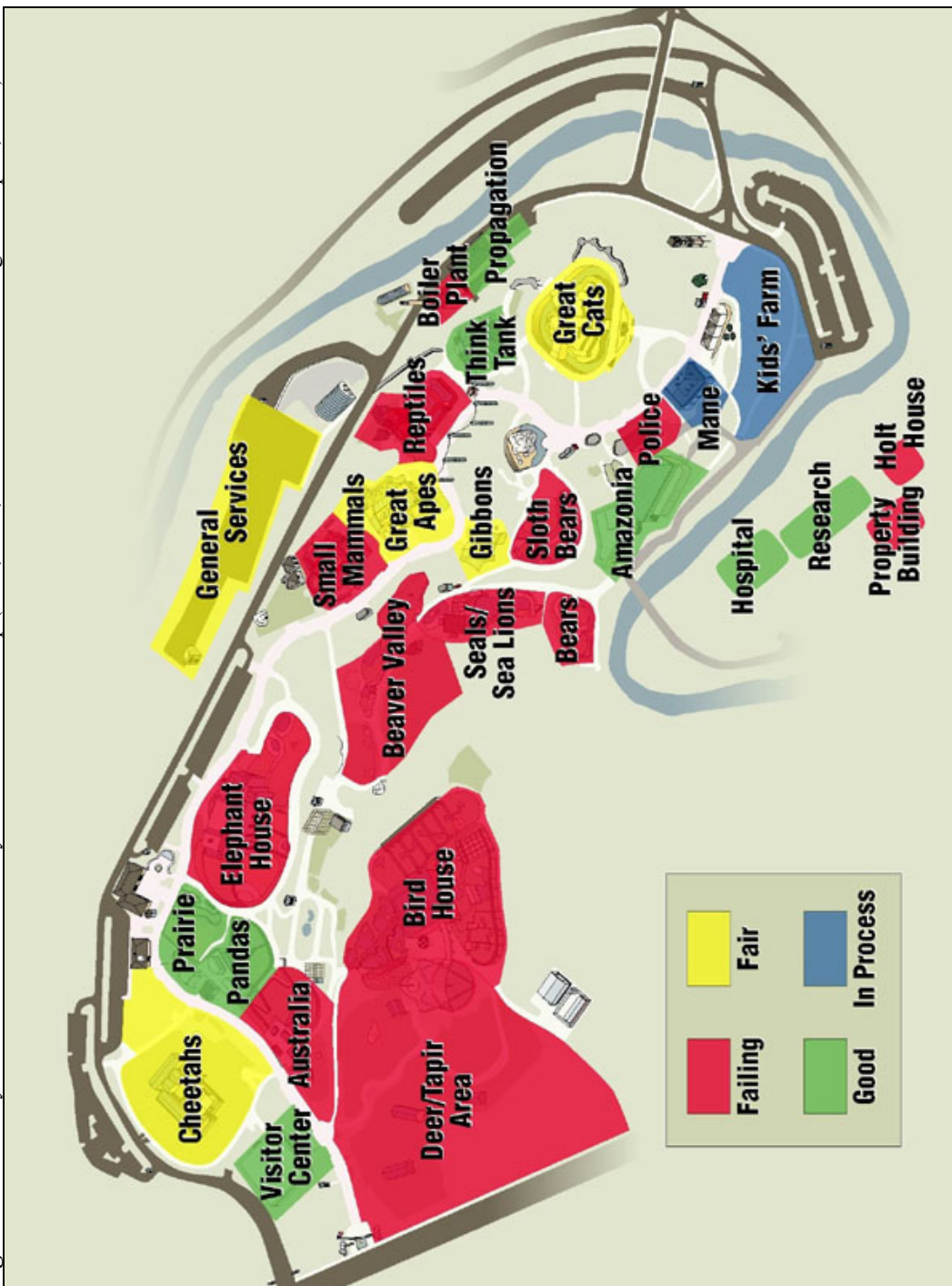


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Table 8-1. Continued

Area	Condition of Facilities as of Feb 2004	Construction, Repair, and Demolition Planned for 2004
Think Tank	Good	Radiant heat installation in outdoor macaque enclosure to be completed in 2004 New flooring at Lemur Island holding area planned for 2004
Great Cats	Fair	Lion and tiger pool repair to be completed in March 2004 Climbing furniture and elevated feeding platform to be installed in Red Panda exhibit
Amazonia	Good	Carpet replacement scheduled for February 2004. Fog system maintenance on hold Pathway improvement on hold for farm construction. Waterproofing/structural study to be postponed until 2004/2005 Upgrade of emergency generators being planned
Kids Farm	Good	Completed in spring 2004

**Figure 8-1.** Facility condition as indicated by the NZP Failure Map (NZP, NZP, AZA Accreditation Progress Report, 2004).



**Table 8-2.** Smithsonian Institution FY 2005 Request to OMB for Major Revitalization of Facilities of National Zoo<sup>a</sup>

	Request in thousands of dollars in FY										
	2003	2004	2005	2006	2007	2008	2009	Out Years		2003-2011	
Design Africa Exhibit	800	0	0	0	0	0	0	0	0	0	0
Asia II and III Design Elephant Relocation	2,500	0	0	0	0	0	0	0	0	0	0
Design Major Revitalization (Africa, Americas, Ape)	1,000	0	6,000	2,000	0	0	0	0	0	0	8,000
Update Rock Creek Master Plan	0	0	2,000	0	0	0	0	0	0	0	2,000
Design Ape Renovation	1,000	0	0	0	0	0	0	0	0	0	0
Design Small Mammals Renovation	0	0	0	0	3,000	0	0	0	0	0	3,000
Design Reptile and Invertebrates Renovation	0	0	0	0	0	3,000	0	0	0	0	3,000
Continue Design for Revitalization of Major Structures (B)	0	0	0	0	0	0	6,000	2,000	0	0	8,000
Design Roof and Skylight Replacement	400	0	0	0	0	0	0	0	0	0	0
Asia Trail I - (renovate Deer and Tapir Area)	7,000	9,000	15,000	0	0	0	0	0	0	0	24,000
Asia Trail II: Elephants FY05 ABOVE LINE REQUEST	0	0	34,000	29,000	0	0	0	0	0	0	63,000
Africa Exhibit	0	0	0	0	20,000	20,000	0	0	0	0	40,000
Renovate Seal/Sea Lion and Lower Bear (Americas)	0	0	0	17,000	20,000	0	0	0	0	0	37,000
Renovate Ape House	0	0	0	0	0	15,000	0	0	0	0	15,000
Renovate Small Mammals	0	0	0	0	0	0	30,000	0	0	0	30,000
Continue Revitalization of Major Structures	0	0	0	0	0	0	0	0	34,000	0	34,000
Construct Consolidated Maintenance Facility	0	0	0	0	0	0	0	0	5,000	0	5,000
Improve/Upgrade Site Utilities	0	0	1,000	500	500	500	500	1,500	0	0	4,500
Improve Bird, Small Mammals and/or Reptiles	0	0	0	0	650	0	0	0	0	0	650
Replace Forest Carnivore Trail	0	0	0	0	220	0	0	0	0	0	220
Renovate/Improve Restrooms and Amenities	0	0	500	1,500	900	0	0	0	0	0	2,900
Repair Seal/Sea Lion and Beaver/otter (Emergency)	75	425	0	0	0	0	0	0	0	0	425
Improve Fire Protection Systems	250	0	600	200	200	500	500	600	0	0	2,600
Upgrade Lion/Tiger Moat and Planters	0	0	0	0	0	900	0	0	0	0	900
Upgrade Lemur Island	0	0	0	0	0	0	0	0	0	0	0
Replace Roof and Skylight Elephant, Reptile, Sm. Mammals	0	0	4,000	2,000	2,000	2,000	0	0	0	0	10,000
Install/Improve Fire Protection Systems	100	0	100	100	100	200	100	300	0	0	900
Subtotal: NZP	13,125	9,425	63,200	52,300	47,570	42,100	37,100	43,400	0	0	295,095

The recent attention to animal enclosures and buildings that house animals is a short-term and favorable trend with long-term implications. Physical facilities should continue to have high priority for attention, and the zoo's strategic plan should integrate the master plan for building and renovation.

### **Animal Programs**

The size of the zoo animal collection started to decline in 1996; by 2002, it had decreased by 54% (NRC, 2004a). Decisions in recent years to improve the quality and safety of animal exhibits and enclosures or to build new facilities before acquiring new animals were generally prudent. The zoo has developed a fairly aggressive animal-collection plan for 2004 (NZIP, Animal Collection Plan, 2004) that could result in the acquisition of about 125 new species (NZIP, Animal Collection Plan, 2004). It is vitally important that the status of individual exhibits and plans for renovation be carefully considered when animal-collection plans are being developed so that failing facilities are not burdened with new animals and species, potentially endangering the animals' welfare and safety.

### **Veterinary Medicine and Veterinary Pathology**

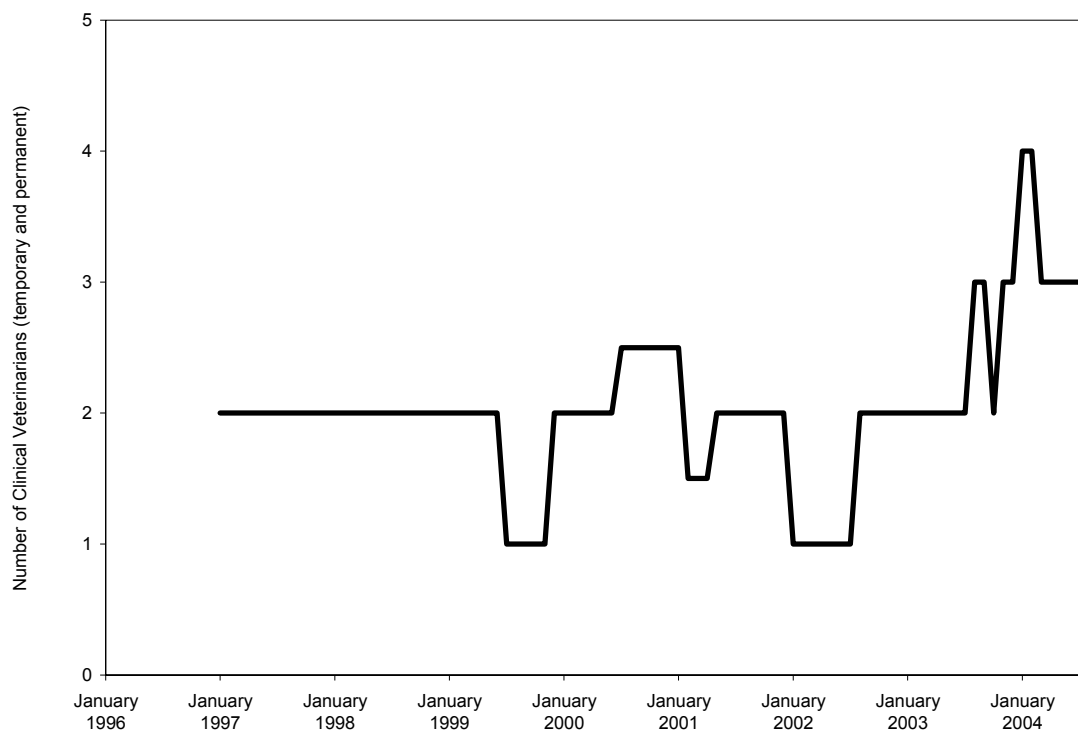
Over the last 5 years, the Department of Animal Health has increased its clinical veterinary staff from one veterinarian in late 1999 to the current contingent of three veterinarians; the number of clinical veterinary staff has fluctuated between one and four during this period (Figure 8-2) (NZIP, DAH 4-year Staffing Chart (1997-2000); NZIP, DAH 4-year Staffing Chart (2001-2004)).

The zoo's veterinary-care program has operated at a suboptimal level in recent years because of a lack of priority-setting, follow-through, and planning. For example, a comprehensive preventive-medicine program has been in place at least since 1998 (NZIP, Preventive Medicine Schedule, 1998), but the program has not been implemented with consistency, and the result was a substantial backlog of preventive-medicine procedures and in some cases the demise of collection animals. Similar problems were uncovered at the Center for Research and Conservation (CRC) Veterinary Services Department.

Since the publication of the committee's interim report, the Department of Animal Health has eliminated the backlog of preventive-medicine procedures, reviewed and updated its preventive-medicine protocols, and established a schedule for preventive-medicine procedures. In addition, the senior management of the zoo has established completion of scheduled preventive-medicine procedures as a monthly performance measure for both the CRC and Rock Creek Park veterinarians. If senior management continues to assess the quality of veterinary care through this and other performance measures, the committee is encouraged that the quality of veterinary care can be maintained.

The zoo's pathology department has been world renown and many important advances in veterinary medicine originated with this group. However, over the last several years, a backlog of pathology cases from 2000-2003 had developed, along with a failure to develop annual morbidity and mortality assessments. With the departure of the head of the department there is an urgent need to reestablish the essence of this department, so that it can once again become the outstanding institution it once was.

Figure 8-2. Veterinary staffing in the Department of Animal Health, 1997–2004



### Animal Welfare

As documented in the interim report (NRC, 2004a), the zoo had not been complying with federal regulations enacted to ensure the welfare of zoo and research animals since 1998. Internal Smithsonian documents also indicate that as early as 1993, the Smithsonian was aware that the zoo was subject to federal animal-welfare regulations—“the Smithsonian Institution is subject to the Animal Welfare Act for all research involving vertebrate animals and is subject to the Public Health Service Policies for PHS-funded research” (Smithsonian Institution, Steiner memo, July 23, 1993)—but was not in compliance with these regulations (Smithsonian Institution, Foss memo, August 17, 1993).

Those letters also document that the Smithsonian was aware that the zoo’s Institutional Animal Care and Use Committee was not being provided with the resources or mechanism to comply fully with federal regulations (Smithsonian Institution, Foss memo, August 17, 1993). Specific recommendations were made by Smithsonian employees on how to attain compliance, but there is no evidence that any of the recommendations were acted on.

After the release of the interim report (NRC, 2004a), substantial changes were made in the zoo’s animal-welfare oversight program, and the zoo was brought into compliance with both the Animal Welfare Act and PHS Policy. Continued vigilance on the part of the senior management is necessary to ensure that the welfare of the animal collection has the highest priority at the zoo.

### **Animal Nutrition**

As one of the first zoos in the country to employ a full-time professional nutritionist (in 1979), the zoo has given animal nutrition a high priority for the last quarter-century. That long-standing commitment has set the zoo apart from most others in nutrition research. However, recent deficiencies in the clinical-nutrition program and a lack of adequate coordination among professional staff on animal diets and feeding programs have resulted in animal deaths.

### **Human Resources and Institutional Capacity**

The zoo employs federal staff and outside contractors. The total number of government full-time equivalents (FTEs) allocated to the zoo decreased from 370 in 1993 to 317 in 2000 (NZIP, FTE Use, August 9, 2004)—a decline of about 14%. That trend has reversed, and the zoo is now allocated 346 FTEs. It should be noted that there was no net change in the number of keeper staff from 1993 to 2000 (NZIP, Staff Gain/Loss Statement 1993-2003, September 24, 2003), although the size of the zoo's animal collection declined by about 38% (NZIP, Status of the Collection Reports, 1993-2002). In fact, as the size of the collection continued to decrease after 2000 to less than 50% of its size in 1993, the zoo added six keepers to its' animal programs staff (NZIP, Staff Gain/Loss Statement 1993-2003, September 24, 2003). The zoo now has 74 permanent keeper positions (NZIP, Tanner memo, July 19, 2004).

### **Training and Development**

Since 1992, AZA has identified the lack of a formal training program for animal staff as a serious deficiency (AZA, 1992; 1997; and 2003a). With no formal training program in place today, the zoo has failed to address this long-standing need. However, the number of employees who chose to participate in professional-development activities (in and outside the zoo) has increased over the last 5 years (see Chapter 3). Nevertheless, there is no formal program in place to train new employees, and less than one-third of the keeper staff will be participating in continuing education in 2004.

It is imperative that the management and staff of the zoo recognize that, in general, institutional knowledge of animal husbandry and welfare has not kept pace with development in the zoologic and wildlife communities. The committee recognizes that during the last year, the zoo has been through a period of upheaval, which may have kept senior management from making substantial strides in developing institutional knowledge and establishing training priorities. However, in the committee's opinion, the greatest outstanding concern at the zoo is the lack of keeper training or plans to advance institutional knowledge of animal husbandry and welfare through education of the current keeper staff.

### **Strategic Planning**

The zoo has been operating since at least 1992 without a strategic plan (AZA, 1992). A strategic plan was completed in May 2004, but it lacked any substantial analysis of the challenges and weaknesses that the zoo must address and overcome to achieve its new vision. In addition, the strategic plan lacks any actionable plan for achieving its stated 1-year and 5-year goals. Without those elements, the committee doubts that the strategic plan can help the zoo to re-establish its preeminence in the zoo community and become "the Nation's Zoo."

### **Summary**

After a decade-long decline in facilities, animal collection, and quality of animal programs, the National Zoo has been through a year of upheaval as it has attempted to reverse some long-standing negative trends. The committee determined that the veterinary-care and nutrition programs had been failing in their charge over the last five years to provide high-quality care for the animal collection. Important deficiencies in supervisory skills, personal responsibility, and professionalism throughout the Department of Animal Programs and management structure contributed to animal deaths at the zoo. In addition, the leadership of the zoo and the Smithsonian Institution over the last 10 years missed prominent opportunities to arrest some of the deficiencies at the zoo. In

particular, the leadership failed to act on deficiencies that were brought to its attention in the early 1990s; this resulted in a lack of resources and support for programs that ensure animal welfare and provide training and professional development.

The committee was presented with copious evidence that the zoo has many strengths, including the quality of its science programs and the dedication of its staff. The zoo staff have expended enormous time and energy to enact favorable changes at the zoo as quickly as possible. Over the last 6 months, they have reorganized the preventive-medicine and nutrition programs, and made great strides in developing an electronic keeper record system, centralizing their commissary, and establishing performance measures and accountability at all levels of the organization.

For the National Zoo to regain its preeminence in the zoo community, the leaders of the Smithsonian and of the zoo must ensure that resources and support continue to flow into the zoo so that the zoo can address the major obstacles still ahead of it: establishing rigorous animal-care staff training, establishing a climate of accountability and personal responsibility, renovation or construction of animal facilities, and the development of a complete and comprehensive strategic plan.

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## **Appendix A**

### **SMITHSONIAN NATIONAL ZOOLOGICAL PARK STRATEGIC PLAN**

# **SMITHSONIAN NATIONAL ZOOLOGICAL PARK STRATEGIC PLAN**

May 28, 2004





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## Introduction

### **The first bold vision**

A bold vision led to the founding of the Smithsonian's National Zoological Park in 1889 in Washington, DC. The Zoo was to be "a home and a city of refuge for the vanishing races of the continent," and its mission "the advancement of science and the instruction and recreation of the people." Beginning with a few bison, a pair of borrowed elephants, and a few keepers, the Zoo grew to be a beautiful 167-acre urban park designed by Fredrick Law Olmsted, along with a 3,200-acre research center in rural Virginia, and dozens of field sites around the world.

The national collection of animals now includes nearly 2,500 individuals of 400 species, many that are quickly "vanishing" from the wild. Hundreds of staff care for the animals, exhibits and grounds, educate the public, and study animals and their habitats. The Zoo has the distinction of being the only zoo in this country that represents a partnership between the federal government and the private sector. Its membership and support organization, Friends of the National Zoo (FONZ), has more than 30,000 family members and 1,000 volunteers, and generates funds for Zoo programs. The Zoo has been internationally recognized for its exhibits and animal collections as well as for its science, conservation, and education programs.

Despite its long tradition and impressive history, the Zoo faces considerable challenges as it enters the 21<sup>st</sup> century. For the most part, its facilities are old. Financial investment has been insufficient for several decades, and operating budgets are lean. As a result, the number of staff and animals declined for many years. The Zoo's science and conservation activities are reflected in just a handful of exhibits. While changes are underway to reverse these trends and rejuvenate the organization, the Zoo needs direction. Staff and supporters recognize that now is the time to develop a comprehensive, forward-looking strategic plan.

### **A vision for the "nation's zoo"**

In the broadest sense, the strategic plan for the Zoo hinges on two questions: What does it mean to be the "nation's zoo?" And, what are the key elements of a "great" zoo? The strategic plan also builds upon the original vision: The Zoo's founders understood that threatened species

needed a place of refuge. This need is even more urgent today: Animals and their habitats are disappearing while scientists continue to gather necessary information to conserve biodiversity. The problem is global, and the list of endangered species is growing.

To be the “nation’s zoo” means setting and meeting the highest standards for animal care and exhibition, zoo-based education and research programs, national and international professional training programs, and field-based research and conservation activities. The Zoo’s animals are national treasures - like the Hope Diamond and the Star-Spangled Banner – and yet they are not one-of-a-kind objects. They serve as ambassadors for their species in the wild. Thus, the stewardship responsibility of the Zoo extends beyond its front gates. Staff reach out to the whole world, working to inspire and teach others to discover and understand animals.

The National Zoo is considered by many to be among the great zoos of the world. Great zoos motivate people to care about animals and to take action to help them, rather than harm them. They collaborate with each other, and with non-governmental organizations involved in wildlife management, science and conservation all over the world. The Zoo is highly respected for its scientific discoveries, multidisciplinary research programs, and commitment to training the next generation of zoo and conservation professionals.

Great zoos create exhibits that provide animals with modern homes, inspire and educate visitors. They provide naturalistic habitats that encourage natural behavior and breeding, and allow visitors the opportunity to see animals they might never see in the wild. Great exhibits also serve as laboratories, where long-term studies of animal health, reproductive biology and behavior yield results that help their management and conservation. Many of the National Zoo’s newer exhibits – Amazonia, Think Tank, Golden Lion Tamarins, Giant Panda Conservation Habitat, and the emerging Asia Trail – are excellent examples.

Zoos have the potential to shape public opinion regarding the need to protect wildlife. If not for zoos, many people would never experience wild animals first-hand or develop the personal bonds that touch hearts and inspire minds. Just as all zoos strive to be great stewards of the animal world, the nation’s zoo must lead by example.

### **The planning process**

After months of careful preparation, strategic planning began in December 2003 with the formation of a 12-member planning team. The team members, nominated by their peers, represented the wide range of functions, tenures, and demographics of the Zoo's large and diverse staff. During the next five months, the team crafted the strategic plan that follows.

The planning team did not work in a vacuum; it received extensive feedback from both internal staff and external stakeholders, including the public and members of the professional zoo, animal science and conservation communities. As a result, this plan belongs to the whole Zoo and its various stakeholders. (For details about the strategic planning process, see the Appendices and References.)

This strategic plan is designed to firmly establish the National Zoological Park in its pre-eminent role as the nation's zoo and an international leader in zoo-based science and conservation. It outlines a challenging journey that will require a sustained effort on the part of many. And it includes performance measures designed to drive change and track the Zoo's accomplishments. The nation's zoo begins its second century with a new, bold vision – a vision with a global reach, inspired by the success of the first 100 years and crafted by the Zoo's dedicated staff and supporters.

## Components of the Plan

**Strategic Plan:** The strategic plan is a roadmap for the future that addresses where the Zoo is going and how it will get there.

**Mission:** The mission is the Zoo's reason for being; what would be lost if it did not exist.

**Core Values:** The core values are the set of beliefs that drive everyday behavior at the Zoo.

**Ten-Year Vision:** The 10-year vision is what Zoo staff and supporters really want to achieve - an exciting, compelling, and attainable future state.

**One- and Five-Year Goals:** The one- and five-year goals are a description of results to be achieved at the Zoo by a particular point in time.

**Strategies:** The strategies are the basic approach to achieving the Zoo's goals. Rather than develop strategies for every goal, the plan includes a small set of strategies, each of which addresses multiple goals; the limited number of strategies is intended to keep the strategic plan tightly focused.

**Performance Measures:** The performance measures are the indicators used to determine if progress is being made toward the Zoo's vision; these are the benchmarks that will be used during the first year of implementation of the plan. At the end of one year, the measures will be assessed based upon the starting point and the degree to which they drive change and reflect accomplishments. As unit plans are developed during implementation, each will include additional performance measures to determine progress within the unit toward the vision.

## **Mission**

We are the nation's zoo, providing leadership in conservation science. We connect people with wildlife through exceptional animal exhibits, explore solutions through science-based programs, build partnerships worldwide, and share our discoveries. We educate and inspire diverse communities so they become part of this commitment to celebrate, study, and protect animals and their habitats.

## **Core Values**

### **UNITY**

We are one Zoo. Our various organizations and departments work in unity toward a common vision.

### **CONSERVATION**

We are environmentally responsible. Our actions, practices, and programs contribute to conservation.

### **STAFF**

We invest in our staff. We value diversity and provide the resources, training, and skills needed to excel in our jobs. Every role is clearly defined and respected.

### **COMMUNICATION**

We communicate effectively. We ensure that the voices of our staff are heard and information is shared throughout all levels of the Zoo.

### **EXCELLENCE**

We are professionals. We set the highest standard in caring for our animals and providing service to our visitors, communities, colleagues, and collaborators. We take responsibility for our actions.

### **FUN**

We make being at the Zoo fun. Our positive attitudes contribute to an enjoyable experience for everyone.

## **Ten-Year Vision**

It takes people to save wildlife. We inspire, train, and empower each generation to care for animals and conserve wildlife. Our impact is global.

### **IN 10 YEARS:**

As visitors enter our urban oasis, they will be inspired by state-of-the-art, innovative animal exhibits that reflect our commitment to animal care, science, and public engagement. Exhibits will connect visitors with the natural world and immerse them in our real-life stories of wildlife conservation. Our outstanding volunteer, education, and international outreach programs will enable people to learn more and take a personal role in the future of wildlife.

Our professional internships and training programs will be sought-after by highly motivated individuals, locally and internationally. Our apprentice programs will attract people from diverse backgrounds to learn the professions of a modern zoo. The National Zoo's facility in Front Royal, Virginia will be fully utilized as a center of excellence in science-based conservation. We will be renowned for developing leaders in the fields of zoo management, veterinary care, conservation science, and education.

The National Zoo will be known for its long-term commitment to capacity building and training. We will share science-based tools and information, empowering local communities to conserve habitats and animals.

Our staff will be respected as leaders and mentors in zoo and conservation sciences nationally and internationally.

## **Ten-Year Vision**

It takes people to save wildlife. We inspire, train, and empower each generation to care for animals and conserve wildlife. Our impact is global.

### **Performance Measures: Vision**

1. Number of exhibits (new and renewed) based on agreed-upon standards for animal care, scientific accuracy, interpretation and exhibitry.
2. Number of training programs offered by Zoo staff covering topics related to zoo-related management, conservation and wildlife issues at various levels (K-12, undergraduate, graduate, professional).
3. Number of certificates awarded to staff and others trained at the Zoo or by Zoo staff in zoo-related management, veterinary care, conservation science and education through internships, apprenticeships, fellowships, residencies.
4. Percentage of staff serving in professional leadership positions or receiving recognition from professional organizations.
5. Number of presentations and publications that connect and inform the general public and the professional community about Zoo animals and science.
6. Number of sites (states/countries/communities) where there is a continued Zoo presence.



## **Goal Category#1: Animal Management**

### **ONE-YEAR GOALS**

1. We have prepared our existing animal data to transition our databases to the new Zoological Information Management System.
2. Cross-departmental interactions for animal management are standard practice and are effective. Roles, responsibilities and decision-making processes are clear.
3. Our collection and exhibit planning process has been established as one of our core management tools, guiding decision making on species acquisitions and animal movements/relocations. This process is criteria-driven, cross-departmental, expeditious, and transparent.

### **FIVE-YEAR GOALS**

1. We use comprehensive, integrated electronic record-keeping systems.
2. Our animal collection is a dynamic expression of our conservation, science, animal management, and education priorities.
3. Our animals thrive in environments that are consistently well maintained and renewed through effective use of resources and animal management practices.
4. Our staff are valued as experts and innovators in the practices of animal health sciences, husbandry, and management.
5. We have expanded our training programs in animal management in two ways: 1) by formalizing staff development, and 2) by increasing internships, apprenticeships, and residencies. These programs attract professionals from around the globe and cultivate future leaders.

6. We have capitalized on our Front Royal land and facilities to expand our collaborations in animal management and conservation with other organizations.

### **Performance Measures: Animal Management**

1. Number of staff participating in Species Survival Plans (SSPs), Taxon and Veterinary Advisory Groups (TAGs, VAGs) and other related national/international organizations.
2. Percentage of scheduled preventive medicine procedures accomplished monthly.
3. Number of sick/injured animals NOT receiving curatorial and veterinary attention within 24 hours of problem reported.
4. Percentage of decisions about animal moves and species acquisition made based upon collection plan that reflects integration of science, education, exhibit and facility priorities.

## **Goal Category #2: Science**

### **ONE-YEAR GOAL**

1. We have established science priorities for the National Zoo that build on our core scientific strengths in conservation biology and animal management. Our collection, exhibit, and education planning reflect these priorities.

### **FIVE-YEAR GOALS**

1. The Zoo is a leader in integrating zoo-based and field-based research programs to study and conserve species and biodiversity.
2. We have established the Center for Conservation Biology at the Zoo's Front Royal facility, a Smithsonian-wide multidisciplinary program focusing on the study of extinction-prone species.
3. We build strategic partnerships to advance Zoo and Smithsonian priorities in science and conservation and are a resource for federal agencies, zoos, universities, and conservation organizations.
4. Our science and conservation activities are reflected in our collection, exhibits and education programs.
5. We have strengthened our national and international training programs for zoo and conservation professionals by unifying, expanding and promoting them.
6. We have expanded our long-term commitment to capacity building and training in countries in which we conduct research. We share science-based tools and information, empowering local communities to conserve habitats and animals.

## **Performance Measures: Science**

1. Percentage of scientific staff serving as adjunct faculty, on graduate committees and sponsors of fellows.
2. Number of active partnerships with other AZA institutions, government agencies, universities that meet agreed-upon standards.
3. Number of projects that integrate zoo-based with field-based research.
4. Number of research programs that are multidisciplinary, partnership-based, and focus on extinction-prone species.
5. Number of peer-reviewed technical publications.

## **Goal Category #3: Education**

### **ONE-YEAR GOAL**

1. We have organized our multiple education programs to ensure they are driven by clear priorities and are well coordinated, with leadership at the senior management level.

### **FIVE-YEAR GOALS**

1. Our education program is built on the integration of the Zoo's work in animal management, science, and conservation.
2. Our formal and informal education initiatives are based on, and contribute to, current education practices and standards to effectively reach our audiences.
3. All departments contribute to the Zoo's education efforts and events with time, content and participation; education staff provide all departments with resources to support these efforts.
4. Our interpretive programs have been expanded Zoo-wide and serve as models for engaging the public.
5. Our professional training programs have been expanded to include mentorships, apprenticeships, and internships in the professions of a modern zoo.
6. We have built strategic partnerships in education with other Smithsonian units.

## **Performance Measures: Education**

1. Number of people reached through formal and informal education programs.
2. Number of educational programs based upon education research theory and evaluated using best practices.
3. Percentage of exhibits with active interpreter programs.
4. Number of educational programs underway in collaboration with other SI units.

## **Goal Category #4: Public Impact**

### **ONE-YEAR GOALS**

1. We have created a distinctive visual identity through consistency in the appearance of our graphics, materials, interpretive elements, and Web site.
2. Feasibility study and business plans have been completed to decide whether to open portions of the Front Royal facility to the public.

### **FIVE-YEAR GOALS**

1. The National Zoo is recognized as one of the finest zoos in the country, both by the public and our professional peers.
2. Our collection, exhibits, and education programs reflect our science and conservation activities.
3. Our actions, practices, and programs contribute to conservation, and this is evident to our audiences.
4. Our exhibits and landscaping connect visitors to wildlife, tell compelling stories about our science and conservation, and inspire visitors to care for and conserve wildlife.
5. All graphics, materials, Web site, and interpretive elements are accurate and well maintained.
6. The Zoo offers excellent visitor services that make visitors feel welcome, comfortable and cared for. All staff provide outstanding customer service.
7. We have significantly expanded our impact by increasing overall attendance and reaching new audiences.

## **Performance Measures: Public Impact**

1. Number of visitors per month.
2. Percentage increase in currently underserved and new audiences to the Zoo and its public programs.
3. Number of Web pages new or updated monthly that reflect current programs.
4. Number of news stories that cover science, exhibit, education and animal care successes.
5. Percentage of Zoo signage that is in good condition and up to date.
6. Number of complaints (unsolicited and from visitor surveys) about visitor amenities and customer service.
7. Number of unsolicited complaints about Zoo cleanliness, overall aesthetics, and customer service.



## **Goal Category #5: Financial Strength**

### **FIVE-YEAR GOALS**

1. Our federal appropriations, revenue-generating activities, and external support are sufficient to fund the Zoo's vision.
2. We have a strong partnership with the SI leadership, providing them with materials and rationale that support the financial requirements of the nation's only federal zoo.
3. We identify funding priorities through Zoo-wide planning, taking advantage of our unique settings and strengths as a zoo.
4. We set and meet ambitious development goals that ensure stability and provide resources for future growth. Our coordinated boards support these efforts and play a major role in securing resources for our priorities.
5. Our revenue-generating activities are based on best business practices, allowing us to maximize income from these activities.

## **Performance Measures: Financial Strength**

1. Funds received from development activities for priority projects.
2. Net income received from FONZ concession activities.
3. FONZ profit margin targets met.
4. Number of successful funding proposals for staff and programs through other organizations and partnerships.
5. Number of master plan projects supported by the five-year facilities capital budget.

## **Goal Category #6: Staff and Organization**

### **ONE-YEAR GOALS**

1. All staff know the core values, and there are mechanisms to establish their practice.
2. Human resource practices are clear, efficient, and take advantage of current technologies and best practices of the government and private industry.

### **FIVE-YEAR GOALS**

1. All managers are effective leaders who guide the Zoo toward its vision.
2. All staff practice our core values. Management models and reinforces them.
3. All staff are well trained and have the resources to grow within their current position. All staff have the opportunity to participate in professional development activities, including attendance at conferences and involvement with professional organizations.
4. Our efficient administrative procedures, and those who manage them, support staff in managing human resources and budgets.
5. We increase staff diversity through expanded recruitment practices nationwide, involvement in our local community, and targeted outreach programs. Staff actively participates in these programs Zoo-wide.
6. Our organizational structures, management systems and processes are aligned and encourage staff to work cooperatively across departments toward common goals and priorities.

## **Performance Measures: Staff and Organization**

1. Percentage of performance ratings completed on time.
2. Percentage of staff meeting or exceeding the performance standard for practicing core values.
3. Percentage of supervisors (including managers) trained in administrative procedures, managing human resources and budgets.
4. Percentage of staff who have completed their professional development plan each year.
5. Number of equal employment opportunity (EEO) informal and formal complaints and union grievances filed.

## **Goal Category #7: Facilities**

### **FIVE-YEAR GOALS**

1. Our master plan guides development of renewed facilities at Rock Creek and Front Royal. The plan is based on sound land use practices, addresses our infrastructure needs, and allows for flexibility in future growth.
2. All renewed facilities incorporate environmentally sound, state-of-the-art design principles, materials, and technologies.
3. The Zoo's physical structures and landscape are well maintained and visually appealing. All maintenance tasks are identified, prioritized, scheduled, and completed in a timely fashion.
4. Our shops and operations support the unique requests related to Zoo functions.
5. The Zoo evaluates and utilizes environmentally sound practices in Zoo operations.
6. The Zoo has significantly increased the quality and quantity of visitor amenities (e.g., restrooms, shaded sitting areas, water fountains, recycling and trash collection points, information stations and concessions).

## **Performance Measures: Facilities**

1. Number of visitor amenity improvements underway or completed.
2. Percentage of work orders completed each month.
3. Number of revitalized buildings or projects that meet agreed-upon standards based on best environmental practices.
4. Number of significant finds (problems) identified by RCM (Reliability Centered Maintenance).

## **Strategies**

### **STRATEGY # 1: MASTER PLANNING**

Develop and complete a visionary master plan that capitalizes on the uniqueness of the Zoo's land and locations, and provides flexibility for future programs and exhibits. It is the physical expression of the Strategic Plan.

### **STRATEGY #2: ORGANIZATIONAL DESIGN**

Examine and adjust as necessary the Zoo's organizational design to align its diverse functions, improve coordination, minimize redundancy, and enhance collaboration. Clearly articulate roles and responsibilities, and establish decision-making authority across units.

### **STRATEGY # 3: INTEGRATED FINANCIAL PLANNING**

Develop a consolidated financial planning process for the Zoo. Use this process to manage our federal and non-federal funds and address financial needs.

### **STRATEGY # 4: LEADERSHIP AND MANAGEMENT**

Assess and enhance the leadership and management skills of Zoo leaders, managers, and supervisors to increase their effectiveness.

### **STRATEGY # 5: CORE VALUES**

Immediately implement a program that will promote the Zoo-wide practice of core values.

### **STRATEGY # 6: VISIBILITY**

Implement a comprehensive plan to maximize visibility of the Zoo's successes and expertise to local, national and international audiences.

## **Appendix A: Strategic Planning Process**

### **GENERAL APPROACH**

There are many approaches to strategic planning, and each has its benefits and limitations. Zoo staff selected a process that allowed them to capitalize on the remarkable talent and commitment of staff and supporters, and the unique nature of the organization among zoos (federal government-private sector partnership). The process was intended to be comprehensive, staff-built, and inclusive of internal and external stakeholders. Staff selected a plan structure that followed the direction of the Smithsonian Institution's strategic plan, and was easily understood. The strategic planning process was informed by the work of John Kotter, Peter Senge, Jim Collins, and Gary Hamel (see References).

### **COMPONENTS OF THE PROCESS**

#### **Staff-nominated strategic planning team**

All Zoo staff were invited to nominate individuals from all levels and all functions across the organizations described above to participate on a strategic planning team. The nomination process resulted in a strategic planning team of 12 individuals representing a wide array of functions, tenure, and demographics. This team worked from December 2003 through May 2004 to conduct site visits, collect stakeholder input/feedback, and write the strategic plan.

#### **Multiple rounds of input from Zoo staff and stakeholders**

Hundreds of Zoo staff met several times to work in cross-departmental groups, giving input on the strategic plan as the team developed a draft. These sessions provided the strategic planning team with rich guidance as they worked on the strategic plan. Each session was facilitated using a system of wireless computers so that staff could input their ideas anonymously, and read all of the input as it was generated. The input from these sessions was regularly posted on the Zoo's intranet for staff to review. The sessions also gave staff an opportunity to meet new colleagues and gain new perspectives on the opportunities and challenges facing the organization.



Several external stakeholder input sessions were also held, both in person and Web-based. The input provided at each stakeholder meeting was compiled and given to the Strategic Planning Team. External stakeholders included members of the following: all three Zoo boards (Zoo Advisory Board, FONZ Board, and CRC Foundation Board), the professional community (other zoos and AZA institutions, scientists, and conservation organizations), FONZ and FONZ volunteers, the local communities in Washington, D.C., and Front Royal, Virginia.

### **Multiple rounds of feedback from Zoo staff**

Feedback sessions for staff were also held multiple times using the wireless computer system. Elements of the plan in draft form were circulated to all staff prior to these sessions. During feedback rounds, the strategic planning team asked staff three questions, and incorporated the responses into their work. These were: What do you like? (Those aspects that are at least an 8 on a scale of 1-10, where 10 is the equivalent of “wow”). What needs more work? (The direction is good but it needs to go farther). What do you not like? (Here is why).

### **Working partnership between senior management and strategic planning team**

As the strategic planning team finalized each portion of the strategic plan based on feedback, they held working sessions with the senior management team to complete the plan. Each group enjoyed the benefits of the expertise and perspective of the other group and was able to make decisions using consensus throughout the process.

### **NEXT STEPS: IMPLEMENTING THE PLAN**

Implementation of the Strategic Plan begins immediately. The strategies will be deployed and necessary staff teams created. By the end of 2004, each “unit” within the Zoo will complete unit strategic plans and performance measures, based on the goals and strategies outlined in the overarching Plan. These unit plans will guide staff performance plans, encourage cross-unit activities, and support the newly identified Core Values.

## **Appendix B: Timeline for Strategic Planning**

### **October 2003**

Oct 2 - 3: Senior management team (“Core Team”) retreat to develop strategic planning assumptions and expectations.

Oct 16-17: Strategic planning process and Core Team’s expectations and assumptions introduced to staff. Staff to provide comments via e-mail.

Oct 23: Staff input received via email on expectations and assumptions.

### **November 2003**

Nov 3, 4, 12, 13: Staff input on Mission, Core Values, Ten-Year Vision and nominations for strategic planning team.

Nov 20: Strategic Planning Team selected.

### **December 2003**

Dec 16 - 17: First meeting of Strategic Planning Team.

### **January 2004**

Jan 6-8: Strategic Planning Team tours Rock Creek and CRC facilities

Jan 22-23: Strategic Planning Team site visit to New York Wildlife Conservation Society.

### **February 2004**

Feb 3,4,7: Input from Zoo Advisory, FONZ and CRCF boards, FONZ members and volunteers, local community members (Rock Creek and CRC), professional community.

Feb 5: Strategic Planning Team announces their communication plan for staff.

Feb 9-11: Strategic Planning Team meeting at CRC.

Feb 17-18: Strategic Planning Team meets with Core Team to discuss draft Mission, Core Values, Ten-Year Vision.

Feb 20: Strategic Planning Team presents draft Mission, Core Values, Ten-Year Vision to staff.

Feb 23-25: Staff feedback on draft Mission, Core Values and Ten-Year Vision.

### **March 2004**

Mar 2-3: Strategic Planning Team meets to review feedback, finalize Mission, Core Values and Ten-Year Vision.

Mar 8-10: Strategic Planning Team meets with Core Team to agree on final Mission, Core Values and Ten-Year Vision.

Mar 12: Strategic Planning and Core Teams present final Mission, Core Values and Ten-Year Vision to Dr. Evans (Under Secretary for Science, Smithsonian Institution); approved.

Mar 16: Final Mission, Core Values and Ten-Year Vision presented to staff.

Mar 17-22: Staff input on Goals, Strategies, and Performance Measures.

Mar 28-30: Strategic Planning Team drafts Goals, Strategies and Performance measures.

### **April 2004**

Apr 6, 7, 15: Strategic Planning Team meets to draft Goals, Strategies and Performance Measures.

Apr 16: Strategic Planning Team presents draft Goals, Strategies and Performance Measures to Core Team.

Apr 20-21: Core Team meets to discuss draft Goals, Strategies and Performance Measures; Performance Measures placed on hold until completion of Goals and Strategies.

Apr 21: Strategic Planning Team meets with Core Team to discuss Goals and Strategies.

Apr 22: Draft Goals and Strategies presented to staff.

Apr 23-27: Staff feedback on Goals and Strategies.

Apr 28-30: Strategic Planning Team finalizes Goals and Strategies.

### **May 2004**

May 5: Strategic Planning Team presents finalized Plan (Mission, Core Values, Ten-year Vision, Goals and Strategies) to Core Team; Plan sent to USS Evans.

May 6: Strategic Planning Team meets with Core Team and USS Evans to agree on final Plan; approved.

May 14: Final Mission, Core Values, Ten-year Vision, Goals and Strategies (without Performance Measures) distributed to staff via e-mail and posted on ZooNet.

May 19: Core Team drafts Performance Measures based upon initial Strategic Planning Team draft from April 16.

May 21: Strategic Planning Implementation Team formed with representatives from Core Team (3) and Strategic Planning Team (2) plus staff from various units and levels; first meeting planned for June 8.

May 21: Core Team distributes draft Performance Measures to staff, Strategic Planning Team and USS Evans for feedback

May 26: Core Team and Strategic Planning Team review feedback and agree on final Performance Measures.

May 27: USS Evans approves Performance Measures and Introduction.

May 28: Plan completed; distributed to all staff via e-mail and ZooNet; prepared for posting on public Web site.

## **Appendix C: Input and Feedback Sessions**

### **STRATEGIC PLANNING PROCESS INTRODUCTION TO STAFF (OCT 16, 17 2003)**

#### **Introduction**

- Strategic Planning process introduced to staff
- Core Team's expectations and assumptions about the plan presented
- Structure of plan outlined
- Working group roles outlined (Core team, coordinating team, strategic planning team, staff responsibilities)

#### **Input Questions via e-mail to staff:**

1. What do you like or would you add to the draft Assumptions about the Zoo's Strategic Planning process that were discussed at last week's meeting?

