

## Part Four Zoo Animal Management - Daily Routine and Basic Husbandry

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There are several reasons for developing a "daily routine" in a zoo or aquarium. First and foremost, a properly conceived and implemented routine will help maintain keeper staff relationships and ensure the best welfare possible for the animals. The more efficient a keeper becomes at completing the basic daily tasks, the more time and resources there will be for the other more interesting aspects of the job.

Additional time may become available for implementing and monitoring enrichment programs, upgrading and changing exhibits, building nests and nest boxes, rearranging substrates to meet a fish's reproductive requirements, adjusting hot spots for reptiles, introducing rain showers for amphibians, or changing other containment furniture. Time may also become available to develop, implement, and complete research projects. Extra time could be used in developing and presenting poster presentations or papers at conferences, and even for being published in professional journals.

After reading this section, the keeper will have an insight into the daily husbandry procedures and day-to-day care of zoo and aquarium animals, especially as these things relate to the basic care of their enclosures and surrounding areas. Topics will include

- the importance of understanding the zoo's geography
- the keeper's basic daily routine, including the need for observing animals, cleaning, feeding, watering, and record keeping the daily animal enclosure inspection
- the important components of a keeper's uniform
- the importance of shifting animals between containment areas (e.g., using remote gates and doors)
- commonly used tools and their use and care, including an overview of mechanical and motorized equipment ergonomics and the need to maintain one's own good physical condition.

### KNOWLEDGE OF THE ZOO

It is imperative that when a new keeper joins an organization, however large, small, or sophisticated, he or she be given a thorough orientation to the facility. This should include introductions to as many of the zoo or aquarium's staff as possible. Many of these people may be required to help the keeper in work such as carrying out repairs, supplying plants and other husbandry materials, marketing the zoo to the public, or perhaps even acting as a backup person in an emergency. In many smaller zoos, and also in some larger ones, the keepers may have to assist with maintenance or grounds keeping (i.e., horticulture) or even do it themselves.



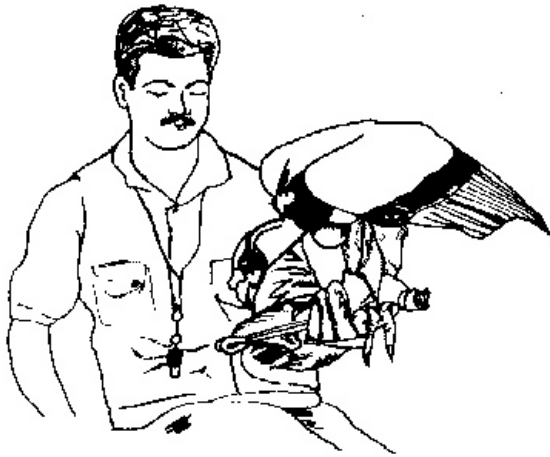
The new keeper should be made aware of the physical layout and structures of the zoo. This should include the location of the zoo's perimeter fencing, animal enclosures, access gates, landscape features, pathways, roads, buildings, and equipment storage locations. This knowledge is useful in emergencies such as animal escapes, intrusions by marauding wild or domestic animals or trespassers, and serious weather. For example, keepers will be better able to visualize the barriers between themselves, the public, and an escaped animal.

Knowing that animals generally run along fence lines may allow the keeper to get a good idea of an animal's direction of travel. With this information, the keeper may be better equipped to inform colleagues of the animal's whereabouts and to move visitors out of harm's way. This knowledge will also make the keeper more comfortable when offering directions and other information to visitors.

In many zoos, the keepers will work within some form of daily work shift system (i.e., with some keepers working an early shift and others working a late shift) to allow the zoo to stay open longer to meet the animals' needs and the visitors' expectations; this maximizes the time that the animals are on exhibit. A new keeper might well find himself working the late shift with fewer staff on duty. In a smaller zoo the keeper may be on duty with only one other person, and if an emergency

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develops they could become responsible for giving directions to the first responders and generally helping resolve the situation. If there is a fire in a building, all staff should be able to direct the fire truck by the quickest and safest route to the area of concern. The keeper may also find that they become a communication conduit between emergency services and other staff, so that the site knowledge becomes even more important.

