

EDITORIAL

Criteria for the Evaluation of Zoo Research Projects

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INTRODUCTION

The goals of any modern zoo should include basic research, conservation, education, and recreation for the public. Basic research is essential to the aims of conservation and education, in that success in these areas is impossible without a strong foundation of information which can only be derived from scientific studies of high quality. Even the provision of recreational experiences for the public requires knowledge mainly obtained from research. The exhibition of a single animal in a bare cage has little interest compared with a family group of the same species in an ecologically relevant display. Thus, any modern zoo should support an active research program, if only to assist in the successful accomplishment of its other objectives.

Research directions in zoological gardens derive from the unique resource inherent to zoos—a diversity of animals in a confined location. Many zoos have taken advantage of this unique resource and have fostered the study of animals in all areas of life sciences, including the disciplines of genetics, nutrition, ethology, psychology, reproductive physiology, evolutionary biology, pathology, and ecology—to name a few. Some major scientific questions have been addressed in research programs supported by zoological gardens, and significant results have been achieved. For example, Heini Hediger developed some important concepts in ethology through his early studies of zoo animal behavior.

Yet not every research program or proposal is appropriate for every zoo. And judgements must be made as to the value of any particular project for a particular zoo's mission. The costs and benefits of particular projects must be evaluated, using criteria that reflect the overall goals of the institution.

It is often assumed that only large institutions with access to major resources can support research programs. In fact, some of the earliest and most significant zoo research in Europe was in the area of ethology or animal behavior, which was

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inexpensive and required little support other than some coordination between the scientist and the zoo staff. Research does not need to be expensive or complex to be exciting, creative, and of clear scientific merit. Thus, small zoos with limited financial resources can still support a research effort. Indeed, they can gain considerable benefit at little cost by supporting inexpensive but high quality research and by encouraging collaboration with other local institutions.

The purpose of this paper is to discuss a number of criteria that should be addressed in the evaluation of research proposals. The first three criteria are of major importance:

SCIENTIFIC MERIT

Research programs or projects should address important scientific questions, and potentially result in significant advances, of either a theoretical, conceptual, or technological nature. The scientific questions should be well defined and the research design carefully considered. Hypotheses should be tested. If a proposed study is not scientifically sound, it is likely not worth pursuing, regardless of whether every other criterion is fulfilled. If the results of a study are going to be questionable, due to poor research design, or the research question is trivial, then the study will be limited in its applicability.

Alternatively, well-designed studies investigating major scientific questions should be sought and encouraged, even if they do not fulfill most other criteria. Zoological parks must support basic research as part of their overall mission, even if there is no *obvious* current application of the results to the conservation or educational objectives of the institution.

CONSERVATION

At a time when whole ecosystems are being annihilated at alarming rates, the modern zoological park must have a strong commitment to species preservation and conservation. Research programs focusing on the biology of critically endangered species should be given high priority, especially where they will enhance the potential for species survival. Such studies can be conducted at a theoretical or conceptual level, and need not directly use the zoological collection, eg, the development of alternative breeding schemes to maintain maximum genetic diversity in captive populations can be facilitated through computer simulations, without direct access to animals. Moreover, a zoo may support field research on threatened or endangered species.

As already emphasized, such studies may range over a variety of disciplines in the life sciences and, indeed, interdisciplinary efforts (see below) should be pursued for maximal benefit.

However, sole concentration on critically endangered species is short sighted for the following reasons: (a) Domestic and more common exotic species can and have served as research models, and have provided the information needed to successfully conserve a related, but more endangered form. They are usually available in greater numbers and thus can be manipulated more readily. (b) Exotic species which are now common can become threatened or endangered rapidly.

Finally, as the functions of zoological parks converge with national parks and reserves, the data base required for conservation will also converge. Thus, zoos

should support significant field research, regardless of whether or not the objectives involve the conservation of a rare or endangered species.

EDUCATION

Research programs must be encouraged which can substantially contribute to a zoo's educational objectives at all levels, including education of the visiting public, training of the curatorial and keeper staff, undergraduate, graduate, and postdoctoral students, and sharing research findings with the scientific community through publications.

Research programs cost money and are ultimately supported by the public. Zoos must make a serious effort to educate the public concerning the importance of basic research and conservation. The future of zoos resides in an informed public which understands, believes in, and supports the goals of zoological parks.