2. What do you like or would you add to the draft Expectations of the Zoo's Strategic Planning process that were discussed at last week's meeting?

3. What do you like about how the Roles of those who will be involved in the Zoo's Strategic Planning process are defined? These include the roles of the Core Team, Strategic Planning Team, Zoo staff, Coordinating Team, stakeholders, etc. What questions do you have about these roles? Is there anything missing in the role definitions?

4. What do you like about the Strategic Planning Schedule that was shown at last week's meeting? What haven't we thought of that could get in the way? What changes/additions does the schedule need?

5. What kinds of communications will work best for you as we begin the Strategic Planning process to ensure you are kept informed?

## **NZP STAFF INPUT SESSION #1: MISSION, TEN-YEAR VISION, CORE VALUES (NOV 3, 4, 12, 13, 2003)**

### **Introduction**

- Review overall strategic planning timeline
- Review purpose of meeting and agenda
- Outline ground rules and assumptions
- Be specific
- Share airtime – listen for fresh understanding
- Ask open-ended questions (not ‘yes’ or ‘no’) to increase understanding
- Input themes (we all agree), patterns, and differences – no right answers or forced agreement
- Switch typists at computer
- Enjoy the conversation

Input Question (discuss and input ideas into computer):

- Here is how we’ll know this effort is real and will make a positive difference, such that we will have confidence and invest in it.

### **NZP’s Mission**

Present current mission

Input Questions:

- What do you particularly like about the mission?
- What else (if anything) is needed to express the National Zoo’s unique value?
- Tip: What would be lost if the National Zoo didn’t exist?

### **NZP’s Values**

Each person thinks of three events that were really telling about ‘how things really work around here’ (positive and negative) (Hurricane Isabel, sick animal, decision to do a new exhibit), then discuss the values evident in these situations.

Small group conversations (with structure) (40 min.)

### Input Questions:

- What are the Zoo's current values?
- What new values need to be added? (Define each value and give an example)

### **NZP's 10-Year Vision**

Set context for visioning activity

Small group discussions and input

Assuming successful implementation of the mission and values, and that you could fund it, what do you want to achieve in ten years? (Here are some conversation starters):

- What would you physically see?
- What are people saying and doing?
- What's our impact beyond the Zoo?
- How is staff behaving?
- What if you were 10 times bolder? What seems impossible now, but if were possible, it's the future you want to see?

### Input Question:

- What are two to three of your best ideas, based on the conversation?

### **Nominating the Strategic Planning Team**

Distribute nominating form

Qualities to think about when nominating staff for the Strategic Planning Team:

- Creative
- Forward-thinking
- Have the ability to work well with others
- Able to represent the whole organization, rather than individual units.

### **Closing**

Individual groupware input: Meeting evaluation (what worked, improvements for next time)

**NUMBER OF SESSIONS HELD: 4**

**TOTAL NUMBER OF ATTENDEES: 350**

**EXTERNAL STAKEHOLDER INPUT SESSION:  
ZOO ADVISORY, FONZ AND CRC FOUNDATION BOARDS  
(FEB 3, 2004)**

**Purpose:**

- To provide an opportunity for stakeholders (i.e., those who impact, or are impacted by, the functioning of the National Zoo) to give input to the Zoo's strategic planning process
- To ensure that the Zoo's Strategic Planning Team develops a plan based on the best thinking of all of the stakeholders, both internal and external
- To provide an opportunity for the Zoo's stakeholders to meet together, to get to know each other better, to learn from each other, and to positively influence each other's contribution to the Zoo

**Welcome**

Welcome; introduction of Strategic Planning Team

Introduction of each board by chairs of each board (Zoo Advisory, FONZ, CRCF)

**Introduce NZP Strategic Planning**

Provide key points on strategic planning and approach NZP is taking

Discuss expectations, agenda, roles, etc.

**Mission/role of the National Zoo**

Present current mission

Small group discussion about questions

- What do you particularly like about the mission?
- What else (if anything) is needed to express the National Zoo's unique value?
- What would be lost if the National Zoo didn't exist?
- What does it mean to be 'national'?

Input two-three best ideas in computers



## **Long-term vision of the National Zoo**

Set context for visioning activity

Assumption: funding will come if a compelling future is defined

- What can you imagine NZP being in 10 years?
- What would you physically see or hear about?
- What positive impact, achievements, stature would be attributed to NZP?
- In the world of conservation?
- In the zoo world?
- In your world?
- What if you were ten times bolder? What seems impossible now, but if were possible, it's the future you want to see?

Input two to three best ideas in computers

## **Your relationship with the National Zoo**

- Ten years from now, what role will you have played in NZP's success?
- How did you participate and contribute?
- What do you hope the other boards here today will contribute to NZP's success?

## **Moving forward**

Next steps in the strategic planning process

Group discussion:

Your role in the remainder of the process

What's the best way to communicate with you?

**NUMBER OF SESSIONS HELD: 1**

**TOTAL NUMBER OF ATTENDEES: 30**

**EXTERNAL STAKEHOLDER INPUT SESSION:  
VOLUNTEERS/FONZ MEMBERS/LOCAL COMMUNITY  
(ROCK CREEK AND FRONT ROYAL; FEB 3-7, 2004)**

**Purpose:**

- To provide an opportunity for stakeholders (i.e., those who impact, or are impacted by, the functioning of the National Zoo) to give input to the Zoo's strategic planning process
- To ensure that the Strategic Planning Team develops a plan based on the best thinking of all of the Zoo's stakeholders, both internal and external
- To provide an opportunity for the Zoo's stakeholders to meet together, to get to know each other better, to learn from each other, and to positively influence each other's contribution to the Zoo

**Introduction to NZP Strategic Planning**

Provide key points on strategic planning and approach the Zoo is taking

Discuss expectations, agenda, roles, etc.

**Mission/role of the National Zoo**

Present current mission

Small group discussion about questions and input in computers

- What do you particularly like about the mission?
- What else (if anything) is needed to express the National Zoo's unique value?
- What would be lost if the National Zoo didn't exist?
- What does it mean to be 'national'?

Summarize two to three best ideas and input them in computers

**Long term vision of the National Zoo**

Set context for visioning activity

Small group discussion about questions

- What can you imagine NZP being in ten years?
- What would you physically see or hear about?

- What positive impact, achievements, stature would be attributed to NZP?
- In the world of conservation?
- In the zoo world?
- In your world?
- What if you were ten times bolder? What seems impossible now, but if were possible, it's the future you want to see?

Summarize two-three best ideas and input them in computers

**NUMBER OF SESSIONS HELD: 3**

**TOTAL NUMBER OF ATTENDEES: 135**

## **EXTERNAL STAKEHOLDER INPUT SESSION: AZA AND SCIENTIFIC COMMUNITY WEB-BASED SURVEY (FEB 6-8, 2004)**

Comments solicited by email using a dedicated list-serve:

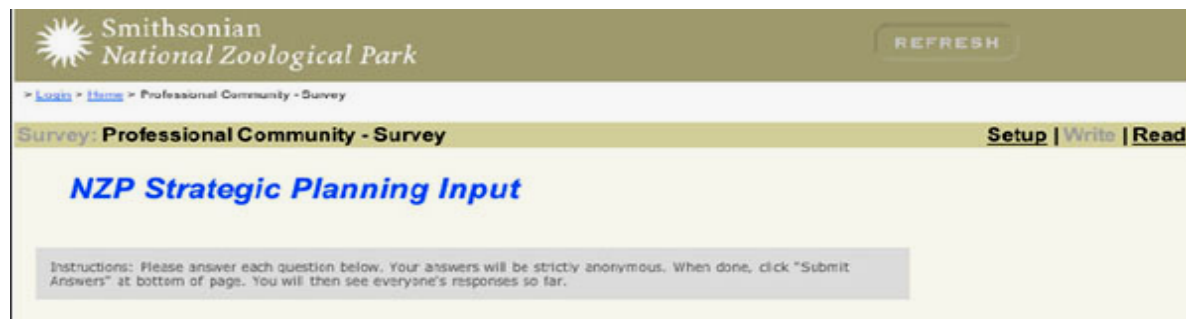
### **Mission**

- What do you particularly like about the National Zoo's mission?
- What else (if anything) is needed to express the National Zoo's unique value?
- What does it mean to be 'national'?
- What would be lost if the National Zoo didn't exist?

### **Ten-Year Vision**

- What can you imagine NZP being in ten years?
- What would you physically see or hear about?
- What positive impact, achievements, stature would be attributed to the National Zoo (in the world of conservation; in the zoo world; in your world)?
- What would be a “ten-times bolder” vision than your answer to the previous question? What seems impossible now, but if it were possible, it’s the future you want to see for the National Zoo?
- How could a bold future for the National Zoo positively support you in your goals?

**NUMBER OF SESSIONS HELD: 1 OVER 4 DAYS**  
**TOTAL NUMBER OF ATTENDEES: 40**



**NZP STAFF FEEDBACK #1 ON DRAFT MISSION, CORE VALUES, VISION STATEMENT  
(FEB 23-25, 2004)**

**For each component of the draft Mission, Core Values and Ten-Year Vision:**

Please rate the component on a scale of 1 to 10 where 1 = "Don't like it at all"; 10 = "Wow!"

- What do you really like? (Please do not change.)
- What needs more work? (We like the direction you're going, but please go further.)
- What do you not like? (Here is why.)
- (For the Core Team: Showstoppers – is there anything that the core team can not live with?)

**NUMBER OF SESSIONS HELD: 3**  
**TOTAL NUMBER OF ATTENDEES: 100**

**NZP STAFF INPUT SESSION #2: FIVE YEAR GOALS, STRATEGIES,  
PERFORMANCE MEASURES  
(MAR 17-19 2004)**

**Identify goal categories**

Input question: To get 'half way there', what are the four to six general categories we need to succeed in over the next five years?

**Describe strengths and weaknesses for each category**

Input Question: what are our current strengths and weaknesses in each of these categories?

**Performance Measures**

Mini tutorial on performance measures (5-7 min.)

Input Question: What are at least two to three ways meaningful ways you could measure progress and/or success in each of your categories?

**Closing**

Input Question: How can we immediately implement our values? (Individuals, units, system-wide)

**NUMBER OF SESSIONS HELD: 5  
TOTAL NUMBER OF ATTENDEES: 110**

**NZP STAFF FEEDBACK ON GOALS AND STRATEGIES  
(APR 23-27, 2004)**

**For each Strategy and Goal:**

Please rate the component on a scale of 1 to 10 where 1 = "Don't like it at all"; 10 = "Wow!"

- What do you really like? (Please do not change.)
- What needs more work? (We like the direction you're going, but please go further.)
- What do you not like? (Here is why.)
- (For the Core Team: Showstoppers – is there anything that the core team can not live with?)

**NUMBER OF SESSIONS HELD: 4**  
**TOTAL NUMBER OF ATTENDEES: 90**

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National Zoological Park (NZP) Science Advisory Group meeting minutes. June 12-13, 2003; July 31 – August 1, 2003; and October 30-31, 2003.

*Smithsonian Institution Science Commission Report*, December 2002.

**OTHER STRATEGIC PLANS REVIEWED:**

National Audubon Society

Conservation International

Fujifilm USA

Nature Conservancy

National Aeronautics and Space Administration

San Diego Zoological Society

Wildlife Conservation Society

Smithsonian Education Strategic Plan, 2004

Smithsonian Institution Strategic Plan, March 2003

## Glossary of Terms

**Animal Health Sciences** – Functions and areas of the Zoo addressing animal health and health assessments including veterinary medicine, pathology and nutrition.

**Animal Management** – All functions and areas of the Zoo focusing on animal well-being. Includes husbandry, enrichment, veterinary medicine, pathology, nutrition, reproductive sciences, behavior and small population management.

**Boards** – The Zoo Advisory board, Friends of the National Zoo board, and Conservation and Research Center Foundation board.

**Capacity building** – To increase the technical and professional skills of people in the U.S. and abroad through a broad range of training activities and through sharing science-based tools and scientific knowledge.

**Conservation Science** – Natural and social science disciplines that advance species and biodiversity conservation through basic and applied research, training, and education. At the Zoo, conservation science includes all programs based on captive and free-ranging animals and their habitats.

**Cross-departmental** – Activities that reach across all of the Zoo’s departments, units and functions.

**Core Team** - The Zoo’s senior management team.

**Development** – Income generating activities focusing on individual donors, corporate donors and gifts. (See also, Fund Raising.)

**Extinction prone** – Species that face greater risk of disappearing because of characteristics that make them more susceptible to changes in the environment. These may include species that are only found in a few places, have a large body size, have small populations, are at the top of the food chain levels, or have poor abilities to spread and colonize new areas.

**Field-based** – Research and science programs that are oriented to studying and conserving animals in their natural habitats and that take place in these habitats, rather than in a lab or zoo setting (also called *in situ* research).

**FONZ** – Friends of the National Zoo.

**Fund raising** – Development activities that focus on generating support from private foundations and private or corporate donors. (See also Development.)

**Individual Development Plan (IDP)** – Training plans, updated annually, developed to encourage professional growth and improve job-related skills of individual employees.

**Managers** – Staff who supervise both people and programs.

**Master plan** – The planning process and document that describes future development of land, facilities and infrastructure at the Zoo; this is the physical expression of its strategic plan.

**Organization design** – Comprehensive term for all of the elements that make up an organization, including: mission, values, vision, goals, strategies, work processes, structure, systems, people, skills, and culture.

**Organization redesign** – The process of analyzing and revising the formal structure of an organization.

**Research** - Acquisition of new knowledge. Basic and applied investigations or experimentations aimed at the discovery or interpretation of facts. In the case of the Zoo, facts about the biology and conservation of species and their habitats.

**Revenue-generating activities** – All business and membership activities that raise money for the organization: concessions, memberships, camps, parking, gift shops, and special events. Funds generated are typically unrestricted as to purpose.

**Science** -- Science at the Zoo encompasses all activities/programs focusing on the knowledge about the biology of animals in captivity or the wild, based on basic and applied research that deals with observing and testing facts about the biology and conservation of animals and their habitats.

**Smithsonian Center for Conservation Biology** – A proposed Smithsonian-wide science initiative, based at the Zoo’s Front Royal facility, which will address research issues on extinction-prone species.

**Strategic Planning Team** - A team of 12 Zoo staff nominated by their peers to draft the strategic plan based upon multiple rounds of input and feedback with internal and external stakeholders.

**Supervisors** – Staff who oversee people.

**ZIMS** – Zoological Information Management System – a data management system in development by the International Species Information System (ISIS) for the broad zoological community.

**Zoo** – Facilities, staff and functions of Smithsonian’s National Zoological Park, Office of Facilities, Engineering and Operations and Friends of the National Zoo in Washington, D.C. (Rock Creek and the National Mall), and Front Royal, Virginia.

**Zoo-based** – Research and science programs that take place in a lab or zoo setting, rather than in animal habitats (also called *ex situ* research).

**Zoo-wide** – All of the various organizations, departments/units and functions of the Zoo.

## About the Authors

**R. Michael Roberts, Ph.D.**, (NAS) (Chair) is the Curator's Professor of Animal Science, Biochemistry and Veterinary Pathology at the University of Missouri. He is best known for his contributions in facilitating our understanding of embryo-maternal communication during the early stages of pregnancy. Roberts was the first to discover that early placentas produce interferons that mediate maternal recognition of the embryo in cattle and sheep. He has broad expertise in plant and animal physiology and experience with the National Academies' deliberative study process. In addition to his current position, Roberts has served as Chair of the Veterinary Pathobiology Department at Missouri from 1995 to 1998, and Chief Scientist for the USDA's National Research Initiative from 1998 to 2000. He was elected to the National Academy of Sciences in 1996. Roberts received his Ph.D. in plant physiology and biochemistry from Oxford University, England, in 1965. Among his numerous awards and honors, Roberts was named a Fellow of the World Health Organization (1977), and has been awarded the U.S. Department of Agriculture Distinguished Scientist (1992), Alexander von Humboldt Award for Agriculture (1996), and the Wolf Prize for Agriculture (2003). He previously served on the National Research Council Committee on Defining Science-Based Concerns Associated with Products of Animal Biotechnology, and currently serves on the Editorial Board of The Proceedings of the National Academy of Sciences.

### Members

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**Lester Fisher, D.V.M.**, is founder and President of LEF Company, a consulting firm to nonprofits. He also is Vice President of the Morris Animal Foundation and Director Emeritus of the Lincoln Park Zoological Gardens in Chicago, where he served as director for 30 years. He received his D.V.M. from Iowa State University in 1943. Fisher was also the owner and director of Berwyn (Illinois) Animal Hospital, Associate Professor in the Department of Biology at DePaul University, and Adjunct Professor of Zoology at the University of Illinois. He has expertise in zoo management and zoo veterinary medicine. Fisher was a member of the International Union of Directors of Zoological Gardens (Vice President 1980-1983; President 1983-1986) and the American Association of Zoo Veterinarians (President 1966-1969). As the second American Zoo and Aquarium Association President, he oversaw the establishment of the International Species Information System. During his presidency, a significant increase in federal legislation affecting zoos was dealt with (including major revisions to the Endangered Species Act), and the Regional Conference Proceedings began publication. Fisher was awarded the American Zoo and Aquarium Association's highest honor, the R. Marlin Perkins Award, in 1996.

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## **Interim Report**

# **Animal Care and Management at the National Zoo: Interim Report**

Committee on a Review of the Smithsonian Institution's National Zoological Park

Board on Agriculture and Natural Resources

Institute for Laboratory Animal Research

Division on Earth and Life Studies

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## THE NATIONAL ACADEMIES

*Advisers to the Nation on Science, Engineering, and Medicine*

The **National Academy of Sciences** is a private, nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. Upon the authority of the charter granted to it by the Congress in 1863, the Academy has a mandate that requires it to advise the federal government on scientific and technical matters. Dr. Bruce M. Alberts is president of the National Academy of Sciences.

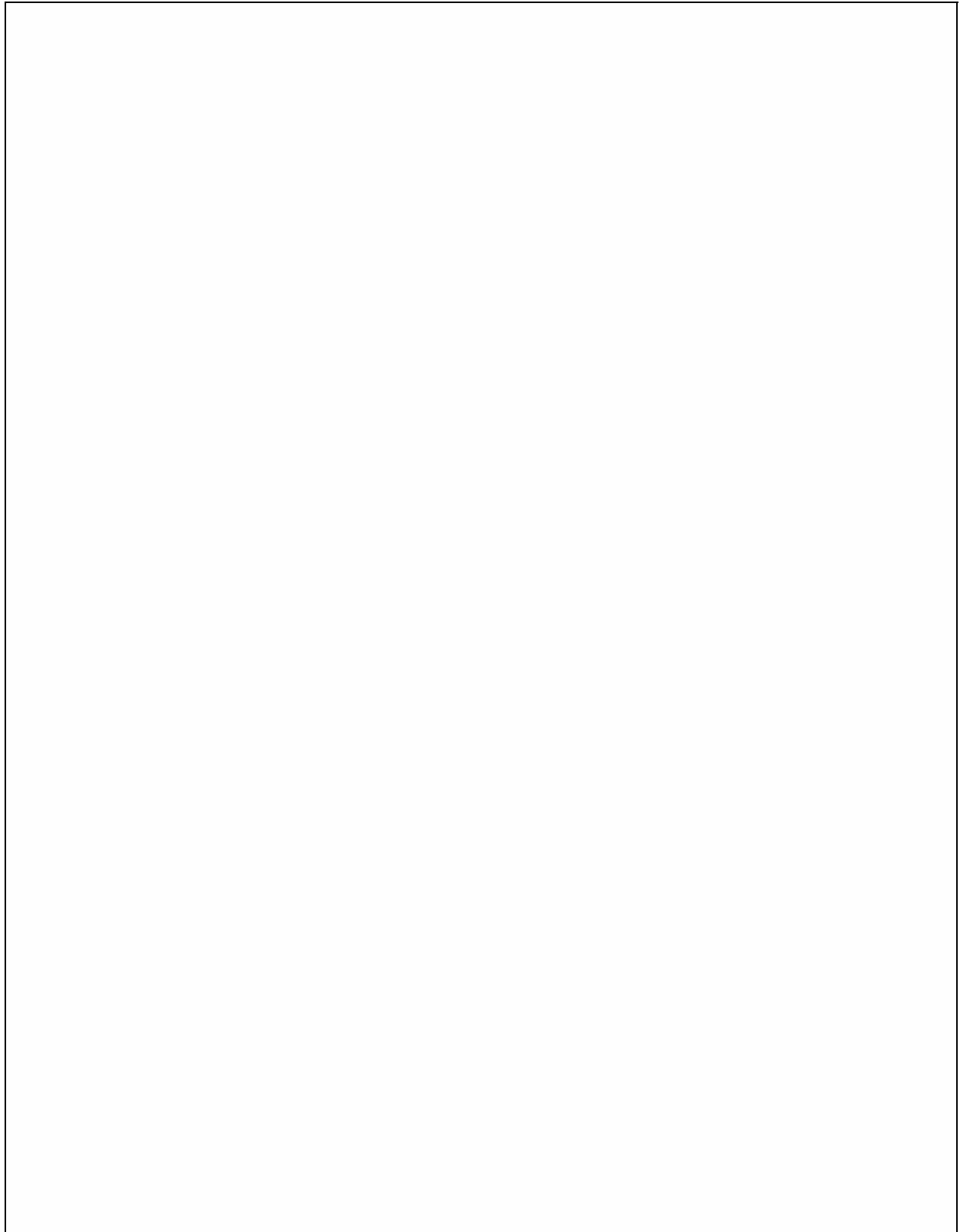
The **National Academy of Engineering** was established in 1964, under the charter of the National Academy of Sciences, as a parallel organization of outstanding engineers. It is autonomous in its administration and in the selection of its members, sharing with the National Academy of Sciences the responsibility for advising the federal government. The National Academy of Engineering also sponsors engineering programs aimed at meeting national needs, encourages education and research, and recognizes the superior achievements of engineers. Dr. Wm. A. Wulf is president of the National Academy of Engineering.

The **Institute of Medicine** was established in 1970 by the National Academy of Sciences to secure the services of eminent members of appropriate professions in the examination of policy matters pertaining to the health of the public. The Institute acts under the responsibility given to the National Academy of Sciences by its congressional charter to be an adviser to the federal government and, upon its own initiative, to identify issues of medical care, research, and education. Dr. Harvey V. Fineberg is president of the Institute of Medicine.

The **National Research Council** was organized by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of furthering knowledge and advising the federal government. Functioning in accordance with general policies determined by the Academy, the Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in providing services to the government, the public, and the scientific and engineering communities. The Council is administered jointly by both Academies and the Institute of Medicine. Dr. Bruce M. Alberts and Dr. Wm. A. Wulf are chair and vice chair, respectively, of the National Research Council.

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NATIONAL ZOOLOGICAL PARK**

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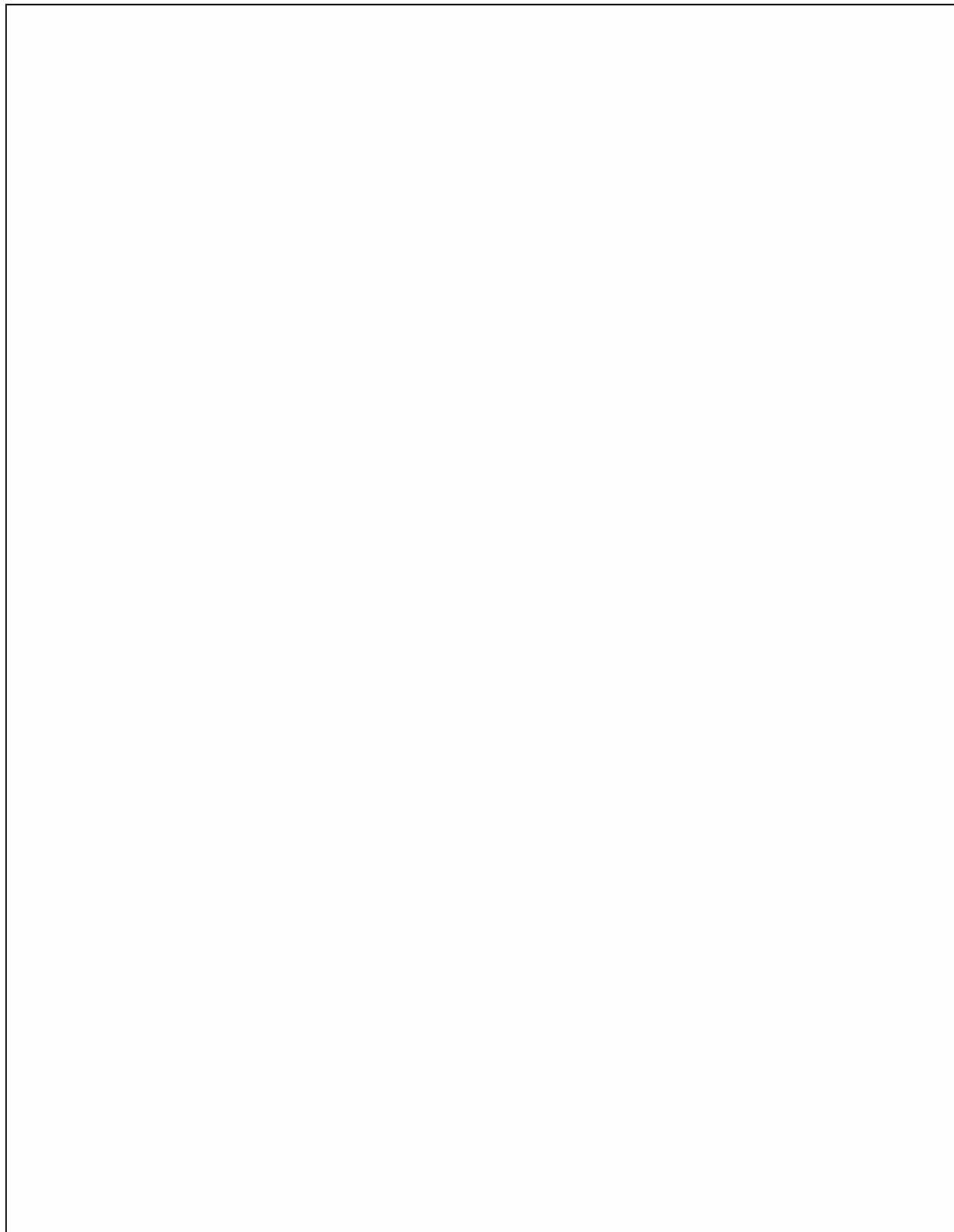
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## Preface

The U.S. House of Representatives Committee on House Administration, chaired by U.S. Representative Robert W. Ney (Ohio-18<sup>th</sup> district), is responsible for oversight of the Smithsonian Institution, which administers the National Zoological Park and the Conservation and Research Center (CRC). Following a hearing held by the Committee on March 5, 2003, in which questions were raised regarding animal care and management at the National Zoological Park, Congress requested a science-based review of the quality and effectiveness of animal care and management at the National Zoo by the National Academies. In response to this request, the Board on Agriculture and Natural Resources and Institute for Laboratory Animal Research convened a committee to conduct the review. The detailed charge to the committee is as follows:

“A committee of experts will be appointed to assess the quality and effectiveness of animal management, husbandry, and care at the Smithsonian Institution's National Zoological Park in Washington, D.C. and the Conservation and Research Center in Front Royal, Virginia. The study will identify strengths, weaknesses, needs, and gaps in the current infrastructure and provide recommendations on changes needed to ensure effective management and care of the National Zoo's animal collection. The study will provide a description of the system currently in place, the elements and characteristics of that system, and the changing nature of concerns surrounding the system. The committee will examine the historic and recent problems with animal health and animal science practices at the zoo, including recent reports on zoo operations and a scientific examination of the causes of recent animal deaths. The committee will review the National Zoo within the context of the larger zoo community, identifying unique aspects of the environment in which the National Zoo operates. The committee will evaluate the communication and coordination of the various divisions of the zoo that impact animal care, analyze the use of resources, and outline attributes of an enhanced system to ensure the health and well-being of the animals at the National Zoo. In addition, the committee will evaluate recent and ongoing changes in zoo operations. An interim report identifying the most pressing issues in animal care and management and aspects of the system in need of immediate attention, will be delivered at the end of the initial 6 months of the study. A final report that provides a comprehensive assessment of the zoo, outlines attributes of an enhanced system to ensure the health and well-being of the animals, and includes the committee's final recommendations, will be delivered at the end of 12 months.”

In view of the complexity of the National Zoo, any review of the institution, even the current one, which is focused narrowly, requires a range of expertise. Accordingly the assembled committee contains individuals experienced in zoo management and operations, as well as nutritionists, veterinarians, and pathologists. Also included were experts in industrial management, toxicology, safety issues in the workplace, animal disease, zoo keeping, animal welfare, and animal physiology. The committee relied heavily on published information on how zoos should operate, input from experts presented at a National Research Council (NRC) sponsored workshop, and

previous evaluations of the National Zoo from the American Zoo and Aquarium Association (AZA), the U.S. Department of Agriculture, and by the Smithsonian Institution itself. Committee members visited the Rock Creek Park and CRC campuses to view the facilities and to meet staff members on site, including all levels of management and animal keepers. Some of these meetings were pre-arranged and organized by the NRC Staff. Others were informal and spontaneous, occurring as the result of chance encounters when committee members were walking through the grounds and buildings. Committee members had open access to the entire National Zoo operation and had the opportunity to inspect the facilities much as the public views them, but also "behind the scenes" in areas where the public rarely visits. Many personal, one-on-one, interviews with National Zoo employees were conducted in order to provide insight into perceived weaknesses and strengths of the National Zoo operation. In addition to these interviews, National Zoo staff members were encouraged to submit information to the committee through NRC staff in such a manner that their identities could be protected. These impressions were discussed during the committee's deliberations and lists of issues identified. As a result, several thousand pages of records and documents were requested from National Zoo management and carefully reviewed. The committee then decided which of the issues were most pressing and described them in this initial interim report along with a series of recommendations that the committee believes should be implemented immediately.

Animal care and management at zoos has changed dramatically in the past several decades and is guided by scientific peer-reviewed literature and other literature (regulatory, accreditation, and professional standards and data available in proceedings). Specific regulatory standards have been established by the Animal Welfare Act (enforced by the USDA Animal and Plant Health Inspection Service) and the Public Health Service Policy on the Humane Care and Use of Laboratory Animals. Standards have been developed and are obligatory for accreditation by the American Zoo and Aquarium Association. National Research Council reports serve as the scientific basis for policy and regulations pertaining to animal nutrition (Animal Nutrition Series) and to the care and use of animals used in research (Institute for Laboratory Animal Welfare publications) as well as standards utilized in industry, research, and academe. Additional standards and guidelines have been developed by professional organizations such as the American Association of Zoo Veterinarians, Zoological Registrars Association, American Veterinary Medical Association, and the Nutrition Advisory Group of the AZA. Many of these same organizations have annual proceedings that contain new and revised opinions on animal care and management. Finally, some data on animal care and management in zoos is available in the scientific peer-reviewed literature. The committee has reviewed much grey and scientific literature and has judiciously used these various sources of information to formulate its findings.

The committee acknowledges the public's disquiet about the present state of the National Zoo and the treatment and condition of the animals housed there. It has looked carefully at the circumstances surrounding the highly publicized animal deaths from the past decade. Several of these cases have been used to illustrate both the strengths and weaknesses of the present National Zoo operation. In other instances, the record is too unclear or incomplete and confounded by hearsay and conflicting statements to allow the committee to reach a firm conclusion.

This is an especially opportune time to explore the weaknesses and strengths of the present operations at the National Zoo, where scrutiny by the media has increased over the months since the committee first met. The committee hopes that this report will provide a balanced evaluation of National Zoo operations and provide the National Zoo's employees a foundation on which they can move forward with some confidence to make the National Zoo a first-rate institution.

R. Michael Roberts, Chair  
Committee on the Review of the Smithsonian Institution's  
National Zoological Park

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## Acknowledgments

This report represents the integrated efforts of many individuals. The committee thanks all those who shared their insights and knowledge to bring the document to fruition. We also thank all those who provided information at our public meetings and who participated in our public sessions.

During the course of its deliberations, the committee sought assistance from many people who gave generously of their time to provide advice and information that were considered in its deliberations. Special thanks are due the following:

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**Denny Lewis**, American Zoo and Aquarium Association, Silver Spring, Maryland  
**Tom Meehan**, Brookfield Zoo, Chicago, Illinois  
**Christian Newcomer**, Johns Hopkins University, Baltimore, Maryland  
**Lucy Spelman**, National Zoological Park, Washington, D.C.  
**Andrew Teare**, Jacksonville Zoological Gardens, Jacksonville, Florida  
**Paul Vinovich**, U.S. House of Representatives, Washington, D.C.  
**Ann Ward**, Fort Worth Zoo, Fort Worth, Texas  
**Richard Watkins**, U.S. Department of Agriculture, Washington, D.C.  
**Rosanne Whitehouse**, University of Michigan Hospitals and Health Centers, Ann Arbor

The committee is especially grateful to the staff members of the National Zoo who took time to speak with the committee about the National Zoo and its operations and who provided essential information for the committee's work. The staff's candid, timely, and thoughtful input greatly facilitated the committee's efforts. The committee also appreciates the National Academies staff members who worked diligently to maintain progress and quality in its work. The study and the resulting report would not have been possible without the dedication and hard work of the two study directors, Dr. Jamie Jonker and Dr. Jennifer Obernier. A special acknowledgement is also due Bill Kearney (Director, Media Relations), who helped guide the committee through the challenges associated with a highly publicized subject. Susan Vaupel is thanked for editing the draft report prior to review.

The report has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise, in accordance with procedures approved by the National Research Council's Report Review Committee. The purpose of this independent review is to provide candid and critical comments that will assist the institution in making its published report as sound as possible and to ensure that the report meets institutional standards for objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process. We wish to thank the following individuals for their review of this report:



**Govindasamy Agoramorthy**, Pingtung Rescue Center for Endangered Wild Animals, Kaohsiung, Taiwan  
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**Linda Munson**, University of California, Davis  
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**Andrew Teare**, Jacksonville Zoological Gardens, Jacksonville, Florida  
**Steven Thompson**, Lincoln Park Zoo, Chicago, Illinois  
**Eduardo Valdes**, Disney's Animal Kingdom, Orlando, Florida  
**Ann Ward**, Fort Worth Zoo, Fort Worth, Texas

Although the reviewers listed above have provided many constructive comments and suggestions, they were not asked to endorse the conclusions or recommendations, nor did they see the final draft of the report before its release. The review of this report was overseen by Harley Moon, Iowa State University, Ames, Iowa and John Dowling, Harvard University, Cambridge, Massachusetts. Appointed by the National Research Council, they were responsible for making certain that an independent examination of this report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of this report rests entirely with the authoring committee and the institution.

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## Executive Summary

The Smithsonian Institution's National Zoological Park (National Zoo) in Washington, D.C., hosts approximately two million visitors annually as a major tourist attraction. For families and children spending time in the nation's capital, the National Zoo is a place away from major museums that provides the opportunity to stroll and relax in a quiet setting. Consequently the National Zoo's well-being is not just a local concern but also one that resonates nationally. The prominence of the National Zoo on the national scene is additionally elevated as a result of Washington being an important media center for radio, television, and the press. The media's scrutiny of several animal deaths brought the National Zoo into the public consciousness and to the attention of Congress.

The National Zoo differs from other metropolitan zoos in that it receives much of its support from the federal taxpayer, a fact that is frequently unappreciated. As part of the Smithsonian Institution, whose museums and galleries were established "for the increase and diffusion of knowledge among men," the National Zoo is an institution in which the nation should be able to take pride. The U.S. House of Representatives Committee on House Administration (with oversight of the Smithsonian Institution) held a hearing on March 5, 2003, in which questions were raised regarding the quality of animal care and management at the National Zoo. It recommended a science-based review of the institution by the National Academies. In response to this request the Board on Agriculture and Natural Resources and the Institute for Laboratory Animal Research convened a committee and charged it to conduct a review of the care and management of animals at the National Zoo.

### THE TASK OF THE COMMITTEE

A world-class zoo has missions that extend far beyond supplying attractive, humane venues for viewing wild animals in captivity. Zoos are complex organizations dedicated to conservation, education, and science with budgets derived from a mixture of sources. Except where these lesser-known aspects of the National Zoo impinged on animal care and management, they were not within the scope of this review. For example, the committee was not asked to review the education programs or the quality of the research carried out at the National Zoo or the scope or effectiveness of its conservation programs. Nor was the perceived adequacy (or inadequacy) of funding to support the various National Zoo activities within the committee's charge, although the utilization of these resources as it relates to animal care and management is within the charge. Instead, the committee was explicitly charged to focus narrowly, considering only those issues related specifically and directly to animal management, husbandry, health, and care.

## THE INTERIM REPORT

### Organization

The interim report is divided into five chapters. The first serves as an introduction providing facts about the National Zoo, including budgetary and personnel information. This information is provided as background material without interpretation, as these were not related to the charge of the committee. The next four chapters detail various aspects of the National Zoo that affect animal care and management at the Rock Creek Park facility. Each of these chapters is divided into four parts for each particular topic area: (1) an introduction that describes attributes of an exceptional zoo; (2) the current status of the National Zoo; (3) strengths and weakness of current practices at the National Zoo; and (4) findings and immediate needs for animal care and management at the National Zoo. In essence, the third part is the logical subtraction of part one from part two, the difference between the National Zoo today and an exceptional zoo leading to the findings and immediate needs. Where data have been available for the interim report, the committee has reported on the zoo in the context of the larger zoo community.

### Criteria for Selecting Findings

The selection of findings that emerged from committee discussions relating to this interim report is based on the following criteria:

1. The immediacy of the threat to animal health and welfare.
2. The severity of the problem, or
3. The practicality of providing a quick solution to the problem in relation to present resources.

The committee relied heavily on published information on how zoos should operate, on input from experts, and on previous evaluations of the National Zoo from the American Zoo and Aquarium Association (AZA), the U.S. Department of Agriculture (USDA), and from the Smithsonian Institution itself. Committee members visited the Rock Creek Park and the Conservation and Research Center (CRC) campuses to view the facilities and to meet staff members, formally and informally. Committee members had open access to the entire National Zoo operation and had the opportunity to inspect the facilities much as the public views them, but also "behind the scenes" in areas where the public rarely visits. In addition, Smithsonian staff members were encouraged to submit information through NRC staff in such a manner that their identities could be protected. These impressions were discussed during committee deliberations, and lists of issues were identified. As a result several thousand pages of records and documents were requested from the National Zoo and were carefully reviewed by the committee. The committee decided which of the issues were most pressing at the Rock Creek Park facility and described them in this initial, interim report.

Based on observation and documentation the committee came to the opinion that the decline in the state of physical plant at the National Zoo had accrued over many years. The overarching questions were whether the visible deterioration was also reflected in the way that the animal collection was managed and in the quality of animal care and husbandry, and whether a pattern in animal deaths could be attributed to a breakdown in the authority of management, poor veterinary or nutritional care, or other types of issues.

The issues identified in this report are science-based and founded, at least in part, on lessons learned from the recent deaths of animals, mainly mammals, in the collection. Although the committee attempted to discern accurately the circumstances that led to many of the deaths, in some cases it was impossible either because the written record was incomplete or because there were conflicting accounts from involved National Zoo personnel. In any case, the charge of this committee was not to assign blame but to present recommendations that would avoid similar incidents occurring in the future. The committee has also noted that the National Zoo has been actively taking steps to correct some of the problems identified here and earlier by the AZA committee on accreditation and the inspection of the animal facilities by the USDA in the summer of 2003.

In the initial analysis of the most pressing needs for the National Zoo the committee has focused on issues identified at the Rock Creek Park facility. Some of these undoubtedly overlap with issues at the CRC (other issues at CRC be reviewed in detail in the final report). Four thematic areas of weaknesses became

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apparent to the committee: (1) animal care and management, (2) record keeping, (3) pest management, and (4) mission and strategic planning for the entire National Zoo complex. These issues are treated sequentially, although in the larger complexity of issues at the National Zoo they clearly overlap.

**FINDINGS AND IMMEDIATE NEEDS**

The National Zoo is one of 213 zoos and aquariums accredited by the AZA. During its last AZA inspection the National Zoo accreditation was extended for one year. This accreditation is scheduled to expire in March 2004. The CRC is one of 16 certified related facilities. The CRC was certified for five years during its last AZA inspection in March 2003. This CRC certification is scheduled to expire in March 2008.

The National Zoo has undergone downsizing in its animal collection, with a decline from a maximum of over 6,000 in 1995 to the 2,600 today. However the drop in the number of species represented in the collection has not declined comparably. The reasons for the decline in animal numbers can be attributable to a drop in acquisitions, a decision to transfer some animals or groups of animals, and mortality in the collection. One of the issues raised is whether mortality rates at the National Zoo fall within acceptable bounds. The National Zoo's mortality rate during the last decade (1993-2002) period was 10.5 percent; in recent years (2000-2002) the mortality rate has declined to approximately 7 percent. The fluctuation in the National Zoo's mortality rate is in part due to biological variation, changing nature of the animal collection (species represented and animal numbers within individual species), and aging of the animal collection. Readers should be aware that the mortality rates at a zoo, whose collection is usually made up of animals with life spans much shorter than those of humans, depend greatly upon the nature of the species it houses as well as the age and health of individual animals.

Responsibility of the health of the animals at the National Zoo resides with at least three of its departments, Animal Health, Pathology, and Animal Programs. Animal Health is responsible for the health of the animals in the collection through ensuring proper nutrition, preventive medicine, and health care. Its staff includes the veterinarians and veterinary hospital staff, and nutritionists. Pathology provides clinical laboratory and postmortem diagnosis as well as research on diseases afflicting a zoo collection. The Animal Programs Department is responsible for the exhibits, day-to-day care of the animals, and the development of the animal collection.

**Animal Care and Management**

***Finding 1:** The current preventive medicine program at the National Zoo is not being fully implemented, and since 1998, veterinary staff members have not been adhering to this program in terms of providing annual exams, vaccinations, and infectious-disease testing. Although efforts have been made in the past year to improve implementation, there is still a backlog of animals that have not received examinations, vaccinations, or tests as prescribed by the preventive medicine program.*

The Preventive Medicine Program includes quarantine, parasite surveillance, immunization, infectious diseases screening, dental prophylaxis, periodic reviews of diets, husbandry techniques, and vermin control. While the written documentation outlining the program is comprehensive and adequate, there has been poor adherence to the guidelines. Since 1998, the committee found numerous failures to provide timely vaccinations, tuberculosis tests, or physical or dental exams to primates, vaccinations and physical exams to carnivores, and vaccinations for avian species. One example is the case of the East African Bush elephant "Nancy," where the failure to administer an annual tuberculosis test resulted in the failure to diagnose an active case of tuberculosis.

During the past year the Department of Animal Health has taken steps to improve adherence with the preventive medicine program, but as of December, 2003 not all animals due to be examined/vaccinated/tested under the preventive medicine program had been treated. In addition, the department should learn to be proactive with regard to emerging problems. For example, in light of the recent death of a colobus monkey from leptospirosis as well as the ongoing issue with rodent control at the National Zoo, routine vaccination against this disease (usually transmitted by the intake of feed or water contaminated with the urine of an infected animal, often a rodent) for animals at risk, should be reevaluated as a component of the preventive medicine program.

**Immediate Needs:** *The Department of Animal Health should promptly eliminate the backlog of animals that should receive preventive care and document its current and future plan for preventive medicine activities. The National Zoo administration should take responsibility for ensuring that the Department of Animal Health has the resources and oversight necessary to adhere to the program.*

**Finding 2:** *Shortcomings exist in the animal nutrition program. There has been inadequate communication between the nutrition, keeper, and veterinary staffs; poor consultation between the research nutritionist and the acting head of clinical nutrition; and a lack of standardization and regular evaluation of animal diets. Nutrition records are not currently integrated with other record-keeping systems and, despite having adequate facilities for over a decade, the National Zoo is only now beginning to move toward a centralized commissary.*

Animal nutrition at the National Zoo is divided into two areas: research and clinical nutrition. The clinical nutrition division resides in the Animal Health Department, while the research nutrition division is located in the Department of Conservation Biology of the CRC. The National Zoo currently has a temporary acting head of clinical nutrition (on a two-year appointment) at Rock Creek Park and a research animal nutritionist in the Department of Conservation Biology of the CRC. Little direct interaction occurs between the acting head of clinical nutrition and the research nutritionist.