When moving around the zoo, keepers must remain diligent. Monitoring the condition and state of repair of all the barriers and fences they pass will help ensure that any potential access and egress points, such as gaps under the fences or excessive gaps around gates (more than 5 cm [2 in.] wide) are remedied. These routine checks are particularly important after weather events, when wind may have blown down branches and trees that can damage fences. Heavy or persistent rainfall will cause erosion and washouts under fence lines. Heavy snowfall and the accompanying buildup may reduce the functional height of a fence. These situations must be reported and remedied before animals can be released into the enclosures.

### **DAILY ROUTINE**

However many work areas ("strings," sections, or units) that a zoo may be divided up into, a daily routine for the animals' care will need to be developed. This routine must be established with the involvement of all the relevant keeping staff. Some zoos may only have a small number of keepers, and each person may be responsible for their own section of animals. In larger institutions, several keepers may be responsible for the same area. In either example, the daily routine will ensure that animal and staff safety, as well as the highest standard of animal care, is established. This routine will also help in maintaining good peer relations between keepers.

Some staff may consider a routine to be uninteresting, un-enriching for the animals, or even unfair to certain individual keepers' capabilities. This is not so, as the daily routine can be flexible, can be

changed, and can recognize individual strengths and areas of special interest, as long as all parties who work in the area are involved in making the changes. This is especially important as more and more zoos and aquariums are developing mixed taxonomic and zoogeographic areas, thus requiring staff to have very diverse skills.

### **COMMUNICATIONS MEETINGS**

A normal daily routine will usually start with a communications meeting. A review of the daily keeper report and topics such as animal births, deaths, and transfers, which animals have been left out on exhibit overnight, and whether an exhibit is closed for maintenance (with the animals off display) should be discussed. The daily and long-term weather forecasts and related precautionary activities, such as moving animals to their holdings to avoid lightning strikes or flooding, should also be discussed. Special educational and public relations events that may be scheduled, especially those involving the animals and the keepers' daily routine, would be useful agenda items. Staff attendance should also be taken at this time, as it is extremely important to monitor the number of keepers on duty and also to have a system established to account for their whereabouts and status before, during, and at the end of the day.

### **AREA INSPECTIONS**

The keeper's first duty upon arriving at their work area is to check for notes in the keeper notebook or on whiteboards. The keeper will then inspect all their animals to ensure that they are accounted for, healthy, and secure. This will involve a sequential visit to each animal enclosure in their area. The enclosures should also be checked to ensure that nothing has been damaged overnight. Food and water consumption should be noted. It is also important to observe the amount and condition of feces and urine that has been excreted overnight. Temperatures and light timer settings should be checked. The animals may have been alone overnight; some will have been on exhibit and others in their sleeping quarters, depending on the weather or hours of operation. Notes should be made of any pertinent changes such as loose feces, rodent droppings in food bowls, or animals not shifting; should the keeper have any doubts, they should consult with more experienced staff or the area supervisor. It must be emphasized that daily tasks such as feeding and cleaning should not start until the head count and physical inspection of the animals has been completed. This will ensure that any newborn, injured, sick, or dead animals can be taken care of as soon as possible.

## **ANIMAL ACCESS AND CONTAINMENT SECURITY**

The keeper will then usually travel through his or her section to sequentially begin the daily husbandry activities. Shifting the animals between holdings and exhibits to facilitate cleaning and feeding will be one of the first tasks. It is important to ensure that all enclosure access, shift gates, and doors are working properly, and that they run smoothly and are free from snow, ice, soil and any other detritus that may impede their proper operation. This will minimize the risk of trapping or injuring animals, as well as lessening the chances of keeper injury if the shift door jams when the keeper is moving it. Zoos will differ in their use of locking points and locking devices, but generally every animal area should be secured in such a way as to prevent escape, entry of intruders, theft, or any other mischief. Whatever locking system is selected by the zoo or aquarium, it must be adhered to by all staff. Proper securing devices must be in place for fish, reptile, and other small animal enclosures. It is not acceptable to place weighty objects on the tops of animal containers; these are unreliable and can damage the tops of the containers. National accreditation organizations and zoo licensing bodies expect "positive" locking systems to be in place. These positive systems are installed in such a way as to make it impossible for an animal or another keeper to open a door, shift, or slide when it is supposed to be locked. For example, in some older institutions some vertical slide doors were held in place by gravity. The controlling wire would run through a series of pulleys to a locking station to be secured. Not only was it possible (although considered unlikely) for an animal to lift the slide, but a person could also pull down on the wire without unlocking the lock. This could potentially have allowed an animal access to a person working on the other side of the slide. Today these pulley systems are still in place, but the slide has to be secured with a lockable bolt system.