Additionally, research programs which incorporate more advanced training of staff and students in the life sciences are critical to the future functioning of zoological parks. Every person we train is a resource we can rely on for future assistance as well as a potential teacher of others. Zoo research projects have constraints and may require a different approach than more traditional studies. These differences must be made clear to new researchers and staff unfamiliar with the constraints imposed by the management of exotic animals.

If a research project is to be considered worthy of support, one of the three major criteria (scientific merit, conservation potential, and educational benefit) must successfully be met. Additionally, the following criteria are relevant.

CAPTIVE MANAGEMENT

A research project which ultimately improves the captive management of a species is usually highly regarded. As the wardens of confined populations, we have a commitment to improved living conditions for the specimens in our care. Thus, research resulting in new and beneficial management techniques is and should be attractive. Additionally, research results deriving from poorly maintained specimens have questionable value. However, such applied research may be overemphasized and detract from studies of greater scope and significance. Moreover, they may address only local transient problems and be limited in their applicability. Finally, focusing specifically on applied research drains resources from basic research studies whose future value for management cannot be assessed. Thus, zoo research programs should avoid a parochial insular approach. As an example, zoos should support field research, wherever possible, since basic biological knowledge derived from ecological and behavioral studies in nature may ultimately provide the essential clues to solving captive management problems.

COLLABORATION

The vision of the lonely isolated researcher is persistent in our culture and, indeed, significant findings often derive from the single scientist immersed in a research problem. However, research programs involving a collaborative effort among a variety of individuals, from different departments, institutions, and disciplines, should be encouraged for the following reasons: (a) The zoo will have access to more

resources, both technological and intellectual, with different departments, institutions, and scientists from diverse disciplines involved. This diversity of input should improve the study design, result in a more clearly defined research problem, and make maximum use of the zoo's animal resources. Collaborative efforts can result in a broader perspective and a more significant study. (b) The commitment of the zoo to the project will increase with a collaborative approach.

As an example, the research on giant pandas at the National Zoological Park has emphasized reproductive and social behavior, vocal communication, reproductive physiology, genetics, and nutrition. Within the National Zoological Park, individuals from the Departments of Mammalogy, Animal Health, and Zoological Research have been involved. Additionally, researchers have made use of the volunteer force of the Friends of the National Zoo for some of the behavior studies. Numerous collaborators have participated in these studies, including individuals from the Museum Alexander Koenig in Bonn, Cornell University, National Cancer Institute, Children's Hospital (Washington, D.C.), Zoological Society of London, New York Zoological Society, and Texas A & M University. The collaboration and the commitment of the National Zoological Park to this research program have resulted in a better understanding of giant panda biology than we have for most of the more common ursids and procyonids found in zoos.

Research efforts which involve participation by outside investigators, either from different departments or outside institutions, may encounter resentment from within a department, which can result in obstructive behavior by staff members caring for the species under the study. There are several causes of such conflict. First, each department has its own goals, organization, and routines. Research projects initiated from outside the department will by their nature disrupt normal functions of the department. Thus, the department's autonomy will seem to be compromised. Outsiders may set the pace for the work, by establishing schedules and setting deadlines. Their demands on departmental staff will have an impact on other programs, which the department itself may consider to be of higher priority. Thus, staff may feel as though they have lost the ability to control their lives and that their "homes" have been invaded.

Additionally, when a department oversees a particular species, there is a sense of responsibility and obligation to that species, even a sense of ownership. Since many research projects will involve changes in management procedures, however slight, departmental staff may question the effect of the manipulations or changes requested on the specimens in their care.

Since problems are likely to arise when outsiders initiate a research program, it is essential for the researchers to be sensitive to how they affect the functioning of the relevant zoo department. To alleviate this problem, it is necessary that curatorial and keeper staff play a major role in the project, both in terms of scheduling and as collaborators. The researchers must minimize disruption to the animals and the departmental routines, insofar as is possible. Requests which do not add substantially to the project's significance should be abandoned. Clearly, without a departmental commitment, no research program can be successful.

COMMITMENT OF RESOURCES

Each institution has limited resources, in terms of staff time, equipment, supplies, and available specimens. Clearly, research projects which do not unduly drain

the zoo's resources are to be encouraged. Indeed, behavior studies in zoos have always been popular since they may involve little expensive equipment compared with other disciplines such as genetics, reproductive physiology, and nutrition.