Lack of adequate nutrition oversight has contributed to animal deaths at the National Zoo. In the case of a zebra at Rock Creek Park in 2000 due to hypothermia and malnutrition, poor communication among keepers, nutritionists and veterinarians, poor record keeping, and a failure of adequate supervision of the health of the animals preceded the death. Nutrition management should take into account natural dietary habits and specific species recommendations. Diets should be analyzed for nutritional adequacy and records kept. Finally, after evaluation and formulation the diets should be appropriately implemented and the nutritional status of the animal monitored constantly by keepers and the veterinary staff. There were failures at many of these levels in the case of the zebra death.

The committee found that nutrition records are not integrated with medical, curatorial, keeper, and other records at the National Zoo. Additionally, there has been a lack of standard protocols for diets and for diet changes. Although the acting head of clinical nutrition built a database of currently fed diets, these are not yet complete. In addition, this staff member has recently been serving as the acting commissary manager (a new commissary manager was recently hired). With no dedicated clinical nutrition laboratory technician, only some routine nutrient analyses on feedstock are performed on zoo grounds. Lastly, the National Zoo has a decentralized commissary at the Rock Creek Park facility, with keeper kitchens for many of the animal enclosures and housing areas. More centralized diet processing could improve nutritional quality of diets, reduce food costs, and reduce pest problems. A 1992 external review requested by the National Zoo suggested the commissary had the physical capacity needed for the centralized program. A draft plan for developing a centralized commissary by 2005 has been developed by the National Zoo but the plan has not been finalized.

**Immediate Needs:** *The National Zoo should immediately use its existing nutrition expertise by increasing coordination and collaboration between the acting head of clinical nutrition and the research nutritionist to address nutritional issues of the animal collection, including diet review, evaluation, and modification. The zoo also should seek a permanent (rather than temporary), qualified experienced person for the role of clinical nutritionist. Centralization of standard diet formulation records and integration of those records with other record-keeping systems for animal care and management at the National Zoo should be completed. An annual schedule for evaluation of diet formulations for each animal or animal group should be developed and implemented. The National Zoo should finalize its draft plan to centralize the commissary and implement it in 2004.*

**Finding 3:** *There is a lack of documentation that the welfare of animals has been appropriately considered during the development and implementation of research programs and that complaints regarding the welfare of animals on exhibit were appropriately investigated. There also has been a lack of understanding within the National Zoo and the Smithsonian Institution of the requirements of federal regulations and Public Health Service Policy and how to maintain compliance.*

Since 1998, at least five research projects at the National Zoo that use animals have received Public Health Service (PHS) funding, which requires that the Smithsonian Institution provide a written Assurance

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acceptable to the NIH Office of Laboratory Animal Welfare (OLAW). Based on its review of records from the Smithsonian Institution Office of Sponsored Projects and the OLAW, the committee cannot confirm whether the Smithsonian Institution had a valid Assurance from 1997 to 2000, a time during which PHS-funded research projects utilizing animals were funded and conducted at the National Zoo. Records indicate that on April 11, 2000 the Smithsonian Institution submitted paperwork to the OLAW seeking to renew its Assurance. On February 19, 2004, the committee received a letter from the OLAW stating that the office recently located this submission and now considers the Smithsonian's Assurance to be approved for the period between April 11, 2000 and March 31, 2004. The committee did not have the opportunity to consider the implications of OLAW's letter in this interim report because it was received only a few days before the report was finalized. The status of the Smithsonian's Assurance will be examined more fully in the committee's final report.

In addition, based on documents provided to the committee, the Institutional Animal Care and Use Committee (IACUC) at the Rock Creek Park facility has not consistently fulfilled its responsibilities for conducting and reporting semiannual facilities inspections, program reviews, and documenting IACUC activities. At best, this committee functioned in an "off-and on-again" manner—e.g., it did not keep adequate records and minutes, and it did not monitor and certify the correction of deficiencies it had previously noted. Because of a lack of record keeping, the committee cannot discern if PHS-funded research conducted at the Rock Creek Park facility was being conducted in accordance with provisions detailed in the Guide for the Care and Use of Laboratory Animals, again mandated by PHS Policy.

It is possible that some PHS-funded research at the National Zoo, as well as some research involving nonhuman primates is subject to the Animal Welfare Act (AWA). However, due to the lack of documentation from the Smithsonian Institution and the National Zoo, the committee was unable to discern whether this research was subject to the AWA or whether it was being conducted in accordance with the standards outlined by the AWA. Further investigation of ongoing research at the National Zoo is warranted to determine if AWA-subject research is occurring.

Although not required by any regulation, the National Zoo did have a committee (previously designated the Animal Welfare Committee and most recently called the Rock Creek Park IACUC) tasked with addressing issues pertaining to the welfare of animals on exhibit and research animals not covered by PHS Policy or the AWA. However, this committee failed to keep acceptable records of its deliberations and activities, and it appears that the committee members saw their mandate as one of solving conflicts between staff members and not of acting as an advocate for the animals. In September 2003 (General Memorandum 15) the National Zoo outlined a new IACUC program, which will be evaluated in the National Academies' final report. Nevertheless, based on the failures of the previous system, the committee believes that the current staff at the National Zoo should receive training to implement the program adequately.

**Immediate Needs:** *The National Zoo and the Smithsonian Institution should ensure compliance with all elements of the Animal Welfare Act and the Public Health Service Policy. The National Zoo and the Smithsonian Institution should seek outside training and assistance to achieve compliance with regulations and implement procedures meant to ensure the welfare of research and exhibit animals at the National Zoo.*

**Finding 4:** *There has been poor adherence to the National Zoo's own policies and procedures for animal health and welfare.*

There has been a longstanding failure of staff to abide by National Zoo policy and procedures. In some cases these failures endanger the safety of the animal collection. These incidents include failure to obtain the appropriate sign-off on nutrition and euthanasia forms, failure to document changes in animal management appropriately, failure to adhere with quarantine procedures, and failure to act in accordance with IACUC protocols (see Finding 3).

The National Zoo's euthanasia policy requires that a euthanasia form be signed by the veterinarian performing the euthanasia, the responsible curator, and the supervisory veterinarian. The case of the bobcat provides an excellent example of where the decision to euthanize was made in a consensual manner with proper documentation. On the other hand, there have been several examples of failures to observe these guidelines (e.g. for the tree kangaroo and the orangutan euthanasia forms). Although there is no indication that these failures led to unnecessary suffering by the animals, proper procedures would have clarified the circumstances surrounding the decisions to euthanize, which in some cases have been clouded with controversy.



The purpose of quarantine procedures and protocols is to prevent the introduction of new pathogens into the collection. Procedures may have been violated when staff-owned pets were brought onto National Zoo grounds for veterinary examinations and care. Even as a professional courtesy, bringing pets into the Zoo represents a potential risk to the zoo collection and a violation of the zoo's own policies and procedures.

**Immediate Needs:** *All levels of management should be held accountable for ensuring that National Zoo policies and procedures are followed. All zoo staff should take personal responsibility for educating themselves and adhering with the policies and procedures that pertain to their position and duties.*

#### Record Keeping

**Finding 5:** *The National Zoological Park lacks a comprehensive information management system for animal husbandry and management records, which results in inconsistent record keeping and practices of alteration in medical records weeks or years after events. While some issues are being addressed (e.g., an electronic keeper log system is in development) these are stop-gap measures often having no concrete timeframe for completion or implementation.*

Adequate and accurate record keeping underpins animal health and welfare. The adequacy of the record keeping at the National Zoo varied greatly across the different units and departments, with a lack of standardized practices for reporting and archiving records. Patterns of inconsistent record keeping and archiving were found in keeper logs, curator reports, nutritionist records, and medical records. One example pertained to the bobcat "Phoenix" for whom 16 weeks of requested keeper records were lost. In addition to poor record keeping, the logs throughout the Animal Programs Department were often archived improperly and many, like those for the bobcat, were irretrievable. Currently each of the eight units is responsible for archiving its own keeper records, but there is no stated expectation of how long they should be kept. No individual within the National Zoo has overall responsibility for documenting or overseeing where keeper records are archived and how they are organized. This fragile knowledge base is particularly compromised at a time of staff turnover.

There were instances of veterinary staff records being altered weeks and even years after the event. The standard practice of editing original clinical notes is unacceptable. The committee does not intend to discourage the National Zoo from using the MedARKS system as a teaching or record-keeping tool, but advises that if erroneous entries are made or pertinent facts identified later, they should be corrected by addenda and not by altering the original entry.

Overall, the National Zoo has been handicapped in its efforts to provide adequate animal care by a nonfunctional information management system. Records should provide an accurate account of situations and practices relating directly to animal management and health. They should permit reconstruction of events in the recent and distant past and should provide a rational basis for decision making. Ideally, a single, comprehensive electronic record-keeping system should be implemented, but the National Zoo may be obliged to use mixed paper and electronic records as a stop-gap measure.

**Immediate Needs:** *The National Zoo should implement an information management system that ensures complete documentation of animal husbandry and management and reasonable accessibility to the records by all units and departments. This does not necessarily mean that the entire system needs to be computerized immediately but rather that consistent practices be put in place, that a system be developed to make the records reasonably accessible, and that an appropriately experienced individual be given responsibility for system oversight.*

#### Pest Management

**Finding 6:** *Even though the pest management program has been reorganized and is showing signs of improvement, pest management remains inadequate and poses a potential threat to the animal collection, employees, and visitors to the National Zoo.*

On January 10, 2003, measures to control rats in the red panda enclosure went awry because the

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National Zoo's own written protocols for approval of chemical use in animal enclosures were not followed. After the red panda deaths, responsibility for the Pest Management Program was transferred to the Pathology Department, and an Integrated Pest Management (IPM) Committee was formed to address the animal and insect pest problem at the zoo. Additionally, the National Zoo began the process of establishing a comprehensive program to address the widespread pest problem, including creation of a pesticide program manager position, which was subsequently filled. Despite many positive efforts by the new IPM Committee, housekeeping and site conditions remain poor throughout the Rock Creek Park facility. Rats and mice are present in animal areas and can be observed crossing public walkways in daylight. These conditions may have been exacerbated by the decision to reduce chemical control for rodents following the panda deaths. Considerable work will be required to ensure animal health and the aesthetic quality of the Rock Creek Park.

**Immediate Needs:** *A comprehensive IPM plan should be developed: (1) in the short term to bring current populations of pests down to acceptable levels and (2) in the long term to maintain those levels using modern IPM techniques.*

### Mission and Strategic Planning

**Finding 7:** *The National Zoo is operating without a strategic plan, which jeopardizes its long-term operations and focused use of the zoo's resources. An integrated plan for the entire institution incorporating the 10-year facility revitalization and animal collections plans has not been developed.*

The National Zoo currently operates without a strategic plan despite the recommendations of previous AZA accreditation reports. It does have an animal collections plan and a 10-year facility revitalization plan in place, but these are not substitutes for a comprehensive planning process that takes into account all aspects of the zoo's operational structure. A strategic planning process was recently initiated as part of a Smithsonian-wide program and is a positive step forward.

An issue to be addressed during the strategic planning process is an evaluation of mission and goals. One challenge for the National Zoo is to maintain alignment with the Smithsonian Institution's mission while identifying and implementing a strategy that will enable its own independent success. Generating a plan that ensures maximum use of current resources will be important. Current and proposed projects, such as the Asia Trail and Farm, should be evaluated as to their fit with the plan.

The National Zoo will need to engage in strategic resource planning (i.e., human resources, facilities) to support its mission. The capability of the National Zoo to engage in resource planning is limited because many resource decisions, such as the recent one to reduce staffing through buyouts across all its units, are made at the Smithsonian level. Such a practice raises issues about the extent to which the National Zoo will lose experienced staff and the capability of the National Zoo to make strategic staffing decisions.

**Immediate Needs:** *The National Zoo should develop a comprehensive strategic plan and provide integrated goals for all aspects of the institution, with operational goals and performance measures, as soon as possible.*

### MOVING FORWARD

While zoos have expanded their general mission over time from simply being exhibition facilities to becoming organizations that address conservation through research and education, their first and foremost responsibility is the health, nutrition, and welfare of the animals they maintain. The findings and immediate needs of the National Zoo outlined in this interim report are focused on correcting clear deficiencies and on enhancing animal care and management. The committee recognizes that some of the problems identified at the National Zoo are unique to the zoo, but many problems are common among other zoos. Situations and practices that negatively impact animal care and management, regardless of how common, are unacceptable at any institution housing captive live animals. The committee believes that the National Zoo should work quickly and diligently to address the problems identified in this report and to ultimately become a leader in effecting science-based change and improvement in the nation's zoo community.

**THE FINAL REPORT**

This interim report presents seven findings in four areas relating to animal care and management, record keeping, and pest management at the Rock Creek Park facility and strategic planning at the entire National Zoo complex. These findings and immediate needs should be considered by the National Zoo immediately because each threatens the well-being of the animals in the collection. The final report will expand on these four issues, particularly those that might be clarified as new information emerges. For example, as strategic planning proceeds the committee will be interested in how the National Zoo envisages its future and how it plans to organize its collection and its two campuses to reflect that vision. The committee will examine in detail any plans developed by the National Zoo to address issues raised in this interim report. In addition to expanding on the above four issues, the committee will also present issues that it did not consider so pressing that immediate steps had to be taken to implement change. Among these the committee has considered and may consider for the final report are management at the National Zoo, personnel health and safety issues, and formal training programs for staff, as they relate to animal care and management. A detailed analysis of other strengths and weaknesses in animal care and management at the CRC will be included in the final report. The final report is anticipated to be released during the second quarter of 2004.

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## Introduction and Background

To appreciate the scope of the study it is worthwhile to consider briefly the particular history of the National Zoo, its budget, the range of its operations, and its main missions. The National Zoo was created by an Act of Congress in 1889 for “the advancement of science and recreation of the people” (NZIP History, 2003). In 1890 the zoo became part of the Smithsonian Institution (NZIP History, 2003). It is one of 16 museums in the Smithsonian complex, from which it receives the majority of its budget. In fiscal year 2003 the federal appropriation to the National Zoo was approximately \$23 million out of a total base budget of \$43.5 million (see Table 1-1), which also includes business income, grants, gifts, and support from Friends of the National Zoo (FONZ) (NZIP Budgets, September 24, 2003). In addition, the National Zoo received \$18.75 million for capital improvement from the Congress in 2003, and it is slated for continued capital support through 2006. Unlike most other zoos receiving substantial public funding, the National Zoo does not charge admission for its estimated two million annual visitors. Despite its quasi-government status, the National Zoo is a complex business operation, which depends on private as well as federal support for its operations. Direct Federal support through the Congress, plus its location in the nation’s capital and accessibility to the many visitors of Washington, D.C., endow the National Zoo with a special aura and prominence. Some would argue that the National Zoo is the nation’s zoo, and that its well-being should be a matter of national and not just local concern.

The operating and capital improvement budgets for the National Zoo come from a combination of sources: the Smithsonian Institution, the Smithsonian Institution Trust, and FONZ. From 1999 to 2003, the budget for salaries and expenses increased approximately 17 percent (see Table 1-1); funds for capital improvements increased from \$4.4 million to \$18.75 million (see Table 1-2). In fiscal year 2004 it is anticipated that the personnel budget will decrease because National Zoo facilities staff are being transferred to the Smithsonian Office of Facilities Engineering and Operations (NZIP Budgets, September 24, 2003). A 1992 accreditation report by the American Aquarium and Zoo Association (AZA, 1992) noted that the National Zoo had sufficient financial support at the time to maintain the zoo, but the zoo needed a plan to support program development and capital improvements.

The National Zoo consists of two campuses. The original site, on 166 acres of Rock Creek Park in northwest Washington, D.C., is open to the public 364 days of the year and houses most of the present collection of approximately 420 species and over 2,500 animals. The second site is the Conservation and Research Center (CRC) on 3,200 acres in Front Royal, Virginia, approximately 65 miles from Washington; the latter is open to the public only on special “open” days, when the CRC showcases its science. The CRC serves as a refuge for vanishing wildlife and as a laboratory for propagating a few rare species and for conservation biology. It is also

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**TABLE 1-1** National Zoological Park Operating Budget

(S millions)	National Zoological Park Operating Budget					
	1999	2000	2001	2002	2003	2004 (est) <sup>a</sup>
SI Federal Salaries and Expenses						
Facilities, staff and support	19.6	20.5	21.0	21.9	23.0	18.3
SI Trust						
Business income, gifts, grants	4.5	5.4	6.0	6.7	7.4	12.7
	<b>Subtotal</b>	24.1	25.9	27.0	28.6	30.4
FONZ Support to NZP Programs	2.3	3.8	3.6	4.2	4.7	5.0
FONZ Operations	6.0	6.0	7.4	8.3	8.4	8.8
	<b>Total</b>	32.4	35.7	38.0	41.1	43.5
						50.7

<sup>a</sup>In fiscal year 2004, facilities staff reprogrammed to Office of Facilities Engineering and Operations, including \$5.9 million and 95 full-time equivalents. This is included in the fiscal year 2004 totals.  
 SOURCE: NZP Budgets, September 24, 2003.

**TABLE 1-2** National Zoological Park Capital Budget from the Smithsonian Institution's Federal Appropriation

(S millions)	National Zoological Park Capital Budget					
	1999	2000	2001	2002	2003	2004 (est.)
Maintenance	3.60	5.20	2.80	4.20	3.95	3.94
Minor revitalization				0.80	3.50	0.40
Major revitalization	0.80	0.80	4.80	5.00	11.30	9.00
Construction (Children's Farm)			4.90			
	<b>Total</b>	4.40	6.00	12.50	10.00	18.75
						13.34

SOURCE: NZP Budgets, September 24, 2003.

a classroom for training wildlife biologists from the United States and abroad. These two campuses participate as partners in conducting the three major missions of first-class modern zoos: education, research, and conservation.

The National Zoo, like all other zoos, must attract the public through its animal collection. As the American public has become more educated about wildlife, the destruction of habitat, and the accompanying threat to animal species over the last quarter century, it has also learned to be more sensitive to the treatment of animals in the wild and in captivity. Likewise, scrutiny of zoos by the media has become more intense. The public perception of zoos is therefore changing rapidly. No longer can a public zoo be viewed simply as a place of entertainment where exotic animals are viewed in cages. Modern expectation is that the wild animals of the collection be displayed in ecologically "natural" surroundings that are sensitive to their physical and psychological needs (Coe, 2003). The accreditation process for zoos, aquariums, and wildlife parks by the AZA reflects these changing expectations and sets standards for how a world-class zoo should operate.

The National Zoo is one of 213 zoo and aquariums accredited by the AZA (AZA, 2003c). During its last AZA inspection, the National Zoo accreditation was extended for one year with a directive to address deficiencies within that timeframe. This accreditation is due to expire in March 2004. The CRC is one of sixteen certified related facilities (AZA, 2003c). The CRC was certified for five years during its last AZA inspection in March 2003. This CRC certification is due to expire in March 2008.

**PERSONNEL**

Day-to-day operations of the National Zoo involve employees and volunteers within the organization, professionals from other parts of the Smithsonian, advisory boards, and others outside the National Zoo, including contractors, who primarily work to maintain the National Zoo's animals and physical plant. The work of the National Zoo includes exhibition, education, research, and recreation. The National Zoo organizational structure (NZP, NZP Organizational Structure, November 20, 2003; see Figure 1-1) is characterized by a hierarchical distribution of management authority and responsibility. At the apex of the structure is the zoo

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director, who interfaces with three advisory boards: (1) the Friends of the National Zoo, (2) the National Zoological Park Advisory Board, and (3) the CRC Foundation. The director is supported by one deputy director.

The National Zoo has eight departments, which essentially operate independently. Departments are led by assistant directors who report to the deputy director and the director of the zoo. The Animal Programs Department (NZN, Animal Programs Organization Chart, November 20, 2003; see Figure 1-2) has primary responsibility over the day-to-day care and management of the animal collections at the Rock Creek Park facility. In the Animal Programs Department assistant curators report to associate curators (who in turn report to the general curator) and are generally individuals who have worked in the National Zoo for many years. The CRC (NZN, CRC Organizational Chart, November 20, 2003; see Figure 1-3) has primary responsibility over the day-to-day care and management of the animal collections at the facility in Front Royal, Virginia. The Animal Health Department includes veterinary and nutrition staff (see Figure 1-4). The Pathology Department has primary responsibility for examining animal deaths, and at the present time administers the pest management program (see Figure 1-5). The other four departments are Public Affairs and Communications, Administration and Technology, Exhibits and Outreach, and NZN Police.

The National Zoo employs both federal staff and outside contractors. The total number of government full-time equivalents (FTEs) decreased from about 350 in 1993 to 290 in 2002 (NZN, National Zoo Work Years September 24, 2003). A decrease in the number of permanent staff has been partially offset by gains in temporary employees, although total FTEs have decreased overall during this time. Of note, in 1996 a large proportion of curator staff left the National Zoo during a federal employee buyout program. The percentage attrition in administrative staff was comparable or higher than among non-administrative staff. While the number of employees at the National Zoo has decreased significantly during the past decade, the number of animals under the care of these employees has also decreased significantly (detailed in the Animal Care and Management chapter). Overall loss of staff has been offset to some extent by recruitment of keeper staff, whose numbers increased by six during this 10-year timeframe (NZN, Staff Gains and Losses FY 1993-2000, September 24, 2003).

### NATIONAL ZOO GENERAL MEMORANDA AND BEST PRACTICES

The National Zoo has an extensive set of General Memoranda (see Appendix A) that details standard operating procedures for employees. Most of the General Memoranda have been revised or are new since April 1, 2003. Additionally, in July 2003 the General Memoranda were summarized into Best Practices for most departments (NZN, Best Practices, 2003). These Best Practices were distributed to all staff, and will be distributed to FONZ employees and new zoo employees.

Many departments and units at the National Zoo have written protocols (NZN Submission, September 24, 2003). The Animal Programs Department's Best Practice Manual serves as a guideline for keepers (NZN, Department of Animal Programs – Best Practices, 2003). Each animal area also has its own protocols for animal care, and are maintained centrally by the general curator.

Best Practices were developed by the National Zoological Park (NZN Submission, September 24, 2003) from their General Memoranda (NZN, General Memoranda, August 8, 2003) for 10 departments and units at the zoo. Each Best Practice manual contains summaries of the General Memoranda identified as core to the institution (General Memoranda #1-15). Additionally, other General Memoranda deemed necessary for successful operation were summarized for each department or unit individually; thus each of the 10 departments or units has unique Best Practices. Best Practices have been developed for the following departments or units at the National Zoo:

- Office of the Director
- Office of Communications and Public Affairs
- Department of Animal Programs
- Department of Conservation and Research
- Department of Administration and Technology
- Department of Exhibits and Outreach
- National Zoological Park Police
- Department of Animal Health
- Department of Pathology
- Office of Facilities Engineering and Operations

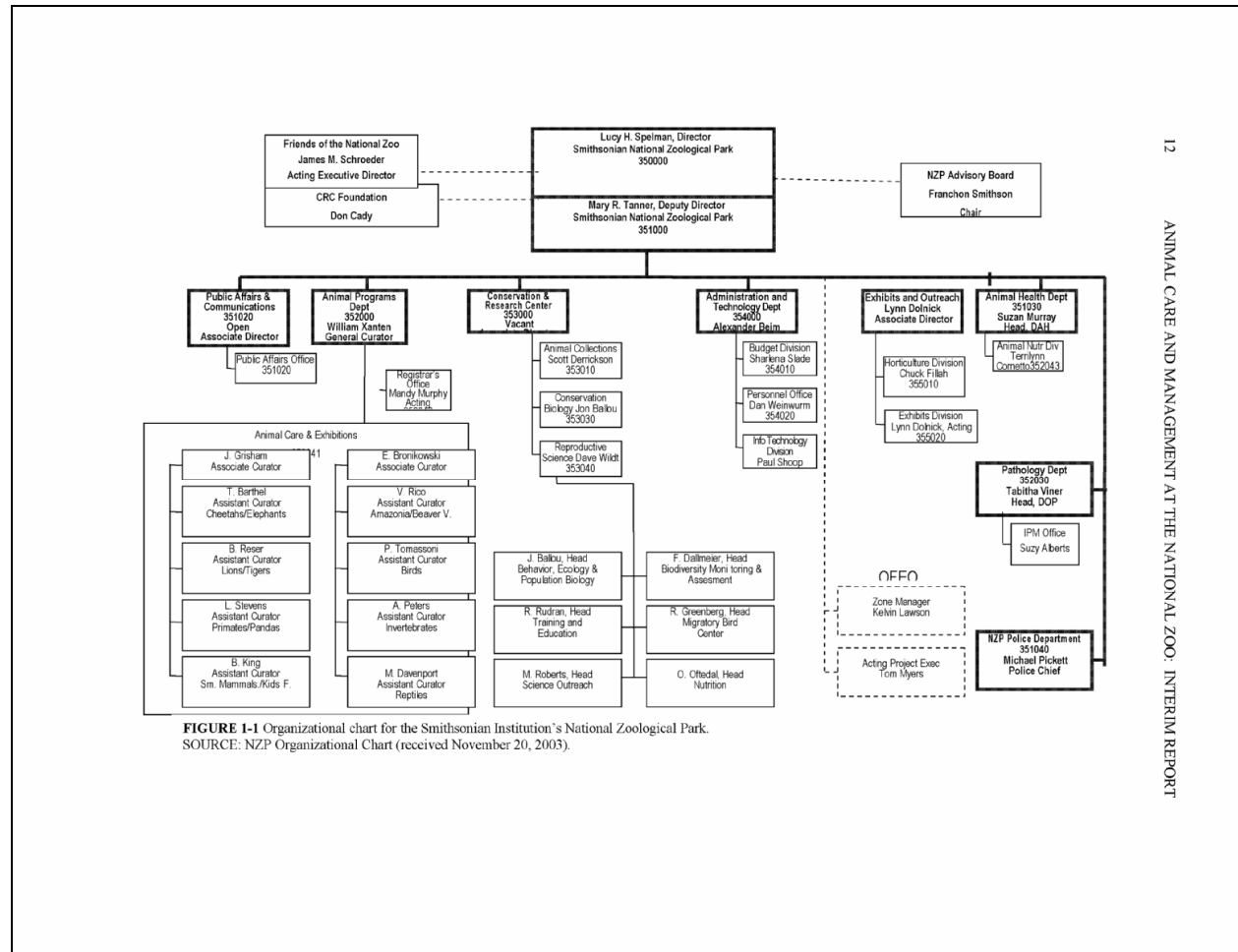


FIGURE I-1 Organizational chart for the Smithsonian Institution's National Zoological Park. SOURCE: NZP Organizational Chart (received November 20, 2003).

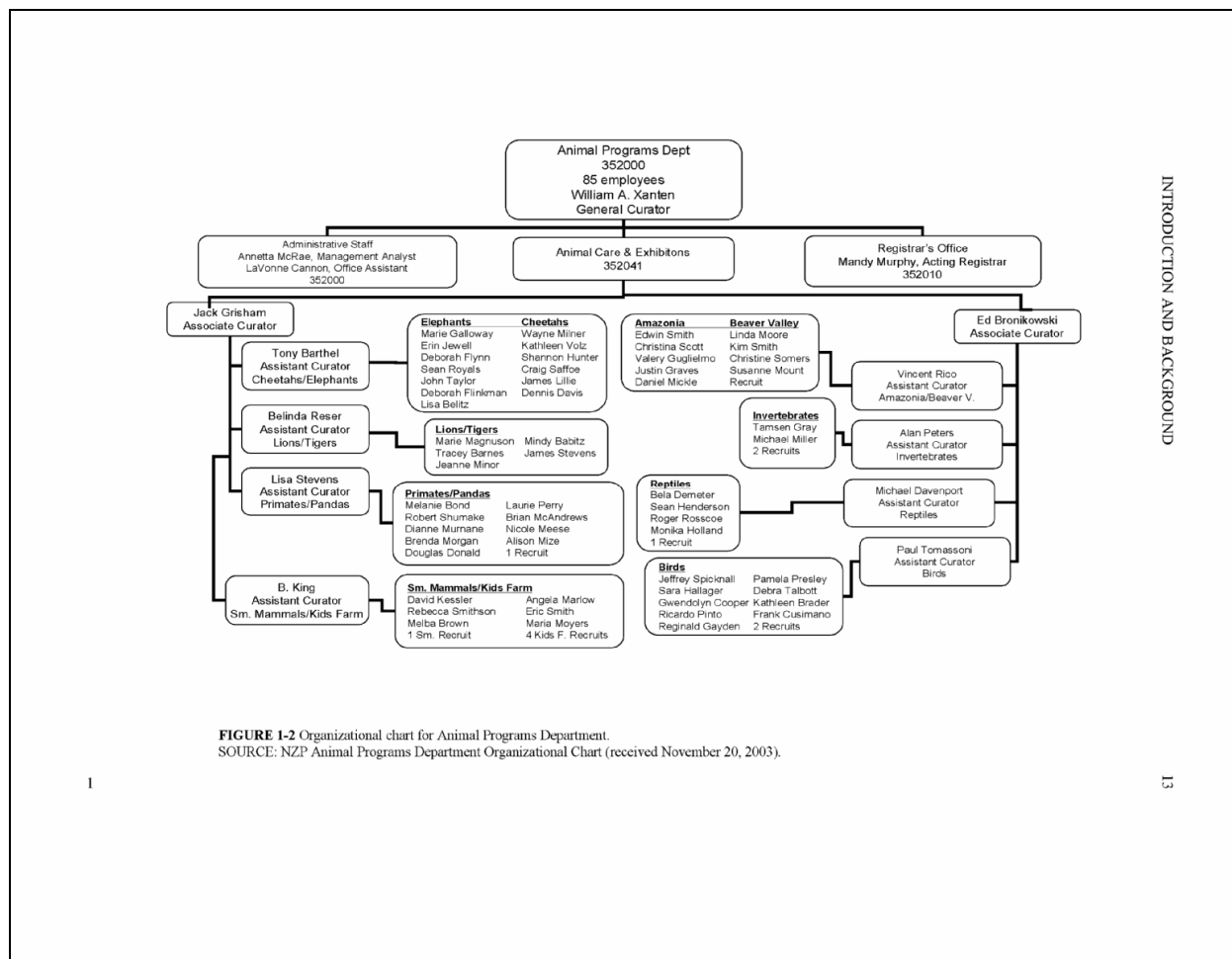
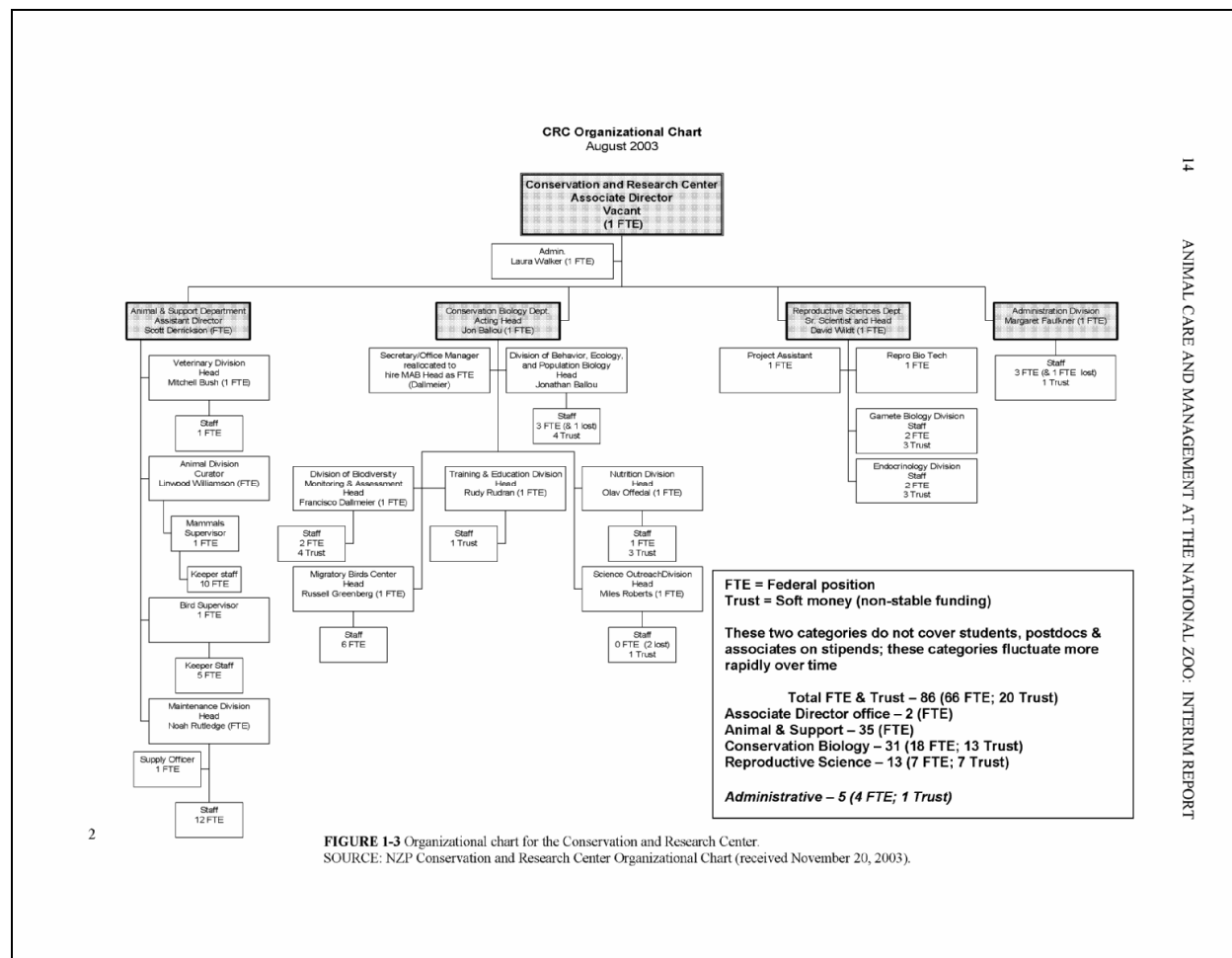


FIGURE 1-2 Organizational chart for Animal Programs Department.  
 SOURCE: N.Z.P. Animal Programs Department Organizational Chart (received November 20, 2003).





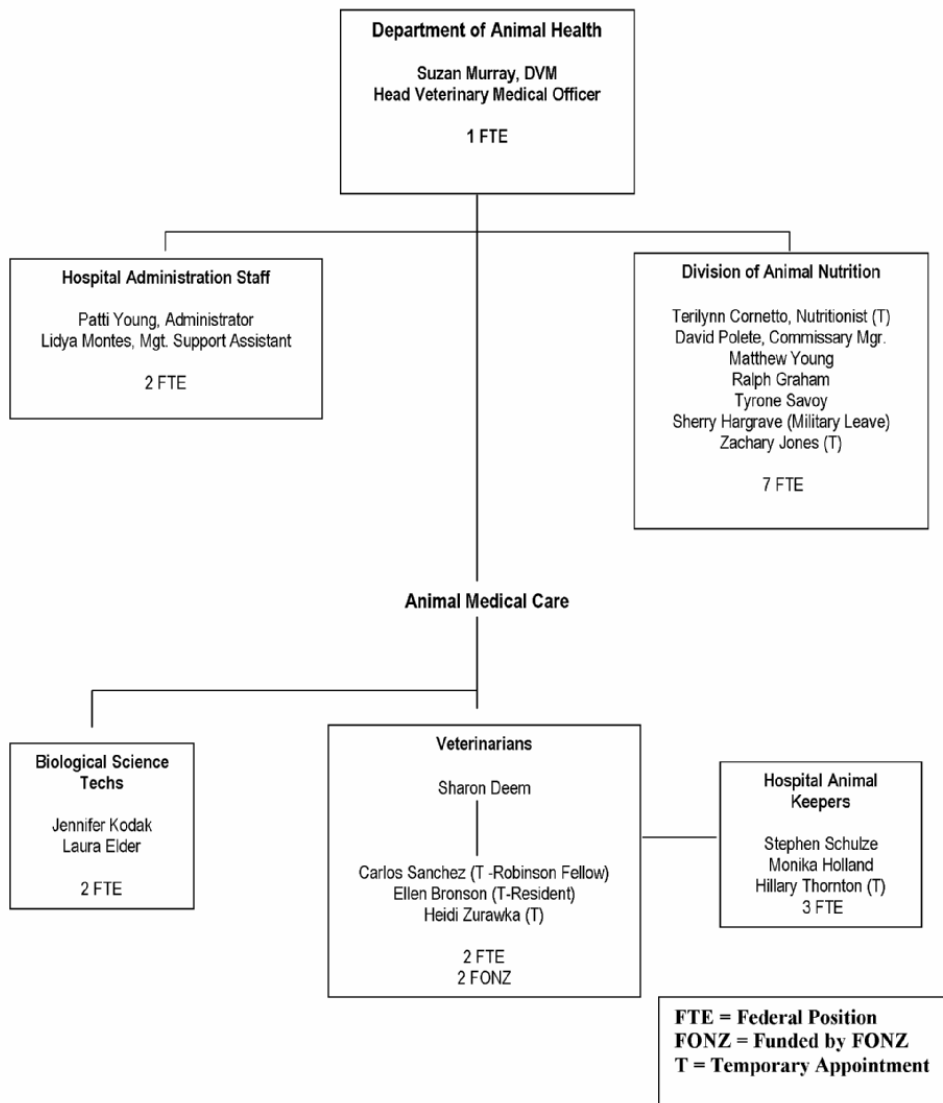
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**FIGURE I-3** Organizational chart for the Conservation and Research Center.  
 SOURCE: NZP Conservation and Research Center Organizational Chart (received November 20, 2003).

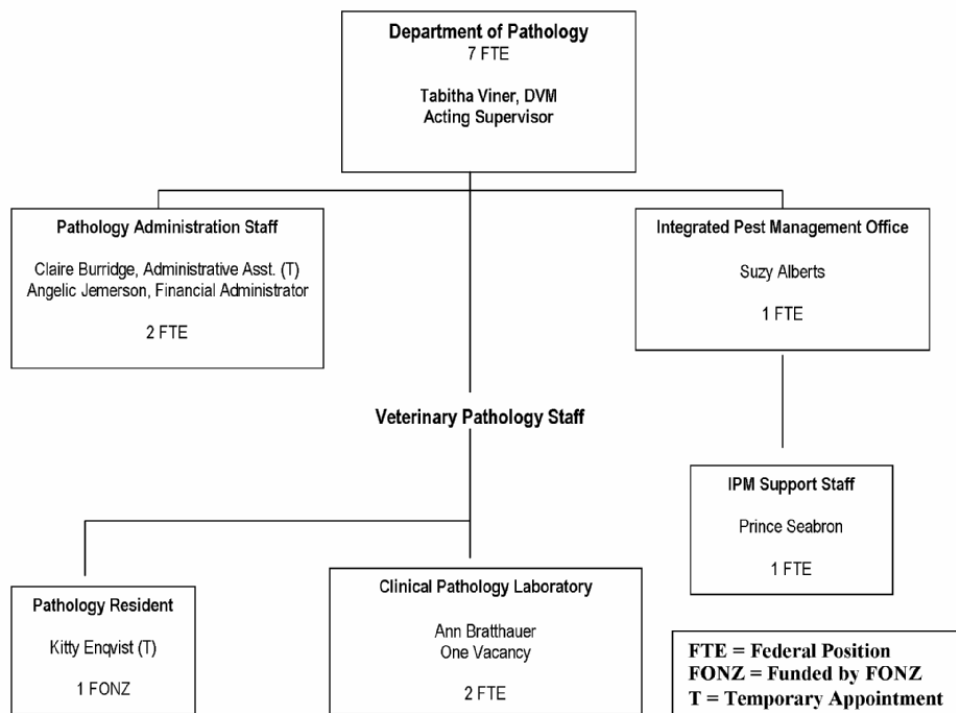
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**FIGURE 1-4** Organizational chart for the Department of Animal Health.  
SOURCE: NZP Animal Health Department Organizational Chart (received February 11, 2004).



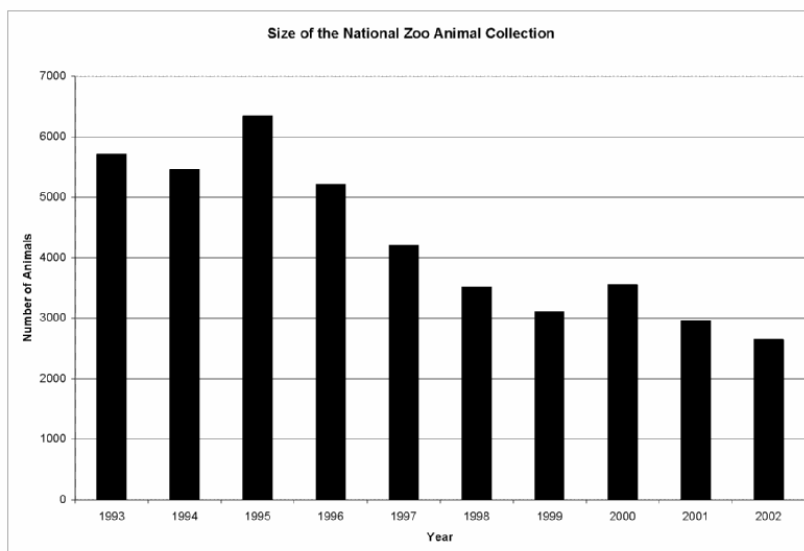
**FIGURE 1-5** Organizational chart for the Department of Pathology.  
SOURCE: NZP Pathology Department Organizational Chart (received February 11, 2004).

### THE ANIMAL COLLECTION

The National Zoo's animal collection currently consists of approximately 2,600 animals representing just over 400 species (NZP, Status of the Collection Report, 2002). The collection has undergone dramatic changes in the past 10 years. From 1993 to 2002 the size of the animal collection has decreased 54 percent (see Figure 1-6). This decrease is due to several factors, including a decrease in the number of animals acquired by the zoo annually, as well as an increase in removal of animals from the collection. As shown in Figure 1-7, the number of animals acquired annually by the zoo was fairly stable from 1993 through 1999, but starting in 2000, there was decrease in the number of animals acquired by the zoo annually, with a 67 percent decrease in annual acquisitions from 1999 to 2002.

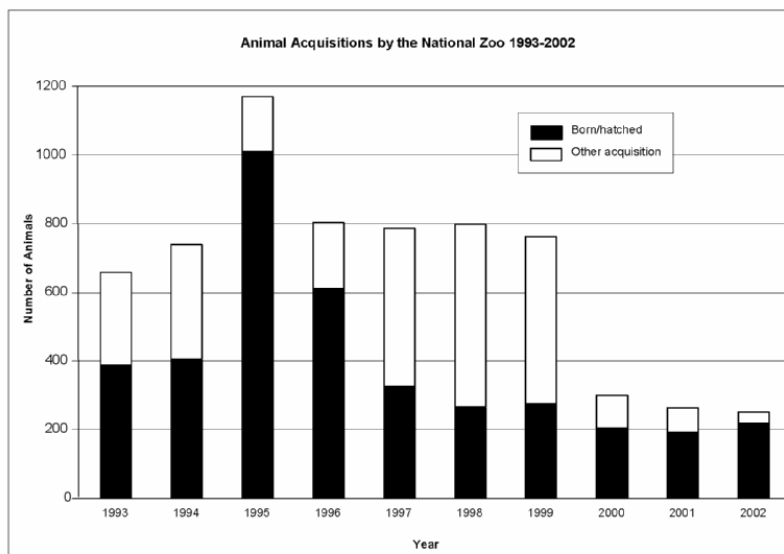
Even though annual acquisitions of animals remained relatively stable throughout the 1990s, the size of the animal collection continued to decline. This decline occurred because the number of animals that were being removed from the collection, either through death or relocation to other institutions (see Figure 1-8), was greater than the number of animals being acquired each year (animals born at the National Zoo or acquired from other institutions). In particular a large number of animals were removed from the collection during 1995-1997. This was partly because of a deliberate reduction in the number of mammals held at the CRC, but it was also because of a large number of animal deaths in those years (due to an increase in the number of fish, amphibian, and invertebrate animal deaths). The CRC deliberately reduced the number of mammalian species in its inventory by about 40 percent during this timeframe through relocation of their animals to other institutions. This decision to concentrate on only approximately 10 species with a high research return provided greater focus to the CRC's research effort.