## **ENCLOSURE INTEGRITY**

The daily routine will be fundamentally similar whether the keeper is working in a large outdoor landscape immersion exhibit, an indoor aviary, a vivarium, or an aquarium. The enclosure will be checked for any sharp or injurious objects including wire, nail ends, and sharp edges of fiberglass in aquarium decor; all should be made safe, if possible, or be reported. It is possible that wild animals may have gained access to the enclosures; rodents (which frequently burrow in and around exhibits) and other pests such as ants, cockroaches, mites, or snails must also be reported. Areas between the public and exhibit barriers should also be inspected. Particular care must be taken following construction or repair of animal exhibits to ensure that all garbage, equipment, and other materials are removed. In some instances it may be necessary to scour the area

with a magnet to find and remove metallic objects that have the potential to cause injury or death to an animal. "Hardware disease" occurs, particularly in ruminants, following ingestion of sharp metal objects such as pieces of wire, screws, and nails, which often settle in the reticulum compartment of the fore stomach. The muscular contractions involved in digestion may push the object through the stomach wall and into the heart, killing the animal.

## **GENERAL CARE**

As the keeper moves from one area to another, they should take the time to pick up any litter they see. It is every employee's responsibility to ensure that the zoo or aquarium is a clean and safe venue for the animals, staff, and visitors. Litter in its many forms, including metal cans, bottles, paper wrappers, plastic bags, and cutlery, presents a potential hazard to the animals and also sends a message of a lack of care to the guests.

## **DAILY HUSBANDRY**

Once the area is secure and the animals are judged healthy, the daily cleaning can begin. This should be done as efficiently as possible with a minimal waste of time, materials, and resources. In large animal exhibits, using shift (shut-off) pens for the animals will ensure that the keeper can concentrate on their work without constantly looking over their shoulder to monitor an animal's whereabouts and behavior. If this is not possible, two keepers should work together so that one can act as a spotter and monitor the animal. In some aviaries, aquariums, vivariums, or small mammal displays, this separation may be impossible where the animals are permanently housed, so a skill sometimes referred to as "animal sense" has to be learned and used. This involves developing an understanding of the animals' behavior, comfort zones, flight distances, agonistic tendencies, and any other behavioral then adjusting the husbandry to cause little or no discomfort to the animals.

## **FEED AND WATER**

Servicing feed and water containers must be carried out daily. Food containers should be cleaned thoroughly, rinsed if detergents or disinfectants are used, and replenished. When the containers are returned they must not be placed under perches of birds or other arboreal animals, as they will quickly become contaminated with excreta. There should be enough feeders so that all animals feel comfortable when feeding and receive their rations. Food that is supplied *ad libitum* must be distributed in a way that prevents contamination. In mixed exhibits, or when weaning animals are present, the use of "creep" feeders may have to be considered. A "creep" can take many forms; it can be as simple as a box, or can be a set of horizontal or vertical barriers that

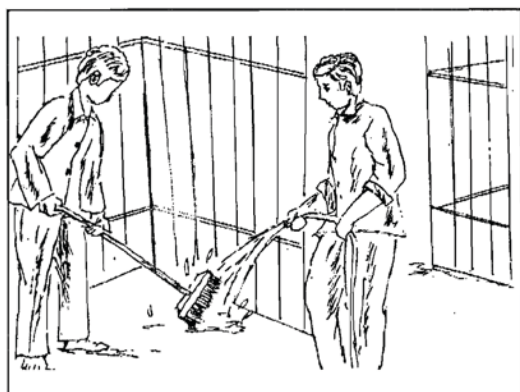
prevent adult or larger animals from gaining access to the small or young animal's food. Nocturnal animals may not require feeding until the evening, although if they remain active during the day, foraging foods may be offered to them as appropriate. If animals are fed on the floor or other surface, or in large feeders or hay racks these locations and pieces of equipment will need to be checked for stale food, mold, pest species, general waste, and a buildup of other contaminants. They should be emptied, cleaned, and refreshed regularly. When cleaning these larger, fixed food stations, water use should be kept to a minimum to avoid moisture buildup and potential for contamination by bacteria and parasites in the surrounding area. If possible, these feed stations should occasionally be relocated to minimize wear and tear of surrounding areas. Water containers come in many types, from a simple bowls or buckets to nonfreezing and automatic-filling containers. In cold climates, outdoor water supplies should be of the nonfreezing type to ensure that the animals have access to clean potable water all day; this is a requirement in many jurisdictions. If waterways or other water features are included in an enclosure, it is good practice to offer a separate supply of clean drinking water, as the water features may become contaminated.

