THE MAMMAL DIVISION: A GENERAL STUDY OF ZOOLOGICAL PARK MANAGEMENT

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THE MAMMAL DIVISION: A GENERAL STUDY OF ZOOLOGICAL PARK MANAGEMENT

By

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A THESIS

Submitted to the School for Advanced Graduate Studies of Michigan State University of Agriculture and Applied Science in partial fulfillment of the requirements for the degree of

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This thesis is dedicated to those who would carry on the zoological park idea to its highest degree of perfection for the benefit and enjoyment of all.

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AN ABSTRACT

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ABSTRACT

This thesis is a result of an effort to provide a consolidation of useful information for the student of zoological park management.

Methods employed in gathering these data include research in the fields of management and zoology, personal observations, as well as contacts with zoological park personnel.

The text consists of three major phases of zoological park management: administration, maintenance, and public relations.

An introduction to zoo administration and general organization provides background for the study. Thus the mammal division is regarded in its proper perspective in relation to total zoo organization. The structure and function of the mammal division work force is examined in detail. Responsibilities and routine duties of the Curator, Junior Curator, Head Keeper, Animal Keeper, and Animal Trainer are described and coordinated.

As apprentices, zoological park students must become thoroughly familiar with animal maintenance routines. A major portion of the text is devoted to mammal maintenance: acquisition, feeding, care and handling. Methods of maintaining a collection at a desired level are examined. Techniques used in handling many types of captive mammals are discussed with reference to their limitations. Alertness and the value of practical experience is stressed. A section on medical

practices emphasizes methods of disease prevention as well as the need for further research in wild animal pathology. The feeding process includes acquisition, care and storage of mammal foods, preparation and the actual feeding of the animals. Basic diets listed for major groups of mammals include preparations used during war-time food shortages and also newly developed and scientifically balanced dry mixtures. Research in animal feeding promises substitutes for scarce natural foods, greater economy through labor saving, less spoilage, and healthier animals. The appendix contains a systematic reference to specific mammal diets.

In order that the purpose of zoo management is not lost in studying the detail of administration and maintenance, the final chapter reviews zoological park goals and public relations. Traditional zoo recreation aspects are aired with emphasis on potential educational values.

The bibliography is subdivided to facilitate reference to further reading.

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PREFACE

Purpose: The object of this paper is to provide a variety of useful information for the student of zoological parks.

Importance: Zoo literature, as a whole, is inadequate and widely dispersed. The author hopes that this attempt at consolidating information will inspire other articles on zoo management and will perhaps serve as a stepping-stone to further research, eventually leading to a detailed management text for zoological park students.

Methods: The material herein presented was accumulated through research, personal observation, and contact with people in the zoological park field.

Scope: In order to establish practical limits, the study has been focused at the division level of organization. The zoological department was selected because of its primary importance to zoological park students. Concentration of the study on a portion of the zoological department was deemed necessary in order that it might be studied in more detail. The mammal division was chosen as a focal point. Private, and foreign zoos were not examined in the study.

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CHAPTER I

ZOOLOGICAL PARK ADMINISTRATION

Through administrative planning, long and short range objectives are determined, policies are formulated, organization structure is streamlined for efficiency and the work of the organization is given coordination, direction and control. Thus an organization accomplishes its objectives through people.

This chapter is devoted to human relationships within zoo organizations.

General Organization

In order to provide background for this study and to place the Mammal Division in proper perspective, a brief review of general zoo organization follows.

Organization on a National Scale

American zoological parks developed quite independently from one another. A number of factors may have contributed in varying degrees to this independent growth. Poor communications in some cases were undoubtedly brought about by the great distances separating some zoological gardens. A friendly spirit of competition may have existed

then, as it does to a certain extent today, creating a delaying effect on the flow of new ideas. Perhaps lack of interest in any form of national organization among zoo people prior to 1924 could be traced to their failure to appreciate the advantages of such an association.

In October of 1924, a group of zoo men with vision gathered in Washington, D. C. to establish the American Association of Zoological Parks and Aquariums as an affiliate of the American Institute of Park Executives, Incorporated. The purpose of the A.A.Z.P.A. as stated in its constitution, reads as follows: "to promote and advance zoological parks and aquariums; to aid in the exchange and importation of zoological specimens; to provide exhibits for scientific, educational and recreational purposes; and to aid in the preservation of wildlife."[1]

The exchange of ideas and scientific data has been encouraging, not only at the annual conventions of the A.A.Z.P.A. but also in the "Zoos and Aquariums" section of Parks and Recreation.[2] The value of such an accumulation of experiences has been immeasurable, considering the inconceivable pitfalls that may beset those who attempt to display, alive, the tremendously varied forms of animal life gathered from the far corners of our earth.

Certainly cooperation on a national scale is a key to continued progress. The A.A.Z.P.A.'s recent legal victory over a bill that would

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[1]1958 Roster and Yearbook of the American Institute of Park Executives, Inc., and American Association of Zoological Parks and Aquariums, Wheeling, W. Va., p. 47.

[2]Journal of the American Institute of Park Executives, Inc.

have prevented the importation of all wild ruminants and swine, is a current example of the value of a strong national organization.[1]

Governing Authorities

Individual zoological park organizations are controlled by a variety of governing authorities. A zoo director may be directly responsible to a city or county commissioner, a city manager, or a mayor. He may be indirectly responsible to these men, through a park superintendent, a public works director, or a public service director. The type of governing authority imposed on a zoo depends on the type of city government and other local conditions. Non-political public boards provide the most satisfactory form of authority.[2] Board members serve overlapping terms, which allows long range planning for program stability and continuity.

Zoological Societies

The importance of a zoological society to the efficient operation of a zoological park can scarcely be overemphasized. By freeing zoo management from political influence, a zoological society encourages a continuity of dedicated management necessary for long range planning.

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[1]W. T. A. Cully, (ed.), "Death Knell for H. R. 12126," Parks and Recreations, Vol. 41, No. 18 (Nov., 1958), pp. 464-465.

[2]Arthur T. Wilcox (ed.), A Zoological Park--Why, Where, How. Michigan State University Agricultural Experiment Station and Cooperative Extension Service, East Lansing. Park Management Series, Bulletin 3, in cooperation with American Institute of Park Executives, American Association of Zoological Parks and Aquariums, Aurora, Ill., p. 6.

Societies provide permanent control of building and operations spending on a non-profit basis. The ability to attract a competent staff of technical advisors and to provide large sums of money through members and friends of the society is also advantageous.[1]

A recent survey of 38 public zoos indicated that over 80% had supporting zoological societies.[2] The extent to which some city-owned zoos are assisted by zoological societies is evident in the following examples.

The San Diego Zoological Society provides animals, buildings, equipment, and about two-thirds of the total operating cost. It maintains the grounds, animals and cages as well as doing all of its own planting and building.[3]

An agreement made in 1929 between the San Antonio Zoological Society and the City of San Antonio, provides for the acquisition of all birds and animals by the society. Equipment and maintenance is furnished by the city.[4]

The Brookfield Zoological Society assists in raising funds by collecting admission fees from adults on certain days of the week, parking fees, money from the sale of refreshments, guide books, souvenirs and the rentals of baby buggies and wheel chairs.[5]

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[1]H. R. Mitchell, "Zoological Park Management Minus Politics," Parks and Recreation., Vol. XIX, No. 3. See George P. Vierhetter, "Financing a Zoo," Parks and Recreation, Vol. XI, No. 2 (Nov.-Dec., 1927), pp. 138-140.

[2]Wilcox, op. cit.

[3]San Diego Zoo Guide Book.

[4]San Antonio Zoo Guide Book.

[5]Brookfield Zoo Guide Book.

The Staten Island Zoological Society furnishes all exhibits, conducts programs and issues publications. The city appropriates funds for maintenance and operation.[1]

At the New York City Zoo, management and details of long range planning are entrusted to the zoological society. The society provides a technical staff, the animal collection, and contributes materially to improvements. Membership fees vary from $15 to $300. Members receive free passes and zoological publications as well as an invitation to the annual meeting and the Spring Garden Party.[2]

Organization of a Large Zoo

The San Diego Zoo is chosen as an example of zoo organization because it's Zoological Department is divided into four parts, including a Mammal Division, and because of an abundance of well-written material on organization from that source.[3]

The San Diego Zoo is managed by the San Diego Zoological Society, Incorporated. The society was incorporated in the State of California in 1916. The corporation was formed for benevolent purposes and scientific research. An ordinance of the City of San Diego grants the Zoological Society the right to operate and maintain the Zoo in

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[1]The Staten Island Zoo Guide Book.

[2]Raymond L. Ditmers and Lee S. Crandell, Guide Book of the New York Zoological Park. For further reading on the advantages of zoological societies see Mrs. Belle J. Benchley, "Woman Zoo Executive Accomplishes Things at San Diego," Parks and Recreation, Vol. XVIII, No. 4, pp. 153-156.

[3]See Neil Morgan, It Began With a Roar, for a detailed account of the founding and development of the San Diego Zoo. Also, Belle J. Benchley, My Life in a Man Made Jungle, (Boston: Little, Brown and Co., 1940) for a wealth of facts about the San Diego Zoo.

Balboa Park. Details of the agreement between the City and the Zoological Society are contained in the original ordinance, #1845 new series, and in new series ordinance #6605.[1]

The Zoological Society of San Diego is administered by a Board of Directors elected by the society at an annual meeting. The Board of Directors elects a President, 1st Vice President, 2nd Vice President, a Secretary, and a Treasurer from among its own twelve members. It is the function of the board to determine policies and represent the society in matters concerning development and welfare of the zoological park.[2]

Standing Committees made up of members of the zoological society are appointed by the Board of Directors, to serve in advisory capacity to the board. Titles of these committees are as follows: Executive, Finance, Buildings and Grounds, Exhibit, Education, Publicity, Legal, and The Children's Zoo Committee.

Also serving in advisory capacity to the Board of Directors and to the Managing Director are the Management Committees: Employee's Council, Budget, Maintenance, Construction, Landscape and Grounds, Security, Safety and Good Housekeeping, Exhibits, Transportation, Salary and Wage, Public Relations, and Health.

The Managing Director is directly responsible to the Board of Directors. All division supervisors are directly responsible to the

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[1]Guide Book of the San Diego Zoo.

[2]Paul Pigors and Charles A. Myers, Personnel Administration, (New York: McGraw-Hill Book Co., Inc., 1947). An excellent reference on understanding and formulating personnel policy.

Managing Director.[1] It is the director's duty to plan, coordinate, and direct the work of the entire zoological garden.[2] He is assisted by his Secretarial Section which handles matters incident to the shipment and receipt of large zoological specimens including customs clearance and insurance, services mail receipt and transmission, arranges general and special board and staff meetings, and maintains central files.

The Childrens Zoo is operated as a division of the organization. Its staff consists of a Superintendent, an Instructor, four Caretakers, two Custodians, and eight part-time Attendants. The function of this division is to plan and set up zoological exhibits that allow children to play with domestic specimens.

The Maintenance and Construction Division consists of the following sections: Maintenance and Construction, Forestry and Landscape, Grounds Maintenance, and Equipment Maintenance.

A Public Relations Division integrates publicity and informational activities via all types of public communications media. This division includes the following sections: Membership and Subscription, Sign Preparator, Publications, Public Information and Audio Visual, Lecture Service, Reference Library, Special Events, and Tour Service.

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[1]Marvin Bower (ed.), The Development of Executive Leadership, (Cambridge, Mass.: Harvard University Press, 1949). Adds perspective to the work of the director. For information on deligating responsibility, see W. H. Seidel, The Development of Office Supervisors, National Office Management Association, April, 1943.

[2]E. Peterson and E. G. Plowman, Business Organization and Management (Chicago: Richard D. Irwin, Inc., 1948). Is excellent for further reading on coordination and other responsibilities of management.