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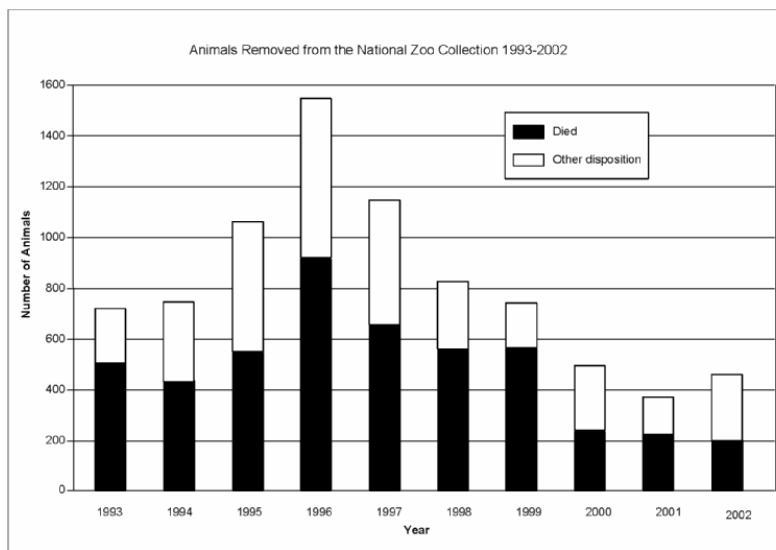
**FIGURE 1-6** Annual status of the National Zoo animal collection. The annual counts for each year are a tabulation of individually counted animals, as well as estimates for groups of animals (such as fish, bats, and frogs), that are not counted individually.

SOURCE: Tabulated from NZP, Status of the Collection Reports, 1993-2002.

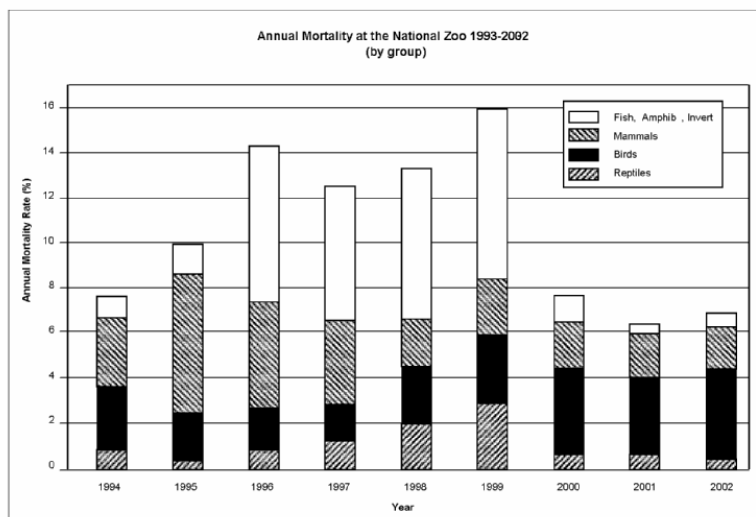


**FIGURE 1-7** Annual animal acquisitions by the National Zoo. Acquisitions include animals born at the National Zoo or acquired from other institutions.

SOURCE: Tabulated from NZP, Status of the Collection Reports, 1993-2002.



**FIGURE 1-8.** Number of animals removed from the National Zoo collection annually. Animals are removed from the collection either by death or relocation of the animal to another institution.  
SOURCE: Tabulated from NZP, Status of the Collection Reports, 1993-2002.



**FIGURE 1-9.** Annual mortality rate at the National Zoo, by animal group. The annual mortality rate is calculated as a percentage of the animal collection that dies each calendar year. Mortality rates were calculated for fish, amphibians, and invertebrates (fish, amphib, invert) as a group; mammals; birds; and reptiles.  
SOURCE: Tabulated from NZP, Status of the Collection Reports, 1993-2002.

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Annual mortality rates are one method of assessing fluctuation in a zoo collection. This rate is determined by calculating the percentage of the total collection that dies each year, usually using the data from an annual animal inventory. To evaluate the National Zoo's annual mortality rate (see Figure 1-9) in the context of the larger zoo community, the committee sought to data from other zoos in the United States. The committee has obtained mortality data from two zoos at this time. The collection size of these two zoos currently range from just under 2,000 specimens to just over 3,700, representing approximately 240 and 750 species, respectively. Both zoo's mortality rates have remained relatively stable or declined over the past 10 years, averaging 6.8 percent (ranging from 4.7 to 9.8 percent) and 10.6 percent (ranging from 8 to 12 percent ) (Denver Zoological Gardens, 2003; North Carolina Zoological Park, 2004) annually. The National Zoo's mortality rate during the same period averaged 10.5 percent (ranging from 6.3 to 15.9 percent). The fluctuation in the National Zoo's mortality rate is in part due to biological variation, changing nature of the animal collection (species represented and animal numbers within individual species), and aging of the animal collection. Readers should be aware that the mortality rates at a zoo, whose collection is usually made up of animals with life spans much shorter than those of humans, depend greatly upon the length of lifespan and robustness of the species, the ratio of short-lived to long-lived animals in a collection, as well as the age and health of individual animals. The committee has requested data from numerous institutions and anticipates having additional data for analysis of annual mortality rates in the final report.

### THE NATIONAL ZOO AS PART OF THE LARGER ZOOLOGICAL COMMUNITY

To review the National Zoo as part of the larger zoo community, data from AZA-accredited zoos (AZA, 2003b) were analyzed for vertebrate animal collection size, total staff number, and annual budget. For data consistency, institutions were excluded from the committee's analysis when the institution was an aquarium or had greater than 70 percent of its vertebrate collection as fish or when no staff or budget data was available. This yielded 156 AZA-accredited institutions, including the National Zoo, for comparison.

For the data from 156 institutions reviewed, budgets ranged from approximately \$60,000 to \$89 million annually, with an average of \$6.6 million (AZA, 2003b). The National Zoo reported a budget of \$34 million (AZA, 2003b), somewhat lower than the operating budget (excluding FONZ operations) provided to the committee by the National Zoo (see Table 1-1). The National Zoo's budget is larger than 96 percent of the AZA-accredited zoos (see Figure 1-10). Staff size ranged from 6 to 1,390 (average of 108) for the 156 institutions (AZA, 2003b). The National Zoo staff is larger than 94 percent of the AZA-accredited zoos (Figure 1-11). The vertebrate animal collection size of the 156 AZA-accredited institutions ranged from 20 animals (6 species) to 12,907 animals (824 species) (AZA, 2003b). The National Zoo vertebrate animal collection size is larger than 89 percent of the other institutions with 2278 specimens (see Figure 1-12). Including invertebrates, the National Zoo collection is approximately 2,500 animals (similar to that discussed earlier). The National Zoo had a vertebrate-animal-to-staff-number ratio of 7.8:1 in its collection (see Figure 1-13), less animals per staff member than 72 percent of the AZA-accredited institutions. This ratio includes all staff (animal care, animal health, research, administrative, service, etc.) reported by each institution; approximately 50 percent of the National Zoo staff is involved directly in animal care and management (Animal Programs, Animal Health, and Pathology departments, and the Animal and Support Department at CRC). Table 1-3 presents 10 AZA-accredited zoos with 2,000 to 3,000 vertebrate animals in their collection, including the National Zoo. Table 1-4 presents 10 AZA-accredited zoos with \$20 to \$46 million annual budgets, including the National Zoo.

### Guidelines and Standard Practices for Zoos

Animal care and management at zoos has changed dramatically in the past several decades, guided by scientific peer-reviewed literature and other literature (regulatory, accreditation, and professional standards and data available in proceedings). Specific regulatory standards have been established by the Animal Welfare Act (enforced by the USDA Animal and Plant Health Inspection Service) and the Public Health Service Policy on the Humane Care and Use of Laboratory Animals. Standards have been developed and are obligatory for accreditation by the American Zoo and Aquarium Association. National Research Council reports serve as the scientific basis for policy and regulations pertaining to animal nutrition (Animal Nutrition Series) and to the care and use of animals used in research (Institute for Laboratory Animal Welfare publications) as well as standards utilized in industry, research, and academe. Additional standards and guidelines have been developed by such professional organizations as the American Association of Zoo Veterinarians, Zoological Registrars Association, American Veterinary Medical Association, and the Nutrition Advisory Group of the AZA. Many of these same organizations have annual

proceedings that contain new and revised opinions on animal care and management. Some data on zoo animal care and management are available in the scientific peer-reviewed literature. The committee has reviewed much grey and scientific literature and has judiciously used these various sources to formulate its findings.

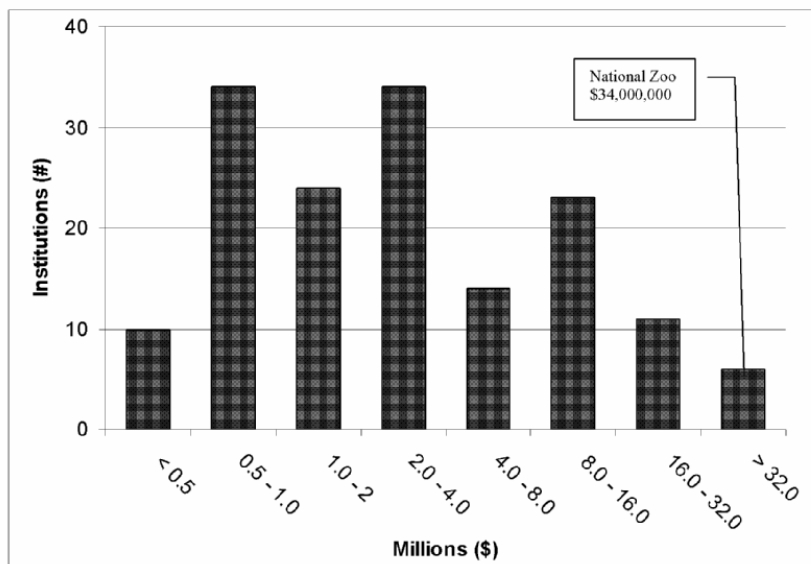


FIGURE 1-10 Annual budget for AZA-accredited institutions reported in 2003.  
SOURCE: Tabulated from the 2004 AZA Membership Directory (AZA, 2003b).

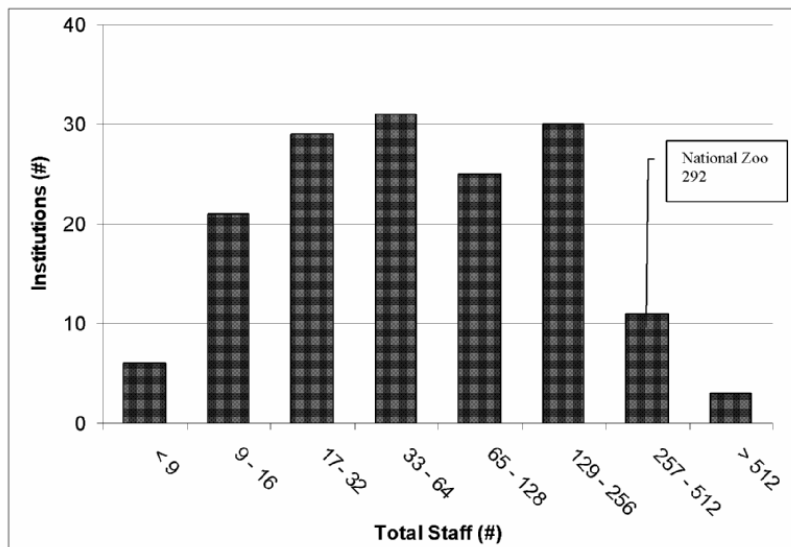


FIGURE 1-11 Total number of staff for AZA-accredited institutions reported in 2003.  
SOURCE: Tabulated from the 2004 AZA Membership Directory (AZA, 2003b).

INTRODUCTION AND BACKGROUND

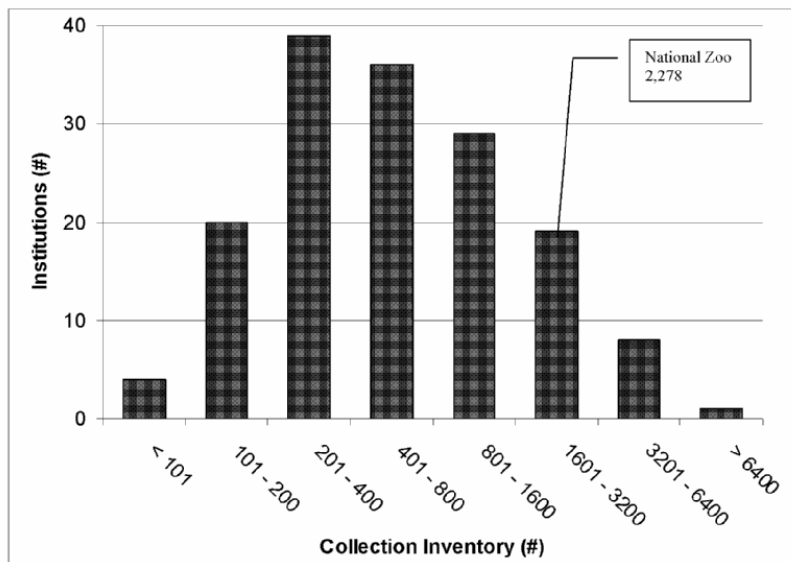


FIGURE 1-12 Vertebrate collection inventory for AZA-accredited institutions reported in 2003. SOURCE: Tabulated from The 2004 AZA Membership Directory (AZA, 2003b).

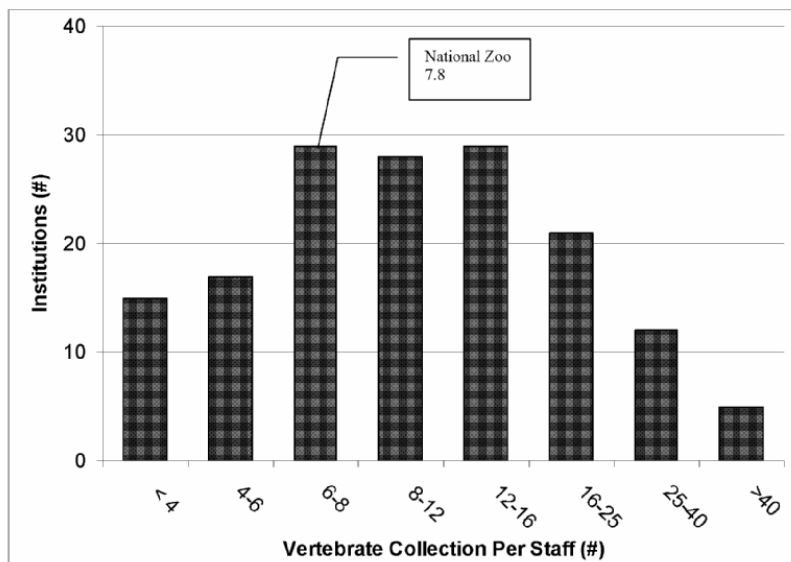


FIGURE 1-13 Number of vertebrate animals per staff for AZA-accredited institutions reported in 2003. SOURCE: Tabulated from the 2004 AZA Membership Directory (AZA, 2003b).



**TABLE 1-3** Annual Budget and Staff Number for 10AZA-accredited Zoos with 2,000 to 3,000 Vertebrate Animals in their Collection (Including the National Zoo).

Zoo	Location	Vertebrate Collection	Invertebrate Collection	Total Staff	Annual Budget (\$)
Milwaukee County Zoological Gardens	Milwaukee, WI	2,024	90	294	19,053,680
Baltimore Zoo	Baltimore, MD	2,037	52	283	11,600,000
Minnesota Zoological Garden	Apple Valley, MN	2,060	1,053	240	15,782,351
Louisville Zoological Garden	Louisville, KY	2,202	62	152	9,336,400
Smithsonian National Zoological Park	Washington, DC	2,278	214	292	34,000,000
Sedgwick County Zoo	Wichita, KS	2,279	384	130	6,600,000
Detroit Zoological Park	Royal Oak, MI	2,320	996	245	20,525,680
Cincinnati Zoo & Botanical Garden	Cincinnati, OH	2,324	45	230	19,385,000
Brookfield Zoo	Brookfield, IL	2,412	2,862	470	35,100,000
Wildlife World Zoo	Litchfield Park, AZ	2,627	100	35	3,500,000

SOURCE: The 2004 AZA Membership Directory (AZA, 2003b).

**TABLE 1-4** Animal Collection Size and Staff Number for Ten AZA-accredited Zoos with \$20 Million to \$46 Million Annual Budget (Including the National Zoo).

Zoo	Location	Vertebrate Collection	Invertebrate Collection	Total Staff	Annual Budget (\$)
Woodland Park Zoological Gardens	Seattle, WA	1,005	51	223	20,235,258
Detroit Zoological Park	Royal Oak, MI	2,320	996	245	20,525,680
The Calgary Zoo	Calgary, Alberta	870	6	199	20,976,000
The Philadelphia Zoo	Philadelphia, PA	1,530	57	250	22,801,000
Museum of Science	Boston, MA	234	4	289	30,732,000
Smithsonian National Zoological Park	Washington, DC	2,278	214	292	34,000,000
Brookfield Zoo	Brookfield, IL	2,412	2,862	470	35,100,000
Saint Louis Zoological Garden	Saint Louis, MO	3,009	3,217	401	39,288,372
San Diego Wild Animal Park	Escondido, CA	3,382	0	650	40,253,000
Bronx Zoo	Bronx, NY	4,370	179	578	45,168,506

SOURCE: The 2004 AZA Membership Directory (AZA, 2003b).

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## Animal Care and Management

At the National Zoo responsibility for the care and management of the animal collection resides in the Animal Programs Department, Animal Health Department, and Pathology Department. These departments are generally responsible for the exhibition, day-to-day care, and health of the animal collection (NZIP, Best Practices, 2003). The National Zoo's Institutional Animal Care and Use Committees (IACUCs) are responsible for reviewing exhibit, management, and research programs to ensure that animals in the collection and research programs receive humane care and treatment (NZIP, General Memorandum No. 15, April 2003, September 2003).

The Animal Programs Department is generally responsible for the exhibition of the animals, day-to-day care of the animals, and development of the animal collection (NZIP, Department of Animal Programs – Best Practices, 2003). The Department of Animal Health consists of the veterinary staff at the animal hospital, as well as the nutrition and commissary staff. This department is responsible for the health of the animal collection: proper nutrition, preventive medicine, and health care (NZIP, Department of Animal Health – Best Practices, 2003). The Department of Pathology provides clinical laboratory and postmortem diagnosis and research to identify diseases that are occurring at the National Zoo and determine how they can be controlled or prevented (NZIP, Department of Pathology – Best Practices, 2003).

### ANIMAL PROGRAMS DEPARTMENT

Within the Animal Programs Department, the animal collection is grouped into eight units, by either species type or exhibit location:

1. Cheetahs and Elephants Unit
2. Lions and Tigers Unit
3. Primates and Pandas Unit
4. Small Mammals and Kid's Farm Unit
5. Birds Unit
6. Reptiles Unit
7. Invertebrates Unit
8. Beaver Valley and Amazonia Unit

The Animal Programs Department is headed by a general curator, who is assisted by two associate curators, each with oversight responsibility of four units. Each unit is managed by an assistant curator. The eight assistant curators, manage the activities of the animal keepers assigned to each respective unit. Responsibilities for animal care and management are divided among the staff as follows:

#### **Animal Keeper**

Keepers are responsible for independently providing the day-to-day care and maintenance of animals and the exhibits in which they are housed. Their primary responsibilities include (NZP, Animal Programs – Best Practices, Primary Keeper Responsibilities; Position Description – Animal Keeper):

- daily inspections of all animals in their care and reporting of any evidence of illness, injury, or abnormal behavior to the curator and veterinarian.
- feeding and watering assigned animals, including preparation of food, and placement in animal enclosures. Maintaining current records on food and water consumption and report deviations from normal or expected patterns.
- daily cleaning of exhibit interiors and exteriors, service areas, and public areas adjacent to the animal enclosure.
- regularly inspecting and maintaining of exhibit area, including trimming and watering of plants, maintenance of furniture, mechanical and life-support systems, and either correcting or referring the problems to the supervisor.
- applying the approved enrichment plan for each assigned animal.
- completing daily reports on assigned animals.

Their duties also consist of other activities such as assisting with research and breeding programs, interacting with zoo visitors, and developing training and enrichment programs.

#### **Assistant Curator**

The assistant curators are responsible for the conception, formulation, leadership, and conduct of all animal care, breeding, conservation, exhibition, and associated public education for a designated portion of the animal collection (called a unit). Their primary duties include (Position Description – Supervisory Biologist):

- responsibility for all aspects of the daily care and exhibition of all animals in their assigned unit. With the Nutritionist, developing diet formulations and protocols for diet preparation and presentation; with the heads of the Departments of Animal Health and Pathology, developing and overseeing preventive medical programs for animals in their assigned unit.
- developing and implementing a detailed collection plan; working with national and international conservation coordinating efforts to identify species and individual animals to be bred and exchanged with other zoo to meet breeding objectives.
- developing plans for the exhibition of the collection.
- working with the registrar to provide accurate and timely information for the NZP animal records systems.
- developing and implementing annual operating budgets.
- supervising animal keepers, scheduling staff, and appraising performance; training and directing volunteers and interns.
- formulating, conducting, analyzing, and publishing research studies that are original, hypothesis-driven research related to managerial and education responsibilities; seeking funding to support research; coordinating research of other scientists wishing to use the collection; reviewing research proposals for appropriateness and routing them to the IACUC for approval.
- working with the Department of Exhibit Interpretation on exhibit materials and providing information for demonstration tours and education materials.
- serving as spokesperson for public information efforts regarding animals in their designated unit.

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**Associate Curator**

Each associate curator oversees 50 percent of the animal collection units, with responsibility for the conception, formulation, leadership, and conduct of all animal care, breeding, conservation, exhibition, and associated public education. Specific responsibilities as listed in the NZP Position Description are essentially identical to those described for assistant curators (Position Description – Associate Curator).

**General Curator**

The general curator has authority and is responsible for participating with and assisting the director and senior management team in the overall planning, direction, and management of NZP programs and activities in the exhibition, study, and care of the living animal collections at the Rock Creek Park facility (Position Description – General Curator).

**VETERINARY CARE**

Zoos differ from some museums in that they have the challenge of maintaining the health and welfare of living animal collections. Zoo animal medicine has made remarkable advances over the past century, in part because zoos have evolved from mere collections of exotic animals to centers of research in animal biology and disease diagnosis, treatment, and prevention. The first book on zoo animal medicine was written in 1923 (Fox, 1923). Until 1960, when the American Association of Zoo Veterinarians (AAZV) was established, few veterinarians were concerned with wildlife disease and captive animal medicine (Fowler, 1986a).

The level of sophistication in zoo animal medicine and husbandry is now such that the care provided to zoo animals is on a level with that provided to companion and other domestic animals. These improvements have resulted not only from research, but also from specialized training of veterinarians in zoo animal medicine, publications devoted to zoo animal medicine, establishment of national zoological organizations, and an increased awareness of both physical and psychological needs of captive wild animals. Zoos are increasingly becoming leaders in the science of conservation biology and in the practice of preserving rare and endangered species and their habitats.

Although variation exists between facilities, modern zoos have accepted certain minimum standards (AAZV, 1999; AZA, 2003c) related to the veterinary medical care provided to animals in their collections:

- An adequate number of technically competent veterinarians (Stetter et al., 2003).
- An adequate number of trained veterinary technicians and support staff.
- A well-equipped, well-designed facility that adequately serves the needs of the animals and the staff (Simmons, 2003).
- A complete and retrievable medical records system.
- Written protocols and procedures (Janssen et al., 2003).
- An organizational structure and medical decision process that places the responsibility for animal health with the veterinarians, while seeking input from other professionals including keepers, curators, nutritionists, and others (Stetter et al., 2003; Janssen, et al., 2003).
- A veterinary department that upholds professional decorum (Janssen, et al., 2003).
- Access to diagnostic laboratory services.

Exceptional modern zoos additionally have

- veterinarians who have received advanced certification or residency training under the auspices of the American College of Zoological Medicine, the American Veterinary Medical Association, or other professional organization.
- an active residency training program.

- opportunities, such as public viewing areas, for the public to observe veterinary medical procedures, gain a better understanding of zoo animal medicine, and acquire a greater awareness of preventive medicine and quality of animal care (Stetter, et al., 2000).

#### Preventive Medicine

Preventive medical programs include all practices that strengthen genetic and immunologic resistance to disease, provide sound nutrition, and minimize exposure to disease agents (Fowler, 1986b). The ultimate goal of a preventive medicine program is prevention and early detection of disease (Miller, 2000; AAZV, 1999). Fowler describes a sound program as one that involves a written plan, education and training of all parties expected to carry it out, continued monitoring, and persistence in the practice of the plan (Fowler, 1986b). An optimum preventive medicine program is reviewed and upgraded annually to reflect collection and species-specific health concerns (Miller, 2000) and it covers the elements listed in Table 2-1.

**TABLE 2-1** Elements of an Effective Preventive Medicine Program<sup>a</sup>

**Quarantine** – Twenty years ago the failure to provide adequate facilities and failure to carry out an effective quarantine program were the most glaring deficiencies in zoos in North America, Great Britain, and Western Europe (Fowler, 1986a). Currently zoos are subject to government quarantine procedures as well as to quarantine requirements adopted by the AZA in 1994 (Miller, 1995). The AZA quarantine requirements (AZA, 2003c), as well as quarantine requirements subsequently laid out by the AAZV (1999), detail the most desirable quarantine design, but enacting this design is not always possible because of constraints of cost, facilities, and personnel, and ultimately each zoo has control over its own in-house quarantine program (AAZV, 1999).

**Parasite Surveillance Procedures and Control** - Parasite control is more complicated than the simple periodic administration of anthelmintic preparations. A regular schedule of fecal examinations is important to facilitate the detection and treatment of parasite infections before clinical signs appear. Fecal examinations are also an important part of the quarantine procedure. External parasites, though more difficult to detect, should also be considered during surveillance procedures. Examination for external parasites should be part of a complete physical exam. The movement of animals or exhibit furniture from one exhibit to another needs to be carefully considered to prevent exposure to parasites that could cause a fatal infection (AAZV, 1999).

**Immunization** - Vaccination programs are a key component of preventive medicine programs. The design of these programs varies widely, and is based on the animal collection, diseases endemic to the area and potential for exposure. There is a further challenge in that vaccination recommendations for exotic species are made in most cases by extrapolation rather than through extensive research (AAZV, 1999).

**Infectious Diseases Screening** – Monitoring the disease status of an animal collection can allow for early detection of outbreaks of infectious disease within zoos. As with vaccination programs the design of an infectious disease screening program depends on the prevalence of a disease in the vicinity of the zoological park or in the prevalence of the disease within the animal collection (AAZV, 1999).

**Periodic Reviews of Diets** - High-quality nutrition is key to animal health. This includes not only developing a complete and balanced diet acceptable to the animals but also ascertaining that the quality of the feed is acceptable (AAZV, 1999). A proper diet is one with which an animal will attain maximum development, maintain normal weight, breed and rear healthy offspring, and live out a full term of life (Clemens, 1984). As in farming, feed costs are one of the top operational costs (the others being labor and facilities).

**Periodic Review of Exhibit Design and Husbandry Techniques** - A review of exhibit design and animal management should be conducted periodically as part of a preventive medicine program. The design of animal enclosures should allow for public viewing of the animal but should also incorporate aspects of animal and keeper safety. Twenty years ago trauma was the most important cause of mortality in captive

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wild animals (Griner, 1983), and is still considered a leading cause of zoo animal death today. Review of husbandry techniques, including the proper handling and disposal of animal wastes, food wastes and other debris is important for the control of infectious agents as well as vermin (AAZV, 1999).

**Periodic Review of Vermin Control** - Control of vermin (both vertebrate and invertebrate) is an important part of a preventive medicine programs because of the potential for pests to serve as vectors or reservoirs of disease. Review of the vermin control program should also take into account the types of pesticides being used and the signs of exposure in collection animals (AAZV, 1999). Toxicologic problems are generally not considered a major cause of mortality in zoos, however, it is a major concern.

**Periodic Review of Mortality and Morbidity** – A review of mortality and morbidity should be conducted periodically as part of a preventive medicine program. Changes in animal health, nutrition, and husbandry can be initiated in response to trends observed in animal illness or deaths.

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<sup>a</sup> Adapted from AAZV (1999) and Fowler, (1986b).

### Veterinary Care at the National Zoo

The National Zoo currently employs three full-time board-certified (by the American College of Zoological Medicine) clinical veterinarians: two individuals at the Rock Creek Park facility and one at the CRC. At the Rock Creek Park facility there are two additional veterinarians: a former veterinary resident, who is on a one-year appointment, and a veterinary resident. In total there are five practicing clinical veterinarians that provide veterinary medical care to the animal collection. A research veterinarian provides additional support to the clinical veterinarian at the CRC when necessary. The Rock Creek Park veterinary staff is supported by three keepers and two veterinary technicians. The CRC veterinarian is supported by one veterinary technician. The keepers are responsible for the daily feeding of the animals currently housed in the hospital, cleaning and maintaining the enclosures, and assisting the veterinarians (NZIP, Department of Animal Health Procedures—Hospitalized Animal Procedures, 2003). The veterinary technicians are responsible for ordering and dispensing all pharmaceuticals, documenting anesthesia and prescription records, and providing technical assistance to the veterinary staff (NZIP, Department of Animal Health Procedures—Veterinary Technician Medical Records, 2003). The Rock Creek Park veterinary facility functions on a seven-day work week, with staggered schedules for the veterinarians, keepers, and technicians. The clinical staff works from a well-equipped facility that fulfills the recommendations for veterinary facilities outlined by the AAZV (1999). Additionally, the National Zoo employs two veterinarians in the Department of Pathology supported by two laboratory technicians (one technician position currently vacant).

Currently the Department of Animal Health has a structured work plan for active case management. Each animal within the hospital is inspected at least twice daily by the veterinary hospital keeper and at least once daily by a veterinarian. Daily rounds are held with the entire hospital staff and often a member of the Pathology Department. During rounds each animal being acutely managed by the hospital is discussed, procedures planned for that day, as well as scheduling for procedures in the future. In addition to daily rounds, the veterinary staff maintains an active case log of both acute cases and chronic cases. This log is updated daily by all veterinarians on clinical service. The veterinary staff meets twice weekly to discuss the management of all cases in the log.

In addition to providing medical treatment to injured or ill animals, the Department of Animal Health is mandated by zoo policy and by professional organizations to establish a preventive medicine program (AAZV, 1999; AZA, 2003c). The preventive medicine program at the National Zoo includes quarantine, parasite surveillance procedures and control, immunization, infectious disease screening, and dental prophylaxis (National Zoological Park Preventative Medicine Program, 1998, 1999, 2001, 2003).

### Strengths and Weaknesses of Veterinary Care at the National Zoo

With three full-time veterinarians and two temporary veterinarians, the National Zoo maintains a larger clinical veterinary staff than many other zoos of similar age, size, and animal collection number. For example, the 100-year-old 200-acre Milwaukee County Zoo, with an animal collection of approximately 2,000 representing over 300 species, employs two full-time clinical veterinarians. The Baltimore Zoo, Minnesota Zoological Garden,

Louisville Zoological Garden, Sedgwick County Zoo, and the Detroit Zoological Garden all with collection sizes and annual budgets similar to those of the National Zoo each employ one or two full-time veterinarians (AZA, 2003b; AAZV, 2004). Approximately 274 veterinarians are employed by the 180 AZA-accredited zoos with on-site veterinary staff (Amand, 2004). Of those veterinarians employed by AZA-accredited zoos, approximately 35 are board certified (by the American College of Zoological Medicine) with six institutions retaining three or more board certified veterinarians: San Diego Zoo, Bronx Zoo (Wildlife Conservation Society), Disney's Animal Kingdom, Saint Louis Zoological Park, North Carolina Zoological Park, and the National Zoo (Amand, 2004).

It is important to note that clinical veterinarians at most other zoos also function as the onsite pathologist (performing necropsies, collecting postmortem diagnostic samples, and assigning gross pathologic diagnoses) in addition to their clinical duties, because most zoos do not have full-time veterinary pathologists or a pathology department (Citino, 2000). Unlike most zoo veterinarians, the clinical veterinarians at the National Zoo do not have responsibility for pathology because the National Zoo employs two additional full-time veterinary pathologists in addition to its staff of clinical veterinarians. The San Diego Zoo, Bronx Zoo (Wildlife Conservation Society), Disney's Animal Kingdom, Saint Louis Zoological Park, Philadelphia Zoo, and the National Zoo are among the few institutions with separate pathology departments. Other zoos utilize schools of veterinary medicine or commercial laboratories for pathology needs.

To assess the quality of veterinary medical care at the National Zoo, members of the committee met with veterinary staff, keepers, and curators; examined written policies and procedures of the Department of Animal Health; evaluated the medical records of select animals currently in the collection, as well as the medical records of particular animals that were brought to the attention of the committee; reviewed the scientific literature; and gathered information on preventive medicine and animal care from other zoological institutions. This process is ongoing and the committee will continue to gather information for the preparation of its final report. However, the information evaluated during the first six months of the project has revealed serious deficiencies in the preventive medicine program at the National Zoo and isolated incidents of unacceptable veterinary care.

To date, the committee has reviewed the majority of the animal deaths at the National Zoo that were brought to the public's and Congress's attention through media coverage. In the committee's opinion, after a review of medical and pathology records, many of these deaths were due to the advanced age of the animals or preexisting conditions and the medical care provided was adequate and in some cases well beyond any reasonable expectation of care. However, the committee did see evidence of a lack of veterinary knowledge regarding the physiology and nutrition of hoofstock (see Box 2-1) and lapses in veterinary care that was provided to an African bush elephant (see Box 2-2).

**BOX 2-1**

**Case Study: Grevy's Zebras (*Equus grevyi*) "Buumba" (Accession #113393), "Shaka" (Accession #113392), and "Arbez" (Accession #113417)**

- |                      |  |
|----------------------|--|
| <b>Spring 1999</b>   | • Three zebras brought to the National Zoo were placed in quarantine (NZIP, Medical Records, Accession #113393, #113392, and #113417, Grevy's Zebras).   |
| <b>May 12, 1999</b>  | • Shaka and Buumba were released from quarantine to the Cheetah/Elephant area (NZIP, Medical Records, Accession #113393 and #113392, Grevy's Zebras).  |
| <b>May 17, 1999</b>  | • Buumba and Shaka examined by the veterinary staff because keepers reported that Buumba had developed a distended abdomen (NZIP, Medical Records, Accession #113393 and #113392, Grevy's Zebras).<br>• Buumba's diet reduced from 2 pounds of pellets and 2 flakes of hay to 1 pound of pellets and 2 flakes of hay (NZIP, Medical Records, Accession #113393, Grevy's Zebras).<br>• Shaka's veterinary record does not reflect any change in (NZIP, Medical Records, Accession #113392, Grevy's Zebras). |
| <b>June 15, 1999</b> | • Arbez was released from quarantine to the Cheetah/Elephant area (NZIP, Medical Records, Accession #113417, Grevy's Zebra).   |
| <b>Summer 1999</b>   | • Zebras' diet was increased to 5 pounds of pellets per day and then later reduced to 4 pounds of pellets and 4 flakes of hay (Wells, 2000b), presumably the diet that these animals received in the fall of 1999.<br>• Dietary changes were not noted in the medical records and no nutritionist records could be produced for these animals.   |

*(continues)*

**BOX 2-1 (continued)**

- October 30, 1999**
- Keepers reported that Shaka developed a bloated abdomen (NZIP, Medical Records, Accession #113392, Grevy's Zebras).
  - Veterinary staff assessed Shaka and ordered a reduction in food intake (NZIP, Medical Records, Accession #113392, Grevy's Zebras).
- November 8, 1999**
- Zebras' diet reduced to 2 pounds of pellets, and hay cut in half, though there is no indication what the hay consumption was previously or what measurable amount it would then be (NZIP, Keeper's Log, Accession #113417 and #113392, Grevy's Zebra).
  - Diet reduction occurred for three or four weeks (Nichols and Stevens, undated; Wells, 2000b).
  - Diet reduction was not noted in any of the three animals' medical records, though the keeper logs indicated the veterinary staff was aware of the diet change; and other National Zoo documents also indicated the change was by order of the veterinary staff (Nichols and Stevens, undated; Wells, 2000a).
- December 1999**
- Zebras' diet returned to approximately 4 pounds of pellets and 3 flakes of hay per day (Nichols and Stevens, undated; Wells, 2000b).
  - This change is not noted in the keeper logs, veterinary medical records, or curator report.
- January 31, 2000**
- Keeper staff observes Buumba lying on the stall floor (NZIP, Keeper's Log, Accession #113393, Grevy's Zebra).
  - Veterinary staff sedate Buumba, examine and administer intravenous fluids and other medications (NZIP, Medical Records, Accession #113393, Grevy's Zebra).
  - Buumba recovered from sedation and was then placed into his stall for the night (NZIP, Medical Records, Accession #113393, Grevy's Zebra).
  - The keeper logs reflect that veterinary staff also examined Shaka and Arbez, and determined that these animals were overweight (NZIP, Medical Records, Accession #113417, #113392, Grevy's Zebras).
  - Shaka's and Arbez's diet were reduced from 4 to 3 pounds of pellets per the veterinarian's orders (NZIP, Keeper's Log, Accession #113417 and #113392, Grevy's Zebras).
  - The examination and resulting reduction in diet were not documented in the veterinary medical record of either animal (NZIP, Medical Records, Accession #113417 and #113392, Grevy's Zebras).
  - Buumba died during the night of hypothermia, with inanition [starvation] as a contributing factor (NZIP, Accession #113393, Grevy's Zebra, Final Pathology Report #2000-0032).
- February 1, 2000**
- Shaka and Arbez were evaluated by the nutritionist and determined to be underweight (NZIP, Keeper's Logs, Accession #113417 and #113392, Grevy's Zebras).
  - Their diet was substantially increased (NZIP, Keeper's Logs, Accession #113417 and #113392, Grevy's Zebras).
  - The examination and diet change of Shaka and Arbez were not documented in the medical record (NZIP, Medical Record, Accession #113417 and #113392, Grevy's Zebras).

Zebras should be fed a diet containing 12-14 percent crude protein and 37-51 percent neutral detergent fiber (90 percent dry matter) (Lintzernich and Ward, 1997) with daily feed intake of 1.5-3 percent of body weight. Diets are suggested to be constituted of 25-40 percent low fiber pellets and 60-75 percent grass hay (Lintzernich and Ward, 1997). Diets may need to be altered to reflect changing physiological or environmental conditions. While complete documentation of the zebras' intake are not available for analysis, the death of Buumba due to hypothermia and inanition [starvation], and poor body condition of Shaka and Arbez clearly indicate the zebras were not receiving adequate nutrition.

Though various internal National Zoo documents (Nichols and Stevens, undated; Wells, 2000b; Wells, 2000a) generated after the animal's death indicated that the keepers, the curator, and the veterinary staff were all aware of the two diet changes that occurred in November and December, none documented the changes completely, if they were documented at all. It is not apparent to what extent the nutritionist was involved in these decisions, since no nutritionist records could be produced for these animals, though there are indications that diet request forms were submitted to the nutritionist (Wells, 2000a). In addition, some keeper logs pertaining to these animals were not archived, while others were improperly archived.

(continues)



**BOX 2-1 (continued)**

Because the reduction in diet for Shaka and Arbez is not reflected in the medical record, it is not apparent what led to the decision of the veterinary staff to reduce the diet of these animals on January 31, 2000. However, the poor condition of the animals upon evaluation by the nutritionist, as well as the inanition, contributed to Buumba's death, reflects an incorrect assessment of Shaka's and Arbez's body condition by the veterinary staff on January 31, 2000. For mammals at the National Zoo body weight is to be monitored monthly under normal conditions, biweekly when diets are changed, and weekly when monitoring health status. Updated body weight information is to be recorded in the daily keeper reports (National Zoological Park, NZP Department of Animal Health Procedures – Animal Body Weights, 2003). It is unknown if functioning scales were available for weighing hoofstock at the time of Bumba's death (Wells, 2003b).

In addition, it is apparent that substantial changes were made to Buumba's medical record. The committee received copies of the medical record from the Smithsonian's inspector general (printed on March 29, 2000), Dr. Donald Nichols, formerly the associate pathologist at the National Zoo (printed on May 30, 2002), and from the National Zoo (printed on October 2, 2003). On review of the clinical note entries it is apparent that changes were made to the entries logged on April 25, 1999; May 17, 1999; May 27, 1999; June 2, 1999; and February 1, 2000; and that a new entry was created for May 18, 1999. Comparison of the three different copies of the medical record indicates that all of these changes occurred between May 30, 2002, and October 2, 2003. Changes to the medical record, in some cases as much as three years after the entry was originally made, affect the credibility of the information contained in the medical record.

Many other details pertaining to the care of the three zebras is a matter of contention among various zoo staff, including whether attempts were made to have the veterinary staff reevaluate the zebras in December and January and whether the curatorial staff was aware and addressing the lack of adequate heat in the building where the zebras were housed (Nichols and Stevens, undated; Wells, 2000b; Wells, 2000a). The committee was not able to address these issues owing to a lack of documentation, however there is ample evidence that poor record keeping, poor veterinary care and decision making, and lack of involvement of the nutritionist contributed to Buumba's death and the poor condition of the other two zebras.

**BOX 2-2**

**Case Study: East African Bush Elephant (*Loxodonta africana*) "Nancy" (Accession #26223)**

On August 22, 2000, an East African bush elephant named Nancy was euthanatized because of her advanced age, severity of her clinical symptoms, and her poor prognosis. Between 1997 and her death this animal had been diagnosed with osteoarthritis (a functional or structural failure of an entire joint, including the nearby muscles, bone, ligaments) and osteomyelitis (a chronic inflammation of the bone caused by an infection), as well as suffering from multiple episodes of abdominal edema, skin lesions, and mastitis (inflammation of the mammary gland). She had been treated at various times with anti-inflammatory agents (Tylenol, ibuprofen, phenylbutazone) and immunosuppressants (imuran, prednisone), appropriate treatment regimens for the conditions she developed during this time. In 1999 she developed a toe lesion on her right front foot caused by the osteomyelitis. This was treated with localized injections of antibiotics (amikacin and trimethoprin sulfadiazine), with some success at first. However, she began to lose weight and her condition became resistant to treatment. In the month before her death her condition deteriorated and her apparent discomfort worsened as she began to refuse food and medication (NZP, Medical Records, Accession #26223, East African bush Elephant). Upon necropsy it was determined that Nancy suffered from infection with *Mycobacterium bovis*, a cause of tuberculosis. This caused extensive pneumonia (inflammation in the lungs) involving 60 percent of her lungs (NZP, Accession #26223, East African Bush Elephant, Final Pathology Report #2000-0331).

In 1996, two circus elephants died and were found to be infected with tuberculosis. This led to the establishment of the *Guidelines for the Control of Tuberculosis in Elephants* (The National Tuberculosis Working Group for Zoo & Wildlife Species, 1997; The National Tuberculosis Working Group for Zoo & Wildlife Species, 2000; The National Tuberculosis Working Group for Zoo & Wildlife Species, 2003), which were widely disseminated in January of 1998. These guidelines are considered the standard of care for captive elephants and were subsequently mandated by the USDA in 1998 (63 Fed. Reg. 15826 [April, 1 1998]).

Under these guidelines captive elephants are to be tested annually for tuberculosis through the use of trunk washes. This is the only acceptable way to test for tuberculosis in elephants, as skin and blood tests, like those done

(continues)

**BOX 2-2 (continued)**

in humans, are unreliable (Montali et al., 1998). Trunk washes will detect only active tuberculosis infections (when the animal is contagious to both other animals and humans) and not latent infections (The National Tuberculosis Working Group for Zoo & Wildlife Species, 2003). During the late 1990s, National Zoo veterinarians were deeply involved in the issue of tuberculosis in captive elephants. In fact, from 1999 to 2001 four scientific articles were published by National Zoo veterinarians on the issue (Larsen et al., 2000; Mikota et al., 2000; Mikota et al., 2001; Montali et al., 1998).

In the summer of 1997 and the fall of 1998 Nancy was tested for tuberculosis by trunk washes. However, from October 1998 until her death National Zoo staff failed to test Nancy for tuberculosis. In addition, Nancy's medical record contains an entry from February 6, 1999, stating that "tuberculosis or other granulomatous disease can not be ruled out" as the cause of her clinical symptoms.

Nancy most likely carried a latent infection of *Mycobacterium bovis*, that was activated by the immunosuppressant drugs she started receiving in 1998 (NZIP, Accession #26223, East African Bush Elephant, Final Pathology Report #2000-0331).

It is impossible to determine whether a tuberculosis trunk wash test in 1999 or 2000 would have detected an active tuberculosis infection in Nancy, however the lack of preventive care is evident. Treatments for tuberculosis were published at least as early as 1994 (Mikota et al., 1994) and if tuberculosis testing of Nancy had been done in 1999 and 2000, it is reasonable to expect that her tuberculosis would have been detected and treated, possibly lessening the severity of her clinical symptoms and her apparent discomfort. However, because her advanced age and the progressive worsening of other medical conditions, it is likely that her euthanasia would still have been necessary at some point.