### **INFORMATION FORMS**

Current diet sheets including any food enrichment options should be posted in the holding area. Any changes to the diets should be discussed with other area keepers, the supervisor, and the person responsible for the diets. Cage cards—laminated index cards containing current information on the animal such as sex, age, parentage, identification, and International Species Inventory System (ISIS) number—should also be displayed.

### **CLEANING**

There is a multitude of methods for daily cleaning and general day-to-day husbandry. Fundamentally, all waste food, urine, feces, broken or damaged furniture, litter, dust, cobwebs, and other unnecessary materials must be removed from the traits they display when the keeper is in their vicinity,



and animals' living areas. Areas such as primate holdings may require cleaning with a prescribed disinfectant to kill microorganisms. In some cases a pressure washer or steam cleaner may be employed.

If one is required to use disinfectants and cleaning compounds, it is important to use them per the manufacturer's instructions. Over-usage does not improve a chemical's effectiveness; it just wastes resources and increases the zoo or aquarium's environmental impact. Other areas may have to be washed (sanitized) with a solution of detergent (soap or surfactant) and water. Some carnivore holdings, for example, have a significant amount of oily deposit on their floors, which may require detergent for removal.

When servicing large outdoor ungulate areas, it is always best to dry clean. Concrete hard standings will generally clean up quite well with dry brushing. It is important to inspect and clean drains before and after servicing. One should not remove the drain screens and allow waste to wash away into the sewage system, as this may overload or contaminate local waterways. It is becoming imperative to conserve water, as it is the planet's most important commodity, so one should dry clean wherever possible; if washing with water is absolutely necessary, the minimum amount should be used. If water is overused, it will cause water damage to buildings and other infrastructure. In some cases, water used at high temperatures or pressures can splatter or create steam that aerosolizes small particles and increases the risk of disease transmission.

The exhibit furniture and decoration should be inspected, cleaned, and refreshed as required. If fresh browse is being used, it should come from a known safe supplier, whether it is for feeding or for exhibit decoration. Furniture should be of natural materials whenever possible. One should scout the local area for tree stumps, rock sources, and substrate availability. Dead leaves should be collected in fall (autumn), bagged dry, and stored if possible so that habitats can be easily changed and enriched throughout the year. It is important to ensure that these resources are free from chemical and biological contamination such as herbicides and rodent and bird feces.

### **FOOD HANDLING**

The daily routine includes the managing and monitoring of foodstuffs. If this is not carried out routinely, it can lead to poor-quality, perhaps contaminated food and a buildup of pests. New food or supplements should never be placed on top of old. Food storage containers must be cleaned inside and out, especially between uses. All containers must



have labels describing the current contents and their use. Large storage bins should be on wheels, if possible, to allow easy movement for proper cleaning of floors. Spilled food must be picked up immediately; otherwise it will not only attract pests but possibly become a trip or slip hazard. Hay, straw, and similar baled materials must be kept off the floor, away from walls, and on racks if possible to minimize the opportunity for pest infestation and associated contamination. For convenience and safety, the bales should not be stacked too high and should also be delivered as needed, since “over-storing” can lead to spoilage, staleness, and pest infestation. (If pests do take up residence, the keeper may have to implement a control program, setting and maintaining humane traps and bait stations.) When opening bales, the keeper should make sure the wire or twine bindings are removed and disposed properly. This will prevent entanglement, strangulation, ingestion, and other injuries to the animals. The wire or twine may be reused to secure perches or to tie up paper bundles, but it must be stored properly.

### **WASTE STORAGE**

Keeping the manure bins and other waste disposal areas clean will prevent both noxious odors and the influx of flies, mosquitoes, wasps, rodents, and other pest species. Good hygiene practices can negate or minimize the use of chemical pesticide sprays.