The Public Service Division operates restaurant, camera, souvenir, and refreshment stands, and caters to special groups and the general public which uses picnic facilities. Division sections include: Camera Stand, Vending Operation, Dining Room, Cashier, Refreshment Stands, Kitchen (visitor service), and Stockroom Section.

The Security Division is divided into a Building Service Section and a Patrol Section. The division's duties are to patrol and protect the zoological garden, enforce security regulations governing exhibits and visitor behavior, supervise public comfort, operate parking lots, direct visitors, locate individuals, render first aid, and destroy predators.[1]

The Fiscal Control Division supervises the financial records, cares for cash and other funds, prepares payrolls, formulates and administers the annual budget, maintains accrual budget records, prepares fiscal reports, keeps the general ledger, supervises inventories, prepares tax returns, maintains insurance coverages, preaudits claims and disbursements, and supervises personnel procedures.[2] The Fiscal Control Division is subdivided into the following sections: Public Service, Inventory Control, Admissions, Payroll, Communications and Reception, and Cashier Section. Within this division the Personnel

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[1]D. B. Dyer and J. G. Lichtig, Liability in Public Recreation, New York: C. C. Nelson Publishing Co., 1949.

[2]George Hjelte, Budget Making and Administration, National Recreation Association (mimeographed) 189 pp.

Section advertizes for, receives, and refers job applicants to the requisitioning authority, analyzes and evaluates jobs, maintains individual employment records, conducts exit interviews, acts in employee disability claims, and supervises clerical operators related to personnel technical services.[1] A final section under the Fiscal Control Division is of the utmost importance to the operation of the Zoological Division. The Commissary Section procures estimates, receives, stores and issues required food and forage for non-human consumption; maintains supplies, cost records and inventory control; prepares budget estimates and consults with curators as to diets. Its personnel consists of one Buyer, two Stock Men, one Store Keeper, one Process Laborer and his assistant, and one Delivery Laborer.

The Research Committee of the Zoological Hospital and Biological Research Institute, acts in an advisory capacity to the Managing Director and to the Zoological Department. The committee consists of twenty or more Ph. D.'s, M. D.'s, and D. V. M.'s who suggest, initiate and govern activities of the Research Institute. They review progress reports of associates engaged in biological research and approve manuscripts prior to publication as scientific bulletins of the Society. A $3,500 Fellowship is granted to a deserving graduate research worker every ten months by the Research Committee. A biological worker, whose problem and qualifications are acceptable to the Research Committee, may use zoo buildings and facilities without charge.

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[1]See Selection and Placement of New Employees, Bulletin No. 9 Melbourne, Australia: Department of Labor and National Service, Industrial Welfare Division, 1946.

The Zoological Department assists in the acquisition and disposal of exhibit animals, plans and sets up exhibits and conducts research in the care and habits of exhibit animals. It furnishes scientific information for the creation of exhibit labels and signs; feeds, breeds, and otherwise cares for exhibit animals; directs the fiscal affairs of the exhibits and other related work.

The Zoological Department is divided into four units known as divisions. The Hospital and Laboratory Division consists of a Manager (veterinarian), a part-time Assistant Veterinarian, a Medical Laboratory Technician, a Senior Custodian, a Stenographer Clerk, a Principal Hospital Keeper, and an Animal Nursery Aid. The Ornithology Division consists of a Curator; a Principal Keeper, Senior; and eight Keepers, Junior and Senior. The Herpetology Division is made up of a Curator; a Principal Keeper, Junior; and a Keeper, Junior. The Mammalogy Division employs a Curator; an Animal Trainer and two Assistant Animal Trainers; one Principal Keeper, Senior; and fifteen Keepers, Junior and Senior.[1]

The Mammal Division Work Force

Variation in zoo organization is such that scarcely two are the same. Some large public zoos do not have a Mammal Division as such. The tasks of the personnel working directly with the animals, however, are so similar that we may combine data from a variety of sources to discuss a hypothetical Mammal Division. In this way we hope to add

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[1]Adapted to the study from a San Diego Zoo organizational chart in Parks and Recreation, Vol. 40, No. 11 (Nov., 1957), pp. 14-15.

scope and depth of the study without attempting to establish an average organization or one that is ideal under all conditions.[1]

A Mammal Division may consist of a Curator; an Assistant or Junior Curator; Keepers of various grades such as; Trainee, Junior, Senior, and Head Keeper or Principal Keeper; and sometimes Animal Trainers of various degrees of skill and seniority. The number of personnel is governed largely by the size and character of the mammal collection.

Curator of Mammals

The Curator of Mammals is subject to administrative direction from the Managing Director. Both men work together, planning and organizing long-range goals of the division.

The Curator supervises personnel engaged in the care of mammals.[2] He conducts in-service training, to improve personnel efficiency.[3] By rating work performance he separates his subordinates for promotion, downgrading, or layoff.[4] He aids in setting employee standards and

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[1]For further reading on traditional, systematic and scientific types of business management see William R. Spriegel, Business Organization, (New York: Prentice-Hall, Inc., 1944).

[2]For valuable information on developing effective work teams see Productivity, Supervision and Employee Morale, Study No. 6, Survey Research Center (Ann Arbor, Michigan: University of Michigan, Nov. 22, 1948).

[3]An excellent article on training zoo personnel by Dr. Charles R. Schroeder, Managing Director, San Diego Zoological Gardens, entitled "Applying Industrial Personnel Management Practices in a Zoo," appeared in Parks and Recreation, Vol. 40, No. 11, (Nov. 1957), pp. 13 and 28.

[4]See M. Joseph Dooher and Vivienne Marquis (eds.), Rating Employee and Supervisory Performance: A Manual of Merit-rating Techniques, American Management Association, New York, 1950, and Wilber R. Hanawalt, "Solving the Problem of Merit vs. Seniority in Layoffs," in Personnel, Vol. 23, No. 6 (1947) pp. 405-409.

interviews prospective Mammal Division employees. Divisional efficiency and morale are of primary concern.[1]

Much of the Curators office work consists of directing the fiscal affairs of the division.[2] The requisition of materials and supplies is highly important and demands constant attention. Complete records are maintained on each mammal in the collection. From these records, useful statistical information is compiled. Written reports on changes within the collection are sent periodically to the Managing Director.

The Curator must explore and bargain with various sources for the purpose of enlarging and improving the mammal collection. The shipment and receipt of all mammalia are his responsibility.

He must frequently observe the animals under his care to avoid deficiencies in security, and insure proper handling.[3] The animals' environment and general health must be checked daily.

The important task of feeding the mammals must be planned, organized, directed, and controlled.

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[1]The American Management Association's, Getting and Using Employees Ideas, Production Series No. 165, New York, 1946, contains material applicable to employee morale improvement. See also, James C. Worthy, "Factors Influencing Employee Morale," Harvard Business Review, Vol. 28, No. 1 (Jan., 1950), pp. 61-73.

[2]A guide to reducing office management expenses, including the cutting of report costs may be found in C. L. Stivers' A Short Cut to Expense Reduction, Office Management Series No. 85, American Management Association, New York, 1938. For a good general reference see H. E. Niles, The Office Manager's Job Today, Office Management Series No. 100, American Management Association, New York, 1943.

[3]Vernon G. Schaefer, Safety Supervision. (New York: McGraw-Hill Book Co., Inc., 1942). Contributes ideas on personnel safety.

The Curator prepares specimens for medical care by the veterinarian and supervises their aftercare. He may be called upon to assist with post-mortems.

As a zoological technician, his advice is highly important to the efficient care, handling and exhibition of mammalia. Questions of a technical nature from public sources will occasionally be referred to him.

Research and the exchange of information with institutions and fellows from all parts of the world is encouraged. Occasionally a need for preparing scientific bulletins occurs.

His zoclogical knowledge must be applied to the construction of mammal housing and exhibits, along with a knowledge of engineering, architecture, landscape architecture, horticulture, and art, as well as a number of other technical skills.[1]

A successful public relations program affording press, radio, and TV coverage of the exhibits is in part a curatorial responsibility,[2] Guiding adult and children's grcups through the exhibits is a popular form of promotion carried out by the Curator. A working knowledge of photography assists greatly in the preparation of guide books, bulletins and other popular zoological publications.[3]

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[1]For a more complete list of skills required and for an excellent general outline on exhibit planning see Wilcox, op. cit., pp. 2-47.

[2]Raymon C. Myer's, How to do Publicity, (New York: Harper and Brothers) and Frank Vadik's "Public Relations and TV Programs in Detroit Parks," in Parks and Recreation, Vol. 36, No. 3, 1953, pp. 5-7, are both informative.

[3]Adapted to the study from a San Diego, Curator job description.

Junior Curator

The Junior Curator is subject to administrative direction from the Curator of Mammals. Under supervision, as part of a training period, the Junior Curator must perform routine chores incident to the curatorial activities. He must follow well defined rules and specific instructions while performing progressively more difficult work involving the acquisition and maintenance of domestic and wild mammals.

Some of the less skilled tasks performed by the Junior Curator include: requisitioning supplies and materials, inspecting exhibits to determine the condition of the animals and their quarters, seeing that the animals are handled correctly, caring for sick animals, assisting with post-mortems; talking to, and guiding groups of visitors through the zoo; assisting in the preparation of guide books, bulletins, maps, and other zoo publications.[1]

Junior Curators are usually recruited considerably in advance of a curatorial opening in an organization.[2]

Head Keeper

The Head Keeper is directly responsible to the Curator of Mammals. Like the Straw Boss of industry, the Head Keeper is in charge of the division when the Curator is absent. He not only supervises keepers

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[1]Adapted to this study from a Detroit Civil Service recruitment specification (10-8-58), for a Junior Zoological Curator's position at the Detroit Zoo.

[2]See G. L. Cullen, "Recruitment and In-Plant Training of College Graduates," Personnel, May, 1947, for a general reference on training needs of college graduates.

engaged in the care of mammals, but participates in the work as well.[1]

Often he is called upon to keep time reports and payroll records for a Fiscal Division.

He must be an expert in handling unruly animals. Sometimes he must devise ways of doing the "impossible" while making cage transfers, crating animals for shipment, or unloading new animals.[2]

The Head Keeper usually starts the day by inspecting all exhibits under his care. The health of the animals and the condition of enclosures are reported to the Curator. Minor ailments are treated by the Head Keeper.

The procurement and preparation of animal food is one of his responsibilities. Light, heat, and ventilation must be adjusted in all of the divisions buildings. The daily routine of cleaning the exhibits is accomplished through his supervision and participation.

In addition, the Head Keeper must frequently supply visitors with information about the mammal collection and the zoo.

Animal Keeper

The Animal Keeper is responsible to both the Head Keeper and the Curator. The general condition of enclosures and mammals under his care are reported daily to the Head Keeper. It is the Keeper's duty to

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[1]For additional reading on leadership and human relations, see O. Tead, The Art of Leadership, (New York: McGraw-Hill Book Co., Inc. 1935), and H. A. Lyon, "The Importance of Human Beings," Annual Conference Proceedings, National Office Management Association (Philadelphia, 1943).

[2]William Bridges, "Around the Zoo with the Head Keeper of Mammals," Animal Kingdom, Vol. XLIX, No. 3 (May-June, 1946), tells how one man came up through the ranks at the New York Zoological Park.

replace needed equipment in the animal enclosures. Repairs needed are reported to the Curator through the Head Keeper for approval.

The Keeper is required to keep animal records and to make simple written reports on the animals for which he is responsible.

He must watch the behavior and condition of his charges constantly for signs of illness or injury. The Veterinarian and Curator occasionally need assistance with surgery or medical treatment.

When necessary, the Keeper assists with catching, crating, and moving the animals.

The mammals must be fed and watered according to schedule. He selects food for quality from the commissary, arranges and prepares it to suit the individual tastes of his animals. Food containers and drinking basins are gathered and washed by the Keeper.

Exhibits and adjacent areas have to be kept scrupulously clean during visiting hours. Drains have to be checked and bedding and litter replenished. It is very important that the keeper knows the proper insecticides, vermine repellants, and cleansing agents to use and under what conditions they may be dangerous to certain mammals.