**Failures in the Preventive Medicine Program**

A review of zoo documents indicates that the veterinary department has been failing to follow various aspects of the preventive medicine program. There have been numerous examples of failures to follow quarantine procedures and provide appropriate vaccinations, infectious disease testing, and annual examinations.

*Quarantine Procedures*

The purpose of quarantine procedures is to prevent the introduction of pathogens to a zoo when a new animal is added to the collection (AAZV, 1999). Depending on the species, these quarantine procedures include fecal, blood, and tuberculin tests; vaccinations; and serology tests for specific pathogens (AAZV, 1999; AZA, 2003c). In reviewing a sample of 26 medical records the committee found six instances from 1999-2001 where veterinary staff failed to document any procedures or tests to which the animals were subjected during quarantine (see Table 2-1), although the quarantine procedures outlined in the National Zoo Preventative Medicine Program were comprehensive and in accordance with recognized standards (AAZV, 1999; AZA, 2003c). In most of the cases listed in Table 2-2, the only information regarding quarantine procedures and tests is a clinical note stating "Released from quarantine" or "Quarantine complete." Because of the lack of appropriate documentation it is impossible to determine whether veterinary staff administered procedures and testing, and thus a portion of the animal's medical history is not available for future assessment.

**TABLE 2-2** Animals for Which National Zoo Medical Records Failed to Document Quarantine Procedures and Tests<sup>a</sup>.

Animal	Accession No.	Year of Arrival at National Zoo
American bison	113418	1999
American bison	113419	1999
Grevy's zebra	113392	1999
Grevy's zebra	113417	1999
Fishing cat	113526	2000
Mexican wolf	113645	2001

<sup>a</sup>The only indication of quarantine procedures noted in the medical record as "Released from quarantine" or "Quarantine complete."

SOURCE: NZIP, Medical Records, Accession #113418, #113419, #113392, #113417, #113526, and #113645.

It appears that zoo policies and quarantine procedures may have been violated on several occasions when staff-owned pets were brought onto National Zoo grounds to have tests performed at the Animal Hospital. Staff members of the Department of Pathology have indicated that most tests performed on staff pets were performed as a professional courtesy, with the approval of the head clinical veterinarian and head pathologist; occasional tests were performed to determine whether an infectious disease was present that could be passed from the pet to a zoo collection animal by way of the staff person (Montali, 2003). It is outside the purview of this committee to comment on whether performing laboratory tests on staff pets as a professional courtesy is a legally acceptable practice at the National Zoo.

According to the National Zoo's General Memorandum No. 525 (August 8, 2003), "by law, pets, regardless of the species, are not allowed in the National Zoological Park." However, clinical pathology logs indicate that over 80 laboratory tests performed on staff pets, some dated as late as April 10, 2003, were processed by the Pathology Department (Clinical Pathology Log, January 2004), although it is not clear whether the animals were on zoo grounds each time. If staff pets were brought onto National Zoo grounds to perform tests as a professional courtesy, this action represents a potential risk to the zoo collection and a violation of the zoo's own policies and procedures.

#### *Vaccination, Infectious Disease Testing, and Annual Examinations*

Since 1998, there have been numerous examples of failure to provide vaccinations, tuberculosis tests, and annual physical exams. A summary of information depicting poor adherence to the preventive medical program for 16 animals derived from a sample of 26 individual medical records of major animal groups at the National Zoo is provided in Table 2-3. It is possible that veterinary decisions were made not to vaccinate or not to test certain animals based on their current medical status; however, if these decisions were made, they were not documented in the medical record as should have been done. A recent USDA inspection (USDA, 2004b) noted that a majority of small primates had not received their annual preventive care exam as outlined by National Zoo standard operating procedures. The National Zoo has acknowledged that from the spring of 1999 through the fall of 2002 that veterinary staff failed to adhere to their preventive medicine program due to a staffing gap (NZZP, Letter to Committee, December 31, 2003).

In the case of the East African elephant, failure to administer an annual tuberculosis test resulted in the failure to diagnose an active case of tuberculosis (see Box 2-2). Annual tuberculosis testing was mandated by USDA in 1998 (63 Fed. Reg. 15826). The National Zoo indicated that the tuberculosis testing that should have occurred sometime in the fall of 1999 was delayed until 2000 "due to a heavy load of veterinary care cases and an understaffed veterinary clinical department" (NZZP, Fact Sheet—Elephants at the National Zoo, December 2003). It is unacceptable for preventive care to be delayed in this fashion. In particular, this elephant was being seen by a veterinarian on an almost daily basis during the fall of 1999 and had already been trained to submit to a tuberculosis test (NZZP, Medical Records, Accession #26223, East African bush Elephant).

Guidelines developed by the AAZV (1999) state that the veterinary medical program at a zoo should emphasize disease prevention. If the failure to provide preventive care to the National Zoo's animal collection was caused by a shortage of staff or the inability of the veterinary staff to implement and follow the National Zoo's preventive medicine program, steps should have been taken immediately by senior management to rectify the situation, either by hiring more temporary or permanent veterinary staff, using existing veterinarians on the research staff to alleviate the backlog of preventive medicine procedures (if these veterinarians are suitably licensed to practice veterinary medicine in Washington, D.C.), providing oversight necessary to ensure effectiveness of the preventive medicine program, or by introducing technical and administrative efficiencies or organizational skills training to increase the efficiency of the veterinary staff. The inability of the National Zoo's veterinary staff to provide vaccinations and annual exams because of time or staffing shortages is not a sound scientific or medical reason for varying from the recognized standard of care outlined in the generally accepted standards preventive medicine guidelines.

During the past year the Department of Animal Health has taken steps to begin to improve the implementation of the preventive medicine program. However, as of December 29, 2003, not all of the collection had received scheduled examinations, vaccinations, or tests that were indicated in the National Zoo's Preventive Medicine Program (2003). Though veterinary staff members are in the process of updating their preventive medicine program, they have yet to create a document that describes the current vaccinations, tests, and exams that are planned for each species. It is imperative for the National Zoo to take steps to immediately handle the backlog of procedures outlined by the preventive medicine program and to ensure that adequate preventive medicine is provided in the future.

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**TABLE 2-3** Lapses in Preventive Medicine Program at the National Zoo between 1998-2003<sup>a</sup>

	<b>AAZV/AZA Vaccination and Testing Guidelines<sup>b</sup></b>	<b>National Zoo Preventive Medicine Program 1998-2003<sup>c</sup></b>	<b>Lapses at the National Zoo<sup>d</sup></b>
<b>Primates</b>	Rabies vaccination as warranted Tetanus vaccination every 3-5 years	Annual exam (great apes exam every 2 years) Rabies vaccination annually TB test annually Tetanus vaccination every 7 years	Accession #103823 – Orangutan Failed to receive annual exam in 2001-2002. Failed to receive rabies vaccination and TB test in 2001-2003. Failed to receive tetanus vaccination in 2002.  Accession #112236 – Sulawesi crested macaque Failed to receive annual exam, rabies vaccination, and TB test in 2001.  Accession #102167 – Orangutan Failed to receive annual exam, rabies vaccination, and TB test in 1999-2000, 2002-2003.  Accession #113376 – White-fronted marmoset Failed to receive annual exam, rabies vaccination, and TB test in 2000-2002.
<b>Canidae</b>	Rabies vaccination as warranted Canine distemper vaccination as warranted	Annual exam Rabies vaccination every 3 years Canine distemper vaccination annually <sup>e</sup>	Accession #111062 – Singing dog Failed to receive annual exam and canine distemper vaccination in 2002.
<b>Felidae</b>	Feline panleukopenia and calicivirus vaccination annually Rabies vaccination as warranted	Annual exam Rabies vaccination every 3 years Panleukopenia and calicivirus vaccination annually <sup>e</sup>	Accession #108412 – Barbary lion Failed to receive panleukopenia and calicivirus vaccination in 1999-2000, 2003. Failed to receive annual exam in 2003.  Accession #113526 – Fishing cat Failed to receive panleukopenia and calicivirus vaccination in 2002-2003 Failed to receive annual exam in 2003.  Accession #113184 – Sumatran tiger Failed to receive panleukopenia and calicivirus vaccination in 1999-2000, 2002, 2003. Failed to receive annual exam in 2003.

	AAZV/AZA Vaccination and Testing Guidelines <sup>b</sup>	National Zoo Preventive Medicine Program 1998-2003 <sup>c</sup>	Lapses at the National Zoo <sup>d</sup>
<b>Hoofstock</b>			
Zebra	Rabies vaccination as warranted Tetanus vaccination annually	Rabies and tetanus vaccination annually	Accession #113417 – Grevy’s zebra Failed to receive rabies and tetanus vaccination in 2003.  Accession #113392 – Grevy’s zebra Failed to receive rabies and tetanus vaccination in 2001.
Deer, gazelle, giraffe, bison	Rabies and tetanus vaccination as warranted	Rabies and tetanus vaccination annually	Accession #113418 – American bison Failed to receive rabies and tetanus vaccination in 2000-2003.  Accession #113419 – American bison Failed to receive rabies and tetanus vaccination in 2000-2003.
Hippo	Rabies and tetanus vaccination as warranted	Rabies vaccination annually	Accession #25308 Hippopotamus Failed to receive rabies vaccination in 1997-2002.
Tapir	No recommendations	Rabies and tetanus vaccination annually	Accession #107049 – Malayan tapir Failed to receive rabies and tetanus vaccination 1998, 2000, 2002.  Accession #106845 – Malayan tapir Failed to receive rabies and tetanus vaccination 1998-1999, 2000, 2002.
Elephant	TB testing annually	Rabies and tetanus vaccination annually TB testing annually	Accession #109171 – Asiatic elephant Failed to receive rabies and tetanus vaccination in 1998, 2000-2003. Failed to receive rabies vaccination and TB test in 1999.

<sup>a</sup>This table presents vaccination and infectious disease test schedules as recommended by the AAZV (1999) and the AZA (2004), and as outlined in the National Zoo’s written preventive medicine program (1998, 2003). This table includes information on the most routinely administered vaccinations and is not inclusive of all requirements of the preventive medicine program.

<sup>b</sup>AAZV, (1999); (AZA, (2003c).

<sup>c</sup>Adapted from NZP, Preventive Medicine Program, 1998; 2003.

<sup>d</sup>A sample of 26 animal records were examined for adherence to the National Zoo’s preventive medicine program (1998, 2003).

<sup>e</sup>May choose to alternate with rabies vaccination.

It is also important for the program to be reevaluated continually, based on new information (Miller, 2000; Fowler, 1986b). For example, vaccination to prevent leptospirosis (a disease transmitted by the intake of feed or water contaminated with the urine of an infected animal, often a rodent) (Aiello, 1998) is indicated only if there is a significant disease risk, and the veterinary staff deemed the Washington, D.C. area to be a low-risk area (Preventative Medicine Program, 2003). In light of the recent death of a colobus monkey from leptospirosis (NZP, Press Room, 2004), as well as the ongoing issue with rodent control at the National Zoo, this is an example of a component of the preventive medicine program that warrants reevaluation.

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The veterinary services program should have clear authority and responsibility for animal health care decisions at the National Zoo. Based on the committee's review, materials examined, and input received, the decision-making process has not been clearly articulated and has likely obscured the authoritative role the veterinary staff should take in making these decisions. Staff participating in the care of the animals at the National Zoo, including keepers, curators, and nutrition staff, should have an opportunity to provide input on health care issues. However, the veterinarian attending to a case should have, and should accept, final authority for health care decisions.

**Findings and Immediate Needs**

Although the preventive medicine program at the National Zoo is generally comprehensive and in accordance with published guidelines (AZA, 2003c; AAZV, 1999), there has been a failure to successfully implement, adhere to, and continually review and improve the preventive medicine program.

***Finding 1:** The current preventive medicine program at the National Zoo is not being fully implemented, and since 1998, veterinary staff members have not been adhering to this program in terms of providing annual exams, vaccinations, and infectious-disease testing. Although efforts have been made in the past year to improve implementation, there is still a backlog of animals that have not received examinations, vaccinations, or tests as prescribed by the preventive medicine program.*

***Immediate Needs:** The Department of Animal Health should promptly eliminate the backlog of animals that should receive preventive care and document its current and future plan for preventive medicine activities. The National Zoo administration should take responsibility for ensuring that the Department of Animal Health has the resources and oversight necessary to adhere to the program.*

**ANIMAL NUTRITION**

Zoo-animal nutrition involves at least four elements to ensure that animals receive adequate nutrition for health and welfare: background, diet evaluation, diet implementation, and diet update (AZA Nutrition Advisory Group, 2001). First, background information on nutritional needs should be evaluated for a specific animal or group of animals. The nutritional needs of the animal are dictated by age, sex, health, and physiologic status (e.g., growth, pregnancy, lactation, activity level), and by external factors (e.g., exhibit conditions, exposure to elements) (Clemens, 1985). Nutritional management should take into account both nutritional and enrichment needs. While general domestic animal nutrition guides (Klasing, 1998; NRC, 1977, 1981, 1982, 1985, 1989a, 1993, 1995, 2000, 2003, 2004; Ullrey, 1981) provide a basis for diet evaluation, diet formulation for exotic animals should include consideration of natural dietary habits, gastrointestinal tract morphology and physiology, and previous diet formulations (Dierenfeld, 1987; Ullrey, 1987). Characterizations of adequate diets exist for some species (AZA Nutrition Advisory Group, 2003; NRC, 2003). Integral parts of diet evaluation are nutrient analysis of feed composition and assessment of live foods (AZA, 2003c) and maintaining those records.

After evaluation and formulation the diets should be appropriately implemented. Diets can be prepared either in a centralized commissary or in a keeper kitchen. A centralized commissary is preferred, to control costs for diet preparation (NZIP, Commissary Review National Zoological Park, May 14-15, 1992). Additionally, centralized operations allow efficient use of time and equipment, and tracking and quality control of diets (NZIP, Commissary Review National Zoological Park, May 14-15, 1992). Maintenance of proper sanitation is important to avoid contamination of food (Stewart, 1986; see Chapter 4). After preparation the diet is delivered to keepers, who provide the diet to the animal or group of animals for consumption. Clear diet and feeding instructions should be shared between the nutritionist, veterinarians, commissary staff, curators, and keepers (AZA Nutrition Advisory Group, 2003).

Updating the diet through monitoring and feedback are the final elements of ensuring that animals receive appropriate nutrition for health and welfare. An animal's physical condition and behavior are perhaps the best indicators of the success or failure of a diet. Body condition (a measurement of animal fat deposits and muscle tone) is an excellent indication of diet adequacy in domestic animals; however, evaluating body condition is often difficult in captive exotic animals. Increasing or decreasing body condition is an indication of an inappropriate diet (unless that change is a desired outcome of the diet). In diagnosing deficiencies of a specific nutrient within an animal,

knowledge of nutrient's metabolism is key (Ullrey, 1996). Animals should also be observed to ensure that the diet is consumed (AAZV, 1999); a simple tool to assess the general nutritional status of an animal is to measure food intake (Allen, 1981). An animal may not consume a diet for such reasons as palatability, group aggression, and excess feed. Changes in the animal's physiologic status (growth, lactation, pregnancy, activity) or environmental conditions may necessitate a change in the diet formulation (Clemens, 1985). Diet preparation and feeding should also be monitored to ensure that the diet is prepared and fed according to the instructions. This monitoring, and feedback, provide an evaluation loop to ensure that animals receive appropriate nutrition for health and welfare. Key components of a nutrition program at a zoo are protocols, record keeping, and communication. Nutrition decisions should be made after input from the nutritionist, veterinarian, curator, keeper, and commissary manager for each animal (Dierenfeld, 1987).

#### **Comparative Nutrition**

Comparative nutritionists play a unique role in animal nutrition. They are asked to formulate diets for potentially thousands of species; domestic animal nutritionists often deal with a single species (Ullrey, 1996). In 1987 only five zoos in North America had nutritionists on staff (Stewart, 1987), and today there are fewer than ten AZA-accredited zoos in the United States with a comparative nutritionist for exotic animals (Braun et al., 2003).

Greater emphasis is being placed on the relevance of nutrition in the prevention of disease; current veterinary medical curriculum does not allow students sufficient time to gain necessary knowledge and skill in animal nutrition, therefore, nutritionists are needed to provide knowledge in the optimal use of nutrition for animal health (van't Klooster, 1999). A zoo should have a comparative nutritionist either on staff or as a consultant (Stewart, 1987). An animal nutritionist has educational training in nutritional sciences (Dierenfeld, 1987), and those responsible for zoo animal collections should have an advanced degree (M.S or Ph.D.) in (animal) nutrition or an equivalent number of years of experience in management, design, and implementation of a zoo animal nutrition program (Crissey and Fulton, 1994). Zoo nutritionists should routinely evaluate diets fed to animals in the collection for nutritional value (Stewart, 1987), and revise diets according to changing nutritional status. A particular challenge for a comparative nutritionist is the formulation of diets for environmental (heat or cold stress) or physiologic (growth, lactation, gestation, ageing) challenges (Clemens, 1985).

#### **Commissary**

A movement toward centralized commissaries for diet preparation has been slowly occurring at zoos in the United States. A centralized commissary is preferred for several reasons. Records kept in a central location are more easily reviewed by both nutritionist and veterinary staff; monitoring food quality and inventory are thereby better facilitated. Pest control (including rodent and insect contamination of feed, ingredients, and storage facilities) is more efficient when there is only one location to monitor. A centralized commissary allows for efficient use of equipment and staff time and for better tracking and quality control of inventory (NZP, Commissary Review National Zoological Park, May 14-15, 1992). Individual diets or diets for groups of animals are prepared entirely in the commissary so that animal keepers can offer the diet to animals in the form in which the keepers receive it (Braun et al., 2003).

To supply foods that help maintain health and reproduction of the animals is the primary goal of a commissary (Crissey et al., 1987). The safety of food for animal diets can be threatened by biological (i.e., bacteria and mold), chemical (e.g., pesticides, heavy metals, sanitizers), and physical (i.e., wire in a bale of hay) factors (Crissey et al., 1987). An important aspect of food storage and diet preparation is the avoidance of ill employees and bacterial contamination resulting from food not being kept in pest-resistant containers (Stewart, 1986). Loss of nutrients due to degradation over time or exposure to certain elements can also compromise the food safety (Crissey et al., 1987). Employee health and well-being in the preparation of diets should also be considered; dust associated with feed, grain, and forages can cause significant respiratory conditions in commissary staff (Aherin, 1986). Commissary management (e.g., proper storage, inventory control, and quality control) plays a vital role in ensuring safety of food in animal diets.

### **Nutrient Analysis and Quality Control**

A foundation for any successful zoo animal diet is knowledge of feed composition (Dierenfeld, 1996). Animal diets should be routinely analyzed for nutrient adequacy and suitability for each species (AZA, 2003c). Ingredients and nutritionally complete feeds should have periodic nutrient analysis to ensure accuracy of published nutrient values, or to determine those values when none exist (AZA Nutrition Advisory Group, 2001). Digestibility (affected by feed intake, chemical composition, particle size, feed processing, exercise, and age) of feed ingredients (and the entire diet) is important to consider because it is nutrient digested which are utilized by the animal meets its nutritional needs (Fahey, 1981).

Because hay (grass or legume) is a significant portion of diets for many herbivores (particularly ruminant and equine animals), its quality is key to diet formulation and animal health. Hay quality varies because of a number of factors: species, maturity and leafiness, harvesting conditions, contamination (by weeds, pesticides, and herbicides) and location (Rohweder, 1986). Digestibility of hay can be measured for ruminants in a digestion trial or *in vitro* using rumen fermentation techniques (Rohweder, 1981). Digestibility can be estimated from chemical composition of fiber (acid and neutral detergent fiber) (Van Soest et al., 1991) or soluble carbohydrates (neutral-detergent soluble fiber) (Hall et al., 1998).

### **Animal Nutrition at The National Zoo**

Animal nutrition at the National Zoo is divided into two areas: research and clinical nutrition. The clinical nutrition division was previously in the Animal Programs Department but now resides in the Animal Health Department (see Figure 1-1) and reports directly to the head veterinarian. The research nutrition division is positioned in the Department of Conservation Biology of the CRC (see Figure 1-1) and reports directly to the head of that department. For the past decade the National Zoo has employed two animal nutritionists: one as head of research and one as head of clinical nutrition. Currently the National Zoo employs a person trained in animal behavior as an acting head of clinical nutrition (on a two-year temporary appointment) at Rock Creek Park and a research Ph.D. animal nutritionist with decades of experience with the National Zoo and its animal collection in the Department of Conservation Biology of the CRC. Little direct interaction occurs between the acting head of clinical nutrition and the research nutritionist. After an initial search for a permanent clinical nutrition position which did not yield an acceptable candidate, the National Zoo is now seeking to fill the position at the Rock Creek Park facility with another temporary appointment (Smithsonian Institution Vacancy Announcement Number 04SP-1021). Physical components of the zoo's nutrition program include a commissary and laboratory.

The 2003 AZA report (2003a) stated that "despite NZP's history of world-class nutritional research, animal diets at the National Zoo were not well coordinated amongst veterinary, nutrition and animal care staff." Protocols have now been developed for any diet changes which require approval by the curator to evaluate the impact on animal behavior and animal husbandry practices, the veterinarian to evaluate the impact on animal health, and the nutritionist to evaluate the impact on animal nutrient and metabolic needs (NZP, Nutrition and Commissary Operating Protocols, September 2003). Specific hospital diets are formulated to meet the challenged nutritional needs of sick or injured animals as approved by the nutritionist and veterinarian (NZP, Nutrition and Commissary Operating Protocols, September 2003). All food used as enrichment for the animals must be approved by the clinical nutritionist, veterinarian, and curator.

An annual evaluation of diets for is to be implemented at the National Zoo. Some diets are to be reviewed seasonally because nutrient needs may change throughout the year. However, these annual (or seasonal) reviews of dietary adequacy have been compromised. Because of a lack of documentation for standard diets or dietary changes (see Chapter 3) the acting head of clinical nutrition has compiled a database based on a variety of records (nutrition, keeper, curatorial, and veterinary). The acting head of clinical nutrition has served as the acting commissary manager for approximately four months (see "Commissary" below).

### **Commissary**

The National Zoo has a decentralized commissary at the Rock Creek Park facility, with keeper kitchens located on separate sites for many of the animal enclosure areas. The commissary has a manager and four commissary stewards. The commissary manager is responsible for quality control, handling, and storage of all food



(NZIP, Nutrition and Commissary Operating Protocols, September 2003). Commissary stewards maintain the physical inventory of food items in one of four areas.

All food orders are prepared and delivered by commissary stewards. Food is delivered during weekdays at the Rock Creek Park facility by commissary staff to the keeper kitchens, where keepers prepare the diets for individual (or groups of) animals; food is delivered weekly to the CRC (NZIP, Nutrition and Commissary Operating Protocols, September 2003). The commissary delivers live food to Rock Creek Park animal units upon receipt from vendors; vendors deliver live food for CRC animals directly to the CRC. A designee in each animal unit orders food by preparing a food order sheet and submitting it to the acting head of clinical nutrition and the commissary manager.

A 1992 review (NZIP, Commissary Review National Zoological Park, May 14-15, 1992) recommended more centralized diet processing to improve nutritional quality and reduce costs. A plan for developing a centralized commissary by 2005 has been drafted (NZIP, Proposed Plan to Develop a Centralized Commissary, October 16, 2003). In the fall of 2003 the commissary manager position became vacant when previous manager retired. The acting head of clinical nutrition assumed the duties of commissary manager. This position has recently been filled on a permanent basis with an experienced warehouse manager who has additional experience as an animal nutrition research technician. The acting head of clinical nutrition will train the new commissary manager.

#### **Nutrient Analysis and Quality Control**

A nutrition laboratory (with six to eight rooms) containing nutrition analysis equipment (aligned with the research nutrition division) is available for nutrition analysis but is underused. The acting head of clinical nutrition performs some nutrient analysis in the laboratory; one federally funded laboratory technician is currently used in a research capacity; other laboratory personnel are only available for research activities because they are supported by research grant funds. Some routine nutritional analysis (mainly mineral and vitamin composition) of feed is performed by outside commercial laboratories.

According to operating procedures for systematic and routine laboratory analyses (proximate analysis, fiber fractions, and some major and trace minerals), analyses will be performed four times per year (March, June, September, and December) for forages and primary dry feeds; secondary dry feeds and moist feeds twice per year; and tertiary dry feeds once per year (NZIP, Nutrition and Commissary Operating Protocols, September 2003). Nutrient composition (proximate analysis, fiber fractions, some major and trace minerals, and some vitamins) for meat-based diets will be analyzed for each shipment. Microbiologic screenings for *Salmonella*, *Campylobacter*, and *E. coli* 0157 will be conducted for meat-based diets and are analyzed for each shipment (NZIP, Nutrition and Commissary Operating Protocols, September 2003).

Hay (timothy, orchard grass, and alfalfa) is grown at the CRC for many captive herbivores in the National Zoo collection (NZIP, Nutrition and Commissary Operating Protocols, September 2003). The harvested hay bales are held off the ground stored in barns at the CRC. The commissary manager is responsible for monitoring the hay supply and coordinating pickups for the Rock Creek Park facility (NZIP, Nutrition and Commissary Operating Protocols, September 2003). Hay quality and nutritional composition are analyzed as forages as mentioned in the previous paragraph.

#### **Strengths and Weaknesses in Animal Nutrition at the National Zoo**

The clinical nutrition program at the National Zoo is currently at risk for continued problems. This is because of several factors, including the lack of permanent, qualified, and experienced leadership; limited or no record keeping over the past decade; poor integration of nutrition with overall animal care programs; and the absence of any documented recent analyses or evaluations of the adequacy of the majority of animal diets. These deficiencies have resulted in several problems affecting the well-being of the animals at the National Zoo. For example, in 2000 a zebra at the Rock Creek Park facility died of hypothermia and malnutrition (see Box 2-1 for detailed discussion). More recently, an unannounced inspection by the USDA identified the inappropriate feeding of seasoned baked fish and beef to apes (USDA, 2004b).

The nutrition problems seen in primates and in equines at the National Zoo are not limited to the specific incidents cited. A rudimentary analysis of documented current diets of several primate groups and of zebra at the National Zoo indicate that the animals are not being fed according to requirements and recommendations established by the National Research Council (NRC) for wildlife and relevant domestic species (see Tables 2-4 and 2-5) (NRC,

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1989a; 2003). The NRC recommendations are used by all government agencies with regulatory oversight of animal care and by the feed industry as the standards for animal feeding.

For three primate groups at the National Zoo, diets appeared to be deficient or excessive in specific key nutrients that are critical to normal gut function and to overall animal health (e.g., protein, fiber, vitamins and minerals), or food items were inappropriate to the species' digestive physiology (see Table 2-4) (NRC, 2003; Stevens and Hume, 1995). Additionally, great apes (gorillas and orangutans), tamarins, and marmosets at the National Zoo are being fed animal products (i.e., meat and/or eggs, yogurt), which are not appropriate food items for these species, as they are neither carnivorous (meat-eater) or omnivorous (meat and plant eater). Great apes are frugivorous (fruit eater) or herbivorous (plant eater); for example, orangutans consume primarily fruits, and gorillas consume primarily pith, shoots, leaves, and stems of herbs and shrubs in the wild (NRC, 2003). Tamarins are frugivorous, gumivorous, or insectivorous. The inclusion of inappropriate food items in an animal's diet can result in digestive problems for the animal, which directly impacts its health and welfare, and can create situations that require veterinary medical attention.

It is not uncommon for diet problems to exist in zoos because most zoos do not employ a nutrition staff as the National Zoo does. It is impossible to know whether the National Zoo diet records used in this rudimentary analysis accurately reflect the diets actually fed or consumed. In addition, published food/feed composition values, rather than analyzed food/feed composition, were used to estimate nutrient composition of the diets. However, the type and magnitude of problems identified in the few diets examined here represent clear examples of deficiencies in the current nutrition program and potential threats to the health and welfare of the animals.

**TABLE 2-4** Key nutrients found to be deficient or excessive in diets fed to three primate species at the National Zoo.<sup>b</sup>

	Nutrient	National Zoo Diet <sup>c</sup>	National Research Council Recommendations <sup>d</sup>	Comments
Orangutan ( <i>Pongo pygmaeus</i> )	NDF (%) <sup>e</sup>	13	20	Deficient
	ADF (%) <sup>f</sup>	4	10	Deficient
	Calcium (%)	0.5	0.8	Deficient
	Phosphorus (%)	0.3	0.6	Deficient
Lemur ( <i>Lemur catta</i> )	Protein (%)	14	15-22	Deficient
	NDF (%)	15	20	Deficient
	ADF (%)	4	10	Deficient
	Vitamin E (IU/kg)	10	100	Deficient
	Calcium (%)	0.7	0.8	Marginal
	Phosphorus (%)	0.4	0.6	Deficient
Tamarin ( <i>Leontopithecus</i> spp.)	Protein (%)	26	7	Excessive
	Vitamin D (IU/kg)	15,327	2,400	Excessive

<sup>a</sup>NZP, Diet Record, Accession #31264, #107881, Orangutan; Accession #106955, #106960, #111251, #111277, #111279, #113319, #113453, #113454, #113482, #113483, #113529, #113530, #113550, #113551, #113569, #113570, #113614, #113670, #113804, #113806, #113807, #113808, Tamarin; and Accession #113682, #113683, #113684, #113685, #113686, #113687, #113688, #113689, Lemur.

<sup>b</sup>The composition of diets fed (obtained from the National Zoological Park Diet Record forms) were compared to published nutrient requirements and feeding recommendations established by the National Research Council (NRC, 2003).

<sup>c</sup>Nutrient composition of the fed diet was determined by calculation of amount fed (as documented on the diet form) and with known nutrient composition of individual diet ingredients as published by USDA Nutrient Database for Standard Reference (U.S. Department of Agriculture, Agricultural Research Service, 2002. USDA National Database for Standard Reference, Release 15, Nutrient Data Laboratory Homepage, <http://www.nal.usda.gov/fnic/foodcomp>) and feed composition tables published by the NRC (NRC, 2003).

<sup>d</sup>From *Nutrient Requirements of Nonhuman Primates, Second Revised Edition* (NRC, 2003).

<sup>e</sup>From *Nutrient Requirements of Nonhuman Primates, Second Revised Edition* (NRC, 2003).

<sup>f</sup>Neutral detergent fiber.

<sup>g</sup>Acid detergent fiber.

**TABLE 2-5** Nutrients found to be excessive or deficient in the current winter diet fed to three zebra<sup>a</sup> at the National Zoo.<sup>b</sup>

<b>Nutrient</b>	<b>National Zoo Diet<sup>c</sup> (adult male)</b>	<b>National Zoo Diet (adult male)</b>	<b>National Zoo Diet (young growing male)</b>	<b>National Research Council Recommendations<sup>d</sup> (adult diet/young growing diet)</b>	<b>Comments (adult diet/young growing diet)</b>
Protein (g/d)	1255	1156	482	536/650	Excessive/ Deficient
Magnesium (g/d)	27	24	10.2	6/5.7	Excessive/ Excessive
Potassium (g/d)	144	123	53.2	20/18.7	Excessive/ Excessive
Calcium (g/d)	85	72	31	16/19	Excessive/ Excessive
Phosphorus (g/d)	40	40	16	11/11	Excessive/ Excessive

<sup>a</sup>NZP, Diet Record, Accession #113392, #113417, and #113805, Grevy's Zebra

<sup>b</sup>The composition of diets fed (National Zoological Park Diet Record form) were compared to published nutrient requirements established by the National Research Council for equines (NRC, 1989a).

<sup>c</sup>Nutrient composition of the fed diet was determined by calculation of amount fed (as documented on the diet form) and with known nutrient composition of individual diet ingredients as published in feed composition tables included in the NRC report series on nutrient requirements of animals (NRC, 1989a).

<sup>d</sup>From *Nutrient Requirements of Horses* (NRC, 1989a).

The National Zoo is not fully using its nutrition expertise. The zoo has an active nutrition research program (funded mainly through external grants) with a research nutritionist who has a wealth of knowledge and experience in zoo animal nutrition. In the short term (while the zoo seeks a clinical animal nutritionist), the research nutritionist should collaborate with the acting head of clinical nutrition, (who has limited relevant experience) in the formulation of diets for the animal collection. The zoo could benefit from hiring a permanent, qualified, nutritionist (M.S. or Ph.D. in animal nutrition) with years of experience managing a nutrition program and training in zoo animal nutrition, rather than filling the position temporarily. A job description for this position should clearly define educational requirements, reporting structure and areas of responsibility, essential duties, and collaboration with a research nutritionist. Lack of continuity is a concern with temporary placement; with a temporary placement the zoo could employ a nutritionist who spends a short time at the zoo and then moves to another organization when the placement is finished. This could lead to disruption of nutritional services at the zoo and a failure to develop institutional memory.

Recently implemented procedures for diet approval (requiring veterinarian, nutritionist, and curator approval) at the National Zoo are appropriate and should help ensure diet adequacy for animals in the collection, but the lack of appropriate expertise and oversight can place the nutritional care of the animal collection at risk. The research nutritionist and the acting head of clinical nutrition should collaborate immediately on completing the centralization of diet formulation records for each species (or individual animal). A schedule for annual (or seasonal, as appropriate) diet evaluations provides an excellent roadmap for routine diet formulation; however, this plan should not be a substitute for dietary evaluation (and reformulation) needed for individual animal needs (e.g., illness, injury, pregnancy, growth). More frequent (rather than only minimal) routine nutrient analysis of feedstocks would be beneficial for diet formulation and evaluation of the animal collection needs. The National Zoo should examine the support needs of the clinical nutrition position and assess the role of the current federally funded nutrition laboratory technician position in the research nutrition division to determine if there are reporting arrangements that would benefit both the research division and the animal collection.

The present commissary has the physical capacity needed for a centralized program and is currently underused (NZP, Commissary Review National Zoological Park, May 14-15, 1992). The National Zoo has developed a draft plan to move diet preparation to a centralized commissary (NZP, Proposed Plan to Develop a Centralized Commissary, October 16, 2003), with an initial pilot program scheduled for late 2004. Many specifics for moving to a centralized commissary are contained both in the 1992 commissary report (NZP, Commissary Review National Zoological Park, May 14-15, 1992) and the National Zoo draft commissary plan (NZP, Proposed Plan to Develop a Centralized Commissary, October 16, 2003). This project will lead to more consistency in diet

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preparation and reduce the time that keepers spend in diet preparation. The zoo should continue this positive step and move toward a centralized commissary by empowering the acting head of clinical nutrition and new commissary manager to finalize the plan and begin implementation during 2004.

Because standard operating procedures, record keeping, and communication protocols have only been updated recently (NZIP, Nutrition and Commissary Operating Procedures, September 2003), these activities as they relate to animal nutrition program have not yet been fully implemented. It is essential for the clinical nutrition division to follow through on the timely implementation of these programs and for the clinical nutrition division under qualified leadership to be given authority and responsibility for the success of these programs. Because these programs are relatively new (or newly updated), their impacts on animal care are likely just beginning, and ongoing reevaluation of their effectiveness is essential. Integration of the nutrition records with other animal records (e.g., medical, curatorial, keeper) in a comprehensive information management system is discussed in Chapter 3.

**Findings and Immediate Needs**

***Finding 2:** Shortcomings exist in the animal nutrition program. There has been inadequate communication between the nutrition, keeper, and veterinary staffs; poor consultation between the research nutritionist and the acting head of clinical nutrition; and a lack of standardization and regular evaluation of animal diets. Nutrition records are not currently integrated with other record-keeping systems and, despite having adequate facilities for over a decade, the National Zoo is only now beginning to move toward a centralized commissary.*

***Immediate Needs:** The National Zoo should immediately use its existing nutrition expertise by increasing coordination and collaboration between the acting head of clinical nutrition and the research nutritionist to address nutritional issues of the animal collection, including diet review, evaluation, and modification. The zoo also should seek a permanent (rather than temporary), qualified experienced person for the role of clinical nutritionist. Centralization of standard diet formulation records and integration of those records with other record-keeping systems for animal care and management at the National Zoo should be completed. An annual schedule for evaluation of diet formulations for each animal or animal group should be developed and implemented. The National Zoo should finalize its draft plan to centralize the commissary and implement it in 2004.*

**ANIMAL WELFARE**

The National Zoo currently has two Institutional Animal Care and Use Committees (IACUCs), one each for the CRC and the Rock Creek facility. Both are responsible for ensuring that the living collection and research subjects receive humane care and treatment. Each IACUC is responsible for (NZIP General Memorandum No. 15, August 8, 2003, September, 2003)

- inspecting all animal areas and supporting facilities twice a year and submitting inspection reports;
- investigating and resolving concerns and complaints brought to their attention;
- reviewing proposals for research using animals at their respective facilities or field sites;
- recommending to the zoo director changes to National Zoo practices and procedures to correct deficiencies;
- recommending to the zoo director the suspension of any activity not being conducted in a manner consistent with current policy and procedures.

**Animals Used in Research Programs**

The responsibilities of the IACUCs, as pertains to research animals, are also federally mandated through the Public Health Service Policy on the Humane Care and Use of Laboratory Animals (PHS Policy) and the Animal Welfare Act (AWA). The NIH Office of Laboratory Animal Welfare (OLAW) and the U.S. Department of Agriculture (USDA) oversee compliance with the PHS Policy and AWA, respectively.

#### **Public Health Service Policy on Humane Care and Use of Laboratory Animals**

Research at the National Zoo that is supported by the Public Health Service (PHS) is subject to PHS Policy, which requires that all institutions receiving PHS support provide a written Animal Welfare Assurance (Assurance), a document that fully describes the institution's program for the care and use of animals in PHS-conducted or supported activities. PHS Policy requires institutions to appoint an Institutional Animal Care and Use Committee (IACUC) to oversee the institution's animal program, facilities, and procedures, including confirming that projects are conducted in accordance with the Guide for the Care and Use of Laboratory Animals (NRC, 1996b). In addition, the IACUC must inspect semiannually all facilities that are used in PHS-funded research, review animal care and use programs, prepare reports of these inspections and reviews, and maintain minutes of the IACUC meetings and records of animal protocols and changes to protocols (PHS Policies IV.C., B., and E.). The Smithsonian Institution maintains one Assurance for all PHS-funded research that occurs within the Smithsonian Institution, including research at the National Zoo. The Smithsonian Institution's Office of Sponsored Projects is responsible for maintaining the Assurance and providing an annual report to the NIH Office of Laboratory Animal Welfare (PHS Policy IV. F.) that outlines changes to National Zoo's facilities or IACUC membership, a notice of the dates of the semiannual inspections, and any serious instances of noncompliance with PHS Policy or deviations from the provisions of the Guide for the Care and Use of Laboratory Animals.

#### **Animal Welfare Act**

The AWA applies to (1) research activities that use warm-blooded vertebrates except birds, rats of the genus *Rattus*, and mice of the genus *Mus* and (2) research that is not initiated to improve nutrition, breeding, management, or production efficiency of the animal under study (9 CFR 1.1).

When research being performed at a federal institution (such as the National Zoo) is subject to the AWA, the AWA-covered research is subject to review and oversight by an IACUC in a fashion similar to that dictated by PHS Policy. The IACUC is responsible for reporting deficiencies in animal care and use that occur regarding research animals that are subject to the AWA. These deficiencies are to be reported to the head of the federal agency as outlined in 9 CFR 2.37:

Each Federal research facility shall establish an Institutional Animal Care and Use Committee which shall have the same composition, duties, and responsibilities required of nonfederal research facilities by Sec 2.31 with the following exceptions:

- (a) The Committee shall report deficiencies to the head of the Federal agency conducting the research rather than to APHIS; and
- (b) The head of the Federal agency conducting the research shall be responsible for all corrective action to be taken at the facility and for the granting of all exceptions to inspection protocol.

Each Federal research facility shall establish an Institutional Animal Care and Use Committee which shall have the same composition, duties, and responsibilities required of nonfederal research facilities by Sec 2.31 with the following exceptions:

Some research at the National Zoo does not fall under the oversight provided by the Animal Welfare Act or PHS Policy. This is because the research pertains to improving the nutrition, breeding, or management of an animal, does not involve an AWA-covered species, or is not funded by the PHS

#### **Animal Exhibition Program at the National Zoo**

The AWA regulates the treatment of animals on exhibition at the National Zoo (7 U.S.C. §2144). The regulations covering the care, facilities, veterinary care, and enrichment that must be provided to animals on exhibit in the United States are described in 9 CFR Section 3. The Animal and Plant Health Inspection Service (APHIS) in

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the USDA ensures compliance with the AWA by inspecting exhibitors, and in cases where the AWA is violated, using civil penalties and legal action to force compliance (USDA, 2002).

While the AWA clearly defines the responsibilities of the National Zoo IACUCs and the Smithsonian Institution as it pertains to oversight and reporting on the care and use of research animals subject to the AWA, the role of the National Zoo IACUCs, the USDA, and the head of the Smithsonian for overseeing the care and use of animals not used for research (i.e., animals on exhibit or used for breeding at the zoo), is not clearly defined. The USDA's current interpretation of the law is that they do not have enforcement authority at the National Zoo (USDA Office of the General Counsel Fax to the National Academies Committee on the Review of the Smithsonian Institution's National Zoological Park, January 13, 2004). Because of a lack of clarity on enforcement authority at federal institutions, in the past USDA has provided only courtesy inspections at the behest of a federal agency, unless a memo of understanding had been entered into with the federal agency to clarify enforcement and inspection issues.

Recently, the U.S. House of Representatives Committee on House Administration, the Smithsonian Institution, and USDA have concluded that inspections of the National Zoo should be conducted without notice or consent (Chairman U.S. House of Representatives Committee on House Administration, 2003; USDA, 2004a). This led to the first unannounced APHIS inspection of the National Zoo's Rock Creek facility in January 2004 (APHIS Inspection Report, 2004). A memorandum of understanding between the USDA and the Smithsonian Institution could clarify issues relating to enforcement of the AWA at the National Zoo.

**Strengths and Weaknesses in Animal Welfare at the National Zoo**

**Public Health Service Policy**

Since 1998, at least five research projects at the National Zoo that use animals (domestic and exotic cats and zebrafish) have received PHS funding through NIH (NIH Grant Abstracts 3R01HD023853, 3R01RR008769, 5K01RR000135, 1K01RR017310, 5R03HD039430). This requires that the Smithsonian Institution provide a written Assurance acceptable to the NIH Office of Laboratory Animal Welfare, fully describing the National Zoo's program for the care and use of animals in PHS-conducted or supported activities. PHS Policy further requires that once every 12 months, the institution provide a written report to the NIH Office of Laboratory Animal Welfare detailing changes to the institution's program, facilities, and IACUC membership, and the dates of semiannual IACUC evaluations of the program and facilities, and any serious noncompliance with PHS Policy or deviations from the provisions of the Guide for the Care and Use of Laboratory Animals (PHS Policy IV.F.). Based on its review of records from the Smithsonian Institution's Office of Sponsored Projects and the NIH Office of Laboratory Animal Welfare, the committee cannot confirm whether the Smithsonian Institution had a valid Assurance from 1997 to 2000, a time during which PHS-funded research projects utilizing animals were funded and conducted at the National Zoo. Records indicate that on April 11, 2000 the Smithsonian Institution submitted paperwork to the NIH Office of Laboratory Animal Welfare seeking renewal of its Assurance. On February 19, 2004, the committee received a letter from the NIH Office of Laboratory Animal Welfare stating that the office recently located this submission and now considers the Smithsonian's Assurance to be approved for the period between April 11, 2000 and March 31, 2004 (Garnett letter of February 19, 2004). The committee did not have the opportunity to consider the implications of this letter in its interim report because it was received only a few days before the report was finalized. The status of the Smithsonian's Assurance will be examined more fully in the committee's final report. The Smithsonian Institution's Office of Sponsored Projects also has been unable to provide the committee with evidence that the annual reporting requirement (PHS Policy IV.F.) was fulfilled from 1995-2003.

Based on the documents provided to the committee, the IACUC at the Rock Creek Park facility has not consistently fulfilled its responsibilities as required by PHS Policy IV.E. Since at least 2000, the IACUC has not conducted semiannual inspections of facilities used in PHS-funded research or documented IACUC activities through minutes (PHS Policy IV.E.). Due to these failures, the committee cannot discern if PHS-funded research at the Rock Creek facility has been or is being conducted in accordance with the provisions laid out in the Guide for the Care and Use of Laboratory Animals (1996), as is required by PHS Policy. These provisions include: avoidance or minimization of pain and distress; appropriate use of sedation, analgesia, and anesthesia; and the consideration of alternatives to animal use and unnecessary duplication of experiments. There is a lack of documentation that appropriate oversight by the National Zoo, the Smithsonian Institution, or the Office of Laboratory Animal Welfare at NIH was being provided to ensure the welfare of animals used in PHS-funded research.