### **DAY'S END**

At the end of the workday the keeper will ensure that the light timers are functioning properly, and adjust them as required. They will also make sure that there is enough food, water, and other material available to the animals. Finally, they will check to ensure that all enclosures and holdings are properly locked. The keeper will then complete a daily keeper report. All animals left in their outdoor enclosures overnight should be noted and reported to the night keepers or security personnel so that they can move carefully around the facility and not be exposed to any surprises. All keepers should be accounted for before the zoo is considered secure.

### **USE AND CARE OF TOOLS AND EQUIPMENT**

Ideally, one set of tools should be available for each work area or containment. The tools should not be distributed randomly or carried from one work area to another. The keeper should purchase quality tools and care for them properly. The tools should be cleaned after every use and stored correctly since they will have been exposed to water, chemicals, and animal waste, all of which are damaging to tools. Wall hangers in various styles are readily available for tool storage, or can be easily constructed. Long nails, driven in side by side, are suitable for hanging brooms, rakes, forks, and shovels. Alternatively, one can drill a hole through the handle of the tool, loop some binder twine through the hole, and knot the ends of the twine. The tool can now be suspended from one nail, allowing it to drain to the floor and dry more effectively. Smaller tools such as scouring pads (“doodle bugs”), window squeegees, nets, siphon tubes, and razors used for cleaning aquariums can all be handled in a similar manner. To identify tools and avoid their loss or removal from one area to another, it may be expedient to paint their handles in different colors. Storage areas, cupboards, and service aisles must always be kept clean and tidy in an effort to avoid cross-contamination. This will also help to keep the work area safe.

### **HANDHELD TOOLS**

Smaller specialized and electrical hand tools should be available to the keeper in the work area or at a central location. A sign-out-and-in system may be implemented to help control the whereabouts of the tools.

Hammers of different sizes are useful for repairs, installation of perching, or the building of nest boxes. A large sledgehammer or maul may be useful for securing lager enrichment materials.

Crowbars and flat bars will be needed for pulling nails, prying apart boxes, and generally levering objects.

Pliers are useful for butting and tying wires, removing stubborn nails, and undoing rusty bolts. There are regular pliers, needlenosed pliers for use in smaller spaces, and locking pliers, sometimes called “mole grips” for really stubborn jobs. For fence repair side cutters, end cutters, fencing pliers, or hog ringers may also be necessary

Screwdrivers come in a variety of types: cross-end (Phillips), flathead (straight), and square-ended (Robertson’s) are the most common. They vary in size, and care should be taken when selecting the right screwdriver for the job. The wrong size will damage the screw head, making it difficult to remove.

Keepers frequently use knives, particularly when preparing food. Good quality chef's knives and sharpening steels are recommended. Learning to use them properly is most important. Many hand injuries result from their improper use. Some zoos may bring in local chefs to instruct the staff in their correct use.

A cordless electric drill with both drill and driving bits is an extremely useful tool. It can be used in the construction of nest boxes, food platforms, perching, and so on. Whenever such a drill is used, the operator must wear safety glasses.

A strong magnet suspended from a rope, on an extendable handle, or between a wheeled axle is useful to have in the zoo. It is used after any sort of maintenance work in an animal area to ensure that no metal parts, wire ends, or welding rods are left behind to endanger the animals' well-being through ingestion or external injury.

### **EXHIBIT MAINTENANCE TOOLS**

There is a large variety of exhibit maintenance tools such as shovels, rakes, brooms, and wheelbarrows. It will be up to the keeping staff to select the tools they feel most comfortable with. The choice is further widened by the introduction of ergonomically modified equipment. In most cases the modifications involve the handles of the tools. Some have had various degrees of curve or bend added to allow easier or safer lifting techniques to be used. Keepers should be encouraged to try using this modified equipment.

The most commonly used tool is the push broom or brush. Some push brooms have hard plastic bristles and are best suited for use on concrete. Where possible, areas should be dry cleaned with the broom, because when fecal material and other dirt is wet it makes the broom very heavy and difficult to use. If working in the wet is unavoidable, banging the broom bristles vertically on the surface will dislodge the buildup. These brooms can also be flipped over and, with the use of a forward scrubbing movement, they will remove almost all adherent waste from the floor. In dry conditions this technique can help save water. Wider, softer-bristled versions of this broom are available, which cover more area in less time. They are particularly useful for drier indoor areas and on rubberized floors. Corn brooms, birch brooms, and other angled long-bristled lightweight brooms are also available, but are generally more suited to indoor areas. Smaller hand brushes may be used for dusting and removing cobwebs, or for scrubbing food and water bowls.