The Keeper assists the police in protecting the animals and the visitors.

He is expected to maintain good public relations by answering general questions about his charges.[1]

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[1]Adapted, in part, from a U. S. Civil Service Commission Announcement, No. 68, (Jan. 21, 1958), announcing an exam for Animal Keeper, for duty at the National Zoological Park, Washington, D. C.

For some helpful rules of conduct for Animal Keepers, see Roger Conant, "Code of Ethics for Keepers," Parks and Recreation, Vol. XV, No. 11 (July 1932), pp. 720-721.

Animal Trainer

An Animal Trainer's duties involve training wild species to perform in a finished animal act. He must take part in performances before audiences at times and places designated by zoo management.

A Trainer must be strong and agile as well as psychologically adjusted to contact with wild animals. He must have a way with animals and know the habits of species with which he is working. A good speaking voice is required to announce acts during the course of a program. The ability to establish and maintain good public relations is highly desirable. Trainers are often obliged to answer general questions concerning the training of animals.

In addition to training duties, an Animal Trainer must care for the animals he is assigned. By feeding his own animals and cleaning their enclosures, the animals become more accustomed to him and consequently are easier to handle. Some zoos require an Animal Trainer to have five years experience as an Animal Keeper.[1]

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[1]From a San Diego Zoo, Animal Trainer job description. For further reading see Frank C. Bostock, The Training of Wild Animals, (New York: Century Book Company, 1915).

CHAPTER II

MAMMAL MAINTENANCE--PROBLEMS AND ROUTINES

Students beginning a career in zoological park work must first become thoroughly familiar with maintenance routines. Most zoos require inexperienced men to serve an apprenticeship of a year or more as Animal Keepers before becoming Junior Curators. During this time the student performs routine animal maintenance duties.

Most of the following information is related to the maintenance routines of Curators, Junior Curators, and Animal Keepers in a Mammal Division.

Acquisition and Disposition

Effective methods of acquisition and disposal are important in maintaining the mammal collection at a desirable level. Animals die and must be replaced. In-breeding is prevented by occasionally introducing new stock. New species in the collection help maintain public interest. Many species produce surpluses that must be disposed of to prevent overcrowding.

Breeding Program

A productive breeding program is an important factor in the efficient management of a mammal division. Successful reproduction

perpetuates existing exhibits with young healthy animals. Surpluses may be of value as stock in trading for new animals or as a source of income when sold. Such noted breeders as rabbits and guinea pigs may be an important source of food for mammalian carnivores.

Surpluses of food animals may be in demand in other divisions. Many reptiles and birds need whole or partial meat diets, which further eliminates the necessity of disposing of most food species outside the zoo.

Publicity derived from new arrivals is often highly beneficial to the zoo. Displays containing young animals in a family group are appealing to everyone.

When rare animals breed successfully, publicity may be world wide, particularly if the event is a first for that species in captivity. Such occurrences may provide a valuable source of scientific information on little known animals. From a conservation standpoint, the steps leading up to the successful breeding of rare animals in captivity may be highly significant.[1]

The importance of keeping good records cannot be overemphasized. Records provide information on breeding performance so that unproductive animals or those that will not feed and care for their young properly may be replaced, or steps taken to correct such situations.[2]

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[1]See reference to world-wide registration of rare zoo animals by Wm. T. A. Cully, "Registration of Przewalski Horses Planned," Parks and Recreation, Vol. 41, No. 12 (Dec.,1958), p. 498.

[2]An example of complete avian breeding records may be found in the War Department's Technical Manual, The Homing Pigeon, T.M. 11-410, (1940), pp. 24-33.

Breeding schedules should be maintained so that matings occur at the proper time. This allows highly productive females to rest between pregnancies if necessary to maintain health. Keepers may be alerted to productive seasons of the rarer species as well as to those that may suddenly become dangerous to work with.

Individual attention should be given expectant females. Some require a certain amount of privacy or in the case of extremely nervous types, complete isolation from the public until the young are taken from the mother, or are out of danger of being killed or deserted by her. Sometimes substitute mothers may be used where records show the true mother to be unpredictable.

Domestic cats often foster young mink, skunks, squirrels, and other small mammals, allowing the foster young to feed among their own kittens.

Breeding rare animals under unnatural conditions is one of zoo work's greatest challenges. Many consider its accomplishment one of zoo work's finest rewards.

Animal Exchange

One of the functions of the American Association of Zoological Parks and Aquariums is to facilitate the exchange of zoo animals. A list of surplus and wanted animals is sent out to all members each Spring and Fall. In this way animals are bought, sold and traded with a minimum of searching for a market. A maximum of saving is encouraged by breaking import monopolies on certain species as well as cutting down shipping distances and consequent mortality. The exchange system

decreases the demand for wild trapped animals imported into the United States, which further safeguards the health of American animals, and serves as a conservation measure.

Public and private zoos as well as animal dealers sell their stock through the A.A.Z.P.A. exchange lists. Since the Association could not possibly guarantee the animals offered for sale, it is well for the buyer to be cautious. Distance often makes it impractical to examine the less valuable animals before purchase, thus offering opportunity for misrepresentation by unscrupulous individuals. The known hazards of shipping are sometimes used to cover pre-shipping ills, though the fact is often impossible to prove. Large, well-established organizations are more able to absorb losses and consequently are sometimes more reliable than the smaller ones, though of course there are exceptions. It is important to know the seller, particularly if large purchases are involved.

Even though reputable dealers attempt to screen sick animals, the symptoms of some diseases do not appear for some time after the animal has contracted the disease. For example; among the small mammals, new animals may arrive at the zoo before they show any sign of the following maladies: pneumonia in monkeys, distemper in dogs, and enteritus in cats.[1]

Like horse trading of old, the trading of zoo specimens is risky business. However, the possibilities of exchanging surplus animals for other species through the A.A.Z.P.A. should not be overlooked.

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[1]See Leonard J. Goss, "Diseases in Zoo Animals," Parks and Recreation, Vol. XXXII, No. 1 (Jan., 1949), pp. 47-49.

Often immediate need places animal values over established market prices, and exchanges may be worked out that are very satisfactory to both parties of the trade.

Gifts

Some animals offered as gifts may be as valuable as others are worthless to a mammal division. Though dogs, cats, and other pets can sometimes be used under special circumstances, they generally should not be accepted. The young of these and other domestic types may add interest to the Children's Zoo, or nursing females may serve as emergency, foster mothers.

Unwanted pets often create problems. Some require a great deal of extra attention and special diets before they become accustomed to zoo life.

Sick, injured, or young, wild animals that have been "abandoned" often become donations to the zoo. Though most of these are of the more common varieties, occasionally a valuable animal may be offered. For this reason, and to promote good public relations, it is advisable not to discourage would be doners from trying again at a later date. Decisions as to the acceptance of animals should be weighed individually.

Donations of expensive animals may be encouraged by giving recognition to donating organizations or individuals. Signs on exhibits indicating the names of local merchants contributing to the collection may encourage others to use this favorable means of advertisement.

Loans and Boarding

Occasionally animals may be offered as loans to a zoological park. In some cases animals from private collections may provide welcome additions to the mammal division, as promotion material and as a change of exhibit. These animals are displayed without charge to the owner. It is advisable to have an agreement in writing with the owner, freeing the zoo from responsibility other than negligence.

Animals may be offered as loans for a variety of reasons. The owners may be going on vacation or city regulations may force them to remove animals from their homes or apartments. Most requests to board animals must be turned down though some animals from this source make excellent temporary additions to a mammal division.

Capture

Wild trapped animals are often inferior to zoo bred specimens for display purposes. Having known freedom, they are seldom satisfied with confinement. Besides showing extreme restlessness, they often are too shy of humans to make good exhibits. As a result of captivity, many wild bred animals fail to eat well and live only a short time, according to Seton.[1]

Some wild trapped species to quite well in captivity, particularly if they can be taken as young animals. In cases where a species does not breed well in captivity, live trapping may be practically the only

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[1]Seton, E. T. Life Histories of Northern Animals. 2 Vols. (New York: Chas. Scribner's Sons, 1909).

means of obtaining these animals. Tigers for example, seldom reproduce in captivity. Their relative scarcity consequently, makes them more expensive than lions and others that breed well in confinement.

Although a great variety of mammals can be purchased through animal dealers, zoos that emphasize numbers of species or that wish to exhibit animals not generally seen in the United States, may occasionally find it advantageous to do their own collecting.

Expeditions into foreign lands need not be as elaborate as one might believe. One man working through local people can be almost as efficient in accumulating a collection of mammals as several staff members and their elaborate equipment without native help.[1] The cost of collecting expeditions and the uncertainty of their results, however, all but eliminates them among the smaller organizations. Often the monetary result is outweighed by the promotional value and other intangibles. A current example is a Texas Zoological Society's expedition into the Himalayan Mountains for the "Abominable Snowman."

Local animals may be caught with a variety of live-traps. Local boys may be encouraged to provide animals for temporary displays during the summer months.

As interesting and practical as trapping may sound, gifts, purchase and trade, are still the favored methods of acquiring animals for zoo collections.

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[1]A one-man expedition is discussed by Lee S. Crandall, in his fascinating account of bird collecting in New Guinea, entitled Paradise Quest, (New York: Chas. Scribner's Sons, 1931), 276 pp.

Forbidden Mammals

To prevent an embarrassing situation it is well to become familiar with restrictions imposed on certain mammals by the United States Department of Agriculture. Small mammals that may not be imported include all species of mongoose; black, brown, roof, and pharaoh's rats; all species of fruit bats; European rabbits and European hares. These animals are considered too hazardous to agricultural interests to import alive. Restrictions have been made to guard against the possibility of their escaping and becoming established in this country.[1]

Disposition

For various reasons it is often necessary to dispose of zoo animals. Animals with incurable diseases that might sweep through the entire collection, are mercifully killed and the bodies are cremated or buried deeply. Animals that could endanger public lives must usually be sacrificed in the event they escape from their cage or enclosure. Individual animals that have killed or maimed a person are usually eliminated to prevent a re-occurrence and to satisfy public opinion. Unmanageable individuals that constitute a threat to keepers' safety should be destroyed and replaced, if possible, by a more amiable member of the species.

Many small mammals such as rats, mice, rabbits and Guinea pigs are killed continuously for animal food. Some animals will only feed

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[1]"Forbidden Animals," Parks and Recreation, Vol. XX, No. 1, (Sept., 1936), pp. 51-52.

on live prey. The public is not allowed to witness these or other killings and they are seldom publicized.[1]

Handling and Care

Groups of similar animals can often be cared for and handled in a similar manner. Sometimes related species show marked differences in habits and temperments. Individual animals may behave differently from others of their kind. To complicate the matter further, some individuals may be entirely unpredictable, reacting differently at various times to a given situation.

There is no substitute for personal experience in learning to cope with the infinite variety of problems that may arise in handling and caring for a collection of wild animals.

The experiences of others may prove helpful as background for routine situations. The following section is devoted to general methods used by zoo people in the care and handling of some of the more common mammals.

Handling

As a rule zoo mammals should be handled as little as possible. Exceptions are made for the extremely tame and hardy specimens used in the contact pens of the Children's Zoo. The amount of enjoyment the children derive from handling lambs, kids, puppies, rabbits, and other

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[1]Clifford B. Moore, The Book of Wild Pets (New York: G. P. Putnam's Sons, 1937), pp. 284-288. This book contains a detailed section on disposing of incurables.

animals commonly used in children's sections, would seem to justify the exception to the rule. Every precaution should be taken to safeguard the public and the animals. These animals particularly should be innoculated regularly against contagious diseases and should be given frequent rest during which they can feed and escape the public. Exhibits of this type should have ample supervision at all times.