### **Animal Welfare Act**

It is possible that some PHS-funded research at the National Zoo from 1998 to the present (specifically that on domestic and exotic cats) was subject to the AWA. The lack of record keeping by the IACUC at the Rock Creek Park facility, as well as the Smithsonian Institution Office of Sponsored Projects, is such that the committee cannot determine whether research being conducted at the National Zoo is subject to the AWA or whether other research projects not funded by PHS are subject to the AWA. For example, in 2001, a project to study the organization of memory in nonhuman primates was approved by the Rock Creek IACUC (NZIP, IACUC Annual Report: Rock Creek Facility, 2001). The project may in fact be subject to the AWA, as it involves an AWA-covered species and it does not involve research to improve nutrition, breeding, management or production efficiency. However, the Rock Creek IACUC meeting minutes from 2001 do not reflect that this project was ever discussed or approved by the IACUC, and the Rock Creek IACUC records do not contain any information describing the research to be performed. There is no documentation to confirm whether the care these research animals received was in accordance with generally accepted standards and possibly the standards outlined by the AWA.

Further, the responsibility for identifying AWA-subject research and notifying the USDA that such research is occurring is the responsibility of the federal agency (in this case, the National Zoo and/or the Smithsonian Institution). This, in turn, triggers the Animal Care Regional Office of the USDA to send annual report forms to the National Zoo to track the research (USDA, 1999). Further investigation of ongoing research at the National Zoo is warranted to determine if AWA-subject research is being conducted.

### **Institutional Animal Care and Use Committee**

Many animal welfare issues at the National Zoo remain unresolved. Because of the failure of the National Zoo and the Smithsonian Institution to provide the committee with sufficient documentation to enable it to ascertain whether the National Zoo is in compliance with PHS policy and the AWA, animal welfare at the National Zoo remains a serious concern of the committee. In addition, the Rock Creek Park IACUC at the National Zoo has not been diligent in establishing its authority and fulfilling its responsibilities.

Although not required by any regulation, the National Zoo did have a committee (previously designated the Animal Welfare Committee and most recently called the Rock Creek Park IACUC) tasked with addressing issues pertaining to the welfare of animals on exhibit and research animals not covered by PHS Policy or the AWA. The Rock Creek Park IACUC did not have a clear mandate as to its responsibilities for ensuring the welfare of exhibit animals and research animals not covered by PHS Policy or the AWA, and generally failed to document their activities adequately. For example, in 2002, four research projects involving exhibit animals were approved; approvals were given for these projects on March 5, March 25, and December 19, 2002 (NZIP, IACUC Annual Report: Rock Creek Facility, 2002). However, the IACUC meeting minutes for 2002 reflect that a single meeting was held on December 9. The minutes of that meeting do not state that any of these projects were discussed or approved.

The Rock Creek Park IACUC also failed to adequately document its oversight of the welfare of exhibit animals not involved in any research effort. For example, the IACUC inspection of Beaver Valley in April 2000 documented numerous deficiencies that required attention and IACUC follow-up (NZIP, IACUC Winter Inspection of Beaver Valley, April 19, 2000). These included (1) the grey seal beach required repair and IACUC needed to make sure that the cooling system functioned properly during the summer; (2) the beaver pool heater required repair and IACUC was to follow up before the winter; (3) the IACUC needed to follow up to ensure that the air conditioning unit in the bobcat enclosure was sufficient during the summer; and (4) a rehabilitating bald eagle required a heat source before the next winter, and the IACUC needed to confirm that this occurred. There is no indication in the IACUC minutes of 2000 or the next IACUC inspection of this area (NZIP, IACUC Inspection of Elephant House and Beaver Valley, May, 2001) that the IACUC discussed these deficiencies or monitored the progress of their correction.

The lack of clarity about how the Rock Creek Park IACUC functioned, its purview, and its performance typifies the lack of consistency seen elsewhere in National Zoo functions. The Rock Creek Park IACUC's oversight of the welfare of exhibit animals appears to have been an "on again, off again" effort, which may have reflected management's failure to embrace its role in promoting and ensuring the welfare of the animals. It is instructive that a response to a request for copies of complaints submitted to the Rock Creek Park IACUC contained the following statements: "Most of the complaints turned out to be caused by differences of opinion or misunderstandings over

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how animals should be cared for..." IACUC members would respond informally to "smooth the ruffled feathers..." (NZP, Nichols, 2003). It is clear that uncoordinated responses to individual complaints and concerns failed to address the fundamental need to provide an institutional structure that promoted and supported animal welfare. These sorts of intramural conflicts are resolved best through training that provides individual competence, and communication that instills confidence in one's colleagues.

Later, in the National Zoo's response (NZP Nichols Memo, October 16, 2003), it is indicated that the Rock Creek Park IACUC did not keep "official records" of complaint investigations because these were informal, and "...turned out to be problems in communications or staff management — not animal welfare issues." Given the deaths of the Grevy's zebra and the red pandas at the Rock Creek facility, it should be evident that communication and management are animal welfare issues, and an institutional failure to recognize this compromised further the welfare of other animals at the zoo. It appears that the Rock Creek Park IACUC saw its mandate as one of solving conflict between staff members and not of acting as an advocate for the animals.

The National Zoo outlined a new IACUC program in September 2003 (General Memorandum 15). This new IACUC program will be evaluated in the National Academies' final report. However, as evidenced by the failures of the previous system and lack of formal training of individuals involved in oversight of animal welfare, the current staff at the National Zoo and the Smithsonian do not have the appropriate training to implement and administer this new IACUC program effectively. It is imperative that the individuals responsible for the administration of the new IACUC program and IACUC committee members receive immediate, extensive training in the rules, regulations, and policies associated with overseeing the use of animals in research from an outside authority. Such training is provided by the OLAW/Applied Research Ethics National Association IACUC 101 course, among others.

Animal welfare should be a daily concern for every employee at the National Zoo. In several locations in the National Zoo, animal keepers are doing an admirable job in providing high-quality animal care, even with failing facilities. For example, during visits to the National Zoo, committee members observed that the seal lion exhibit was in severe disrepair, although it continued to house several geriatric animals. The keepers in that area worked around the ongoing repairs to provide the sea lions and seals with excellent training, enrichment, and care. Management should take an active role in promoting staff development and training that instill in the staff the skills needed to fulfill the requirements for animal welfare. Additional aspects of formal training programs and the IACUC programs will be considered for the final report.

**Findings and Immediate Needs**

**Finding 3:** *There is a lack of documentation that the welfare of animals has been appropriately considered during the development and implementation of research programs and that complaints regarding the welfare of animals on exhibit were appropriately investigated. There also has been a lack of understanding within the National Zoo and the Smithsonian Institution of the requirements of federal regulations and Public Health Service Policy and how to maintain compliance.*

**Immediate Needs:** *The National Zoo and the Smithsonian Institution should ensure compliance with all elements of the Animal Welfare Act and the Public Health Service Policy. The National Zoo and the Smithsonian Institution should seek outside training and assistance to achieve compliance with regulations and implement procedures meant to ensure the welfare of research and exhibit animals at the National Zoo.*

**OVERARCHING ISSUES**

National Zoo staff members have expressed a great affection for the animal collection and a strong desire to provide quality care. While these good intentions provide a fertile ground for high-quality care, the information reviewed by the committee and the direct observations of committee members during inspection tours of the zoo revealed a lack of evidence that the administration has embraced its role in providing for animal care and management; this is compounded by a lack of responsibility and accountability at all levels. While there appears to be pockets of excellence in various units and departments, personal responsibility and accountability for animal care and management are not pervasive at the National Zoo.

In reviewing the records of animals in the National Zoo collection, it was apparent that there is a longstanding issue with staff failing to abide by National Zoo policy and procedures. In some cases these failures



endanger the safety of the animal collection. These incidents include the previously described failures to document changes in animal management (see Box 2-1), failures to adhere with quarantine procedures (Finding 1), and failures to comply with animal welfare policies and procedures (Finding 3). The committee found evidence of failures to obtain the appropriate sign-off on euthanasia forms for an orangutan (NZIP, Euthanasia Request Form, Accession #100797, Orangutan) and a tree kangaroo (NZIP, Euthanasia Request Form, Accession #110974, Tree Kangaroo). Although there is no indication that these failures led to unnecessary suffering, following proper procedures would have clarified the circumstances surrounding the decisions to euthanize, which in some cases are now clouded by controversy. The committee also found evidence of failures to complete nutrition forms for diet changes (see Box 2-1).

#### **Findings and Immediate Needs**

***Finding 4:*** *There has been poor adherence to the National Zoo's own policies and procedures for animal health and welfare.*

***Immediate Needs:*** *All levels of management should be held accountable for ensuring that National Zoo policies and procedures are followed. All zoo staff should take personal responsibility for educating themselves and adhering with the policies and procedures that pertain to their position and duties.*

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## Record Keeping

*"Information, not data, is critical to the survival of a health care organization."  
Diedling and Welfeld (1995)*

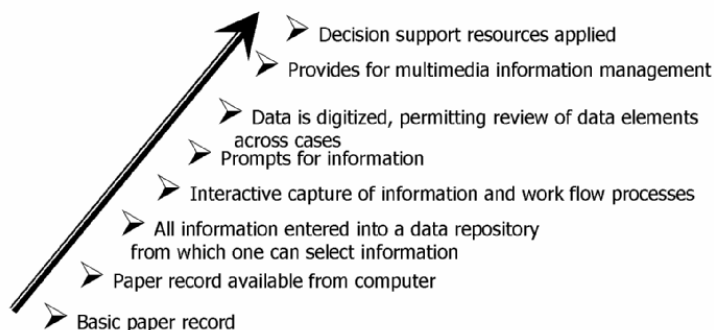
Information management is fast becoming the key to effective action in animal care. As wildlife habitat for many threatened and endangered species continues to shrink, a greater responsibility is placed on zoos to function in part as the last refuges for more rather than fewer species (Teare, 1998). Long-term survival of small populations of captive wildlife requires intense management that encompasses information derived from numerous scientific disciplines, including genetics, nutrition, ethology, and veterinary medicine (Teare, 1998). When faced with questions regarding the care and management of wildlife species, literature surveys and reviews of individual medical records are labor intensive and time consuming. Thus, the more information that can be accurately collected and maintained and later effectively retrieved and used, the more successful captive animal management will become (Earnhardt et al., 1995). As with any facility responsible for the care of its residents, modern zoos require effective systems for gathering relevant information from the field, processing it in ways that provide maximum value, and presenting it in a form that is easy for staff to use in implementing appropriate actions to achieve effective animal management and disease control programs (Morris, 1991). Responsibilities of the chief information officer and managers of those systems are equally important in ensuring effectiveness (Greer, 1998).

Several published reviews describe objectives for information management systems and criteria for information-gathering activities in animal health that should be met to ensure effectiveness (Morris, 1991; Harris, 1991). Information management systems are the functional coordination of data (records) from input (the data that goes into the system) through processing (what is done with the data) to output (the information that is produced). Ten characteristics are important in any information management system (R. Whitehouse, Associate Hospitals Administrator and Director, Medical Information Services-University of Michigan Hospital and Health Centers, "Clinical Information Systems" presentation to committee, October 2, 2003):

1. Accessibility,
2. Accuracy,
3. Appropriateness,
4. Comprehensibility,
5. Comprehensiveness,
6. Consistency,
7. Relevance,
8. Reliability,
9. Timeliness
10. Usefulness

These characteristics apply to systems ranging from simple (paper record) to complex (decision support software) (see Figure 3-1). Two critical aspects of paper systems are tracking and accessibility of the records.

Records should provide an accurate account of situations and practices relating directly to animal management and health. They should permit reconstruction of events in the recent and distant past and provide a rational basis for decision making.



**FIGURE 3-1** Range of complexity in information management systems (R. Whitehouse, Associate Hospitals Administrator and Director, Medical Information Services-University of Michigan Hospital and Health Centers, "Clinical Information Systems" presentation to committee, October 2, 2003).

#### ELECTRONIC DATA MANAGEMENT IN ZOOLOGICAL INSTITUTIONS

Many software programs used for zoo and aquarium animal information management have been developed by the International Species Information System (ISIS), a small nonprofit membership organization that maintains a data depository for its institutional members. It has, however, not kept pace with advances in information technology, and it does not have the resources to ensure the accuracy of member records. In an effort to supplement animal collection records, several institutions and some zoo and aquarium associations have developed additional software. For example, the Australasian Regional Association of Zoological Parks and Aquaria (ARAZPA) developed REGASP, software for managing institutional and regional collection planning data. REGASP is now used by several regional associations. The Zoological Society of London supported the development of software to manage invertebrate populations. Several individual institutions have developed in-house inventory systems that meet their individual needs but still export data to a central ISIS database (Dubois, et al., 2003). In addition, veterinarians have been searching to find a replacement for the DOS-based Medical Animal Record Keeping System (MedARKS) software program, which has been adopted as the "de facto" standard for computerized medical records in zoos. It was developed in 1986 and later supported by ISIS. MedARKS is the single largest computerized database of medical information on captive wildlife (Teare, 1998); approximately 200 institutions in over a dozen countries maintain health records in these systems.

A new Zoological Information Management System (ZIMS) is being developed by the American Zoo and Aquarium Association (AZA) and a consortium of zoological and professional organizations (Cook and DuBois, 2003) and is being coordinated by ISIS. This new system is being designed to create a global animal information system for zoos and aquariums. It will include modules for animal inventory, veterinary care, nutrition, husbandry, environmental monitoring, collection planning, and research, and will be designed to accommodate expansion (ZIMS, 2003). ZIMS will support all of the information that is in the current ISIS software (ARKS, MedARKS) and additional information as determined by planners.

The recognition that well-designed, standardized electronic medical record-keeping systems are essential to proper animal care is not limited to the zoological community. The U.S. Department of Agriculture's (USDA) Animal and Plant Health Inspection Service (APHIS) recently announced a proposed regulation of medical record keeping for research facilities, dealers, and exhibitors (Docket No. 97-033-1), which includes zoological institutions. Maintenance of medical records is implied in the Animal Welfare Act, but the regulations do not specifically stipulate the maintenance of medical records as one of the elements in a program of adequate veterinary care. The

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proposed rule would amend the Animal Welfare Act (7 U.S.C. 2131 et seq.; 9 CFR 2) to require these entities to maintain medical records as part of adequate veterinary care. The proposed maintenance of medical records "would serve as a basis for reviewing the medical history and planning veterinary care, and provide a mechanism of communication for matters of animal health, behavior, and well-being. Medical records document the animal's illness, veterinary care, and treatment and serve as a basis for review, study, and evaluation of veterinary care rendered by the facility."

The lack of a standardized information technology strategy for regulatory veterinary medicine resulted in state and federal information systems evolving separately (Miller et al., 1994). Animal managers ultimately pay the price for deficiencies in regulatory coordination of U.S. animal health and disease information. As seen in the recent identification of the first U.S. case of "mad cow disease," our national system for tracking and coordinating information on animal health and management needs to be improved, and the USDA has expedited its current efforts (USDA, 2004c). The longer the development of information technology strategies is delayed, the more costly it will be to correct the deficiency (Miller et al., 1994).

In another example of moving toward record standardization, the Department of Health and Human Services (DHHS) recently announced the development of a new Systematized Nomenclature of Medicine (SNOMED) for veterinarians and physicians, which was originally created for human medicine, but has been expanded to include veterinary terms; SNOMED will allow institutions throughout the country to share information electronically (AVMA, 2003). In addition, the National Academies' Institute of Medicine has been asked by DHHS to design a standardized electronic health record.

**Information Managers**

Information managers, or chief information officers, have become increasingly important in recent years, especially in the human and veterinary medicine fields (Greer, 1998). These people typically occupy positions at the executive management level in the human medical field and administrative or management positions in the veterinary medical (zoo) field (Greer, 1998; Zoo Registrars Association, 2003).

There are only two formally established regional groups of animal records keepers: the Australasian Animal Records Keeping Specialist Advisory Group and the North American Zoo Registrars Association. The membership of these organizations consists of people with primary responsibility for animal record keeping in zoological institutions, aquariums, and similar organizations (i.e., registrars). A zoo registrar's responsibilities are varied and complex (see Table 3-1). Two AZA scientific advisory groups (the Institutional Data Management Advisory Group and the Small Population Management Advisory Group) have produced official standards for data management in AZA-accredited zoos. The AZA offers professional training in record keeping.

**TABLE 3-1** General Responsibilities and Qualifications of a Zoo Registrar<sup>a</sup>

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**Responsibilities:** Serves as a member of the Animal Management Team, assists in the development and implementation of the zoo's Collection Management Policy, and its resulting collection plans. Monitors all transactions for adherence to policies. Manages animal records and ensures the maintenance and quality of animal records for use in the management and development of husbandry and breeding programs, preparation of scientific publications, and provision of data for cooperative ventures at both the regional and international level. Serves as liaison and information source to other departments and organizations. Provides a complete inventory and record of all animal transactions. Monitors legislation for compliance with wildlife laws. Collaborates with curators. Works under the supervision of the Zoo director. (Specific responsibilities detailed in Appendix E).

**Qualifications:** Four-year college degree in biology or related field plus two years of experience. Knowledge of concepts, principles, and practices of professional museum and zoo registration methods and collection management standards. Knowledge of inventory accession and record-keeping practices; zoological nomenclature; laws regulating animal acquisition, disposition, exhibition, husbandry standards, and transportation within the United States and abroad; and statistics and population management. Experience with computers, animal records, and word processing software. Ability to collect and collate information from a variety of sources into concise and accurate reports. Good communication and organizational skills, and attention to detail.

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<sup>a</sup>Adapted from Zoo Registrars Association (2003).

### RECORD KEEPING PRACTICES AT THE NATIONAL ZOO

Within the National Zoo, animals are assigned a "local ID" in the form of an accession number. This accession number uniquely identifies each animal in the National Zoo and is used in each type of record generated at the National Zoo. The National Zoo generates many types of animal management and husbandry records, including

- *Keeper logs* – generated by the zoo keepers to document daily observations of each animal.
- *Curator reports* – generated by the curator, usually weekly, to highlight significant events noted in the daily keeper logs of that week.
- *Specimen reports* – generated by the records keeper within the registrar's office. It is the official history of the animal and documents major events such as birth, death, origin of specimen, medical history, behavioral and husbandry concerns, and location of a specimen (Earnhardt et al., 1998). These reports are generated from information in the curator reports.
- *Nutritionist records* – generated by the nutritionist to document diet management.
- *Veterinary medical records* – generated by the veterinary staff to document the medical care received by an animal, including clinical notes, laboratory results, anesthesia records, and parasitology records.
- *Pathology records* – generated by the Pathology Department to document the examination of tissue or fluid samples as well as the findings of necropsies.

The veterinary medical records are generated on MedARKS (ISIS, 2004; AAZV, 1999). The specimen reports are generated using the Animal Record Keeping System (ARKs) software package developed by ISIS. The keeper logs, curatorial reports, and nutritionist records are generated in a variety of ways detailed below.

#### Keeper Logs

The keeper log is the only record of normal daily observations of individual animals. In the past these records were generated through the use of a carbon paper form called the zookeeper's daily report. Over the past five years a prototype electronic keeper record system called the Daily Animal Records System (DARS) was developed and implemented. DARS was implemented in only one unit to test the system; that unit still uses the system. A second electronic system is being developed and implemented, using a Web-based form found on the National Zoo's intranet. This initiative was started approximately a year ago. It uses a form similar to the zookeeper's daily report on paper, and currently two units are using the system, though not every keeper within the unit uses it (NZIP, Animal Records Procedures: Statement of Practice, 2003; J. Block, Registrar, National Zoo, personal communication). Both the DARS and the new intranet-based system allow for electronic entry of data onto the form; however, there is no electronic archiving of the information. The forms are printed out and the paper copies are to be archived (J. Block, Registrar, National Zoo, personal communication).

#### Curator Reports

Curator reports are generated by the curator, usually weekly, and contain the most salient animal management and husbandry information gleaned from the keeper reports. For one unit this report is generated through the DARS system; for all other units it is generated by a version of a curator report form. Paper copies of these reports are forwarded to the registrar's office, where they are archived, and salient information from the curator reports is included in the specimen report (NZIP, Animal Records Procedures: Statement of Practice, 2003).

#### Nutritionist Records

In the past and currently the development, implementation, recording, and archiving of nutritionist records has been at the discretion of the National Zoo nutritionist. Nutrition files were kept on hard copy, though it was evident that there was a lack of standard documentation on the current diet of each animal and any changes made to

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the diet (e.g., see Box 2-1). The acting head of the clinical nutrition program, appointed for a two-year term, has begun organizing the nutrition records, and is developing and implementing a new electronic record-keeping system for nutrition records.

**STRENGTHS AND WEAKNESSES IN RECORD KEEPING AT THE NATIONAL ZOO**

**Failure to Adequately Document Animal Management, Husbandry, and Medical Care**

With the exception of the Pathology Department, the adequacy of the record keeping varied greatly within the different units and departments of the National Zoo, and often was deficient, as in the case of the Grevy's zebra "Buumba" (see Box 2-1). This resulted in part from a lack of standardized practices for reporting and archiving records. Patterns of inconsistent record keeping and archiving were found in keeper logs, curator reports, nutritionist records, and medical records. The National Zoo has acknowledged errors in record keeping for a number of animals (African lion [Accession # 108413], bobcat [Accession # 103175], East African bush elephant [Accession # 26223], eastern bongo antelope [Accession # 110565], Geoffrey's marmoset [Accession # 113220], Masai giraffe [Accession # 104081], Sumatran orangutan [Accession #100797], tree kangaroo [Accession # 110974], Vietnamese pot-bellied pig [Accession # 109080], zebra [Accession # 113393]; NZP, Letter to Committee, December 31, 2003).

**Keeper Logs**

The keeper log is a particularly important record as it is a primary source for information used for animal management decisions (Eamhardt et al., 1998). There were numerous instances of keeper logs not reflecting important changes in an animal's behavior or management (e.g., see Box 2-1). This may occur for a variety of reasons, including a failure to appropriately train keepers regarding the information that should be recorded in a keeper log and a failure of the curator to provide appropriate quality control. Another keeper log issue that arose was a failure to archive these records (see Boxes 2-1 and 2-2). Currently each unit is responsible for archiving the daily keeper logs, though there is no stated expectation of how long to archive the materials. There is a lack of appreciation at all levels of the importance of these records, and that in various situations it may be essential to be able to review weeks, months, or even years of keeper logs on a particular animal or group of animals. Not only were there numerous failures to archive these records but there was also a failure to manage these records as a whole. In essence, no individual within the National Zoo has responsibility for documenting where the records are archived and how they are organized. This leaves each unit's records vulnerable when staff turnover occurs. When staff leave the National Zoo (particularly curators, who are responsible for overseeing the quality and archiving of keeper logs), knowledge as to where the records are kept and how they are organized is lost. With the large amount of staff turnover resulting from the buyouts, it is particularly important to standardize practices relating to keeper logs, so that these records are accessible regardless of the current staffing situation.

**Curator Reports**

Curator reports also failed to provide complete information regarding animal management (e.g., see Box 2-1). This is partially because curator reports are compiled from keeper logs (which were deficient in many cases) but also because of a failure to appropriately train curators regarding their responsibilities in generating complete and accurate curator reports, and also their responsibilities in overseeing the quality and completeness of the keeper logs. There is no formal training process; rather, the registrar, on a case-by-case-basis, informally discusses record keeping with a curator. In addition, few curators have received training on record keeping through the AZA (2003a). The National Zoological Park Animal Records Procedures, which outline the responsibilities of the curator and the information for which they are responsible, was developed in July 2003, and there has been no organized effort to educate curators of the contents of the document, ensure they are properly trained to carry out its policies, or provide oversight to ensure they are adhering with the policies.

### **Nutritionist Records**

In the past there has been a failure to maintain accurate, up-to-date records on the diets and nutritional management of animals at the National Zoo. This situation arose due to several factors, including: a failure on the part of nutritionists to fulfill their responsibility to maintain adequate records, the lack of written expectations as to what would be contained within nutritionist records and how they were to be managed and archived, and the failure of senior management to provide appropriate oversight to ensure that the nutrition department was fulfilling its responsibilities.

An acting head of clinical nutrition has been hired for a two-year appointment and the process of organizing the few records that do exist, developing an electronic system to document diet management, and creating a diet management record for each animal in the collection has begun. The original intent was to have a diet management record created for each animal in the collection, and to have these records accessible via the Intranet. However, due to the retirement of the commissary manager, the acting head of clinical program temporarily assumed the responsibilities of the commissary manager, which has delayed completion of the nutrition records. A new commissary manager has been hired. Those nutrition records that have already been created are slated to be assessable via the Intranet in early 2004.

### **Veterinary Medical Records**

In general the medical records kept by the veterinary staff at the National Zoo were acceptable, however there were multiple instances of medical records being altered weeks and even years later (see Box 2-1). The National Zoo, like many other zoos, uses the MedARKS system as a teaching tool, by allowing veterinary students and residents to create the initial clinical note in an animal's record and then, at a later point, editing these records when errors are made. The MedARKS system documents the initials of the person who creates the clinical note, though the system does not automatically identify the user when edits are made to a record. Recently the veterinary department established a variety of policies regarding the identification of persons who enter or edit a record, including having students use the initials of the case veterinarian and most recently, having students use their own initials as was done previously. When edits are made, case veterinarians should manually enter their own initials. Though editing of clinical notes is a standard practice at the National Zoo, it is an unacceptable practice as currently implemented.

The American Animal Hospital Association has established clear standards for medical records, including "the author of medical record entries is permanently and uniquely identified (by a code numbers/letters, initials, or signatures) in a manner that is understood by anyone examining such records." The National Zoo's practice of editing medical records without identifying the changes made or the individual making the changes casts doubt on the credibility of their records, especially when the quality of the veterinary care is called into question. If erroneous entries are made, they should be corrected by addenda, not by altering the original entry. If the National Zoo continues to allow students to make medical record entries, the students need to be carefully supervised to limit inconsistencies and errors that would require the supervising veterinarian to create an addendum; these addendums should be made in a timely fashion.

### **Lack of Records Accessibility**

There are two main issues regarding accessibility of records. The first was discussed above and involves a failure to consistently and appropriately archive keeper logs and curator records. Each unit and the nutrition department is responsible for archiving the unit's/department's generated records, with no apparent oversight. This has resulted in records being lost or misplaced. When records are not retrievable in a reasonable manner, their value is lost.

Second, all pertinent animal information is not archived in one location (be it paper or electronically). Currently at the National Zoo the information management infrastructure is set up so that daily information about an animal is included in the keeper log; the curator summarizes this information into a weekly curator report; medical information is contained within the MedARKS medical records; and nutritional information is contained within the nutritionist records, which are still being developed. Many units within the National Zoo submit all of their keeper logs to the veterinary medical department daily. Some do this by faxing the forms, while others send it by e-mail. Other units submit only their weekly curator reports to the veterinary medical department by fax, while at least one

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unit does not submit any reports to the veterinary medical department (J. Block, Registrar, National Zoo, personal communication). In addition, there is no expectation, nor should there be, that the veterinarians archive these materials for future use. In an emergency, if veterinarians needed access to these records (for example, to determine if medications were administered or behaviors were altered.), they would have to rely on locating a member of the unit staff to find the paper copies of these records and transmit them to the veterinary staff in a timely fashion.

According to National Zoo policy (NZP, Animal Records Procedures, July 2003), the registrar is responsible for setting the standards and overseeing the animal records systems, maintaining the transaction files and the core data in the specimen records, and reporting on collection holdings and changes. In reviewing keeper logs, curator records, medical records, pathology records, and specimen records over the last six months, the committee found that the type of information being documented in the keeper and curator records was inconsistent and the keeper and curator records were inappropriately archived – if they were retained at all. These deviations from stated policy directly affected the quality of care some animals received (see Box 2-1) and hampered the investigation of the circumstances contributing to animal deaths at the National Zoo. It is clear that there was not adequate oversight of keeper and curator record keeping and archiving by the registrar. It is not apparent whether adequate policies on record keeping and archiving were in place prior to July 2003. The committee was unable to determine whether the registrar had a clear mandate and appropriate authority to ensure adequate record keeping and archiving by the keeper and curatorial staff.

**Findings and Immediate Needs**

As with any zoological park it has often been necessary at the National Zoo to review the history of an animal in the collection to help determine a future medical treatment, a change in diet, or to help identify a cause of illness or death. The National Zoo has been handicapped in its efforts to provide adequate animal care by a nonfunctional information management system (see Box 2-1).

***Finding 5:** The National Zoological Park lacks a comprehensive information management system for animal husbandry and management records, which results in inconsistent record keeping and practices of alteration in medical records weeks or years after events. While some issues are being addressed (e.g., an electronic keeper log system is in development) these are stop-gap measures often having no concrete timeframe for completion or implementation.*

***Immediate Needs:** The National Zoo should implement an information management system that ensures complete documentation of animal husbandry and management and reasonable accessibility to the records by all units and departments. This does not necessarily mean that the entire system needs to be computerized immediately but rather that consistent practices be put in place, that a system be developed to make the records reasonably accessible and that an appropriately experienced individual be given responsibility for system oversight.*

It is essential that the problems outlined within this section be addressed immediately, either through better use of the ARKs system already in place at the National Zoo or through efforts to standardize record keeping and archiving and to make records accessible. Based on the deficiencies in record keeping observed by the committee, when developing and implementing a system, the following performance standards should be established:

- There should be standardized practices for recording and archiving animal husbandry and management information. These practices should outline the information to be contained in each type of record and how and where these records are to be archived.
- Employees should be appropriately trained and prove their competence regarding recording and archiving standards.
- There should be oversight to ensure compliance with recording and archiving standards.
- A communication system should be developed to ensure that all appropriate individuals are notified about significant changes in animal husbandry or management.
- A protocol should be developed to allow for pertinent information related to a specific animal or group of animals to be reasonably accessed by an employee, even if that employee is attached to a different department.



- The information management system should be implemented in such a way that record keeping, archiving, and accessing records is unaffected by staff illness, absence, or turnover.

Records should provide an accurate account of situations and practices relating directly to animal management and health. They should permit reconstruction of events in the recent and distant past and should provide a rational basis for decision making in the present. Records should indicate

- who generated them
- which animals were involved
- when the observation was made or procedure done
- what practices were carried out or problems were encountered
- where events took place
- why actions were taken

There are several ways these performance standards can be achieved. Ideally, a single, comprehensive electronic record-keeping system should be implemented. The National Zoo already uses such a system (the ARKS and MedARKS systems), though it currently uses it only to generate specimen reports for communication with institutions outside the National Zoo. The ARKS system was developed as an electronic information management system to provide a way to organize all information about an animal and make it electronically accessible to keepers, curators, and veterinarians, nutritionists. In addition to the ARKS software, an entire system was developed around this software to describe how a zoo could standardize record keeping and use the ARKS system most efficiently and to the fullest extent. This information is contained in the document "Standards for Data Entry and Maintenance of North American Zoo and Aquarium Animal Records Databases: (Earnhardt et al., 1998).

If the National Zoo were to choose the ARKS system to address the most pressing issues relating to information management, the system would have to be accessible to all appropriate staff within the zoo, including keepers. Data entry would have to occur daily, and be derived directly from keeper reports that are quality checked by the curator. To control the security of the system the data entry and data changes should be limited to the registrar's office (Earnhardt et al., 1998).

The current staffing level of the registrar's office (a recently retired registrar who has not yet been replaced and an assistant registrar) and the lack of appropriate computer equipment and training might preclude these improvements. The National Zoo would also need to devise a system in which pertinent information originating in the veterinary hospital or nutrition department is sent to the registrar's office for daily data entry. The ZIMS system currently being developed by AZA could be an ideal solution for the National Zoo; however, it will be at least two years before this system is available. It is unacceptable for failures in the current information management system to remain unresolved for two or more years; therefore, the National Zoo may choose to make improvements to its current system (mixed paper and electronic). Resolving the failures in the current mixed paper and electronic information management system will require a quick and thorough evaluation of the current system under the direction of an individual versed in implementing and overseeing a successful information management system.

It is essential that a qualified individual be clearly designated to oversee the evaluation of the current system, development and implementation of new practices and standards, and adherence with these new practices and standards. This individual should have the authority and responsibility for achieving these goals. With the recent retirement of the National Zoo's registrar after decades of service to the zoo and significant contributions to the field of animal record keeping (Miller and Block, 1992), the zoo should quickly identify and hire an individual to head the record-keeping functions of the zoo. This person should be qualified in implementing and overseeing a comprehensive information management system.

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## Pest Management

Pests, including insects, rodents, nuisance birds, and certain mammals, are common in zoos because of the ready availability of shelter, food, and water. Control of pests is a critical aspect of preventive medicine at zoological parks (AAZV, 1999). Pests are vectors or reservoirs of disease that can adversely affect zoo animals. Pests can also significantly degrade the aesthetic quality of the park and cause economic loss from damage to stored foods and to physical facilities. Development of a comprehensive program to address a pest control problem, including safe and appropriate pesticide application protocols, generally involves determining the scope and magnitude of the problem(s), identifying appropriate expertise, defining who will do the work, devising a safe and effective plan, implementing the program, continuously evaluating the program, and making program improvements where necessary. Licensed animal facilities are required to maintain a pest management program (Animal Welfare Act; 7 U.S.C. s/s 2131 et seq.).

A successful pest management program combines a thorough knowledge of both the biology of the pests in question and the effects of any proposed control methods on the pests, and on the zoo's animal collection, employees, and visitors (AAZV, 1999). The most successful control programs at zoos use integrated pest management (IPM; Collins and Powell, 1996) as a pest management strategy, wherein natural processes (natural pest mortality factors, pest-predator relationships, genetic resistance) can be manipulated to maximize their effectiveness. Commonly, chemical controls are used only when natural processes of control fail (NRC, 1989b, 1996a) and in a way that minimizes economic, health, and environmental risks. The goal of IPM is to reduce pests to a tolerable level through methods that are least disruptive to the environment.

### CONSIDERATIONS FOR INTEGRATED PEST MANAGEMENT AT ZOOS

Key pest management issues at zoos are rat and mice control, insect (primarily cockroach) control, nontarget concerns, and identification of nonchemical alternatives. A zoo poses unique problems because it is necessary to control pests without harming exhibit specimens. Both the primary toxicity of the materials used as well as relay toxicity should be considered (e.g., zoo animals consuming insects and dead rodents contaminated with pesticide). Because of these risks, trapping is preferred over baiting for removal of vertebrate pests, unless there is severe rodent overpopulation (Spelman, 1999). Fogging and fumigation should be strictly controlled, and only certified, experienced applicators should be used. A pest management program should be the responsibility of senior management personnel (limited to a very few people) who are knowledgeable about pest management principles. Each aspect of the program should be reviewed prior to implementation, and chemical storage, inventories, safety procedures, application techniques, and legal aspects (e.g., adherence to Environmental Protection Agency pesticide and state or local rules and requirements for certified applicators, restricted use pesticides, use concentrations) should be fully discussed before the pest management department conducts an application.

Personnel directly responsible for the pest management program should be knowledgeable in all areas of pest management operations and should regularly attend continuing education in professional pest management. The input of management, curator staff, safety department, exhibit personnel, keepers, and the sanitation department is essential for a successful pest management program.

A successful IPM program at a zoo includes several steps to control, reduce, or eliminate pests (Spelman, 1999). These may include inspection, exclusion and habitat management, sanitation, trapping, baiting, repellents, and other methods. As a preventive measure routine inspection of animal facilities may identify a pest problem before developing into an infestation. Physical barriers (e.g., fencing, netting, and roofing) provide a first line of defense against pest infestation (Spelman, 1999). Habitat management is intended to reduce the attractiveness of an animal enclosure to the pest.

Sanitation and proper storage and removal of solid waste (bedding, feed, enrichment items, dirt, and debris) are important steps in pest management (AAZV, 1999). Appropriate food storage bins that are well sealed will reduce potential pest problems. Cleaning and disinfecting food and water containers should occur routinely (AAZV, 1999). Public areas (e.g., walkways, concession areas) should be cleaned regularly, and the public should be discouraged from feeding animals (Spelman, 1999). The Animal Welfare Act (7 U.S.C. s/s 2131 et seq.) contains specific sanitization regulations for certain animals in captivity (e.g., indoor primary enclosures for nonhuman primates must be sanitized at least once every two weeks).

Physical (trapping), chemical (baiting, repellents, and fumigation), and biological controls (predators, contraceptive vaccines, species-specific disease) may need to be used for more severe pest infestations. Trapping of pests reduces the risk of relay and nontarget toxicity that may occur in zoos, and it is preferred except in the cases of severe rodent infestation (Spelman, 1999). Biological controls may be used in very specific situations when carefully monitored (e.g., an oral contraceptive agent [viral vectored immunocontraception] may prove effective for the control of feral rabbits and red fox (Holland and Robinson, 1995) although there is currently no biological control for rodent infestations).

Chemical use should be considered a last resource for pest management because of the aforementioned toxicity concerns; indeed, intoxication from chemical use in zoos has been reported many times. Pesticide use at zoos is a concern because of potential impacts on animal health. At the National Zoo two red pandas died as a result of ingesting aluminum phosphide placed in the animal enclosure to control a rodent infestation (see Box 4-1) (Enquist and Montali, 2003). Second-generation anticoagulant rodenticides have been associated with toxicity and in some circumstances death in several bird species: white-winged wood duck (James et al., 1998); turkey vultures, kookaburra, von der Decken's hornbill, and crested wood partridge (Borst and Counotte, 2002). Additional specific chemical toxicities in wildlife have been reviewed thoroughly (Fowler, 1978; Plumlee, 1997).

#### PEST MANAGEMENT AT THE NATIONAL ZOO

On January 10, 2003, when two red pandas consumed restricted-use fumigant tablets and later died, pest management was the responsibility of the safety manager. Although a contractor applied the fumigant, the application was carried out under the direction of an onsite zoo employee (a certified pesticide applicator located in the Office of Safety) who manages some pest management programs. At the National Zoo at that time the certified pesticide applicator was responsible for in-house chemical applications and baits targeted for insects, as opposed to large treatments such as rat fumigation. To become a certified pesticide applicator, an individual must complete training and pass an examination administered by the state or local authority that enforces Environmental Protection Agency regulations for pesticides (Federal Insecticide, Fungicide, Rodenticide Act; 7 U.S.C. s/s 136 et seq. as amended). This certification allows the person to purchase and apply restricted-use pesticides and is typically a benchmark for training.

After the red panda deaths the National Zoo transferred responsibility for the Pest Management Program to the Pathology Department. An Integrated Pest Management (IPM) committee has been formed to address the animal and insect pest problem at the zoo. Since February 28, 2003, the IPM committee has conducted routine inspections of the zoo to identify areas that require pest management attention (NZZP, Integrated Pest Management Team Review, September 22, 2003). Additionally, the National Zoo began the process of establishing a comprehensive program to address the widespread pest problem (NZZP, General Memorandum Draft, September, 2003), including creation of a pesticide program manager position, which was subsequently filled by an entomologist with IPM experience.

**BOX 4-1**

**Lack of Procedures Jeopardizes Animal Welfare: Red Panda (Accession #113194 and #111967) Deaths**

Prior to the panda deaths the National Zoo was experiencing a growing rat problem. An outside contractor was hired, but proper procedures were not in place to assure that the contractor was licensed and qualified to perform necessary activities, including application of fumigant. Mothball-size pellets (approximately 3 grams each) of aluminum phosphide were placed by the contractor with long-handled tongs approximately 2 feet deep in the rat holes inside the parapet walls while the pandas were high up in 15-20 foot trees (see photo). During this activity there was an animal attendant present. The pest holes were not all covered completely with steel plates (only eight or nine were covered), and the applicator indicated that only seven burrows were filled with the fumigant (Fumitoxin® tablets - Pestcon Systems, Inc. <http://acc.orst.edu/info/extoxnet/pips/alumphos.htm>). The fumigant (phosphine gas) is released upon contact with moisture. However, when the animals came down out of the trees they likely ingested some of the pellets; pathology records show that both aluminum and phosphine were detected in the stomach contents of both pandas. According to the pathology report, no signs of digging were noted in the panda yard, and it is unlikely the pandas would be able to dig deeply enough to retrieve and ingest the pellets; the most likely scenario is that the pandas (nocturnal animals) descended from the tree to investigate changes in their environment and, by their curious behavior and investigative nature of tongue-tasting, ingested portions of the pellets remaining in the yard. It is likely that they ingested fragments (product shelf life information suggests that some fragmentation may occur) of pellets that were dropped/spilled during the application on the ground. The pandas were found dead at approximately 9:00 a.m.

An outside contractor (not certified to apply pesticides in Washington, D.C.) had applied pesticide in the panda yard, and there was no material safety data sheet (MSDS) for the pesticide, no formal use plan for the fumigation, no safety policies, no posting of signs, no approval system prior to application, or pesticide use policy. According to product label restrictions for Fumitoxin® tablets: "The use of any pesticide in a manner that may kill or otherwise harm an endangered or threatened animal or adversely modify their habitat is a violation of federal laws." At the time of the investigation, information about the occurrence was scant. In response to this incident, National Zoo management took the following actions:

- Implementation of a procedure to approve the use of all chemicals, including pesticides.
- Transferred responsibility of pesticide use to the Pathology Department.
- Canceled the existing pest control contract.
- Created and filled a new position of Pest Control Manager who reports to the Pathology Department.

Since the red panda deaths, a number of actions have been taken to address issues associated with both vertebrate and insect pests at the zoo (NZIP, Integrated Pest Management Team Review, September 22, 2003):

- Suspension of fumigation as a primary rat control technique.
- Recovery of numerous poison bait boxes formerly used throughout the Rock Creek Park facility.
- Assessment with recommendations for infrastructural pest exclusion procedures in many of the animal unit facilities.
- Incorporation of trash receptacles with water-shedding covers at secondary holding sites.
- Introduction of animal food containers designed to exclude insects.
- Rat activity assessment and trapping in major harborage sites.
- Major roach reduction in a high-profile exhibit and holding areas with minimal pesticide application.
- Implementation of improved animal food management and feeding times, and redesign of some outside exhibits to reduce vermin attraction.
- Trash management coordination of daily pickup and removal of trash by FONZ and National Zoo personnel during peak visitor activity.
- Mosquito, wasp, and yellow-jacket trapping and control, and elimination of mosquito breeding sites.
- Educational sessions and reports on IPM activities to National Zoo and Smithsonian personnel.

Despite these efforts, housekeeping and site conditions are still poor in numerous areas throughout the zoo, both in public and in nonpublic areas. Unsecured refuse (garbage in bags outside cans) and litter were observed throughout the zoo complex. There is a lack of housekeeping and janitorial staff in public areas. Rodents (rats/mice) were present in animal exhibition areas and were observed crossing public walkways in daylight, which is significant because these pests are generally nocturnal. A Recent USDA inspection (USDA, 2004b) noted numerous

mice were observed inside primate exhibit areas.

#### STRENGTHS AND WEAKNESSES IN PEST MANAGEMENT AT THE NATIONAL ZOO

Prompt and appropriate actions were taken after the deaths of the red pandas to address contributing factors. These actions included reassignment of pest management responsibilities, cancellation of the existing pest management contract, suspension of rat fumigation programs, formation of an IPM committee and draft of an IPM plan, and creation of a professional pest control manager position (NZIP, Integrated Pest Management Team Review, September 22, 2003; NZP, General Memorandum Draft, September, 2003). However, emphasis on pest management should continue to address the existing pest problem fully. Site observations indicate that considerable work is necessary to ensure animal health and the aesthetic quality of the zoo (USDA, 2003). A comprehensive IPM plan for pest management needs to be finalized and should

- establish clear goals and objectives, (e.g., bring current populations of pests down to acceptable levels and maintain those levels using modern IPM techniques incorporating routine management of sanitation, janitorial, trapping, treatment, and inspection.
- incorporate the input of management, curatorial staff, exhibit personnel, sanitation, facilities, and safety personnel.
- be under the leadership and direction of a pest management expert and the auspices of the pest management department (other departments should not be allowed to alter or supplement the program).
- consider consolidating the nutrition department so that food stock is in a central location.
- include continued training, certification maintenance, and professional development for pest control managers.
- involve continuous reassessment and improvement.