Shovels come in several shapes and sizes; a long-handled flat (spade-or square-mouthed) shovel is the most versatile. It can be used for digging, picking up

piles of waste, and scraping floors to remove fecal material or ice. The long, straight handle offers more leverage and suits keepers of all heights. A round-nose (-ended) version is also available, but is more suited to digging. Larger aluminum, steel, or plastic scoop shovels are also part of the inventory. The aluminum or plastic versions are good for moving large amounts of lighter materials such as soft snow, wood chips, wood shavings, and sawdust. Because the plastic is a little softer than metal, it is preferred for use in areas with rubberized floors. The heavier steel shovel may be better for moving gravel and sand, but it should not be overloaded or it may result in strains. The snow shovel or scoop, generally reserved for more northern climates, is, as its name implies, used for removing snow. Snow shovels come in steel, aluminum, and plastic. They vary in shape and size. Some are shaped like conventional shovels, while others have larger, flatter push blades. They can be extremely useful as "barn scrapers," and they push large fecal boluses very well.

Different types of rakes are also available. Fan rakes, as their name implies, are fan-shaped and constructed of metal or plastic; they are sometimes known as leaf rakes. They are frequently used for raking feces of smaller ungulates as well as leaves and other light materials. Hard garden or landscape rakes also have their uses, particularly in drier areas, for leveling various stony or gravel substrates and for grading smaller exhibits.

Forks usually have long straight handles and metal or plastic tines or prongs. Mainly used for moving bedding materials, they come in three basic types. The metal-tined hay or pitchfork, which may have between three and five 30.5 cm (12 in.)-long tines spaced 5 cm (2 in.) apart, or the ensilage fork, with fifteen 38 cm (15 in.)-long metal tines spaced 2.5 cm (1 in.) apart, are more suitable for use with hay and straw bedding. The other group are the plastic-tined stall and basket forks, usually with eighteen 30.5cm (12 in.)-long tines spaced 1 cm (3/8 in.) apart, which are better suited for manipulating shavings and sawdust. They are particularly useful in hoof stock holdings, as they retain all but the smallest of fecal boluses while allowing the bedding material to fall back to the floor, thereby helping to minimize waste.

The wheelbarrow—or, as it is now sometimes called, the cart—has probably undergone the most change. It has evolved from being the heavy, one-wheeled, difficult to balance, easy to overload behemoth of the large-ungulate keeper to a well-balanced, lightweight two-wheeled vehicle used in food prep areas and small exhibits and as a general runabout. It is more ergonomically designed and easier to work with. It comes in a variety of sizes and styles, all

based on the idea of a box with wheels. It generally has more carrying capacity than its predecessor, especially for lightweight materials. It must not be overloaded with heavy materials. When using wheelbarrows, keepers should be very conscious of their surroundings, especially when going forward. Keepers should judge passage widths and turning radii, and should avoid bumping into things. It is often better to pull wheelbarrows backward over humps and other obstacles.

A squeegee is constructed with a strip of rubber or similar material sandwiched in a metal holder, and its main purpose is to move water from a surface. Squeegees come in various sizes, including larger ones up to 60 cm (2 ft .) in width with long handles for floor surfaces. It should be noted that they often work far more effectively when pulled over the wet surface rather than pushed. The smaller, lighter short-handled version is most frequently used to clean glass exhibit windows and other finer surfaces.

Magnetic window cleaning devices are a unique and very useful tool for cleaning large aquarium glass. They take the form of two strong magnets, surfaced with cleaning cloth, which are placed opposite each other on either side of the window to be cleaned. The keeper can move the outer magnet, which in turn moves the inner one, thus cleaning the glass on both sides. This tool is particularly useful for cleaning algae off underwater viewing windows. The magnets can be left in place until the next use.