To eliminate handling of wild zoo animals, methods must be worked into display design that allow the keeper to clean pens and enclosures without endangering himself or giving his charges an opportunity to escape. Shift cages are essential in working with dangerous species. Dens or nest boxes may be used that can be closed from the outside for control of lesser animals. Walker[1] suggests, a box or crate may be placed over small animals to keep them quiet while cleaning out their cages. He also states that mice and other very small mammals may be controlled by using telescoping cardboard nest boxes with a piece of screen that slides between the cardboard layers to cover the entrance.

In transferring animals, occasionally cage openings may not coincide so that animals may not be transferred directly from one cage to the other. If the animal is not too large, it may be worked into a cloth bag placed over the entrance and then carefully worked out of it, inside the new cage.[2]

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[1]Ernest P. Walker, "Care of Captive Animals," Annual Report of the Smithsonian Institution, (Washington, D. C.: U. S. Government Printing Office, 1941), p. 316.

[2]Ibid.

Larger mammals, and those that might be too dangerous to handle in a bag, may be transferred by live-trapping them in their enclosures. Once in the trap the animal may be transported at will. Sometimes trap-shy individuals can be induced to take an anesthetic with their food.

Nets with handles of various lengths are used to catch some small mammals. Nets are particularly effective in handling monkeys. Burlap and sometimes canvas material is used for the net to prevent the animals from tearing them. The net or bag is quite deep so the animal can be scooped into the pocket and the rim flipped over to prevent its escape. From the net, the animals are transferred into smaller cages or held with thick leather gloves for examination.

Care should be taken not to excite the animal any more than is necessary while they are being handled. Methods should be used that do not require chasing the animal about its enclosure. If an animal must be caught, it should be cornered, if possible, and slow deliberate motions used throughout the "chase."

Once caught, for any reason, the animal should be given a thorough examination to eliminate handling it again in the near future. Hoofs and toenails may be clipped, immunization shots given, monkeys may be tested for TB, teeth of rodents may need cutting or canines of unruly monkeys may be drilled out, mink canines may be clipped; feet, legs, and bodies should be examined for sores, and any parasites should be eliminated. A number of other routine tasks may be performed all in one operation.[1]

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[1]The Merck Veterinary Manual, (Rahway, N. J.: Merck and Co., Inc., 1955), p. 1250.

When a squeeze cage is used, procedures that can be accomplished are limited if the animal is not anesthetized. Ingrown claws may be cut, injections administered, and topical medication applied, but the large animals should be anesthetized to--extract teeth, reduce fractures, and suture major wounds.[1]

Though general rules may be applied in handling groups of similar animals, certain types require special handling techniques.

Porcupines present an obvious handling problem. They can be transported with a special carrying devise. A nail keg, split lengthwise, and hinged so that it can be closed around the "Porky" and secured with hooks, solves the quill problem quite well.

Lundy[2] contrasts behavior in the two-toed, and in the three-toed sloths. The former, a savage dangerous animal, the latter, easily held by the armpits after detaching all four sets of claws from a limb at once.

Tiny animals are best carried in small boxes, eliminating the possibility of squeezing them too hard.

Upon release, animals should be allowed to come out of containers of their own accord without being hurried. Precautions should be taken to protect an animal from injury if it is being released in an area with which it is unfamiliar. Windows should be opaqued with soap and burlaps hung near walls if an animal is inclined to be extremely panicy.

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[1] Ibid., p. 1247.

[2] William E. Lundy, "The Upside-down Animal." Natural History, Vol. LXI, No. 3, (Mar., 1952), pp. 114-119.

A keeper who does not make pets of his charges, yet can capture them without exciting them, is ideal. However, there will always be animals that will not cooperate with the best of animal men. Zoo personnel must be on their guard continually for the unexpected, not only for their own protection but to safeguard the animals and the public as well.[1]

Shipping and Receiving

It is vitally important that animals arrive at their destinations in as short a time as possible. Close confinement, uncertain feeding and watering, and unaccustomed noise and motion for prolonged periods often prove fatal. A few hours may be the difference between a delicate animal's safe arrival or its death.[2] For shipping animals long distances, air transportation is generally preferred. Though initially more expensive, the high cost is balanced by a lower mortality rate.

It is advisable to determine the most efficient shipping methods and the most reliable transportation organizations for one's own particular part of the country.[3]

Extremely valuable animals are usually flown to their destinations and often are accompanied by an attendant who cares for them enroute. Hardy animals, those of lesser value or from nearer places may be shipped satisfactorily by less expensive means.

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[1]Additional information on handling animals may be found in William Bridges', "Handling Animals," Bulletin, N. Y. Zool. Soc., Vol. XLII, No. 2 (Mar.-Apr., 1939), pp. 35-46.

[2]David Fleay, "Flight of the Platypuses," National Geographic, Vol. CXIV, No. 4, (Oct., 1958), pp. 512-525.

[3]Belle J. Benchley, "Shipping Wild Animals," Parks and Recreation, Vol. XXX, No. 12, (Dec., 1947), pp. 585-587.

Shipping crates should be designed to protect the animals and the people who must handle them. Directions to transportation company personnel on the outside of boxes should be combined with safe means of administering food and water. Ample ventilation is important, particularly during the summer months. Some tropical species should be protected from drafts at all times.

Monkeys are sometimes provided with perches and a burlap screen to give them a sense of security. Aquatic mammals should never be shipped in tanks of water without some means of getting out of the water to dry off.[1] Sea Lions become feverish when they are closely confined in shipping crates. They should be shipped with ice, according to Dr. Harry Wegeforth, of the San Diego Zoological Society.

Capturing and shipping is a tremendous shock for most animals. Only those in perfect condition should be crated, and then with the utmost care and patience.[2]

Benchley[3] suggests that carnivores be crated and fed the night before shipping. Arrangements for feeding them in transit need not be made if they are to arrive at their destination within a week.

The hoofed animals, Benchley[4] claims, should be crated just before shipment and loaded within two or three hours, before they become

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[1]Walker, op. cit., pp. 335-336.

[2]In the future, shipping dangers may be reduced by new tranquilizing drugs. See Helen Buechl, "Animal Tranquilizers," Science Digest (Oct., 1958), p. 98.

[3]Benchley, op. cit., pp. 153-156.

[4]Ibid.

accustomed to their crates and begin to struggle. Once in darkened compartments and underway, the motion tends to calm them and encourage them to lie down.

As soon as animals are sent out, a telegram should be sent ahead informing the recipient when to expect their arrival.

It is helpful to have standing agreements with transportation offices to notify the zoo immediately when a shipment arrives, so the animals can be properly cared for at once.

New arrivals are usually frightened and tired. Caution and patience should be exercised in uncrating them. Window glass should be opaqued with soap and walls padded if an animal is of a highly nervous disposition. Animals that have been spoiled as pets may require special attention before they can be weaned to a regular zoo diet. All new animals should be fed sparingly at first.[1]

Preparations for new animals should be made well in advance by completely disinfecting all cages and displays previously used by other animals. Arrangements should be made for additional types of food to be stocked if so required by a new species.

The public should be informed of the new arrivals as soon as they can be put on display.

Disease Prevention

The prevention of disease is probably the most important phase of any medical program. Zoo people have found it more practical to prevent

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[1]The Merck Veterinary Manual, op. cit., p. 1248.

disease through such precautionary measures as cleanliness, and improved diets than to lose public favor and endanger human lives with costly epidemics among the animals.[1]

Many species of mammals can be innoculated against the various diseases that afflict their kind. Most shots should be administered according to a schedule though some booster shots may be given when it is necessary to handle an animal at a later date. At any rate, complete medical records are highly important.[2]

Goss[3] claims, by properly innoculating racoons, binturongs, and all members of the dog and weasel families against distemper, and by innoculating racoons and all members of the cat family, except lions (they are immune), against cat plague, 90% of these animals can be saved from these two diseases.

Tests may disclose types of disease that do not produce symptoms until advanced stages of the illness have been reached. Monkeys should be tested yearly for tuberculosis, to which they are highly susceptible. Tuberculosis can destroy an entire collection if it is not detected in time.

Barriers may be used effectively to prevent valuable animals from being exposed to disease by the public. Gorillas are sometimes protected by panels of glass between their cage and the visitors. These glass panels serve several purposes. They prevent the primates from

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[1]For further reading on the passive role of the zoo veterinarian see William Bridges, "Keeping the Animals Well," Parks and Recreation, Vol. XXIII, No. 5 (Jan., 1939), pp. 253-262.

[2]The Merck Veterinary Manual, op. cit., pp. 1245-1251.

[3]Leonard J. Goss, "Disease in Zoo Animals," Parks and Recreation, Vol. XXXII, No. 1, (Jan., 1949), pp. 47-49.

throwing things at the public as well as eliminating drafts and contact with the public.

Through careful planning, other features of zoo design may contribute to the prevention of disease by making routine jobs of sanitation more simple and efficient. Drains and sewer systems should be large enough that they will not be plugged by straw and other bedding material that will inadvertently be washed into them.

Shift cages allow keepers to work in safety while doing a thorough job of cleaning exhibits. Well placed gutters allow fast, efficient follow-up cleaning with hoses during visiting hours.

Simplicity of design is a must in small areas. Cluttered mammal exhibits are usually time consuming and difficult to maintain.

The problem of keeping animals in small cages clean, might be solved by the use of wire mesh bottoms, that allow droppings to fall into throw-away containers, or into running water.

It is important to know the natural history of each mammal thoroughly. Many species or groups, have special requirements they easily satisfy for themselves in the wild. In captivity, if some of these special requirements are not provided, the result may be poor health, or even death.

Some animals need special conditions to groom themselves in order to maintain their fur in good condition or to free themselves from insects and mites. Many of the rodents and other small mammals require fine dry sand to roll in. The horses and many of the hoofed animals also enjoy taking dust baths.

Rhinos and most of the hog family thoroughly enjoy mud baths during the hot summer months.

Deep pools are a must for many species during hot weather. Hippos, elephants, and most bears, seem more content with access to deep water. Even the tiger, (one of the few water-loving members of the cat family) likes to go for an occasional swim.[1]

The platypus must have access to grit and gravel for his cheek pouches to assist in the chewing process. And watch out for those one-half inch, poison-dealing spurs, on each hind foot of the male.[2]

The rodents need pieces of bone or antler to gnaw, for it's calcium content and to prevent their incisors, which grow continually, from becoming too long.

Many of the horned or antlered species need something to fight, in order to work off extra energy. Ted Downey, Director of the Potter Park Zoo in Lansing, Michigan, tells of an old bison that used to keep himself in good mental health by battling a section of log, hung by a short chain from a homemade turnstile.

Animals should be encouraged to exercise as a means of preventing cage paralysis and other afflictions attributed to inactivity. Treadmills, wheels, and ladders, as well as balls and other toys may prove helpful. Companionship often encourages activity, though overcrowding can be detrimental.

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[1]San Diego Zoo, op. cit., p. 46.

[2]Fleay, op. cit., pp. 512-525. (These spurs are only poisonous during the mating season).

Adequate diets are so important to animal health and disease prevention, an entire section has been devoted to feeding.

Animals should be checked frequently for internal and external parasites that cause discomfort and may spread disease. Lice, fleas, and many other external parasites can be eliminated with compounds that will not harm the animals themselves. Remedies for internal parasites are becoming more specific, making an accurate diagnosis a necessity. Goss[1] warns that an adequate dosage is important or the parasite may become immune. For this reason, guessing at an animal's weight may not be accurate enough. He recommends putting small mammals in a crate for accurate weighing.

House mice and rats should be discouraged with design features that exclude them from buildings and food storage areas.[2] English Sparrows and Rock Doves may also be excluded to some extent by this method. Both groups of potential disease carriers are attracted by wasted food that remains after exhibit animals have eaten.

Flies and roaches are attracted to wasted food and filth. Sanitary conditions and insecticides, used with caution, tend to control these pests. Flies may be discouraged from bothering wounds by painting the wound area with tar, according to Walker.[3]

Disinfectants must be used frequently on dishes, concrete floors, and other hard surfaces of zoo buildings and exhibits. Walker[4] relates,

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[1]Goss, op. cit.