Collaborators have the advantage of providing access to resources, both people and equipment, which a zoo might not be able to afford. Thus, the impact on other zoo priorities can be reduced, especially in small zoos without large budgets.

Prior to approval of any research project, a zoo must be aware of and approve the total resources required to accomplish the study successfully, including the number of specimens involved, keeper time, special housing requirements, equipment needs, and other administrative support. If a proposed study is worth doing, it is worth doing well.

EFFECT ON ANIMAL COLLECTION

Zoos exist to preserve and exhibit a diversity of life forms. Some research will require manipulation of specimens. Research proposals must justify any procedure which involves pain, discomfort, or stress. The following questions derived, in part, from the Animal Behavior Society's Animal Care Guidelines, must be addressed: (a) Are all Federal, State and local regulations being followed, including the Animal Welfare Act (1970), Endangered Species Act (1973), etc? (b) Is the species being used the most appropriate for the study? (c) Is the smallest number of animals required being used? (d) Are there alternative procedures available to achieve the same research goals? (e) Are the animals being maintained so that their species-typical and individual needs are met? (f) Does the scientific gain outweigh the cost to the individual animal or species, in terms of unavoidable stress or discomfort? (g) Has unavoidable stress or discomfort been minimized to the extent possible?

All research supported by a zoo, whether using animals in the collection or in the field, must be conducted in as humane a manner as possible, in line with the zoo's mission to preserve and respect life. However, we must recognize that the value of different animals in our collection is not equal, and a research project considered appropriate for one species may be totally inappropriate for another. Indeed, individual specimens differ in importance, eg, two tigers of the same age and sex may have different value for a zoological park because one may be from an extremely rare gene line with the second deriving from a common genetic background. The conservation mission of a modern zoo requires that we discriminate and differentiate between species and among individuals in the evaluation of research proposals.

ZOO OBJECTIVES

Proposed research should, to the extent possible, complement the zoo's goals and current programs. An investigation of fish parasites in an institution housing few fish might seem to make little sense. Additionally, certain types of studies of domestic species may be inappropriate in a zoo setting. However, if the research has broad scientific-conservation significance, it is worthy of support, regardless of whether the study involves domestic forms or is conducted in the field. In such cases, advances of considerable importance to the zoological community may be achieved, because of the research question being addressed, rather than the species being studied or the site of the investigation (see Appendix).

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APPENDIX

Research mission statement: National Zoological Park

The missions of the National Zoological Park (NZN) include the conservation of wildlife and living systems, research in the life sciences, education of the public, staff, and students, and recreation for visitors.

The research mission is pivotal to the success of the three functions of conservation, education, and recreation, in that the knowledge accumulated from basic and applied research provides the foundation for all other major programs. Conservation of wildlife both in captivity and in natural settings requires intimate and detailed knowledge of the species and ecosystems to be conserved. We cannot educate our visitors, staff, or students without a baseline of information. We cannot even provide the visitor with the recreational experience unique to a zoological park—the awe generated by a close-up view of the diversity of living organisms—without some reference to our knowledge of living systems. Thus, all other missions of the zoo are informed by our research mission, which therefore is a major objective of our organization. However, all four missions are essential, complementary, and interdependent.

Our primary resource as a zoological park is our living animal collection. Our research promotes, but is not restricted to, studies of this collection. We encourage research that opens new directions, addresses basic scientific questions, and produces new and significant knowledge, as well as more applied studies with specific objectives. The accumulation of basic knowledge may be important to the solution of future problems whose appearance is not even foreseen at the time a study is conducted.

The National Zoological Park promotes research which (1) supports the mission of the Smithsonian Institution—the increase and diffusion of knowledge; (2) addresses significant scientific problems, and may result in major theoretical, conceptual, procedural, or technological advances in the life sciences; (3) will support the zoo's conservation efforts by the preservation of species in zoos and the maintenance of biological diversity in situ; (4) addresses basic problems in management and propagation of wild animals in captivity; (5) involves the expertise of many scientific disciplines and institutions, and uses multiple approaches to solving problems; encourages outside collaborators in the study of our animal collection and promotes an educational and training function through the association of students and visiting scientists; (6) adheres to all applicable governmental regulations and requirements; additionally, research is scrutinized to prevent discomfort or pain to animals; (7) enhances current research interests and programs of the NZN staff.