Hoses are constructed of various soft pliable materials in many lengths and diameters. The keeper must choose the diameter required to fit the taps, faucets, and hydrants in the area. Fittings are usually attached to a hose, and a keeper should know how to change them when they are damaged. Hose nozzles also come in various sizes, types, and degrees of quality, including metal twist nozzles as well as nozzles operated by a trigger mechanism. The twist nozzle is generally considered the most resilient as it usually has fewer working parts. Changing from jet to spray can easily be achieved by twisting the nozzle. Like an electrical cable or a rope, a hose has a "life" and can be difficult to coil or store on a reel. It may go its own way forming twists, kinks, and even knots. To resolve this problem, uncoil the hose and lay it out on a level surface, allowing it to straighten. After use, follow the same procedure; disconnect the hose from the tap and remove the nozzle. Allow the hose to empty, and then coil it. Larger, "looser" loops are easier to work with. Once this technique is mastered, it will save many sore wrists and much frustration. Better-quality hoses are easier to work with, and they last longer.

## **MECHANICAL EQUIPMENT**

Keepers may have access to a large array of time- and labor- saving equipment, including vehicles ranging in size from the standard pickup truck to smaller, more versatile utility vehicles. The latter can move around easily on a variety of terrains and are well suited to zoo work. Some are fitted with a tipping "box" or bed, enabling them to carry and dump good-sized loads of hay, straw, wood wool, shavings, rocks, stones, logs and other enrichment materials easily. They can also dispose of large amounts of waste and manure. Some units may be fitted with equipment for snow removal and grading. The vehicles come in a variety of configurations including four- and six-wheeled, with covered or open driving positions, and with standard or tipping box. They can run on gasoline (petrol), diesel fuel, or electricity. Given the uneven nature of many zoo areas, they should be driven with great care by approved drivers.

Bobcats or "skid steers" are small bulldozer-like machines that can be fitted with a variety of equipment such as buckets, and snow removal equipment—all very useful to the keeper. They require a skilled operator to be used effectively, so proper training is essential.

Snow blowers are available to keepers in many zoos that experience significant snowfall. Small electrical units are available, but the majority of heavier-duty units are powered by gasoline (petrol). They are reasonably easy to operate if staff members have experience with them or are given direction. Units should be self-propelled with directional controls, as they are heavy and may be difficult to maneuver. The blower unit and its screw blades are prone to damage if they hit or intake hard objects such as ice, stones, or broken tree limbs. Although the blower is fitted with shear pins that will disable the machine should it ingest an object, extreme caution should be exercised when using the machine.

Pressure sprayers are usually either gasoline-or-electric-powered pumps that force a stream of pressurized water through a variety of nozzles. Some units can heat water and produce steam under pressure. Protective clothing and equipment should always be worn when operating these devices, to prevent contamination due to "splash back" and inhalation of spray mist. This is particularly important when working with cleaning and disinfectant chemicals. The sprayers' steam capability allows for the thorough disinfection of holdings and service areas. The units are not generally used on a daily basis except perhaps in some large ungulate, elephant, and primate holdings. Frequently built as mobile units, they can be transported from one area of the zoo to another as required.

A boat may be required if a zoo has significant bodies of water to be managed. It should be lightweight and stored where required or in a central location, and may be fitted with an outboard motor. Oars and lifejackets should always be available and stored with the boat. Lifejackets should be worn at all times when the boat is in the water. The boat can be used for cleaning the waterways, managing water plants, and for rescuing people or animals that may inadvertently find themselves in the waterway.

### **OTHER KEEPING TOOLS**

Keepers may use specialized tools for feeding animals, such as forceps and tongs of varying sizes, ranging from small surgical forceps to larger graspers (similar to those used in stores for removing objects from shelves). Restraint equipment might include a variety of nets, catchpoles, and snake hooks that will be discussed in other sections of this text. Most aquariums and some zoos employ keepers who either are or become qualified divers to service the aquatic animals and their environments. Countless other specialized tools may be required in different facilities. Keepers in and around aquatic environments will require a working knowledge of water testing instruments.