[2]See Rat Control, a free publication, (CB-8) of the U. S. Dept. of Agriculture, Washington, D. C.

[3]Walker, op. cit., p. 338.

[4]Ibid., p. 313.

the National Zoo makes its own inexpensive formula as follows: 18 ounces of lye dissolved in 1 to 2 gallons of water in an enamel or earthern container, stir slowly as this solution is poured into 5 gallons of 5% solution of hypochlorite. For use, add 1 pint of this stock solution to 2 gallons of water. Caution: 1) Hypochlorite poured into lye causes a violent reaction, 2) This formula will remove paint.

An effective deodorant used by the National Zoo consists of: 4 ounces of oil of pine to 1 gallon of water. Caution: The formula is harmful to reptiles.[1]

Where illness or death of an animal is attributed to a contageous disease, every square inch of it's enclosure must be decontaminated. Hard surfaces must be disinfected, the soil in yards must be turned over, and bedding, toys, etc., should be destroyed. Cage mates should be isolated for observation. If deaths occur, the bodies should be burned, after autopsies have been performed.

The quality of routine cleaning reflects on every member of the organization and indirectly upon every member of the community. Its importance in the prevention of disease is paramount. Each exhibit and its adjacent area must be thoroughly cleaned each morning before the public arrives. Frequent spot checks and touch-ups should be made throughout the day. Bedding must be inspected and changed frequently

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[1] Ibid., p. 313. Also, Reuben Hilty in "Words of Caution Here and There," Parks and Recreation, Vol. XV, No. 6 (Feb., 1932), pp. 370-373, stresses the importance of knowing the content of such formulas. Among other ingredients, he lists antimony chloride and cresylic acid as being poisonous to cats, and possibly to other animals.

to keep the animals clean and free from mites. Animal food is inspected before each feeding to guard against contamination. Shortly after the animals have finished eating, Keepers should remove all leftover food and wash and disinfect the feeding dishes.

Animal records must be maintained daily and the proper authorities notified of changes within the collection.

Quarantine

Quarantine can be an effective method of preventing the spread of disease in zoo animals. All animals being imported are quarantined for varying lengths of time depending on the species and the areas they come from. Until the legal quarantine period is over they are not allowed to enter the United States. In this way animals in the United States are protected from diseases that might be brought in from other countries.[1]

Animals are also quarantined upon arrival at a zoo before being put on display. This guards against the introduction of diseases not screened in other quarantines or those contracted enroute.

Quarantine is essential for animals that are suspected of having contageous diseases. Mammals that appear ill make a poor public impression and should not be displayed even though the illness may be noncontageous. Often, complete rest away from crowds of people is a major factor in an animal's quick recovery.

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[1]See Alden S. Wood, "America's First Animalport," Nature, Vol. 51, No. 6, (June-July, 1958) pp. 305-307, screening animal diseases.

For a maximum of protection for the animals, zoo personnel, and the public, quarantine should take place in a separate area of the zoo and should be managed by a separate caretaker.

Acclimatizing

As a general rule, animals from cold climates adjust to high temperatures more easily than animals used to extreme heat adjust to cold.[1] There are exceptions of course.

Some tropical species do very well when allowed access to the outdoors all winter long. Some of the African monkeys grow thick coats of hair and are less likely to take cold than if they were suddenly turned out of a warm building to spend cool summer nights on a monkey island or in other outdoor exhibits.

Campbell[2] claims lions, Grevy's zebras, Indian water buffalo, Indian antelope and many of the primates, including chimpanzees, have thrived outdoors all winter. He has seen South American, African, and Indian primates outside in -10°F. weather and there has been, "practically no respiratory troubles now for twenty years."

Gradual acclimatization is the answer to successful adjustment of mammals from warmer climates that are to be exhibited outside. They should be allowed to gradually lengthen the time they spend outdoors during cold weather until they finally have access to the outdoors at

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[1]According to Dr. Rollin H. Baker, Director of the Michigan State University Museum, in a lecture on zoogeography.

[2]J. A. Campbell, "Some Observations Relative to Ailments of Inmates in a Zoological Park." Parks and Recreation, Vol. XVII, No. 9, (May, 1935), pp. 378-382.

all times. They should never be denied access to adequate shelter from the cold.

For many delicate tropical species, indoor exhibits must be used in the temperate zone, at least during the cold season. Many are so delicate they should be displayed indoors at all times, where humidity and drafts can be controlled.

Even though heated buildings are provided for winter quarters, mammals such as marmots, that normally hibernate, should be allowed to do so or they may not survive the second summer.[1]

In order to hibernate, Walker[2] informs us, mammals must get fat and have cool, dark quarters that are insulated against freezing. The humidity should be high and the temperature quite stable. A final requirement of most hibernating mammals is a nest of absorbant material such as sugar cane pulp.

The cooling affect of water can be important in making mammals from cold climates, as well as some tropical animals, more comfortable through the hot days of temperate zone summers.[2] Water falls, pools of running water, and shade not only give an impression of coolness but may actually lower temperatures considerably in the exhibit area. Concrete surfaces may be hosed down for added relief from extreme summer heat.

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[1]Walker, op. cit., pp. 315-316.

[2]Ibid.

[3]Campbell, op. cit. (Discloses that elephants, because of their hairless skin, are unable to stand extremes of cold or heat.)

A proper balance of sun and shade is important to the well-being of most mammals. Even when ultra violet lamps are used, an adequate proportion of shade should be provided. Air conditioning may be necessary where lights tend to overheat indoor exhibits. Most nocturnal mammals apparently do not require sunlight for their general well-being.

As a group, with their constant body temperature control mechanism and efficient insulation, the mammals manage to survive as great a variety of habitats as any group of animals on earth.[1]

Evidence of Poor Health

The effective cure of most illnesses depends on early detection. It is important that keepers observe their charges carefully each day for signs of trouble. Some of the more common symptoms of poor health to be watched for among mammals are lack of appetite, weight loss, lack of grooming, unusual lack of activity, eyes not bright, unseasonal loss of hair, looseness of bowls or constipation, convulsions, coughing, excessive thirst, discharges from eyes or nose, and rapid or labored breathing.[2]

When there is reason to believe an animal needs medical attention, the veterinarian should be notified at once.

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[1]Ivan T. Sanderson, Living Mammals of the World (Garden City, New York: Hanover House, (n.d.), p. 10.

[2]The Merck Veterinary Manual, op. cit., p. 1246.

Medical Care

Though much has been accomplished in the past fifty years there is still much work to be done concerning the cure of diseases in wild animals. Due to the rarity of some species, without enough animals for experimentation, a vacuum of medical knowledge concerning their care often makes diagnosis and treatment extremely difficult.

Our knowledge of domestic species can often be applied to zoo animals of similar physiology. Most diseases of domestic rabbits are analogous to those found in wild Lagomorphs. Among the Canines, Felids, Mustelids, and other large families, analogies can be made, yet occasionally perplexing differences do occur.

Often there is no domestic relative to be compared, as in the case of aardvarks, the egg-laying mammals and many others. Where gaps of medical knowledge occur, often intuition must be combined with experience in caring for a great variety of animals. Complete records, including autopsy data of diseases occurring in rare species can be of tremendous value in treating similar cases.[1]

Fortunately, many diseases are confined to families or other groups of similar animals. Tuberculosis is an exception. It can be found in one form or another in almost all of the warm-blooded animals.[2]

Much of the success achieved in the actual treatment of zoo animals depends on ingenuity in devising means of restraining them while

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[1]Herbert Fox, Disease in Captive Wild Animals (Philadelphia: J. B. Lippincott Co., 1923).

[2]Campbell, op. cit., pp. 378-382. Lists factors conductive to the occurrence of tuberculosis.

medication is applied, without exposing personnel to danger, or unduly exciting the animal. Often more harm than good comes from restraining wild animals. To some, weakened by disease, capture and rough handling necessary to force medication could be fatal.

Whenever possible, medicines should be administered by mixing them with an animal's favorite food, preferably when the animal has been made hungry by skipping a regular feeding.

Milk is a very good medium for disguising the taste of medicine, according to Bridges.[1] Sick mammals will often take milk in preference to any other food. It should be discontinued temporarily if diarrhea occurs. Only canned or pasteurized milk should be used in order to safeguard the animals against tuberculosis.

Mechanical injuries such as broken bones usually require that the animal be restrained in order to set the bone and construct a cast that will stand considerable abuse. The animal's temperment and condition determine whether it shall be anesthetized while the bone is being set. If an anesthetic is used, the amount is determined by the animal's body weight and temperment.

Major surgery is seldom attempted unless absolutely necessary. It may not only disfigure an animal, but the aftercare is so difficult in wild animals that it is quite impractical in most cases.

Wide wooden collars are sometimes employed to prevent animals from chewing on bandages or body wounds.[2]

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[1]William Bridges, Zoo Doctor, (New York: William Morrow and Co., 1957).

[2]Moore, op. cit., illustrated p. 341.

The Feeding Process

In an effort to acquaint the reader with some of the work and problems involved in feeding zoo mammals, this section is devoted to acquisition, storage, the actual feeding, basic diets and reference to specific diets.

Acquisition of Food

In the larger zoos, food acquisition is accomplished by curators working through a commissary section.

Most animal foods are purchased wholesale and in quantity. Quantity buying not only saves time and money, but lessens the chance of running out of certain seasonal foods.

In order to promote good public relations and as insurance against high prices and deficiencies, it is good business to patronize as many local food wholesalers as possible.

Grocery wholesalers provide much of the food required by the mammal division. Meat packing plants are excellent sources of meat scraps, bones, chicken heads and other meats necessary in a well-rounded diet for carnivores. Bakeries may supply quantities of inexpensive stale bread. Hay, grain, and a variety of other farm produce may be purchased directly from local farms, in season. Misshapen cull vegetables may be purchased cheaply at local markets.[1] Pet supply houses usually stock a variety of less common animal foods such as ant eggs, meal worms,

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[1]Other aspects of food quality must not be sacrificed for bargain prices. Frost-touched cabbage; for example, has been known to make elephants deathly sick.

dried flies, and many others that are relished by certain monkeys, many of the rodents, marmosets, and other of the more delicate small mammals. Biological supply houses may sometimes provide hard to get foods such as frogs, snakes, lizards, and others. Fish markets usually carry a variety of sea foods. During the summer months, local boys may be encouraged to gather wild materials, both plant and animal. Hunters and trappers may also be of some help. Earthworms, grubs, minnows, and many other bait items may be purchased from fish-bait dealers.

Moths and other night-flying insects may be trapped in large numbers during warm weather, by using mercury vapor lamps to attract them.[1]

Under extreme circumstances, it may be necessary to have exotic foods shipped in, for rare animals, until suitable substitutes can be found.

Raising Food

By raising its own food, a zoo may not only cut food costs considerably, but may assure itself of certain hard to get items as well.

Most of the hay used in the Potter Park Zoo, is grown by its Director, Ted Downey, on undeveloped park lands. Thus he is assured of less expensive, top quality hay. He personally inspects it for coarse material such as foxtail and other grass-like vegetation with barbed awns.[2]

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[1]Lincoln Barnett, "Rainbow Realm of Tropical Insects," Life, (Nov. 3, 1958).

[2]See Walter C. Muenscher, Poisonous Plants of the United States, (New York: Macmillan Co., 1951).

During the summer months, grass clippings may be saved for the herbivores. Branches pruned from certain types of trees and shrubs are enjoyed by browsing animals throughout the year. In the Fall, acorns and other nuts may be gathered from city-owned land. During World War II many zoos were forced to raise their own vegetables on city property.[1]

Many of the common small mammals with high breeding potentials, such as rabbits, Guinea pigs, white rats, and others are used as food for carnivores. Certain birds and reptiles are used for this purpose, too.