Success in pest management has been achieved at other zoos with a comprehensive IPM plan (Collins and Powell, 1996). With the widespread rodent problem the National Zoo may initially need to use chemical controls to reduce rodent populations to levels that can be managed by nonchemical methods. Care should be exercised to select the most suitable products or chemicals to minimize the hazards to nontarget animals. Ensuring that accidental poisoning does not occur in the animal collection is a significant challenge. The Philadelphia Zoo has successfully used hydrogen phosphide pellets and anticoagulants (bromadiolone) to control rat populations, but anticoagulants (particularly brodifacoum) should not be used near bird collections because of its high toxicity (AAZV, 1999). Other zoos have used expertise from the USDA-APHIS Wildlife Service Program for pest management.

#### Findings and Immediate Needs

***Finding 6:** Even though the pest management program has been reorganized and is showing signs of improvement, pest management remains inadequate and poses a potential threat to the animal collection, employees, and visitors to the National Zoo.*

***Immediate Needs:** A comprehensive IPM plan should be developed: (1) in the short term to bring current populations of pests down to acceptable levels and (2) in the long term to maintain those levels using modern IPM techniques.*

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## Mission and Strategic Planning

Strategic planning is essential to the success of any organization—large or small, public or private, for profit or nonprofit. Rather than being reactive to emergencies, strategic planning is proactive and is based upon decisions about the future of an organization (Steiner et al., 1994). Specific internal (e.g., change in leadership, high turnover, loss of focus, crisis) and external (e.g., competing organizations, changing accreditation, societal changes) indicators can increase the urgency for strategic planning (Steiner et al., 1994). There should be a firm commitment within an organization to completion of a strategic plan.

Many different models for strategic planning exist for nonprofit, for-profit, and governmental strategic planning (Bryson, 1988; Crittenden and Crittenden, 1997; Godet, 2000; Gummer, 1997; McNamara, 2003; Steiner et al., 1994). In one model a strategic planning process can involve six steps (McNamara, 2003): (1) assessing the current status of an organization (where we are); (2) identifying resources (human, physical, and capital) that are available to the organization (what we have to work with); (3) envisioning the future status of an organization (where we want to be); (4) formulating a process to position the organization into the future (how we get there); (5) monitoring and evaluating the strategic plan (have we implemented the strategic plan); and (6) revising the strategic plan (is the strategic plan still appropriate).

The act of creating a strategic plan facilitates organizational performance through several mechanisms: (1) It forces an organization to identify its internal strengths and weaknesses and its external opportunities and threats (SWOT analysis). This information is then used to formulate a strategy that enables the organization to capitalize on strengths and opportunities and to neutralize weaknesses or threats (Gibis et al., 2001). An organization's strategy answers the basic question of "how we will compete and be successful." (2) The strategic plan, when adequately communicated to organizational members, provides a framework for guiding and evaluating individual-, unit-, and organizational-level actions and behaviors, decision making, and planning. In other words, the strategic planning process not only identifies the organizational goals and mission but also specifies how those goals will be achieved, and what the objective, quantifiable indicators of progress and success will be (McNamara, 2003).

Strategic planning can be performed by an internal facilitator or by an external facilitator (or consultant). The use of an external facilitator may be advantageous for several reasons (McNamara, 2003). Nonprofit organizations which use a formal approach to strategic planning may have higher levels of social and financial performance than those with more informal procedures (Siciliano, 1997). Within an organization, the appropriate expertise to conduct a strategic planning process may not exist. An internal facilitator could either inhibit participation from others or may not have the opportunity to participate in planning fully. An external facilitator will likely not have strong preconceived ideas about the organization's strategic issues and ideas.

A broad range of participants (a planning team) is needed for a successful strategic planning process. The planning team should include the organization's director and, if applicable, board chair to drive development and implementation of the strategic plan (McNamara, 2003). Staff at various levels in the organization should be part of the process. Information flow throughout the organization's hierarchy is essential to obtain contributions to the

strategic planning process (Crittenden and Crittenden, 1997). Stakeholders (e.g., funders, trade associations, potential collaborators, vendors and suppliers, consumers, volunteers,) should be included to ensure that the needs of the organizations clientele are considered in the strategic plan. Volunteers particularly focus their attention on organizations that have a formal decision-making process (Crittenden and Crittenden, 1997).

A strategic plan has no value if it is not implemented, evaluated, and updated. A strategic plan should be clearly communicated at all levels within an organization before it can be fully implemented. An implementation strategy will ensure that goals and objectives set forth by management can be achieved by staff with quantifiable results (Bonoma and Clark, 1990). Allocation of responsibilities to specific members through detailed action plans are necessary elements (Crittenden and Crittenden, 1997). A strategic plan should specify who is responsible for overall implementation and should assign responsibility for achieving each goal and objective to individual staff members. Finally, a strategic plan should not be a static document; it will need to be revised in response to changing internalities and external circumstances.

In a broader context, contemporary zoos are guided by five basic principles that should be considered in a strategic plan: conservation, education, science (research), entertainment, and animal welfare (Maple, 2003). At zoos conservation goals may be inconsistent with animal welfare concerns (Cohn, 1992). Because captive animals live longer (due to improved medical care and animal husbandry, and improvements in facilities and social grouping), additional consideration should be given to the care and management of geriatric animals (Maple, 2003). As part of its accreditation process the American Zoo and Aquarium Association (2003c) requires a strategic plan for zoos. Specific elements of the strategic planning process for a zoo should include (adapted from Pensacola Junior College, 2004):

- defining the mission
- describing its organization
- outlining its vision for the future
- identifying focus areas
- detailing primary strategies to address the main issues
- setting goals and implementation strategies
- stating specific expected results in support of the goals
- performance measures

Measuring performance is critical to evaluating the success or failure of goals and objectives outlined in the strategic plan. The Perth (Australia) Zoo measures annual performance by effectiveness and efficiency indicators in three areas (Perth Zoo, 2003): (1) wildlife conservation, (2) customer awareness of conservation, and (3) customer service. A performance audit for the Philadelphia Zoo (City of Philadelphia, 1997) identified strengths, opportunities, and recommendations. In 2000 the Oregon Zoo (Metro, 2000) performance measures were evaluated by comparisons with other zoos. Other zoos have used a variety of objective, performance, and activity measures (Auckland Regional Council, 2003; City of Topeka, 2003; Woodland Park Zoological Society, 2003).

### STRATEGIC PLANNING AT THE NATIONAL ZOO

The National Zoo has defined its mission as exhibiting and protecting biodiversity by joining public education and recreation with research in conservation biology and reproductive sciences (NZZP, History, 2003). The mission articulates a goal to be a world-leading institution.

The mission of the National Zoological Park (NZZP) is to celebrate, study, and protect the diversity of animals and their habitats. The NZZP exhibits living animal and plant collections, conducts research in conservation biology and reproductive sciences, and provides educational and recreational environments for the visiting public (Smithsonian Institution, 2004).

The National Zoo currently operates without a strategic plan that incorporates all elements of the National Zoo, and it has not recently performed a SWOT (strength, weaknesses, opportunities, and threats) analysis (NZZP, October 16, 2003). The 1992 accreditation report (AZA, 1992) also indicated the lack of a strategic plan. The National Zoo was scheduled to begin a strategic planning process in October 2003 as part of a Smithsonian-wide

program (NZIP Submission, October 16, 2003). The zoo does have an animal collections plan and a 10-year facility revitalization plan.

#### STRENGTHS AND WEAKNESSES IN STRATEGIC PLANNING AT THE NATIONAL ZOO

The National Zoo currently does not possess a strategic plan; a strategic planning process was recently initiated within the National Zoo as part of a Smithsonian-wide program (NZIP Submission, October 16, 2003). This process is a positive step forward, because strategic planning is a critical and immediate need for the National Zoo. It should proceed as quickly as possible and incorporate both the animal collections plan and the 10-year facility revitalization plan, while the critical areas of needed repairs to the physical plant are under way. The strategic plan should also consider the five basic principles to which contemporary zoos are dedicated: conservation, education, science (research), entertainment, and animal welfare (Maple, 2003). This process is being facilitated by a person external to the National Zoo and the Smithsonian Institution. By having an external facilitator strong conceptions about the National Zoo's strategic issues and ideas can be avoided. The strategic plan is anticipated to be approved by the National Zoo and the Smithsonian Institution in April 2004, with implementation beginning in May 2004 (NZIP, Strategic Planning Timeline, January 8, 2004).

The strategic planning process for the National Zoo has representation from a variety of internal stakeholders (NZIP, Draft NZIP Strategic Planning Roles, January 9, 2004). Leadership from the National Zoo and the Smithsonian Institution is critical to the success of the strategic planning process. Staff from all levels within the zoo is represented during the planning process, along with various internal stakeholder groups (e.g., NZIP Advisory Board, CRC Foundation, Science Advisory Group, FONZ Board.) (NZIP, Draft NZIP Strategic Planning Roles, January 9, 2004). Although external stakeholders (e.g., USDA-APHIS, Congress, Fish and Wildlife Service, AZA, the public) are not directly represented in the strategic planning process (NZIP, Draft NZIP Strategic Planning Roles, January 9, 2004), they had an opportunity to participate through several stakeholder sessions held in February (NZIP, Smithsonian's National Zoological Park Strategic Planning, 2003-2004, January 7, 2004). The strategic planning process would be strengthened by having direct representation from some of those external stakeholder groups in addition to the stakeholder sessions already held. One issue the National Zoo will need to address during the strategic planning process involves evaluating and identifying its mission and goals. One challenge for the National Zoo as part of the Smithsonian Institution is to maintain alignment with the Smithsonian Institution's mission while identifying and implementing a strategy that will enable its independent success. In addition, the National Zoo needs to decide whether it will position itself as a metropolitan zoo or as the nation's zoo. The decision should be driven by a pragmatic evaluation of the National Zoo's internal strengths and weaknesses (SWOT analysis) in areas such as human resources, facilities, animal collection, and funding. It should also be driven by an evaluation of the external marketplace, including an assessment of current and potential competition. Competition for the National Zoo consists not only of other zoos but also of other organizations that may compete with the National Zoo for visitors and private and public funding. Most successful zoos have established a niche or brand that enables them to attract visitors, secure financial resources, and generate national recognition. The National Zoo needs to identify what its niche should be.

After identifying its generic mission the National Zoo will need to develop clear and specific strategies and action plans that outline how the mission will be achieved. Key to successful implementation of the new strategy will be effective use of organizational resources. Some strategic initiatives may require additional resources. For example, as the National Zoo expands and revitalizes the animal collection, it will be important to plan for the additional needs these changes will create in facilities and staffing.

More important than acquiring additional resources will be generating a plan that ensures maximum use of current resources. For example, decisions regarding facilities repair and maintenance should consider the role of different facilities in the strategic plan. Current and proposed projects should also be evaluated in relation to their fit with the strategy. For example, it will be important to think about how current projects such as the Asia Trail and Farm can be aligned with the new mission or how current or future research will relate to conservation objectives. Similarly, it will be important to consider how to best leverage FONZ to help the zoo achieve its new strategies. FONZ members may possess unique skills or abilities that the National Zoo can tap to help implement its strategies.

The National Zoo will need to engage in strategic resource planning (i.e., human, facilities, funding) to support the mission. In the past the capability of the National Zoo to engage in resource planning has been somewhat limited because many resource decisions were made at the Smithsonian level. For example, the Smithsonian is currently conducting staff reductions (i.e., buyouts) across all its units, including the National Zoo. This practice not only raises concerns about the extent to which the National Zoo will lose valuable personnel and



expertise but also severely limits the capability of the National Zoo to make strategic staffing decisions. Moreover, the National Zoo has not been informed by the Smithsonian of the employees that are eligible for buyout, which has prevented planning for loss of staff and expertise. Overall, effective use of organizational resources will be critical to successful implementation of the National Zoo's strategic plan.

#### **Findings and Immediate Needs**

***Finding 7:*** *The National Zoo is operating without a strategic plan, which jeopardizes its long-term operations and focused use of the zoo's resources. An integrated plan for the entire institution incorporating the 10-year facility revitalization and animal collections plans has not been developed.*

***Immediate Needs:*** *The National Zoo should develop a comprehensive strategic plan and provide integrated goals for all aspects of the institution, with operational goals and performance measures, as soon as possible.*

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Accession #102167, Orangutan  
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Accession #106845, Malayan tapir  
Accession #107049, Malayan tapir  
Accession #108412, Barbary lion  
Accession #109171, Asiatic elephant  
Accession #111062, Singing dog  
Accession #112236, Sulawesi crested macaque  
Accession #113184, Sumatran tiger  
Accession #113376, White-fronted marmoset  
Accession #113392, Grevy's Zebra  
Accession #113393, Grevy's Zebra  
Accession #113417, Grevy's Zebra  
Accession #113418, American Bison  
Accession #113419, American Bison  
Accession #113526, Fishing Cat

### Keeper's Log Reports

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Accession #113417, Grevy's Zebra

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Accession #110974, Tree Kangaroo

### Diet Record

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Accession #102167, Orangutan  
Accession #103643, Orangutan  
Accession #103823, Orangutan  
Accession #106955, Tamarin  
Accession #106960, Tamarin  
Accession #107579, Orangutan  
Accession #107881, Orangutan  
Accession #111251, Tamarin  
Accession #111277, Tamarin  
Accession #112790, Tamarin  
Accession #113319, Tamarin  
Accession #113392, Grevy's Zebra  
Accession #113417, Grevy's Zebra  
Accession #113453, Tamarin

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Accession #113454, Tamarin  
Accession #113482, Tamarin  
Accession #113483, Tamarin  
Accession #113529, Tamarin  
Accession #113530, Tamarin  
Accession #113550, Tamarin  
Accession #113551, Tamarin  
Accession #113569, Tamarin  
Accession #113570, Tamarin  
Accession #113614, Tamarin  
Accession #113670, Tamarin  
Accession #113682, Lemur  
Accession #113683, Lemur  
Accession #113684, Lemur  
Accession #113685, Lemur  
Accession #113686, Lemur  
Accession #113687, Lemur  
Accession #113688, Lemur  
Accession #113689, Lemur  
Accession #113804, Tamarin  
Accession #113805, Grevy's Zebra  
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Accession #113808, Tamarin

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## APPENDIX A

### National Zoological Park General Memoranda

#### GMs 0-99 -- General

- GM No. 1 General Memoranda  
April 1, 2003 (Reissued)
- GM No. 2 Mission, Goal, People, and Organization  
April 1, 2003 (Revised)
- GM No. 3 Standards of Conduct  
April 1, 2003 (Revised)
- GM No. 4 Relationship Between the Smithsonian's National Zoological Park and Friends of the National Zoo  
April 1, 2003 (Revised)
- GM No. 5 Wearing of Identification Badges (IDs)  
April 1, 2003 (New)
- GM No. 6 Electronic Mail (Email) Usage  
April 1, 2003 (New)
- GM No. 7 Animal Escape Protocol  
April 1, 2003 (Revised)
- GM No. 8 Weekend and Holiday Duty Officers for Senior Management and Curatorial Staffs  
April 1, 2003 (New)
- GM No. 11 Uniforms and Safety Shoes  
April 1, 2003 (Revised)
- GM No. 12 Animal Environmental and Life Support System Emergency Contact List  
April 1, 2003 (New)
- GM No. 13 Performance Management and Awards  
July 15, 2003 (New)
- GM No. 14 Recycling Plan  
April 1, 2003 (New)
- GM No. 15 Institutional Care and Use Committee (IACUC)  
April 1, 2003 (New)
- GM No. 16 Media Contact and Access Plan  
April 1, 2003 (New)
- GM No. 17 Crisis Communications Plan  
June 25, 2003 (New)

#### GMs 100-199 -- Safety and Security

- GM No. 100 Safety Program

April 1, 2003 (Revised)

GM No. 105 Occupational Injury and Illness Responsibilities and Procedures  
April 1, 2003 (Revised)

GM No. 110 Emergency (Contingency) Self-Protection Plan  
April 1, 2003 (Revised)

GM No. 115 Security Key, Lock and Access Control  
April 1, 2003 (Revised)

GM No. 120 Energy (Electrical) Conservation and Emergency Procedures in the Case of Partial Power Loss  
April 1, 2003 (Reissued)

GM No. 125 Hazard Communication Program  
April 1, 2003 (Reissued)

GM No. 130 Chemical Hygiene Plan  
April 1, 2003 (Reissued)

GM No. 135 Lead Abatement Program  
April 1, 2003 (Revised)

GM No. 140 Asbestos Management Program  
April 1, 2003 (Reissued)

GM No. 145 Motor Vehicle Operations  
April 1, 2003 (Revised)

GM No. 155 Visitor Safety Near Exhibits  
April 1, 2003 (New)

GM No. 160 Screening of Mail and Packages  
April 1, 2003 (New)

**GMs 200 - 299 -- Administrative/Human Resources/Travel/Purchasing/ Budget**

GM No. 200 Parking in Areas Reserved for Official Business  
April 1, 2003 (Reissued)

GM No. 205 Emergency Dismissal or Closure Due to Adverse Weather Conditions or Other Emergency Situations  
April 1, 2003 (Reissued)

GM No. 210 Official Travel  
April 1, 2003 (Revised)

GM No. 215 Timekeeping and Paid Time Off  
April 1, 2003 (Revised)

GM No. 220 Purchasing Supplies and Contracted Services  
April 1, 2003 (Revised)

GM No. 225 Management Responsibilities Outside Normal Working Hours  
April 1, 2003 (Revised)

GM No. 230 Professional Accomplishments Evaluation Committees (PAEC)

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April 1, 2003 (Revised)

GM No. 235 Non-Employee Associates  
April 1, 2003 (Revised)

GM No. 240 Employee Vehicle Identification Stickers  
April 1, 2003 (Reissued)

GM No. 245 Grants, Awards and Other Non-Appropriated or Interagency Funds or Personnel  
July 1, 2003 (Revised)

GM No. 250 Processing Personnel Actions for Federal Recruitments  
April 1, 2003 (New)

**GMs 300 - 399 -- Facilities/Motor Pool/Landscape**

GM No. 300 Motor Vehicle Operations  
April 1, 2003 (Revised)

GM No. 305 Stock Requisitions  
April 1, 2003 (Reissued)

GM No. 310 Requisitions for Supplies and Services  
April 1, 2003 (Revised)

GM No. 320 Landscape Management  
April 1, 2003 (Revised)

GM No. 325 Access for the Disabled  
April 1, 2003 (Revised)

GM No. 330 Review of Physical Plant Construction and Improvement Projects  
April 1, 2003 (Revised)

GM No. 335 Snow Removal Plan  
April 1, 2003 (Reissued)

GM No. 340 Waste Management Plan  
April 1, 2003 (New)

**GMs 400 - 499 -- Information Technology**

GM No. 400 Information Technology Resources and Support  
April 1, 2003 (Revised)

**GMs 500 -599 -- Animal Programs**

GM No. 500 Health Program for Employees Exposed to Animals  
April 1, 2003 (Revised)

GM No. 505 Snakebite Antivenin for Use Outside the Smithsonian's National Zoological Park  
April 1, 2003 (Revised)

GM No. 506 Snakebite and Antivenin Use Inside the Smithsonian's National Zoological Park  
April 1, 2003 (Revised)

GM No. 511 Animal Escape Protocol at the Smithsonian's National Zoological Park's Conservation and

Research Center (Front Royal)

April 1, 2003

GM No. 515 Provision of Facilities and Assignment of Dwelling at the Front Royal, Virginia Conservation  
and Research Center of the Smithsonian's National Zoological Park  
April 1, 2003 (Revised)

GM No. 520 Animal Products  
April 1, 2003 (Revised)

GM No. 525 Service Animals for Persons with Disabilities  
April 1, 2003 (Revised)

GM No. 530 Stray and Injured Animals on the Grounds  
April 1, 2003 (New)

GM No. 535 Collections  
April 1, 2003 (New)

GM No. 540 "Behind-the-Scenes" Tours  
April 1, 2003 (New)

**GMs 600 - 699 -- Fund-raising/Revenue Opportunities**

GM No. 600 Special Events  
April 1, 2003 (Revised)

GM No. 605 Naming Animals  
April 1, 2003 (Revised)

GM No. 606 Naming Areas  
April 1, 2003 (Revised)

**NZP Procedures and Practices**

Guidelines and Procedures for Use of NZP Animals in Education Programs and Presentations  
(no date indicated)

NZP Webcam Views (Interim)  
(no date indicated)

Work Requests for Routine Maintenance and Small Animal Program Jobs  
(no date indicated)

**SD's and Other Policies**

Smithsonian Standards of Conduct  
(no date indicated)

Centrally Managed Award Programs and Federal Pools

Source (NZP, August 8, 2003)



#2, 2

Clinical Notes - Individual Specimen Report  
NATIONAL ZOOLOGICAL PARK

----- Page 2 -----

Scientific Name: EQUUS GREVYI  
Common Name: GREVY'S ZEBRA  
Name: Bumba

Accession #: 113393  
Sex: Male  
Birth: 2.Aug.1998

-----

26.Apr.1999  
Rx: Doing well. w/ lib access to water today.  
Foods: visual obs: all skin wounds appear dry, mild IS lameness but  
other wise calm and well adjusted.  
A: Lameness, mild, LH  
w/ transport injury soft tissue  
P: Monitor lameness (IS)

27.Apr.1999  
Rx: Abrasions over eyes healing well. Active and eating well (IS)

30.Apr.1999  
Rx: All abrasions healing, but fresh abrasions both hooves.  
Foods: visual obs: Superficial new abrasions over caudal aspect of both  
hooves (from lying down on cement)  
A: Abrasions, minor, hooves  
w/ rough substrate  
P: Switch to rubber pads and shavings and spot cleaning (IS)

3.May.1999  
Rx: Hooves healing well. lies down on pads/shavings (IS)

11.May.1999  
Rx: PYRANTEL PASTE (STRONGID P) 1250 mg PO SIG for 1 dose. (IS)

12.May.1999  
Rx: Abbrivated quarantine complete. Released to HK today. Ferals  
have been negative  
Foods: visual obs: all abrasions healing well, slightly overweight with  
a very round abdomen  
P: Begin routine deworming 3x/yr: IML, Ivermectin, pyrantel  
Advised HK staff to use caution when transitioning onto new grass  
in new exhibit (IS)

17.May.1999  
Rx: Keepers report distended abdomen, but eating well  
Foods: visual obs: eating hay, all plant material closely cropped in  
the holding yard, normal stools. Abdomen is full, but no signs of  
abdominal discomfort. Being fed 2 flakes of hay and two pounds of  
"low pro" pellets twice a day. Exhibit has lush grass (straw not yet  
given access)  
A: Abdominal distension, mild  
w/ overfeeding vs mild colic  
At risk for laminitis, colic on new grass  
P: Brouha diet - consider reducing hay, possibly also pellets,  
limiting access to grass once introduced to exhibit (IS)

Printed on: 19.Mar.2000 /2526/ModARKS/5.31f





#2, 4

Clinical Notes - Individual Specimen Report  
NATIONAL ZOOLOGICAL PARK

-----  
Scientific Name: EQUUS GREVY  
Accession #: 113393  
Common Name: GREVY'S ZEMRA  
Sex: Male  
Name: Buumba  
Birth: 2.Aug.1998  
-----

1.Feb.2000

poor anesthetic risk

P. Exam ASAP  
Given time of day and cold ambient temps, plan for first thing tomorrow  
Increase food offered to test appetite  
Recommend separating from other zebra's w/n to monitor food intake and stool/urine output, and maintain body temp  
Keepers concerned about stress to zebra if separated in stalls w/n as they have not been regularly locked in at night

Comment: discussed hierarchy among the 3 zebra's. This individual is apparently the dominant of the 3 as lack of access to feed seems unlikely.  
Also reviewed parasitology screening - no parasites seen in this group. (LLE)

12. 1400: Keopsis report zebra down in stall

A. Recumbent  
P/O weakness, neurologic, hypothermia  
Prognosis poor

P. Exam now

From LLE and RAY:

1. Sedation: Detomidine 10 ug (est 20 ug/Kg) and butorphanol 10 mg (est 50 mg/Kg) IM via pole syringe in left triceps. Animal sedated and able to be blindfolded at 9 minutes. Some movement in lateral recumbency, supplemented with butorphanol 5 mg and Detomidine 5 ug IV at 20 min. Some muscle twitching and rear limb stiffness, supplemented with midazolam 2 ml (10 mg) IV at 22 min with good effect.  
HR 32 (15 min) and 34 (55 min)  
RR 16 at 15 min  
SPO<sub>2</sub> 13%

Reversed with yohimbine 25 mg (12.5 mg IV, 12.5 mg SQ) at 61 min and Naltrexone 100 mg IM at 80 min, with slight effect. Nystagmus present for several minutes, unable to stand but made attempts at least observation.

Keepers called as instructed 1 hr and 2 hr later, described zebra as more calm and more alert but still recumbent.

2. P/M: Hypothermic (99.1).  
M/W: Thin with decreased muscle mass of shoulder girdle, chest and pelvis. HEENT: Hydration appears OK, no sign of dental trauma or infection; mucous membranes color pink

Printed on: 19.Mar.2000 /1818/MedARKS/5.31f

#2, 5

Clinical Notes - Individual Specimen Report  
NATIONAL ZOOLOGICAL PARK

-----  
Scientific Name: EQUUS GREVYI  
Common Name: GREVY'S ZEBRA  
Name: Suuska  
Accession #: 113393  
Sex: Male  
Birth: 2.AUG.1998  
-----

1. Feb. 2000

R/I: susculis normally  
ABD: very reduced gut sounds  
3. Blood sample: STAT EDTA and clot tube  
4. IV catheter: 16 ga 2 inch, right jugular vein  
5. SPC2 recorded using Mallor syphon w/ probe on the tongue  
6. Bed stall with hay  
7. Run on heater in stall  
Rx: IBS 4 l IV (w/med)  
Rx: B vitamins 5 ml IV in 1 l D5B  
Rx: F50 15 ml IM R caudal thigh  
Rx: Bactal 4 g IV  
Rx: penicillin 4 ml (400 mg) IM R caudal thigh  
Rx: Dexamethasone 12 ml IV

Obs: Initial labwork nondiagnostic; CRP elevated as expected

A: Hypothermia  
i/o exposure, lack of so fat stores associated with metabolic

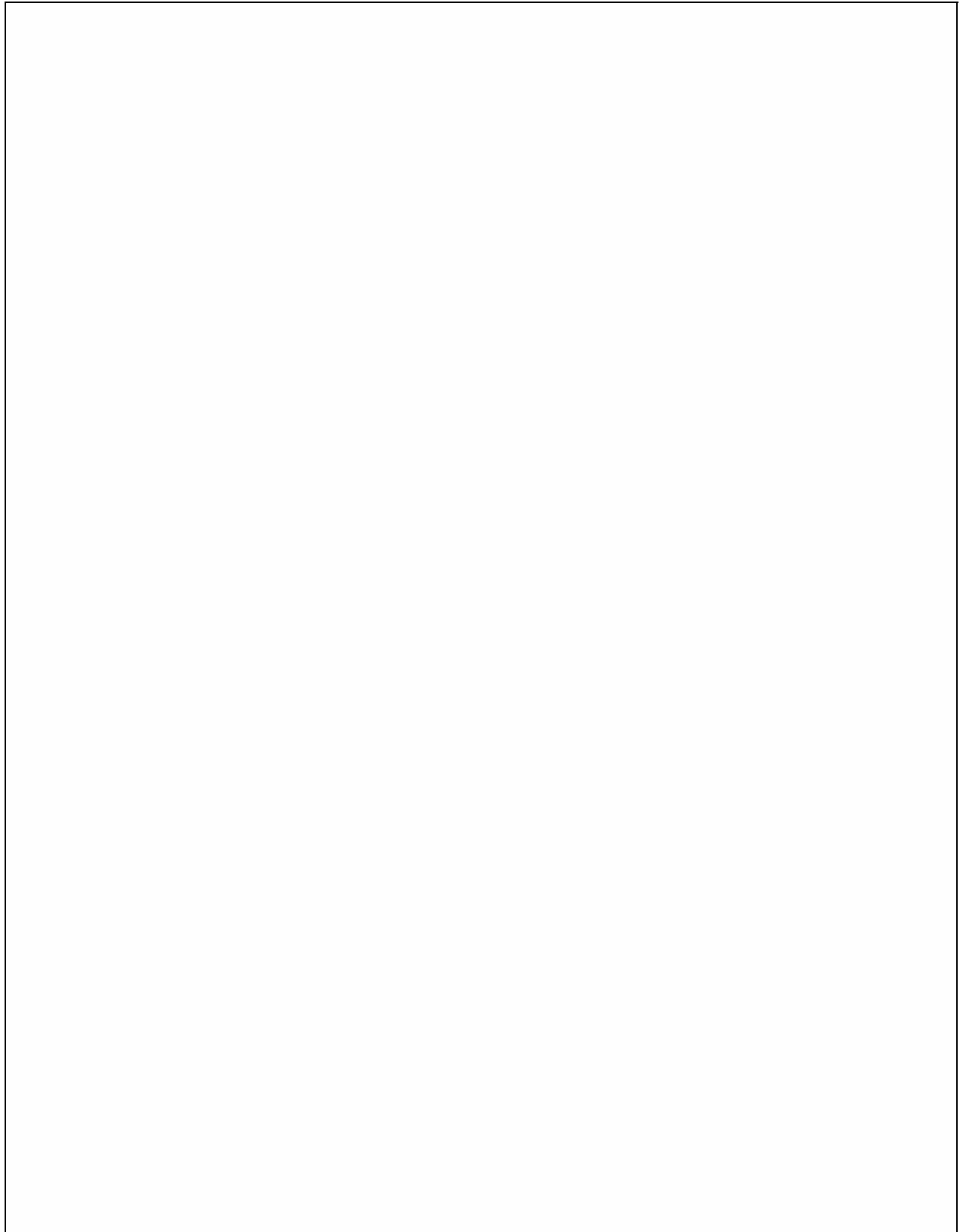
B: Underweight, severe  
i/o hypothermia vs metabolic disease  
Recumbent  
i/o neurologic vs weakness  
Poor prognosis

C: Monitor for next hour +  
Keep as warm as possible; curator to secure a space heater for this  
stall to supplement wall panel  
Recheck vit  
Increase diet  
Consider WET and ESB liters, rabies  
Repeat fecal for parasite screen (RAV)

2. Feb. 2000

Obs: found dead in stall this am  
From: visual exam: stall is cold; no supplemental heater in stall  
and wall panel is barely putting out heat. Evidence that zebra  
struggled somewhat as hay is displaced and animal is facing the  
opposite direction. (RSP)

Printed on: 28.Mar.2000 /1818/MedARKS/S.31f



## APPENDIX C

Clinical Notes Summary Report  
MedARKS Medical Record for Grevy's Zebra "Buumba" (Accession #113393)  
Source: Dr. Don Nichols

Page 1

Clinical Notes - Individual Specimen Report  
NATIONAL ZOOLOGICAL PARK

-----  
Scientific Name: *EQUUS GREVYI* Accession #: 113393  
Common Name: GREVY'S ZEBRA Birth: Male  
Name: Buumba Birth: 2.Aug.1998  
-----

....1998...

10.Aug.1998 Weight: 39.01 Kg (86.0 lb)  
Manual restraint for physical examination. Appears very strong and healthy, with two normal testes. Bled for CBC, bank, glucose, and gluteraldehyde test. Transpondered in left neck - AVID\*028791\*001.  
HR 280, resp 56. Normal after release.  
Rx: TETANUS ANTITOXIN (BOVINE ORIGIN) 1500 u IM SID for 1 day.  
Rx: PENICILLIN G BENZATHINE 3.000 MU IM SID for 1 day.  
Rx: MU-SR 5 mg IM SID for 1 day. (DWA)

1.Oct.1998  
Rx: IVERMECTIN 200-lb dose PO SID for 1 day. (DWA)

....1999...

9.Apr.1999  
Sedated today for pre-shipping exam. He is being sent to the National Zoo sometime this month. Sedated using 40mg detomidine and 40mg butorphanol IM via dart. Sedation adequate for restraint achieved in 20mins. Blood was drawn and submitted for CBC, chem, bank, and Coggins test. Fecal sample taken for exam. Upon examination of the scrotum, no testicles could be palpated. Sedation was partially reversed with 200mg naltrexone IV. Recovery was rapid and uneventful. (CAK)  
  
Rx: RABIES VACCINE (KILLED) 1 ml IM  
Rx: ENCEPHALOMYELITIS EWV/TETANUS TOXOI 1 ml IM (DWA)

16.Apr.1999  
Rx: FENBENDAZOLE 2500 mg PO SID for 5 days.  
Has recovered fully from sedation. (CAK)

25.Apr.1999  
RM: Detrait: On trailer 18 hours. Did not eat or drink during transport when offered. Very nervous, up on hind feet much of the time. Off loaded with no problems.  
FROC: Visual obs: Minor abrasions but many - above both eyes, along ventral surface of the mandible, lateral pectoral regions. Offered water but nosed it only, apparently dumping the bucket.  
A: Abrasions, facial, pectoral region, superficial, iatrogenic  
Newly arrived  
Dehydration, possible  
Mycoplasma possible  
F: Restrict access to water somewhat during the day (offer 1/4 bucket every 2 hrs) to protect against overconsumption.  
Monitor closely (LS)

Printed on: 30.May.2002 /ISIS/MedARKS/5.31g

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Clinical Notes - Individual Specimen Report  
NATIONAL ZOOLOGICAL PARK

- page 2 -

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Scientific Name: *EQUUS GREVYI*      Accession #: 113393  
Common Name: GREVY'S ZEBRA      Male  
Name: Duumba      Birth: 2 Aug. 1998

-----

**26.Apr.1999**  
Hx: Doing well, ad lib access to water today.  
Proc: visual obs: all skin wounds appear dry, mild LH lameness but  
other wise calm and well adjusted.  
A: Lameness, mild, LH  
      r/o transport injury soft tissue  
P: Monitor lameness (LS)

**27.Apr.1999**  
Hx: Abrasions over eyes healing well. Active and eating well (LS)

**30.Apr.1999**  
Hx: All abrasions healing, but fresh abrasions both hocks.  
Proc: visual obs: superficial new abrasions over caudal aspect of both  
hocks (from lying down on cement?)  
A: Abrasions, minor, hocks  
      r/o rough substrate  
P: Switch to rubber pads and shavings and spot cleaning (LS)

**3.May.1999**  
Hx: Hocks healing well, lies down on pads/shavings (LS)

**11.May.1999**  
Rx: PYRANTEL PASTE (STRONGID T) 1320 mg PO SID for 1 dose. (LS)

**12.May.1999**  
Hx: Abbreviated quarantine complete. Released to HH today. Fecals  
have been negative  
Proc: visual obs: all abrasions healing well, slightly overweight with  
a very round abdomen  
P: Begin routine deworming 3x/yr: fns, ivermectin, pyrantel  
      Advised HH staff to use caution when transitioning onto new grass  
      in new exhibit (LS)

**17.May.1999**  
Hx: Keepers report distended abdomen, but eating well  
Proc: visual exam: eating hay, all plant material closely cropped in  
the holding yard, normal stools. Abdomen is full, but no signs of  
abdominal discomfort. Being fed 2 flakes of hay and two pounds of  
"low pro" pellets twice a day. Exhibit has lush grass (zebras not yet  
given access)  
A: Abdominal distension, mild  
      r/o overfeeding vs mild colic  
      At risk for laminitis, colic on new grass  
P: Discuss diet - consider reducing hay, possibly also pellets,  
limiting access to grass once introduced to exhibit (LS)

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Clinical Notes - Individual Specimen Report  
NATIONAL ZOOLOGICAL PARK

Scientific Name: *EQUUS GREVYI* Accession #: 113393  
Common Name: GREVY'S ZEBRA Male  
Name: Kumba Birth: 2 Aug. 1998

27 May. 1999  
Hx: Keeper (D. Davis) reports that zebra has been lame on the right front leg for 1-2 days duration. Lameness worse in the afternoon.  
Procedure: Visual exam (AM): Zebra is moderately lame on the RF. There is no swelling of the coronary band, fetlock, or carpus. There were no hoof wall or sole abnormalities noted. Tends to point toe as if pain is in the caudal solar region. Ground in enclosure has a lot of gravel that varies in size. Grass in enclosure still plentiful  
A: Lame, RF  
r/o sole bruise, abscess, laminitis (but not bilateral)  
P: Monitor lameness  
If lameness static or slight improvement, sole bruise more likely  
Consider analgesic/antiinflammatory - phenylbutazone (LS)

2 Jun. 1999  
Hx: Keepers report that lameness on RF has resolved. Eating and acting normal.  
A: Lame, RF, resolved  
r/o sole bruise  
P: No further concern at this time (LS)

3 Jun. 1999  
Hx: Keepers fed hay this morning then let zebras out into new exhibit with lush grass. Brought back in 20 minutes later by encouraging them with apples and some pellets.  
A: Continue gradual adjustment to pasture  
At risk for laminitis, colic  
P: Continue to allow out onto exhibit grass for gradually increasing periods of time.  
Monitor for any developing signs of laminitis or colic. (LS)

.....2000...

1 Feb. 2000  
Hx: Curator reports animal thin, left portion of food from last PM. drinking and defecating small amounts. Late afternoon. Keeper reports animal down in stall, unable to stand despite multiple efforts.  
PROC:  
1. Visual exam (early afternoon): animal eating weakly, walking with stiff, upright rear gait. Small muscle mass of chest and hindquarters. ears drooping.  
A: Wt loss, severe  
r/o hyponutrition due to behavior vs dental or other  
Weakness  
r/o neurologic, metabolic

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1A3

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Clinical Notes - Individual Specimen Report  
NATIONAL ZOOLOGICAL PARK

Scientific Name: *EQUUS GREVYI*      Accession #: 113393  
Common Name: GREVY'S ZEBRA      Male  
Name: Duumba      Birth: 2.Aug.1998

-----

1.Feb.2000

P: Poor anesthetic risk  
Exam ASAP  
Given time of day and cold ambient temps, plan for first thing tomorrow  
Increase food offered to test appetite  
Recommend separating from other zebras o/n to monitor food intake and stool/urine output, and maintain body temp  
Keepers concerned about stress to zebras if separated in stalls o/n as they have not been regularly locked in at night

Comment: discussed hierarchy among the 3 zebras. This individual is apparently the dominant of the 3 so lack of access to feed seems unlikely.  
Also reviewed parasitology screening - no parasites seen in this group. (LHS)

Hx: 1400: Keepers report zebra down in stall  
A: Recumbent  
w/o weakness, neurologic, hypothermia  
Prognosis poor  
P: Exam now

Proc (LHS and RAY):  
1. Sedation: Detomidine 10 mcg (est 50 mcg/Kg) and butorphanol 10 mg (est 50 mcg/Kg) IM via pole syringe in left triceps. Animal sedated and able to be blindfolded at 9 minutes. Some movement in lateral recumbency, supplemented with butorphanol 5 mg and detomidine 5 mg IV at 20 min. Some muscle twitching and rear limb stiffness, supplemented with midazolam 2 ml (10 mg) IV at 27 min with good effect.  
HR 32 (15 min) and 34 (58 min)  
RR 16 at 15 min  
SPO2 93%

Reversed with yohimbine 25 mcg (12.5 mg IV, 12.5 mg SQ) at 61 min and Naltrexone 100 mg IM at 80 min with slight effect. Nystagmus present for several minutes, unable to stand but made attempts at last observation.

Keepers called as instructed 1 hr and 2 hr later: described zebra as more calm and more alert but still recumbent.

2. PEK: Hypothermic (93.1).  
M/R: Thin with decreased muscle mass of shoulder girdle, chest and pelvis. SEMI: Hydration appears OK, no sign of dental trauma or infection; mucous membrane color pink

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IAN

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Clinical Notes - Individual Specimen Report  
NATIONAL ZOOLOGICAL PARK

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Scientific Name: <i>EQUUS GREVYI</i>	Accession #: 113393
Common Name: GREVY'S ZEBRA	Male
Name: Dumba	Birth: 2 Aug 1998

-----

1 Feb 2000

H/L: auscults normally  
ABD: very reduced gut sounds  
3. Blood sample: STAT EDTA and clot tube  
4: IV catheter: 16 ga 2 inch, right jugular vein  
5: SPO2 recorded using Nellcor Symphany w/ probe on the tongue  
6: Bed stall with hay  
7: Turn on heater in stall  
Rx: LRS 4 l IV (warmed)  
Rx: B vitamins 5 ml IV (in 1 l LRS)  
Rx: PPG 15 ml IM R caudal thigh  
Rx: Naxcel 4 g IV  
Rx: Banamine 4 ml (200 mg) IM R caudal thigh  
Rx: Dexamethasone 12 ml IV

Obs: Initial labwork nondiagnostic; CRP elevated as expected

A: Hypothermia  
r/o exposure, lack of sc fat stores associated with metabolic dx  
Underweight, severe  
r/o hypohydration vs metabolic disease  
Recumbent  
r/o neurologic vs weakness  
Poor prognosis

P: Monitor for next hour +  
Keep as warm as possible: curator to secure a space heater for this stall to supplement wall panel  
Recheck AM  
Increase diet  
Consider NEB and EEB titers, rabies  
Repeat fecal for parasite screen (RAY)

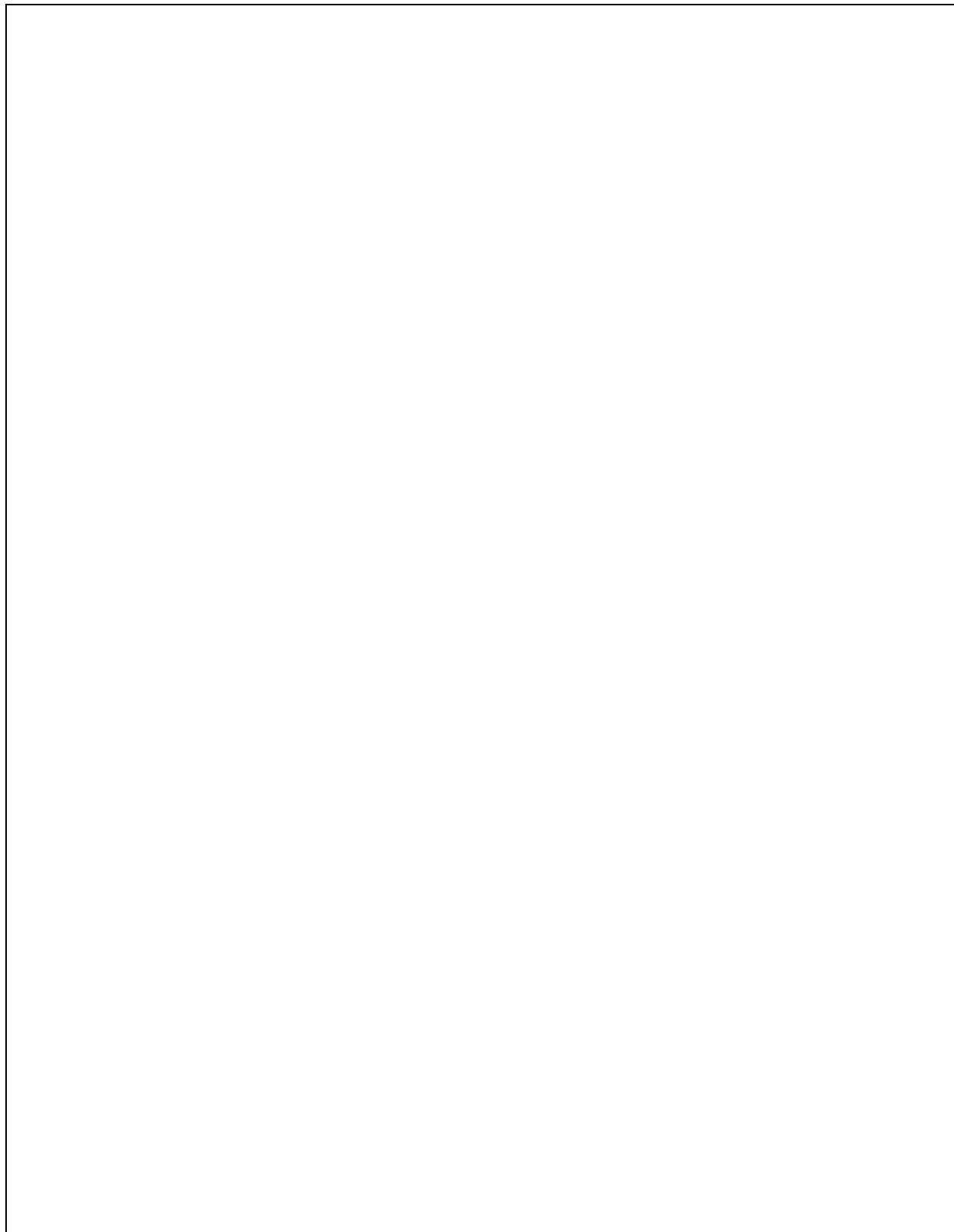
2 Feb 2000

Hx: found dead in stall this am  
Proc: visual exam: stall is cold; no supplemental heater is present and wall panel is barely putting out heat. Evidence that zebra struggled somewhat as hay is displaced and animal is facing the opposite direction. (LRS)

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JAS





## APPENDIX D

Medical Record Report (includes clinical notes, prescription record, parasitology record, etc.)  
MedARKS Medical Record for Grevy's Zebra "Buumba" (Accession #113393)  
Source: National Zoological Park

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-----		-----	
Scientific Name: EQUUS GREVYI	Accession #: 113393		
Common Name: GREVY'S ZEBRA	Sex: Male		
Name: Buumba	Birth: 2.Aug.1998		
-----	Tag/Barcode: 028-791-001		
-----	-----		
Clinical Note:		10.Aug.1998	
Manual restraint for physical examination. Appears very strong and healthy, with two normal testes. Bled for CBC, hemk, glucose, and glutaraldehyde test. Transpondered in left neck - AVID-028-791-001. HR 200, resp 60. Normal after release.			
Rx: CEPHANUS ANTIPOXIN (ROVINE ORIGIN) 1500 u IM SID for 1 day.			
Rx: PENICILLIN G BENZATHINE 3,000 MIU IM SID for 1 day.			
Rx: MORSE 5 mg IM SID for 1 day. (OWA)			
-----			
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Medical History Report - Individual Specimen page 1  
NATIONAL ZOOLOGICAL PARK

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Scientific Name: *EQUS GREYI* Accession #: 113333  
Common Name: GREY'S ZEBRA Male  
Name: Bumba Birth: 2.Aug.1998  
Tag/Brand: 028-791-001

---

**Prescription Data >>** Starting date: 10.Aug.1998  
Drug: PENICILLIN G BENZATHINE 3,000 MIU IM SID  
Formulation: 1.50 MIU/ML suspension  
Prescribed by: DWA (10.Aug.1998) Filled by: DWA (10.Aug.1998)  
Treatment weight: 39.01 kg

---

**Prescription Data >>** Starting date: 10.Aug.1998  
Drug: MU-SE 5 mg IM SID  
Formulation: 10.00 mg/mL injectable  
Prescribed by: DWA (10.Aug.1998) Filled by: DWA (10.Aug.1998)  
Treatment weight: 39.01 kg  
MU-SE - TOCOPHEROL, ALPHA + SELENITE, SODIUM

---

**Prescription Data >>** Starting date: 10.Aug.1998  
Drug: TETANUS ANTITOXIN (EQUINE ORIGIN) 1500 u IM SID  
Formulation: 1500.0 U injectable  
Prescribed by: DWA (10.Aug.1998) Filled by: DWA (10.Aug.1998)  
Treatment weight: 39.01 kg

---

**Clinical Note:** 1.Oct.1998  
Rx: IVERMECTIN 200-1b dose PO SID for 1 day. (DWA)

---

**Purpose:** Routine deworming

---

**Prescription Data >>** Starting date: 1.Oct.1998  
Drug: IVERMECTIN mg PO SID  
Formulation: 18.7 mc/gm paste  
Prescribed by: DWA (22.Sep.1998) Filled by: CAP (22.Sep.1998)  
Treatment weight: 39.01 kg

---

**Daily Treatment Notes >>**  

DATE	TIME	SUBSTANCE	BY	COMMENT
1.Oct.1998	17:00	100%	CP	

---

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Scientific Name: **EQUUS GREVYI** Accession #: **113393**  
Common Name: **GREVY'S ZEBRA** Male  
Name: **Bumba** Birth: **2 Aug. 1998**

---

Parasitology Examination:  
Submission Data >> Sample ID: **1998A094**  
Type: Fecal sample Date collected: **28 Dec. 1998**  
Purpose: **ROUTINE EXAMINATION** Collected by: **CS**

Collected from: Enclosure: **VELDT #1**  
Group of specimens housed together.