Some of the specialty foods such as meal worms, wax worms, and maggots may be raised in quantity in a very small space. Meal worms are easily raised on bran, mixed with green vegetables, between two layers of burlap. Maggots may be stored indefinitely by keeping them in jars in a cooler so they will not pupate.[2]

Substitutes

Often, when certain foods are not available or become too expensive, suitable substitutes must be found. In many cases it is impossible to supply exotic animals with their native foods. Often their feeding habits are unknown. Walker[3] suggests introducing new diets in the following manner; offer as wide a variety as possible so the animal may choose the kinds that suit its needs. An ample quantity and variety

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[1]Roger Conant, "Zoo Food Shortages," Parks and Recreation, Vol. XXVII, No. 1 (1944), pp. 35-38.

[2]Walker, op. cit., pp. 323-325. Describes methods of raising several forms of insects.

[3]Ibid., p. 319.

should be given so the animal will not be forced by hunger to eat food that may be harmful. It should be given plenty of time to select its food as it may take a week or more to sample certain foods with which it is unfamiliar. A careful record should be made of foods sampled and the quantity eaten, so that a permanent diet can be established.

The growing scarcity of horse meat presents a problem in feeding carnivores. The W. K. Kellogg Company of Battle Creek, Michigan, is experimenting with dog and mink foods in an attempt to produce high protein grain formulas that are acceptable to the animals and that will maintain health, reproductive efficiency and high pelt quality.

Corbin and Schafer[1] tell how young cats may be changed to a mink supplement diet by first feeding ground meat and gradually increasing the amount of supplement mixed with the meat and water. They claim, in the near future, all cats may be fed a completely dry ration. A lack of flavor seems to be the limiting factor at present.

Lucky and Hittson[2] tell of a superior lioness raised by the Fort Worth Zoo on a meatless diet. They believe, in a short time, all carnivores may be fed prepared foods.

Food Storage

In most well-planned zoos, adequate food storage facilities are provided in a centrally located commissary building. A receiving clerk

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[1]Dr. J. E. Corbin and H. C. Schafer, "Feeding the Specialty Animals." Parks and Recreation, Vol. 41, No. 8 (Aug., 1958), pp. 339-342.

[2]T. D. Lucky and H. Hittson, "Lion Feeding in the Future," Parks and Recreation, Vol. 35, No. 5, (1952), pp. 32-33.

records all deliveries and speeds the multitude of foods to their special storage places.[1] Bags of meal and feed are sent to the grain room. Fish, meat, vegetables and fruit go to their respective refrigerators, and hay, to the lofts.

Well designed buildings employ many labor saving devices such as ramps, loading shoots, mechanical dollys, elevators, modern cooking facilities and gravity fed food storage outlets.

Foundations, walls and floors are designed to exclude rodents. Screens keep flies and other pests out of the spotless kitchen, and ventilation systems help create sanitary and enjoyable working conditions.

Food Preparation

Full-time cooks are on hand, in larger zoos, to prepare basic diets, bake bread, and generally assist keepers in the daily food preparation. The Curator must establish each animal's ration, but it is up to individual keepers to check daily the quantity and quality of the food and to make final preparations to suit the individual taste of each of his animals.

Feeding

In order for a feeding program to operate efficiently, a feeding schedule must be established. Regularity promotes good health among the animals, allows supervisors to check the feeding, allows accurate,

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[1]Freeman M. Shelly, "Cage Service," Fauna, Vol. 1, No. 3 (Sept. 1939).

daily quantity checks to be made and encourages the public to watch the feeding operations.

Most adult mammals may be fed once every day. Some of the smaller, more delicate species must be given more attention. Shrews for example, must feed almost constantly.

Pregnant females and females with nursing young, as well as growing animals, should receive special attention.

The larger carnivores remain in better health if they are kept a little hungry and if they have one fast-day each week. A practical method of determining how much to feed the big cats, according to Stephan,[1] is to allow each animal to gorge itself during each feeding, for several days, keeping track of the quantity eaten, by weight, each time. As the animal begins to taper off, in amount consumed, set its daily ration somewhat below that figure. This procedure should be repeated occasionally as a check.

As a rule, most other species remain in better health if they are not allowed to become overweight. Extra fat encourages inactivity, a negative value for display purposes. Bear often develop sore feet from walking on concrete, as a result of being overweight.[2]

With the exception of most of the herbivorous mammals, that must feed for long periods to sustain themselves, extra food should be cleaned up shortly after the animals have finished eating. At the

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[1]Capt. S. G. Stephan, "Sick Call," Parks and Recreation, Vol. XXV, No. 4, (Dec. 1941), pp. 157-162.

[2]Many types of animals may develop sore feet from walking on concrete. See illustration in Walker, op. cit., pl. 8, fig. 2, of monkey's foot worn to the bone.

same time, feeding pans should be collected and taken to the commissary to be thoroughly washed.

Keepers must see that weaker animals get their share of food, even if it means feeding them separately from their cage mates.

Cool fresh water must be available to the animals at all times.

Basic Diets

The quantity and variety of foods stocked by large zoos is enormous. A few of the more common types stocked for mammal consumption are as follows:[1]

apples	raisins	meal worms
oranges	nuts	rabbits
bananas	oats	fowl
sweet potatoes	sunflower seed	earthworms
white potatoes	millet	liver
greens	bran	bones
beets	willow branches	grasshoppers
carrots	evergreen branches	chameleons
corn	bread	fish
alfalfa[2]	oatmeal	mink supplement
timothy hay	meat	dog meal
apricots	eggs	Mellin's food mixture
grapes	milk	
prunes	bone paste	

Herbivores

For the large herbivores, Shelly[3] recommends a mixture of grain and legume-meal, reinforced with vitamins and minerals. A low protein

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[1]The Merck Veterinary Manual, op. cit., Table 31.

[2]Second and third cuttings of this legume are preferred. First cuttings are too laxative.

[3]Shelly, "Feeding Zoo Animals," Parks and Recreation, Vol. XXX, No. 11 (Nov. 1947), pp. 548-550.

dairy ration containing 30% alfalfa leaf meal improves the vitamin "A" content and compensates for a lack of green grass.[1] Mix with an equal quantity of dried beet pulp, wet thoroughly and add 10% green vegetables. Mixed hay should be fed separately. Shelly claims most hoofed and horned animals do very well on this diet. Kangaroos and their relatives, he says, should be given additional carrots, sweet potatoes and other vegetables.

Corbin and Schafer[2] offer the following information on herbivore diets. For ruminants, 3/4 lb. of supplement is normally fed for every 100 lbs. of body weight, plus all the high quality legume hay the animal will consume. The supplement should be fortified with essential vitamins and minerals designed for developing young and for reproduction, not a high energy mixture that produces excessive body fat. A high quality milk replacer, followed by a calf starter, will usually help poor milk producers raise strong offspring. Bloating and scouring may be remedied by mixing legume hay with straw or grass, or by using a legume hay with smaller leaves.

Non-ruminants such as horses, donkeys, and zebras remain in good health when fed 1/2 lb. of high molasses supplement per 100 lbs. of body weight, with grass hay offered as free choice. Legume hay may cause scouring or impaction in these animals.

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[1]Glen G. Crosbie, "Feeding and Care of Wild Mammals and Birds," Parks and Recreation, Vol. 37, No. 12, (Dec. 1953), states that a lack of vitamin "A" lowers resistance to colds and pneumonia. It may cause nervous disorders, loss of young, and weakness. It is necessary for maintenance of body growth, reproduction and lactation.

[2]Corbin and Schafer, op. cit., p. 340.

Trace minerals and salt should be offered both groups as a free choice.

Walker[1] suggests trying such animals as deer, sheep, goats, antelope, and bison, on silage.

Of the Rodents and Leporids, Corbin and Schafer[2] claim such groups and species as chinchilla, nutria, prairie dogs, and rabbits, do very well on prepared rabbit rations and water. They add that developing and dry adults should be fed sparingly or they become too fat.

In addition to green leafy vegetables provided for small herbivores high protein foods such as meat or egg should be offered, to supplement worms, insects and bird eggs they obtain in the wild. They should also be given a generous amount of multivitamin preparation daily.[3]

Omnivores

Shelly[4] recommends that omnivorous animals be fed a mixture of whole grains, processed legume meals, dried milk products, yeast, cooked ground meat, and fortified with vitamin preparations and minerals. Except for highly specialized animals, most subhuman primates, bears, and most raccoons and their relatives do very well on this diet. Fresh fruits and vegetables may be added.

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[1]Walker, op. cit., p. 331.

[2]Corbin and Schafer, op. cit., p. 340.

[3]The Merck Veterinary Manual, op. cit., p. 748. For further information on vitamins see The Physician's Vitamin Reference Book, issued by the E. R. Squibb Co. The A. J. Heinz Co. issues charts on nutrition.

[4]Shelly, op. cit., p. 549.

A well-balanced dog ration and water constitutes a complete diet for members of the canine family, racoons, and most bear, according to Corbin and Schafer.[1] During lactation, additional meat should be fed to increase the female's milk supply. These animals should be fed all of the commercial ration they can eat, within a half-hour period, once every day.

Walker[2] observes that seasonal diet changes seem to be necessary for proper development in some species.

Concerning the feeding of bear, Crosbie[3] suggests that grizzlies, polars, Himalayans, and Eurasian browns be fed: eggs, vegetables, fruits, bread, bran, and honey three days per week. A mixture of half dog food and half meat, with a little fish added, should be fed three days per week, and the seventh day should be a fast day.

Cooks at the National Zoo make bear bread in 200 lb. lots. The following materials are thoroughly mixed, allowed to rise, and then baked like other breads; 100 lbs. flour, 60 lbs. bran, 2 lbs. salt, 1/2 lb. yeast, and 1 lb. blackstrap molasses. This is fed with a variety of meats, including the hair, feathers, bones, viscara, and supplemented with vegetables and occasionally a small amount of honey.[4]

Commercial monkey rations containing ascorbic acid eliminates the necessity of feeding fruit or green supplements to most primates.[5]

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[1]Corbin and Schafer, op. cit., p. 340.

[2]Walker, op. cit., p. 307.

[3]Crosbie, op. cit., p. 19.

[4]Walker, op. cit., p. 342.

[5]Previously, citrus fruit has been fed as a source of vitamin "C" a lack of which causes scurvy in the Primates and Guinea Pigs.

The leaf-eating monkeys are an exception. They should still be fed flowers, leaves and meal worms.

Dog pellets are an excellent basic food for baboons, porcupines, otter, and beaver.[1]

A formula for a basic pellet ration that assures animals of all the necessary food elements was made by O'Connor[2] during World War II. The following materials were ground and mixed: cooked corn and wheat cereals, protein meat meal, liver meal, soybean oil meal, dried skim milk, wheat germ, tomato pomace, yeast, whitefish meal, cheese, alfalfa meal, bone meal, salt, and fortified codliver oil.

Carnivores

A diet used successfully by the Philadelphia Zoo for such flesh eaters as wolves, foxes, and even birds of prey, consists of: 30% Shelly's dry, "Mix for Omnivores,"[3] 60% ground raw meat, and about 10% tomato paste, or an equal amount of green vegetables, plus added vitamins and minerals. The cat family will not accept this mixture consistently, so they are fed whole meat, supplemented by rabbits and domestic fowl, exclusively.

O'Connor[4] claims that lions may be maintained on the dry mix he recommends for omnivores.

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[1] The Merck Veterinary Manual, op. cit., p. 749.

[2] Patrick O'Connor, "Wartime Animal Nutrition," Parks and Recreation Vol. XXVII, No. 1, (Jan.-Feb., 1944), pp. 38-41.

[3] Shelly, supra, p. 52.

[4] O'Connor, op. cit., p. 40.

Corbin and Schafer[1] say that a combination of 35% mink supplement and 65% meat, with added water, offers the best diet for cats. This formula may cut meat consumption as much as 60%. Young cats are easily changed to mink supplement by mixing increasing amounts with ground meat.

Besides good muscle meat, carnivores should receive generous portions of liver and other viscera. Bone meal or bone paste and cod-liver oil is particularly important to the well-being of young growing animals.[2]

Crosbie[3] recommends that amino acid supplement be added to the lean horse meat, liver, vitamins and minerals fed to Felines. He also suggests that at least once per week the cats should be given a whole rabbit or jungle fowl. Canines should be given rabbits, jungle fowl, or Guinea pigs occasionally. Young animals should get plenty of milk, vitamins and minerals. Adults do well on half dog food, half meat, six days per week.

The small mammalian carnivores should be fed generally in the same manner as the larger meat eaters. Offered as a supplement to prepared foods, freshly killed mice, rats, and small birds, add variety to a well-rounded diet.

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[1]Corbin and Schafer, op. cit., p. 340.

[2]The Merck Veterinary Manual, op. cit., p. 748.

[3]Crosbie, op. cit., p. 19.

Insectivores

Many small mammals eat great numbers of insects in the wild. Some feed on them almost exclusively. Others acquire them while eating plant foods. Insects raised at the zoo fulfill the needs of some of these animals. Others can be induced to change to other foods.[1]

Piscivores

Fish eaters may be fed fresh or frozen fish. As yet, no food substitute has been found for animals that feed entirely on fish. Vitamins may be added to whole fish by pouring them directly into the fishes mouth. Frozen fish should be thoroughly thawed and all fish must be checked for fish hooks. Even slightly tainted fish may kill sea-lions.

Fish are an important diet supplement for many fur-bearing animals such as mink and fox. Canned, dried, fresh, or frozen fish may be fed to these mammals.

Reference to Specific Diets

The Merck Veterinary Manual published by Merck & Co., Inc., Rahway, N. J., 1955, contains diets in table form (pages 750-757) for over seventy-five groups and species of mammals from all over the world.

Ernest P. Walker, "Care of Captive Animals," Annual Report of the Smithsonian Institution 1941, United States Government Printing Office,

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[1]William Bridges, "Anteaters Become Milk-Egg-Meat-Eaters in the Zoo," Animal Kingdom, Vol. 59, No. 2 (April, 1956), pp. 43-46.

lists about sixty-five diets (pages 339-347) for groups and species of mammals not mentioned in the Merck Manual.

For detailed diets of most North American mammals, see Clifford B. Moore's, The Book of Wild Pets, G. P. Putnam's Sons, New York, 1937, pages 307-397.

All three of these references also have sections on bird and reptile diets.

For reference to diets for specific mammals see the appendix of this thesis.

CHAPTER III

PUBLIC RELATIONS

Probably no one factor is more important to the continued success of a zoological park than favorable public relations. As a public institution, a zoo's history from inception through ultimate success or failure is determined largely by weight of public opinion. Quality of public relations is influenced by every member of an organization. In a zoological park organization, favorable public relations is a product, a means to an end, and even an end in itself.

Zoo Products and Management Goals

Schroeder reminds us that, "a zoo is a business. We have a board of directors, a management staff and production workers. Our product is the exhibition of animals."[1]

In a modern zoo there may be other products. The quality and character of these products determine to what extent zoo goals will be achieved.

The Mammal Division's contribution to zoological park goals is accomplished primarily through display, programing, and the interfusion of favorable public relations.

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[1]Dr. Charles R. Schroeder, "Applying Industrial Personnel Management Practices in a Zoo," Parks and Recreation, Vol. 40, No. 11 (Nov., 1957), pp. 13-15, 28.

Display

Perspective in planning and design is the key to effective zoological display. Consideration must be made for: the personnel who work with the animals; the peculiarities of each species of mammal, and the people who come to see the displays.[1]

Efficiency and personnel safety are two of the most important considerations in planning for maintenance. Ample escape doors, shift cages, maintenance aisles, adequate drainage systems, and a host of other essential maintenance features must be given top priority.[2]

Each species of mammal must be considered individually with regard to its special needs and for the purpose of showing it in the most interesting and effective manner possible. Of the exhibition of animals, Schroeder says, "To improve our product we must show animals in better condition and to better advantage; to be more efficient we must keep them longer and have them reproduce, and do it with greater food efficiency and avoid lost motion."[3]

To best serve the visiting public an over-all balance of beauty, entertainment, and education is needed.

Beauty may be achieved through contemporary landscape practices that blend well-made buildings and enclosures with natural materials, to create harmony and unity of the total design. A means of relating

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[1]For considerations in master planning see Wilcox, op. cit., 48 pp., and Robert F. Mainone, A Master Plan for the Potter Park Zoo, Lansing, Michigan, Part I and II, M. S. U. Res. Dev. Dept., 1957, unpublished.

[2]Mainone, A Hoofed Stock Display, M. S. U. Res. Dev. Dept., 1957, unpublished.

[3]Schroeder, op. cit., p. 13.

man to nature according to Eckbo.[1] Just as trees, shrubs and flowers are chosen for size, color and shape, animals, too, should be considered as elements of design in the production of individual exhibits.[2]

The entertainment value of groups of young, active animals would seem to warrant further experimenting with untried combinations of one or more species.[3] Well designed exhibits may add considerably to a specie's entertainment value.

The potential educational value of zoological displays may be brought out, in part, through the effective use of interpretive signs.[4] Conservation, natural history, ecology, and other subjects related to zoology, may be made interesting and practical through modern museum techniques.[5] Electronic devices offer a great range of future interpretive possibilities.

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[1]Garrett Eckbo, "Animals in the Landscape," Landscape For Living, (Los Angeles: Duel, Sloan & Pearce, 1950), p. 115.

[2]Ibid.

[3]Mainone, Notes on the W. K. Kellogg Experimental Mink Colonies and Their Relationship to Zoological Gardens, M. S. U. Res. Dev. Dept. 1957, unpublished. Also, see W. C. Allee, Animal Aggregations: A Study in General Sociology, (Chicago: University of Chicago Press, 1931).

[4]For details on signs read Victor A. Greulach, "The Use of Illustrated Zoo Labels," Parks and Recreation, Vol. XXVIII, No. 3, (May-June 1945), pp. 164-170.

[5]Lawrence Curtis, "The Rain Forest at Ft. Worth Zoo," Parks and Recreation, Vol. 41, No. 9, (Sept. 1958), pp. 394-395. Also, see Peggy Pickering Larsen, "A Living World Underground," Nature, Vol. 51, No. 6, (June-July, 1958), pp. 288-292, 332.

Programing

In a well-rounded zoo program aimed at maintaining favorable public relations; promotion, entertainment, and education may become inseparable.[1]

Long-range planning is the key to effective program organization. Consideration must be given to finance, leadership, the effect on individual animals and the people that will be participating in the programs.

As programs become larger in scope, the responsibility of finance and leadership may shift. Finance may come in part, or entirely, from other local organizations, institutions, local tax funds, gifts, special money making projects, or from the programs themselves.

Sources of professional and volunteer leadership should be determined.

The effect of programs on the animal's well-being must be considered. Safety of animals and the public should be of primary concern. Habits and disposition of individual animals are important planning considerations.

The age, sex, physical, emotional, social, and mental characteristics of the people who will participate, must be determined to best serve their diversified interests. From such surveys, a favorable balance of entertainment and educational activities may be planned.

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[1]See Fletcher A. Reynolds, "The Zoo Naturalist," Parks and Recreation, Vol. XXX, No. 12, (Dec., 1947), pp. 582-585, on public relations. For some excellent programing ideas, check the Park Management Series Bulletins, edited by Arthur T. Wilcox and Leslie M. Reid, through the Michigan State University Agricultural Experiment Station and Cooperative Extension Service, in cooperation with the American Institute of Park Executives Park Education Program; Bulletin 6, Outdoor Education; Bulletin 7, Interpretive Programs; Bulletin 8, Park-School Programs.

An opportunity for participation at various levels of proficiency adds depth to the total program. Variety and flexibility insure continued interest for the greatest number of people.[1]

Favorable Public Relations--A Means of Achieving Zoological Park Goals

Organization policy, attitudes of personnel, appearance of the physical plant, facilities and services provided, combine to shape public attitude, which, in the final analysis, determines whether or not a public zoo will develop and maintain public support.

The three major goals of a zoo public relations program are: to promote and perpetuate the organization itself; to provide entertainment and recreation for all, and to contribute to community, national, and world culture, through education.

Emphasis on Education

The zoo's ability to create interest in the life sciences among people of all ages has caused an increasing demand from educational institutions and the general public, for zoo sponsored education programs at all levels. Much has been done by many of our zoos to

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[1]See Robert F. Mainone and Alex Wynstra, Jr., A Zoo Recreation Program, M. S. U. Res. Dev. Dept. 1957, 9 pp., unpublished outline. Creating interest in a zoo through a recreation program. The paper includes planning, organizing, specific activities including zoo arts and crafts projects at various levels of proficiency. Hobbies associated with zoos, and other related activities lead up to a zoo sponsored, city-wide American Indian pagent. The costumes and other paraphernalia are produced, in part, from zoo animal products such as feathers, hides, horns, antlers, teeth, etc. Included in the outline are other ideas on educational programs and reference to further reading.

answer this demand, and more will be done in the future as our search for knowledge becomes more intense.[1]

Cooperative programs that bring organizations together add greatly to the depth and scope of ideas; such as, conservation education and nature interpretation. Through careful consideration, program balance may be planned to provide still greater good for greater numbers, and yet provide "something for everyone."

Through education-centered displays and programs, with the aid of all forms of communications media and modern interpretive techniques, the zoo can become a center for discovery, teaching, and stimulating interest in science. Imagination is the major limiting factor. The creative possibilities are infinite. A tremendously exciting challenge for those who would solve the fascinating problems of nature and inspire others in the quest for that knowledge for the betterment of mankind.

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[1]The world's total knowledge is now doubling every fifteen years and there is every reason to believe this rate will continue to increase. Wernher von Braun (1958).

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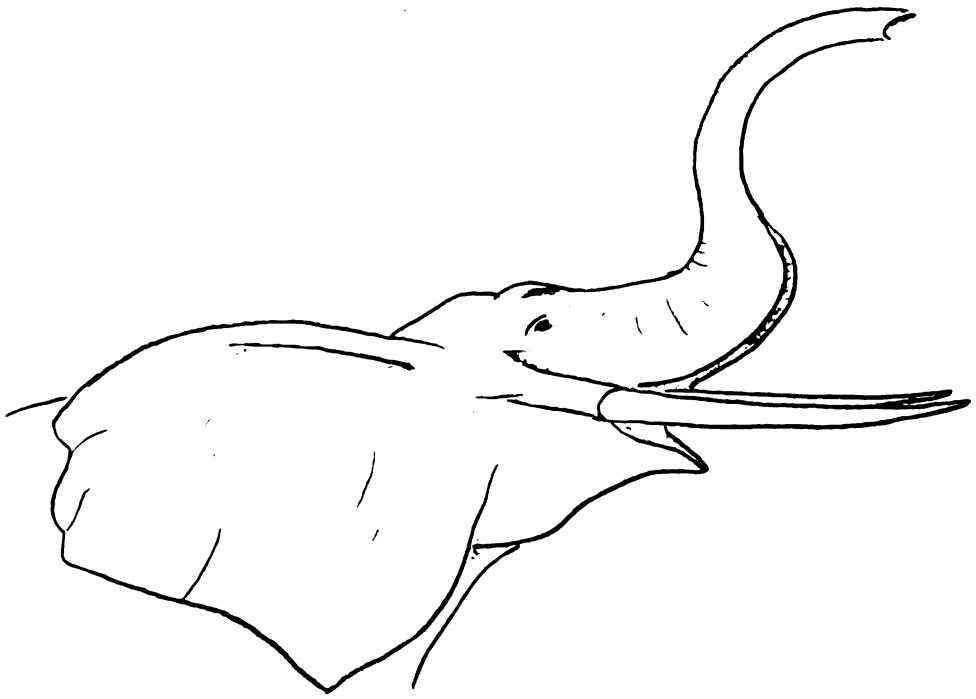

APPENDIX

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APPENDIX

A REFERENCE TO MAMMAL DIETS

Classification by order and family, Simpson (1931).
Common names, Sanderson (n.d.), Walker (1941), Burt (1948).
Distribution, Burt (1948).