Examination Data >>  
Storage: **refrigerated** Date examined: **29 Dec. 1998**  
Consistency: **formed**  
Gross appearance: **Typical** by: **CAR**

Tests & Results >>  
**FLOTATION - NA NITRATE NO PARASITES SEEN**

---

Clinical Note: **9 Apr. 1999**  
Sedated today for pre-shipping exam. He is being sent to the National Zoo sometime this month. Sedated using 40mg xylazine and 40mg butorphanol IM via dart. Sedation adequate for restraint achieved in 20mins. Blood was drawn and submitted for CDC, chem, bank, and Coombs test. Fecal sample taken for exam. Upon examination of the scrotum, no testicles could be palpated. Sedation was partially reversed with 200mg naltraxone IV. Recovery was rapid and uneventful (CAR)

---

Clinical Note: **9 Apr. 1999**  
Rx: RABIES VACCINE (KILLED) 1 ml IM  
Rx: ENCEPHALOMYELITIS ENV/TETANUS TOXOI 1 ml IM (CWA)

---

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Scientific Name: *EQUUS GREVYI* Accession #: 113393  
Common Name: GREVY'S ZEBRA Male  
Name: Duumba Birth: 2 Aug. 1998  
Age: 8W 6D

---

**Clinical Note:** 26 Apr. 1999  
HX: Doing well, no lth access to water today.  
PRD: Visual obs: all skin wounds appear dry, mild LH lameness but  
other wise calm and well adjusted.  
A: Lameness, mild, LH  
r/o transport injury soft tissue  
P: Monitor lameness (LS)

---

**Submission Data >>** Sample id.: 901318  
Type: Fecal sample Date collected: 25 Apr. 1999  
Purpose: QUARANTINE EXAMINATION #1

**Collected from:** Enclosure: QUAR  
From an individual specimen

**Examination Data >>** Date examined: 25 Apr. 1999  
Storage: room temperature  
Consistency: Not specified  
Gross appearance: Typical

**Tests & Results >>** FLOTTATION - SUGAR NO PARASITES SEEN

---

**Clinical Note:** 27 Apr. 1999  
HX: Abrasions over eyes healing well. Active and eating well (LS)

---

**Clinical Note:** 30 Apr. 1999  
HX: All abrasions healing, but fresh abrasions both hocks.  
PRD: visual obs: Superficial new abrasions over ocular aspect of both  
hocks (from lying down on cement?)  
A: ABRASIONS: MINOR, HOCKS  
r/o rough substrate  
P: switch to rubber pads and shavings and spot cleaning (LS)

---

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Medical History Report - Individual Specimen  
NATIONAL ZOOLOGICAL PARK

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Scientific Name: *BOVUS OREUVI* Accession #: 113393  
Common Name: OREUVI'S SEBRA Male  
Name: Surumba Birth: 2 Aug. 1998  
Tag/Brand: 028-751-001  
-----

Prescription Record (continued):  
11 May. 1999 1003 T2

-----

Clinical Note: 12 May. 1999  
Hx: Abbreviated quarantine complete. Released to HR today. Fecals  
have been negative.  
Proc: Visual obs: all abrasions healing well, slightly overweight with  
a very round abdomen.  
P: Begin routine deworming 1x/yr: Eby, ivermectin, pyrantel.  
Advised HR staff to use caution when transitioning onto new grass  
in new exhibit. (LS)

-----

Submission Data >> Sample ID: 991566  
Type: Fecal sample Date collected: 12 May. 1999  
Purpose: QUARANTINE EXAMINATION #1

Collected from: Specimens: DAN C  
From an individual specimen.

Examination Data >> Date examined: 12 May. 1999  
Storage: room temperature  
Consistency: formed  
Gross appearance: Typical

Tests & Results >>  
FLORINATION -- SUGAR NO PARASITES SEEN

-----

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Scientific Name: *EQUUS GRESVYI* Accession #: 113393  
Common Name: GREVY'S ZEBRA Male  
Name: Buumba Birth: 2 Aug. 1998  
Tag/Brand: 028-731-501

---

**Clinical Note:** 17.May.1999  
Obs: In a small enclosure up at the cheetah center that is fairly well grassed (a mixture of grass and broad leaf weeds). Noted to be eating grass the majority of the day. Keepers remark that his abdomen is getting distended. Stools are normal. No signs of abdominal discomfort. Being fed 2 flakes of hay and two pounds of "low protein" a day.  
Obs: Abdomen is mild to moderately distended.  
A: Overweight  
P: Cut back grain to one pound bid. (DLM) (LS)

---

**Clinical Note:** 18.May.1999  
Obs: Keepers report distended abdomen, but eating well.  
From: Visual obs: eating hay, all plant material closely cropped in the holding yard, normal stools, overweight.  
P: Reduce pellets 50% to 1#, reduce hay 50% to 2 flakes (LS)

---

**Clinical Note:** 27.May.1999  
Obs: Keeper ID: Davis reports that zebra has been lame on the right front leg for 1-2 days location. Lameness worse in the afternoon.  
Procedure: Visual exam (AM): Zebra is moderately lame on the RF. There is no swelling of the coronary band, fetlock, or carpus. There were no hoof wall or sole abnormalities noted. Tends to point toe as if pain is in the caudal solar region. Ground in enclosure has a lot of gravel that varies in size.  
A: Rinse, treat, RF  
P: Monitor lameness. If remains static or slight improvement, likely sole bruise. However, if worsens, it may be a sole abscess in which case drainage needs to be established.  
Consider course of phenylbutazone for arthropedic analgesia. (DLM) (LS)

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Scientific Name: **EQUUS GREVYI** Accession #: **113393**  
Common Name: **GREVY'S ZEBRA** Sex: **Male**  
Name: **Brunba** Birth: **2.Aug.1998**  
Tag/Brand: **028-731-001**

---

**Clinical Note:** 2.Jun.1999  
Hx: Keepers report that lameness on RF has resolved. Eating and acting normal.  
A: Lam, RF, likely sole bruise, resolved  
(DLM) (JG)

---

**Clinical Note:** 3.Jun.1999  
Hx: Keepers fed hay this morning then let zebras out into new exhibit with lush grass. Brought back in 30 minutes later by encouraging them with apples and cone pellets.  
A: Continue gradual adjustment to pasture  
At risk for laminitis, colic  
P: Continue to allow out onto exhibit grass for gradually increasing periods of time.  
Monitor for any developing signs of laminitis or colic. (JG)

---

**Submission Data >>** Sample id: 993056  
Type: Fecal sample Date collected: 28.Sep.1999  
Purpose: ROUTINE EXAMINATION

**Collected from:** Enclosure: HH 6  
Group of specimens housed together.

**Examination Data >>** Date examined: 28.Sep.1999  
Storage: Room temperature  
Consistency: Formed  
Gross appearance: Typical

**Tests & Results >>**  
FLOTATION - HUGER NO PARASITES SEEN

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Scientific Name: *EQUUS GREVYI* Accession #: 113393  
Common Name: GREVY'S ZEBRA Male  
Name: Duumba Birth: 2 Aug. 1998  
Tag/Brand: 026-791-501

---

**Clinical Note:** 1.Feb.2000

Re: Curator reports animal thin, left portion of food from last PM, drinking and defecating small amounts. Late afternoon, keeper reports animal down in stall, unable to stand despite multiple efforts.

From:

1. Visual exam 0200 (in early afternoon): animal eating weakly walking with stiff, upright rear gait. Small muscle mass of chest and hindquarters. Ears drooping.

A: Wt loss, severe  
r/o hypernatrition due to behavior vs dental or other

Weakness  
r/o neurologic, metabolic  
Poor anesthetic risk

P: Exam ASAP  
Given time of day and cold ambient temps, plan for first thing tomorrow

Increase food offered to test appetite  
Recommend separating from other zebras o/n to monitor food intake and stool/urine output, and maintain body temp  
Keepers concerned about stress to zebra if separated in stalls o/n as they have not been regularly locked in at night

Comment: discussed hierarchy among the 2 zebras. This individual is apparently the dominant of the 2 so lack of access to food seems unlikely.  
Also reviewed parasitology screening - no parasites seen in this group. (LHS)

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Scientific Name: EQUUS GREVYI	Accession #: 113393
Common Name: GREVY'S ZEBRA	Sex: Male
Name: Burumba	Birth: 2 Aug 1998
	Tag/Brand: 028-731-001

-----

Clinical Note: 1.Feb.2000

Re: 1400: Keepers report zebra down in stall

A. Recumbent:  
r/o weakness, neurologic, hypothermia  
Prognosis poor

B. Exam note

Procs (GHS and RAY):

1. Sedation: Detomidine 10 mcg (50 mcg/kg) and butorphanol 10 mcg (50 mcg/kg) IM via pole syringe in left tricep. Animal sedated and able to be blindfolded at 9 minutes. Some movement in lateral recumbency, supplemented with butorphanol 5 mcg and detomidine 5 mcg IV at 26 min. Some muscle twitching and rear limb stiffness; supplemented with midazolam 2 ml (10 mg) IV at 32 min with good effect.

MR 32 (15 min) and 36 (58 min)

RR 16 at 15 min

SPO2 83%

Reversed with yohimbine 25 mcg (12.5 mcg IV, 12.5 mcg SQ) at 61 min and Valproic acid 100 mcg IM at 66 min, with slight effect. Myasthenia present for several minutes, unable to stand but made attempts at least observation

Keepers called as instructed 1 hr and 2 hr later; described zebra as more alert and more alert but still recumbent.

2. PER: Hypothermic (93.1).

M/E: Thin with decreased muscle mass of shoulder girdle, chest and pelvis. EENT: Hydration appears OK, no sign of dental trauma or infection; mucous membrane color pink

H/E: Auscultate normally

ABD: Very reduced gut sounds

3. Blood sample: STAT EDIA and clot tube

4. IV catheter: 18 ga 2 inch, right jugular vein

5. SPO2 recorded using Nellcor Symplicity w/ probe on the tongue

6. Bed stall with hay

7. Turn on heater in stall

Rx: LRS 4 l IV (warmed)

Rx: B vitamins 5 ml IV (in 3 l LRS)

Rx: FFP 15 ml IM R caudal thigh

Rx: Baxcel 4 g IV

Rx: Bannamine 4 ml (200 mg) IM R caudal thigh

Rx: Dexamethasone 12 ml IV

UWB: initial: iadwork nondiagnos@cc

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Scientific Name: *EQUUS GREVYI* Accession #: 113393  
Common Name: GREVY'S ZEBRA Male  
Name: Bumba Birth: 2 Aug. 1998  
Tag/Brand: 028-791-001

---

**Clinical Note:** 1 Feb. 2000

A: Hypothermia  
r/o exposure, lack of an fat stores  
Underweight, severe  
r/o hyponutrition vs metabolic disease  
Recumbent  
Poor prognosis

P: Keep as warm as possible; curator to secure a spare heater for this stall to supplement wall panel.

Recheck AM  
Increase diet  
Consider WSK and NEP titers, rabies  
Repeat fecal for parasite screen (RAY)

---

**Submission Data >>** Sample Id.: 2000-0320  
Type: Fecal sample Date collected: 1 Feb. 2000  
Purpose: POST-MORTEM EXAMINATION

**Collected from:** Enclosure: REMOVED  
Pres an individual specimen.

**Examination Data >>** Storage: room temperature Date examined: 1 Feb. 2000  
Consistency: Not specified  
Gross appearance: Not specified

**Tests & Results >>**  
FLOTATION - SUGAR NO PARASITES SEEN

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Scientific Name: EQUUS GREVYI	Accession #: 113393
Common Name: GREVY'S ZEBRA	Sex: Male
Name: Buzuba	Birth: 2 Aug. 1998
	Tax/Hand: 028-791-001

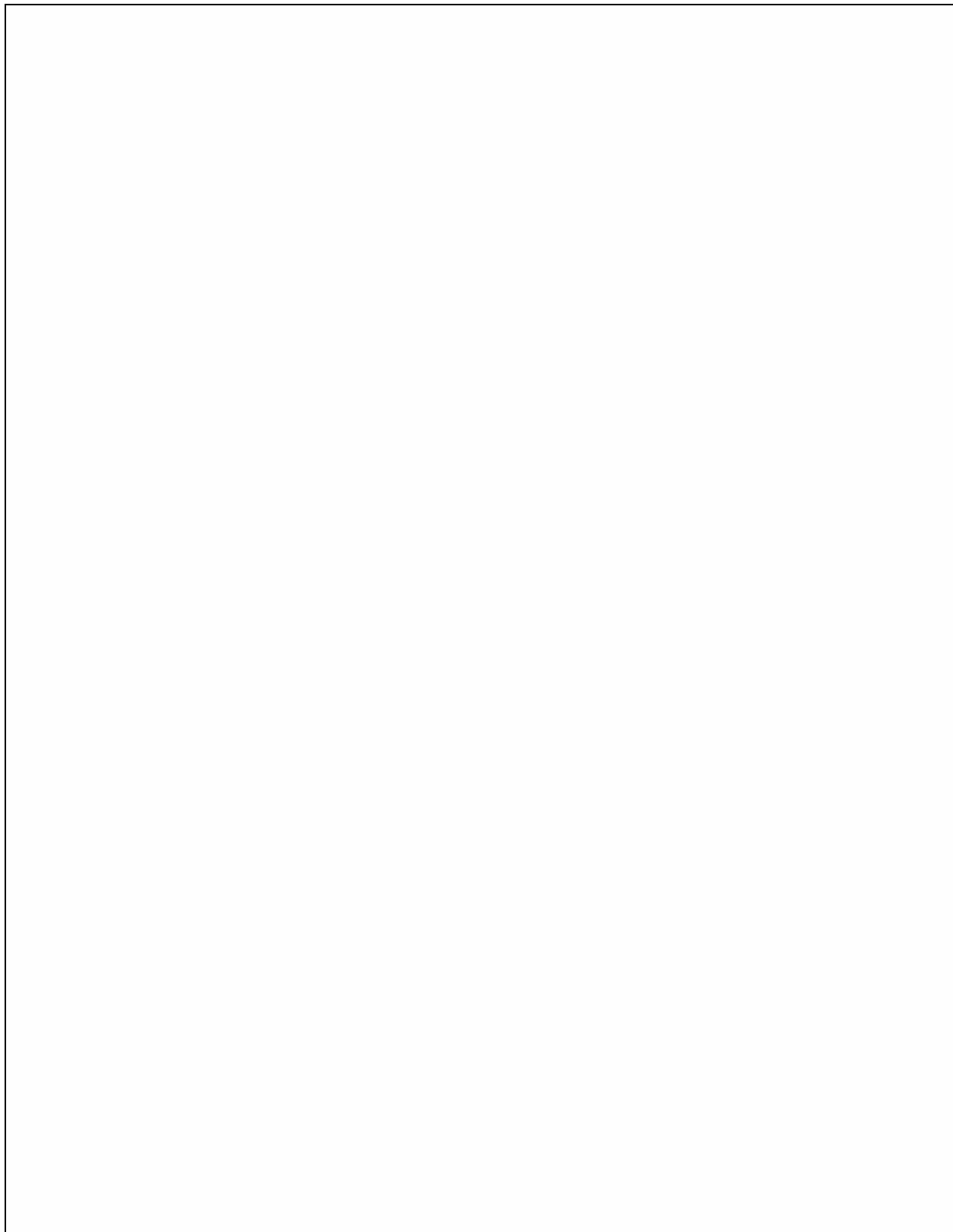
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Clinical Note: 2.Feb.2000

Obs: found dead in stall this am  
Temp: visual exam: stall is cold; no supplemental heater is present  
and wall panel is barely putting out heat. Evidence that zebra  
struggled somewhat as hay is displaced and animal is facing the  
opposite direction. (1999)

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## APPENDIX E

Zoo Registrar – Job Description  
Zoological Registrars Association  
(<http://www.zra.homestead.com>)

### Zoo Registrar - Job Description

**TITLE: Zoo Registrar**

**DESCRIPTION**

This is a management position. Serves as a member of the Animal Management Team, assists in the development and implementation of the zoo's Collections Management Policy, and its resulting Collection Plans. Monitors all transactions for adherence to those policies. Manages Animal Records and ensures the maintenance and quality of animal records for use in the management and development of husbandry and breeding programs, preparation of scientific publications, and provision of data for cooperative ventures at both the regional and international level. Serves as a liaison and information source to other departments and organizations. Provides a complete inventory and record of all animal transactions. Monitors legislation for compliance with wildlife laws. Collaborates with curators and works under the supervision of the Director.

**MAJOR DUTIES AND RESPONSIBILITIES:**

Serves as principal advisor to the Director on registration and collections management, adherence to collections management policy and to senior staff on legal and logistical aspects of collections activities. Participates with administrative, curatorial and other support staff in implementing and reviewing various collections management objectives, setting and developing policy and procedures.

Monitors collection activity for compliance with policy and procedure and advises Director of problems and progress. Prepares reports on collections activity and management to the Director and other institutional officials as scheduled and on own initiative.

Monitors status of legislation pertaining to wildlife and transport procedures. Procures and maintains required Federal, State, and Local permits necessary for the maintenance and transport of wildlife in accordance with regulations. Files annual reports and renews permits as needed.

Sets procedures for domestic and international shipments of live animals, parts and products. Checks legal regulations and zoo policies for compliance, directs document preparation, logistics planning, scheduling and quarantine for animal shipments. Establishes and implements documentation standards for shipment records with advice of legal council and curatorial staff in coordination with national and international standards and requirements.

Develops and directs the collection and maintenance of an inventory of the zoo's animal collection, and records of daily transactions including shipments, births, deaths, behavioural, reproductive and medical notes. Reports these activities to the administrative, curatorial and appropriate staff.

Develops procedures and systems for inventory control of the collection via automated and manual systems. Reviews record-keeping and transaction procedures, implementing improvements to standards of records management.

Develops and implements internal and external quality control measures to ensure the quality of institutional animal records data.



Serves as liaison to the International Species Information System (ISIS), submits data to this system, and analyzes and disseminates data received from this system.

Serves as a liaison between the institution and outside organizations/institutions, as well as other departments within the zoo on matters of animal records and related issues. Interacts with board members, directors, curators, registrars, keepers, researchers, customs brokers, lawyers, and government officials.

Works with curators and keepers through education/training programs and regular contact to improve record systems, and solve problems.

Compiles an animal inventory on an annual basis that includes data regarding activities in the animal collection.

Composes loan agreements with administrative, curatorial and legal staff, and monitors the status of loan specimens.

Maintains files of all documents related to animal transactions (eg., loans agreements, contracts, permits, etc.).

Provides institution data for studbook reports, questionnaires, surveys and Species Survival Plan updates, or directs to appropriate staff members.

Acts as a data specialist providing statistical analysis and reports for various departments regarding the animal collection.

Performs genealogy searches for use in the selection of appropriate specimens for breeding/exhibit for in-house populations as well as proposed incoming animals.

Evaluates records of animal management programs to determine historical trends and recommend improvements where necessary.

Participates in the development and implementation of conservation projects in accordance with goals established by the institution.

Assists in the zoo's participation in Species Survival Plans by maintaining SSP correspondence, generating computer analysis using population genetics software, and by attending masterplanning sessions.

Monitors SSP, TAG, FIG and various national as well as international programs to assist in the long-term management and development of captive management programs, and the preservation of endangered species.

Prepares statements concerning proposed legislation and governmental actions regarding wild and captive animals.

**QUALIFICATIONS:**

Four year college degree in biology or related field plus two years experience in a registrar-type position in a zoological institution. Previous animal experience desirable.

Knowledge of concepts, principles, and practices of professional museum and zoo registration methods and collection management standards.

Knowledge of inventory accession and record-keeping practices.

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Knowledge of zoological nomenclature.

Knowledge of the laws regulating animal acquisition, disposition, exhibition, husbandry standards, and transportation within the U.S. and abroad is desirable.

Knowledge of statistics and population management skills is desirable.

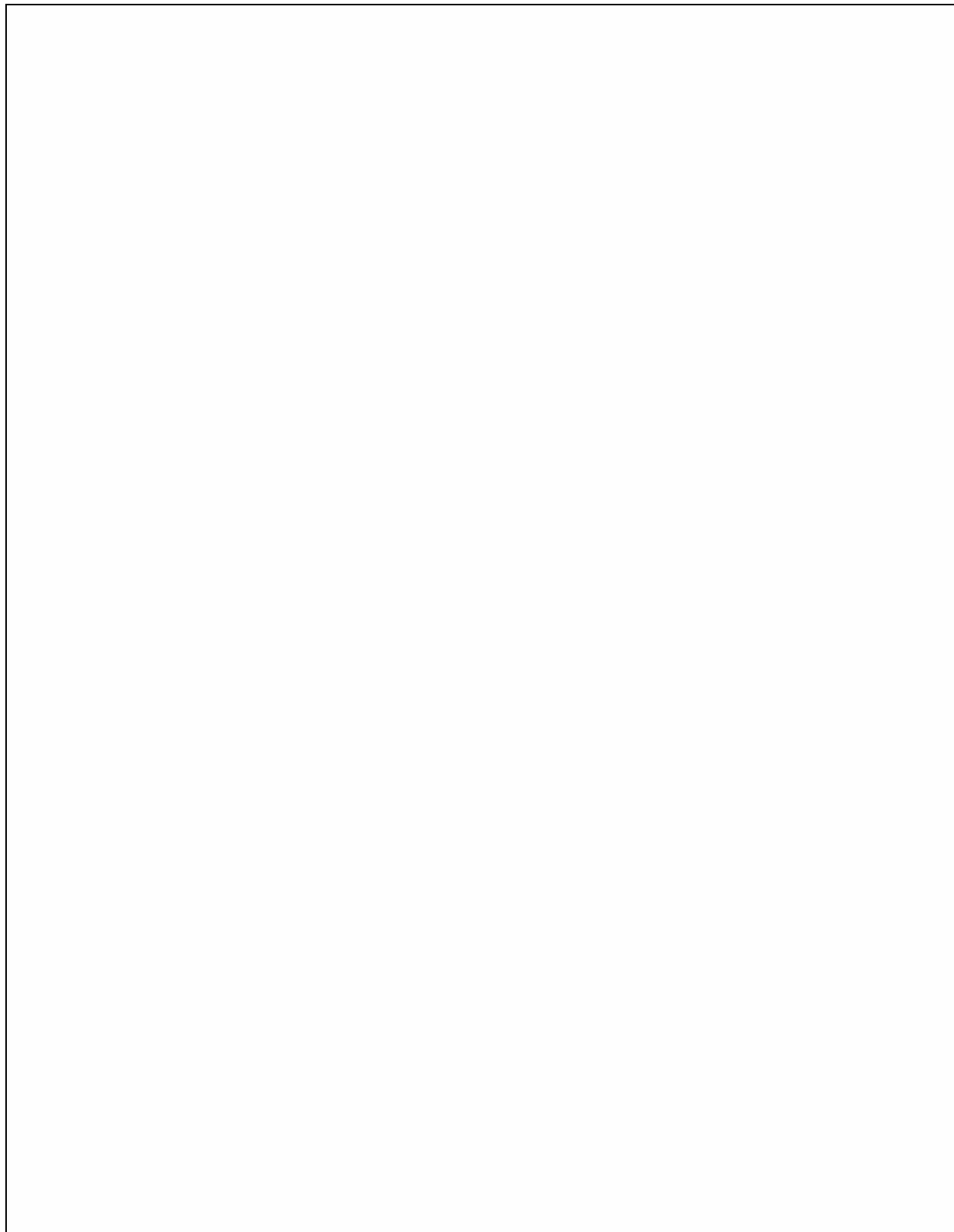
Experience with computers and animal records software (eg., ARKS, SPARKS). Experience with word processing software.

Ability to collect and collate information from a variety of sources into concise and accurate reports.

Good communication and organizational skills.

Attention to detail.

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## APPENDIX F

### Public Meeting Agendas

#### Wednesday, August 27, 2003 – Washington, DC

##### Session 1: 10:30 am to 12:30 am

- 10:30**      **Welcome and Introductions**  
Dr. R. Michael Roberts, Chair  
National Academies Committee on the Review of the Smithsonian Institution's National Zoological Park
- 10:40**      **Sponsor Perspectives**  
Paul Vinovich, Staff Director  
Committee on House Administration
- Dr. David Evans, Under Secretary for Science  
Smithsonian Institution
- Dr. Lucy Spelman, Director  
Smithsonian Institution's National Zoological Park

**12:30 PM**      **Adjourn for Lunch**

##### Session 2: 2:00 pm to 3:30 pm

- 2:00**      **Welcome**  
Dr. R. Michael Roberts, Chair  
National Research Council Committee on Review of the Smithsonian Institution's National Zoological Park
- 2:10**      **Public Comments (Registered persons)**
- 3:00**      **Public Comments (Open)**
- 3:30**      **Adjourn**

#### Thursday, October 2, 2003 – Washington, DC

##### **Animal Care and Management in Zoos: Past, Present, and Future**

- 8:30**      **Zoological Institutions: Evolution over Time**  
Mike Hutchins, AZA
- 9:15 a.m.**      **Zoo Animal Medicine and Veterinary Care**  
Lynn Kramer, Denver Zoo
- 10:00 a.m.**      **Zoo-Animal Nutrition**  
Ann Ward, Fort Worth Zoo  
Mark S. Edwards, Zoological Society of San Diego

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**10:45 a.m. Accreditation and Inspections of Zoological Institutions**

Denny L. Lewis, AZA  
Richard Watkins, APHIS

**11:30 a.m. Strategies for Record Keeping Systems at Zoos: Insights from the Zoo and Beyond**

J. Andrew Teare, Jacksonville Zoological Gardens  
Christian Newcomer, Johns Hopkins University  
Rosanne Whitehouse, University of Michigan Hospitals and Health Centers

**12:30 p.m. Public Comment**

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## ABOUT THE AUTHORS

**R. Michael Roberts, Ph.D., (NAS)** (Chair) is the Curator's Professor of Animal Science, Biochemistry and Veterinary Pathology at the University of Missouri. He is best known for his contributions in facilitating our understanding of embryo-maternal communication during the early stages of pregnancy. Roberts was the first to discover that early placentas produce interferons that mediate maternal recognition of the embryo in cattle and sheep. He has broad expertise in plant and animal physiology and experience with the National Academies' deliberative study process. In addition to his current position, Roberts has served as Chair of the Veterinary Pathobiology Department at Missouri from 1995 to 1998, and Chief Scientist for the USDA's National Research Initiative from 1998 to 2000. He was elected to the National Academy of Sciences in 1996. Roberts received his Ph.D. in plant physiology and biochemistry from Oxford University, England, in 1965. Among his numerous awards and honors, Roberts was named a Fellow of the World Health Organization (1977), and has been awarded the U.S. Department of Agriculture Distinguished Scientist (1992), Alexander von Humboldt Award for Agriculture (1996), and the Wolf Prize for Agriculture (2003). He previously served on the National Research Council Committee on Defining Science-Based Concerns Associated with Products of Animal Biotechnology, and currently serves on the Editorial Board of The Proceedings of the National Academy of Sciences.

### Members

**Joseph W. Alexander, D.V.M.**, is Vice President for Research and External Relations at Oklahoma State University, and previously was the Dean of the College of Veterinary Medicine. His responsibilities in administration of research services include ensuring that all research programs and policies are in compliance with state and federal regulations. He has extensive experience with the administration of veterinary hospitals. Alexander's research has focused on orthopedics and dysplasia in cats and dogs, with additional research involving marine mammals. While at Oklahoma State University, he oversaw the operation of the Boren Veterinary Medical Teaching Hospital. During his tenure with Virginia Tech, he was the Director for the Veterinary Medical Teaching Hospital. Alexander was selected as a Distinguished Practitioner by his peers in the National Academy of Practice in Veterinary Medicine in 1997. He is a past president of the Association of American Veterinary Medical Colleges and a past president of the International Association of Aquatic Animal Medicine. He has also been a Diplomate of the American College of Veterinary Surgeons since 1979. He is the editor of several books on the veterinary clinics of North America, and orthopedic diseases. Alexander has a B.S. in animal science from the University of Arizona, an M.S. in educational administration from the University of Tennessee and supervision, and a D.V.M. from Colorado State University.

**Bradford S. Bell, Ph.D.**, is an Assistant Professor of Industrial and Labor Relations at Cornell University. Previously, he was a lecturer in industrial and organizational psychology at Michigan State University. Bell has experience in organizational psychology studying the implications of integrating the features of active learning techniques into complex and dynamic learning environments. His primary research focuses on developing learning

systems that can enhance individual, team, and organizational effectiveness. His most recent research examines the implications of errors for individual and organizational learning. Bell's research has also examined the impact of individual attributes on learning, and the implications this has for designing effective organizational learning systems. His work has been published in numerous journals and books. He has also worked as a consultant, designing training and development, selection, and performance management systems for a variety of public and private organizations, including the Michigan Occupational Safety and Health Administration, Veterinary Centers of America, the Michigan Center for Truck Safety, and the Toledo Police Department. He is a member of the Society for Human Resources Management, the American Psychological Association, the American Psychological Society, and the Society for Industrial and Organizational Psychology. Bell received his M. Am. and Ph.D. in industrial and organizational psychology from Michigan State University, and his B.A. in psychology from the University of Maryland at College Park.

**Kurt Benirschke, M.D.**, is a Professor Emeritus and former Chair of the Department of Pathology at the University of California, San Diego. He also has served as Director of Research at the San Diego Zoo, and Chair of the Department of Pathology at the Dartmouth Medical School. Benirschke served on the Board of Directors (1986-2000) and as President (1998-2000) of the Zoological Society of San Diego. He has served as a consultant to the National Institutes of Health, World Health Organization, the Armed Forces Institute of Pathology, and Max Planck Institute for Evolutionary Anthropology. He has expertise in pathology, zoo research, and zoo administration. He received his M.D. in 1948 in Hamburg, Germany. Benirschke was elected to the New York Academy of Sciences in 1993 and the American Academy of Arts and Sciences in 1994. He previously served on the National Research Council Committee on the Use of Animals in Biomedical and Behavioral Research and Panel on Microlivestock. Benirschke was awarded the American Zoo and Aquarium Association's highest honor, the R. Marlin Perkins Award, in 1998.

**Janet Brannian, M.A.**, is an Adjunct English Instructor at University of Sioux Falls and freelance journalist. She has experience as a zookeeper and animal technician. From 1983 to 1988 she was a Bird Keeper, then an Animal Technician at the Kansas City Zoo, where she maintained the animal collection and trained the zoo volunteers to handle education animals. Brannian also supervised zookeepers in the bird department. Brannian was a science museum educator at the Oregon Museum of Science and Industry from 1990-1992, developing and presenting science demonstrations to museum visitors, and outreach classes to local schools. She currently volunteers at the Sertoma Butterfly House, preparing diets and providing care for butterflies and other invertebrates, and at The Outdoor Campus, providing care for education animals. Brannian received her B.A. (1981) in psychology from the University of Missouri and M.A. in English from the University of South Dakota.

**Charles C. Capen, D.V.M, Ph.D., (IOM)** is a Distinguished University Professor in the Department of Veterinary Biosciences at The Ohio State University. Capen received his D.V.M from Washington State University, and his M.S. and Ph.D. in veterinary pathology from The Ohio State University. He has expertise in comparative pathology, medicine and toxicology. Capen has been a Diplomate of the American College of Veterinary Pathologists since 1965, and was named a Distinguished Member in 1999. He is a past president of the Society of Toxicologic Pathologists and the Association of Veterinary Pathology Chairpersons in North America. Capen has served on the editorial boards of Drug and Chemical Toxicology, Experimental and Toxicologic Pathology, and Food and Chemical Toxicology. He has served on the U.S. Environmental Protection Agency's Science Advisory Panel on Endocrine Disruptor Screening Programs, and the World Health Organization's International Agency for Research on Cancer.

**Rhetaugh Graves Dumas, Ph.D., RN, (IOM)** is Vice Provost Emerita, Dean Emerita and Lucille Cole Professor of Nursing at the University of Michigan School of Nursing. Previously, she was the Deputy Director of the National Institute of Mental Health (NIMH) of the U.S. Department of Health and Human Services. Dumas is currently finishing a book on the complexities of leadership in human groups and organizations, and continues to provide lectures, consultations, and technical assistance to students, faculty, and administrators in nursing, health care, and various other fields. She has expertise in health care and administration. She is a fellow and former President of the American Academy of Nursing and the National League of Nursing, and served as a member of President Clinton's National Bioethics Advisory Board. Dr. Dumas holds a B.S. degree in nursing from Dillard University, New Orleans, an M.S. in Psychiatric Nursing from Yale University, and a Ph.D. in social psychology from the Union Institute of Cincinnati, Ohio. She was elected to the Institute of Medicine in 1984. She previously served on the National Research Council Committee to Review the Department of Defense's Breast Cancer Research Program, Committee on A National Neural Circuitry Data Base: A Shared Resource for the Basic and Clinical Neurosciences,

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and Committee to Plan a Major Study on National Long Term Care Policies.

**Lester Fisher, D.V.M.**, is founder and President of LEF Company, a consulting firm to nonprofits. He also is Vice President of the Morris Animal Foundation and Director Emeritus of the Lincoln Park Zoological Gardens in Chicago, where he served as director for 30 years. He received his D.V.M. from Iowa State University in 1943. Fisher was also the owner and director of Berwyn (Illinois) Animal Hospital, Associate Professor in the Department of Biology at DePaul University, and Adjunct Professor of Zoology at the University of Illinois. He has expertise in zoo management and zoo veterinary medicine. Fisher was a member of the International Union of Directors of Zoological Gardens (Vice President 1980-1983; President 1983-1986) and the American Association of Zoo Veterinarians (President 1966-1969). As the second American Zoo and Aquarium Association President, he oversaw the establishment of the International Species Information System. During his presidency, a significant increase in federal legislation affecting zoos was dealt with (including major revisions to the Endangered Species Act), and the Regional Conference Proceedings began publication. Fisher was awarded the American Zoo and Aquarium Association's highest honor, the R. Marlin Perkins Award, in 1996.

**Harold F. Hintz, Ph.D.**, is a Professor and Chair Emeritus of the Department of Animal Science at Cornell University. He has extensive expertise in animal nutrition, with a specialization in energy, mineral, and protein and amino acid metabolism in equines. Throughout his career, Hintz has also conducted nutrition research in felines, canines, and a variety of zoo animals. He is currently president of the American Academy of Veterinary Nutrition and is president emeritus of the Equine Nutrition and Physiology Society. In 2002, Hintz was named an Honorary Diplomate of the American College of Veterinary Nutrition. Previously, he has served as chair on both the National Research Council Committee on Animal Nutrition (1992) and Committee on Nutrient Requirements of Horses (1978). He also served as chair of the 2002 meeting of the International Conference on Equine Exercise Physiology. Hintz received his B.S. from The Ohio State University in animal science, and M.S. and Ph.D. from Cornell University in animal nutrition.

**Paul W. Johnson, Ph.D.**, is the owner and operator (along with his family) of Oneota Slopes Farm near Decorah, IA, since 1974, where he has been involved raising dairy, corn, soybeans, hay, beef cattle, sheep, and Christmas trees. He has expertise in practical care and feeding of domestic livestock, and experience in managing a multifaceted operation involving animals and plants. Johnson served three terms in the Iowa State Legislature, 1984-1990, and was chief of the Soil Conservation Service (now the Natural Resources Conservation Service, NRCS) at the U.S. Department of Agriculture from 1993 to 1997. He served as the director of the Iowa Department of Natural Resources from 1999 to 2000. Johnson received a B.S. and an M.S. in forestry from the University of Michigan, and conducted doctoral research in tropical-forest ecology in Costa Rica. He holds an honorary doctorate from Luther College in Decorah, IA. He served as a Peace Corps volunteer in Ghana from 1962 to 1964. Johnson served two terms on the National Research Council Board on Agriculture (1988-1993), where he reviewed the National Research Council report on alternative agriculture and took part in the development of the National Research Initiative Competitive Grants Program. He served as an ex officio member of the Committee on Long Range Soil and Water Conservation Policy in 1990-1993, and helped to implement many of its recommendations while chief of NRCS. He most recently served on the National Research Council Committee on Opportunities in Agriculture.

**Maxim Kiefer, C.I.H.**, is Director of the Atlanta Field Office and Senior Industrial Hygienist at the National Institute for Occupational Safety and Health (NIOSH) of the Centers for Disease Control and Prevention in Atlanta, Georgia. He is responsible for supporting the NIOSH health hazard evaluation program by planning, organizing, and conducting comprehensive industrial hygiene assessments in all industrial sectors involving chemical, biological, and physical hazards. Kiefer has expertise in providing technical advice, assistance, and training on a wide range of industrial hygiene matters to employers, employees, and the occupational safety and health community. He has served as a weapons inspector for the United Nations in Cyprus, and is a Certified Hazardous Materials Emergency Response Technician. He received the Division of Health and Human Service Award for Distinguished Service during the emergency response to the World Trade Center. He received an M.S. from Colorado State University (1984) and B.S. from the University of Georgia (1982), both in environmental health.

**Rebecca Remillard, Ph.D., D.V.M.**, is a Staff Veterinarian and Clinical Nutritionist at MSPCA Angell Memorial Animal Hospital. She is also Director of Hospital Continuing Education and Director of Clinical Research at MSPCA Angell Memorial Animal Hospital. As a practicing veterinarian in a large state-of-the-art medical center, she has extensive knowledge of current veterinary medicine practices and expertise in animal nutrition. Her major



research interest is finding objective measures of nutritional status in animals to augment evaluations of patient progress. Remillard is a licensed veterinarian in Massachusetts. Since 1991, she has been a Diplomate of the American College of Veterinary Nutrition certified in comparative veterinary nutrition. She received a B.S. from Purdue University, an M.S. from University of Maine, and a Ph.D. from Colorado State University, all in animal science, and her D.V.M. from Tufts University. She is a past president of the American Academy of Veterinary Nutrition and Vice President of the American College of Veterinary Nutrition.

**Bernard A. Schwetz, D.V.M.**, is the Acting Director for the Office for Human Research Protections at the Department of Health and Human Services. Schwetz earned his D.V.M. from the University of Minnesota and Ph.D. in pharmacology from the University of Iowa. He is nominated as a member of the committee because of his expertise in developmental and reproductive toxicology. Dr. Schwetz is a diplomate of the American Board of Toxicology. Previously, he was Acting Deputy Commissioner, Acting Principal Deputy Commissioner, and Senior Advisor for Science at FDA. He was also Director, National Center for Toxicological Research. He was also associate director of the National Toxicology Program at NIEHS. Dr. Schwetz is a member of the Society of Toxicology (SOT) and is past president of the Reproductive Toxicology Specialty Section of the national organization and of the North Carolina and South Carolina Regional Chapters of the SOT. He was editor of *Fundamental and Applied Toxicology* from 1986-1992, and serves on the Editorial Advisory Board of *Environmental Health Perspectives* and *Critical Reviews in Toxicology*. Dr. Schwetz was elected to the Institute of Medicine in 1998.

**Thomas M. Yuill, Ph.D.**, is Emeritus Director of Gaylord Nelson Institute for Environmental Studies at the University of Wisconsin. He received his B.S. (1959) in wildlife management from Utah State University, and M.S. (1962) and Ph.D. (1964) in wildlife ecology and veterinary science (virology) from the University of Wisconsin. Yuill is also a professor emeritus in the Department of Animal Health and Biomedical Sciences and Department of Wildlife Ecology at the University of Wisconsin. He has expertise in virus ecology, arthropod-borne virology, animal ecology, and the environmental effects on epizootiology of animal diseases (emphasis on wildlife). Yuill is past president of the Organization for Tropical Studies and of the Wildlife Disease Association, and past Director for the Center for Livestock in International Development. He is a consultant to the National Institutes of Health (and past chair, U.S.- Japan Panel on Viral Diseases), Environmental Protection Agency, and U.S. Agency for International Development, and has served on the Board of Directors of the Tropical Agricultural Center for Research and Instruction (CATIE), headquartered in Costa Rica. He previously served on the National Research Council Panel on Microlivestock.

**Stephen L. Zawistowski, Ph.D.**, is Senior Vice President and Science Advisor of The American Society for the Prevention of Cruelty to Animals. He has worked extensively in animal behavior and welfare. He joined The ASPCA in 1988 as vice president of education, after an academic career that included the University of Illinois, Indiana University, and St. John's University in New York. Zawistowski received his Ph.D. in 1983 and A.M. in 1979 from the University of Illinois in psychology and genetics. Zawistowski is on the Board of Directors for the National Council on Pet Population Study and Policy and is the Chairman of the Animal Behavior Society's Board of Professional Certification. He is a Certified Applied Animal Behaviorist, a Certified Technical Animal Rescue Specialist, and founding co-editor of the *Journal of Applied Animal Welfare Science*.

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