Monotremata (egg-laying mammals)
- Tachyglossidae (Australia, Tasmania, New Guinea)
  - spiny anteaters or echidnas[1,2]
- Ornithorhynchidae (Australia and Tasmania)
  - duck-billed platypus[1]

Marsupialia (pouched mammals)
- Didelphiidae (North, Central, and South America)
  - opossums[1,2,3] mouse-opossums[1,3] water opossums[1]
- Dasyuridae (Australia and Tasmania)
  - dasyures[1] Tasmanian devil[2] pouched wolf or Tasmanian tiger[1]
- Notoryctidae (Australia)
  - marsupial mole[1]
- Peramelidae (Australia)
  - bandicoots[1]
- Caenolestidae (South America)
  - caenolestes[1]
- Phalangeridae (Australia, Tasmania, New Guinea, New Zealand)
  - phalangers[1,2]
- Phascolomiidae (Australia and Tasmania)
  - wombats[1,2]
- Macropodidae (Australia and Tasmania)
  - kangaroos[1,2] wallabies[1,2] tree kangaroos[2]
- Phascolarctidae (Australia)
  - koalas[4]
- Myrmecobiidae (Australia)
  - banded anteaters[1]

Insectivora (insect-eating mammals)
- Tenrecidae (Madagascar)
  - tenrec[1]
- Potamogalidae (Africa)
  - African water shrew
- Solenodontidae (Cuba and Haiti)
  - solenodon[1,2]

Diets: [1]Walker (1941); [2]Merck (1955); [3]Moore (1937); [4]Sanderson (n.d.)

Chrysochloridae (Africa)
golden mole[1]
Erinaceidae (North Africa, Europe, Asia)
hedgehogs[1,2]
Soricidae (northern South, Central, and North America, Europe, Asia, Africa)
shrews[1,3] water shrews[1] sun shrews[1]
Talpidae (North America, Europe and Asia)
moles[1,2,3]
Tupaiidae (East Indies)
tree shrews[1,2]
Macroscelididae (Africa)
jumping or elephant shrews[1]

Dermoptera (gliding mammals)
Galaeopithecidae (Malay Peninsula, Thailand, Sumatra, Java, Borneo, Philippines)
flying lemur or colugo[1]

Chiroptera (flying mammals)
Pteripodidae (tropical and subtropical regions of the Old World, east to Australia, Samoa, and the Caroline Islands)
fruit-eating bats or flying foxes[1]
Rhinopomidae (north Africa and southern Asia)
valve-nosed bats[1]
Emballonuridae (tropical parts of both hemispheres)
sac-winged bats[1]
Noctilionidae (tropical America)
fish-eating bats[1]
Nycteridae (Africa, Malay Peninsula, Java, Timor)
long-tailed bats[1]
Megadermatidae (Africa, southern Asia, Australia)
large-winged bats[1]
Rhinolophidae (Europe, Africa, Asia, Australia)
crest-nosed bats[1]
Hipposideridae (Africa, southern Asia, Australia)
horseshoe-nosed bats[1]
Phyllostomatidae (tropical America, northward to southern United States)
leaf-nosed bats[1]
Desmodontidae (tropical America)
vampire bats[1] false vampire bats[1]
Chilonycteridae (tropical America)
large-lipped bats
Natalidae (tropical America)
straw-colored bats[1]
Furipteridae (South America)
funnel-eared bats[1]

Diets: [1]Walker (1941); [2]Merck (1955); [3]Moore (1937)

Thyropteridae (tropical America)
disk-thumbed bats[1]
Myzopodidae (Madagascar)
bats with suctorial disks on thumbs and feet[1]
Vespertilionidae (nearly world-wide)
vespertilionid bats[1,3]
Mystacopidae (New Zealand)
mustache-lipped bats[1]
Molossidae (world-wide in tropical and subtropical regions)
free-tailed bats[1]

Carnivora (flesh-eating mammals)
Ursidae (Europe, Asia, North and South America)
bears[1,2,3]
*Ailuridae (Asia)
pandas[1,2] lesser pandas[1,2]
Procyonidae (Asia, North and South America)
raccoons[1,2,3] coatis[1,2] kinkajous[1,2]
Bassariscidae (North and Central America)
cacomistle, bassariscus or ring-tailed cat[1,2]
Mustelidae (Asia, Africa, Europe, North and South America)
weasels[3] mink[3] martin[1] sable[1] badgers[1,2] sun badgers[1,2]
skunks[1,2,3] wolverine otter[1,2,3] fisher
Viverridae (Europe, Asia, Africa)
civets[1,2] mongooses[1] genets[1,2] binturongs[1] fossa[1]
Canidae (Africa, Europe, Asia, Australia, North and South America)
dogs[1] wolves[1,2] coyotes[1] foxes[1,2,3]
Hyaenidae (Africa, southwest Asia)
hyenas[1,2]
Felidae (Europe, Asia, Africa, North and South America)
lions[1,2] tigers[1,2] leopards[1,2] jaguars[1,2] pumas[1,2] lynx[2]
other cats[1,2]
Otariidae (North and South America, Australia, Antarctica)
eared seals[1] sea lions[1,2]
Phocidae (all seas)
hair seals[1] sea elephants[1]
Odobaenidae (Arctic America, Europe)
walruses[1]

Cetacea (marine mammals)
Iniidae (Asia, South America)
fresh-water dolphins
Ziphiidae (all seas)
beaked whales
Delphinidae (all seas)
porpoises[1]

Diets: [1]Walker (1941); [2]Merck (1955); [3]Moore (1937).

*Classification from Walker (1941).

Platanistidae (Asia)
river dolphins
Delphinapteridae (Arctic)
narwhales white whales or belugas[1]
Physeteridae (chiefly tropical seas)
sperm whales
Rhachianectidae (North Pacific)
grey whales
Balaenopteridae (all seas)
finback whales humpback whales
Balaenidae (all seas)
baleen whales

Rodentia (gnawing mammals)
Aplodontidae (northwestern North America)
sewellel or mountain beaver[1]
Sciuridae (Africa, Europe, Asia, North and South America)
tree squirrels[1,2,3] flying squirrels[1,3] chipmunks[1,3]
spermophiles[1] marmots[1,2,3] prairie dogs[1,2,3]
Castoridae (Europe, Asia, North America)
beavers[1,2,3]
Heteromyidae (North and Central America)
kangaroo rats[1,2] pocket mice[1] spiny mice[1]
Geomyidae (North and Central America)
pocket gophers[1]
Spalacidae (Europe, Asia, North Africa)
blind mole rats[1]
Muridae (now world-wide)
Old World rats and mice[1,3]
Cricetidae (Europe, Africa, Asia, North and South America)
hamster-like rats and mice[1,3] muskrats[3] packrats[2]
Muscardinidae (Africa, Europe, Asia)
dormice[1]
Rhizomyidae (Africa, Asia)
bamboo rats[1]
Thryonomyidae (Africa)
cane rats or African pouched rats[1]
Ctenodactylidae (Africa)
dassie rats, African jumping mice or gundi[1]
Zapodidae (Europe, Asia, North America)
jumping mice[1]
Dipodidae (Africa, Europe, Asia)
jerboas[1,2]
Bathyergidae (Africa)
mole rats[1]
Anomaluridae (Africa)
spiny-tailed squirrel, or large African flying squirrel[1]

Diets: [1]Walker (1941); [2]Merck (1955); [3]Moore (1937).

Pedetidae (Africa)
springhaas or African jumping hare[1]
Hystricidae (tropical parts of Africa, Europe, and Asia)
Old World porcupines[1]
Erethizontidae (North and South America)
New World porcupines[1,2,3]
Dinomyidae (South America)
dinomys, or Branicks rat[1]
Dasyproctidae (South America and southern North America)
agoutis[1,2]
Caviidae (South America)
guinea pigs[1,3] cavies[1]
Chinchillidae (South America)
chinchillas[1] viscachas[1]
Capromyidae (West Indies)
hutias, or tree rats[1,3]
*Myocastoridae (South America)
nutria or coypu[1]
Octodontidae (South America)
small rats tuco tuco
Echimyidae (South and southern North America)
spiny rats[1]
Cuniculidae (South and southern North America)
spotted pacas[1,2]
Hydrochoeridae (South and Central America)
capybaras[1,2]

Lagomorpha (leaping mammals)
Ochotonidae (Europe, Asia, North America)
pikas[1]
Leporidae (Africa, Europe, Asia, North and South America)
hares[1] rabbits[1,3]

Primates (top mammals)
Lemuridae (Madagascar)
lemurs[2]
Indriidae (Madagascar)
woolly lemurs
Daubentoniidae (Madagascar)
aye-aye, or rodent lemurs[1]
Lorisidae (Africa, southern Asia)
galagos, or bush babies[1,2,3] slow lemurs, or slow lorises[1,2]
Tarsiidae (East Indies)
tarsiers[1,2]
Cebidae (South, Central, and southern North America)
cebus monkeys[1,2,3] howler monkeys[1]
Hapalidae (South and Central America)
marmosets[1,2] tamurins pinches

Diets: [1]Walker (1941); [2]Merck (1955); [3]Moore (1937).
* Classification from Walker (1941).

Cercopithecidae (Africa, Asia, Gibralter)
Old World monkeys[1,2,3]
Colobidae (Africa)
leaf-eating monkeys[2]
*Hylobatidae (Asia)
gibbons[1]
Pongidae (Africa, Asia)
gorillas[1,2] chimpanzees[1] orang-utans[1,2]
Hominidae (world-wide)
man

Nomarthra (scaly mammals)
Manidae (Africa, Asia)
pangolins[1]

Xenarthra (left-over mammals)
Myrmecophagidae (South, Central, and southern North America)
anteaters[1,2]
Brodypodidae (South and Central America)
three-toed sloths[1,2]
Chloepodidae (South and Central America)
two-toed sloth[1,2]
Dasypodidae (South, Central, and southern North America)
armadillos[1,2,3]

Tubulidentata
Orycteropodidae (Africa)
aardvarks[1,2]

Proboscidea
Elephantidae (Africa, Asia)
elephants[1,2]

Hyracoidea
Procaviidae (Africa, Asia)
conies, hyraxes, or dassies[1,2]

Sirenia (sea cows)
Dugongidae (Red Sea, Indian Ocean, western Pacific Ocean)
dugongs[1]
Trichechidae (Atlantic Ocean of North and South America, Africa)
manatees[1]

Artiodactyla (hoofed mammals with an even number of toes)
Tayassuidae (North, Central, and South America)
peccaries[1]

Diets: [1]Walker (1941); [2]Merck (1955); [3]Moore (1937).

*Classification from Sanderson (n. d.).

Suidae (Africa, Europe, Asia)
pigs[1] hogs[1]
Hippopotamidae (Africa)
hippopotami[1,2] pigmy hippopotami[1]
Camelidae (Africa, Asia, Europe, South America)
camels[1,2] llamas[1,2] vicunas[2]
Tragulidae (Africa, Asia)
mouse deer[1] water chevrotain[1]
Cervidae (Africa, Asia, Europe, North, Central and South America)
deer[1,2,3] elk[1] moose[1] caribou[1]
Giraffidae (Africa)
giraffes[1,2] okapi[1]
Antilocapridae (North America)
pronghorn antelope[1]
Bovidae (Africa, Europe, Asia, North America)
cattle[1] goats[1] sheep[1] Old World antelopes[1,2]

Perissodactyla (hoofed mammals with an odd number of toes)
Equidae (Africa, Asia)
horses[1] zebras[1,2] asses[1,2]
Tapiridae (Asia, South and Central America, southern Mexico)
tapirs[1,2]
Rhinocerotidae (Africa, Asia)
rhinoceroses[1,2]

Diets: [1]Walker (1941); [2]Merck (1955); [3]Moore (1937).

[redacted]

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