A hydrometer is a delicate instrument used for measuring the specific gravity of water. The resulting reading will give a good indication of water salinity in a marine environment. A refractometer can also be used to obtain similar information. Dissolved oxygen (DO) meters are sensitive hand-held electronic devices used for monitoring the concentration of dissolved oxygen in water. Many simpler test kits available for aquarium hobbyists may also be of use in smaller zoo or aquarium operations. These require the user to introduce the water sample into a simple tube containing chemicals, so that coloration changes can indicate the levels of ammonia-nitrate and nitrate for example, in the water. These measurements should always be confirmed if the results fall outside the expected levels (see chapter 33 for further information on aquarium science). As terrestrial exhibits become more complex, mixing animals and plants into rain forest habitats, keepers will need to become familiar with devices for measuring humidity (hygrometers), and temperature (thermometers). Electronic hydrometers are available which will give both relative humidity (RH) and temperature.

### **EMERGENCY EQUIPMENT**

The daily routine will require that the keeper is cognizant of the facility's policies and procedures concerning the use of emergency equipment, as well as of the equipment's whereabouts. The most important emergency equipment is the communications system, which may consist of numerous handheld radios used to communicate with

a central "control" person; or, in smaller zoos, a basic two-way communication system using handheld radios. Regular "landline" systems are often also available, with telephones situated in various locations throughout the facility. There should also be designated emergency systems even in smaller private zoos, with some telephones available to the public, usually in the vicinity of dangerous animals, and others kept specifically for keeper use. These telephones are usually colored red. The keeper emergency telephones and alarms should be situated in dangerous animal areas—for example, near venomous reptiles and large carnivores. Operable by the keepers, these systems should be set up in such a way that an alarm sounds in a central location when the system is triggered, and help is dispatched even if the injured keeper is incapacitated. Cell phones are also available and allowed for communications use in some institutions. A simple but effective system is for the keeper to carry a whistle or other noisemaking device that is small and loud, easily carried (perhaps on a belt loop), and readily available. Whatever system is in place, the new keeper must be aware of its associated codes and policies for use, and a consistent code of practice should be followed. Many zoos will have emergency equipment situated in central locations. This may consist of ropes, ladders, and nets for helping people or animals out of wet or dry moats. A boat or life belt may also be included in this kit. Recapture equipment, large antelope nets, hand nets, and catchpoles, for example, may also be kept in a centralized location. Guns and anesthetic projectile weapons ("dart guns") will usually be stored under strict security. The new keeper should quickly become aware of the equipment's location and be trained in the attendant responsibilities. Zoos will often have a shooting team that is kept trained and up to date on firearms use and policy. Fire can be one of the most dangerous events to affect an animal care facility, so many will have first aid equipment for firefighting in place. Frequently, building codes will dictate that smoke alarms and associated sprinkler systems be in are in good working order and that their batteries are replaced as required. Fire extinguishers should also be in place, and it is important that the new keeper receives training in how and when to use them. Remember that the first action is always to notify others of the situation and ask for help.

### **UNIFORM AND PERSONAL EQUIPMENT**

Many zoos require their staff to wear a uniform, and it will be up to the individual organization to decide and implement a dress code. What follows are some suggestions for that uniform. Long sleeves, long trousers, hats, and sunscreen are recommended to protect the keeper from the damaging rays of the sun. The weight and quality of the materials selected

should reflect the climate in which the keeper is working. There are many new materials that suit different climatic conditions. For working in cold climates, it is suggested that the keeper dress in several layers of clothing rather than one really heavy warm coat. This will allow for the removal of layers as the day gets warmer, or the heat generated by work dictates. One should wear comfortable clothing. The keeper should also keep gloves available: a strong, pliable pair for daily work routines and for restraining animals. Good- quality, lightweight, water-resistant, insulated gloves are suggested for keepers working outdoors in cold weather. Protective footwear (safety shoes) may also be required, but may be expensive, and they can be damaged by repeated exposure to animal waste and water. It is in the keeper's best interest to make the effort to change between protective safety shoes and rubber boots as work conditions require. Insulated winter boots for cold climates are a must. A keeper should also carry a small pocket- sized notebook and open it while going about their daily routine. Moisture- resistant notebooks are now available that are less vulnerable to the wet conditions a keeper frequently encounters. Notes taken during the day may be indispensable when one fills out the daily report at day's end. A small, good-quality pocket knife or multi-tool is also indispensable for many unforeseen tasks such as cutting binder twine, repairing hoses, or recovering foreign bodies from those hard- to-reach corners.

**SUGGESTIONS FOR BEST PRACTICE** What follows are a few suggestions to make the new keeper's workday safer. Do not climb fences, as it is not a safe practice and will damage the integrity of many fences. There are many sharp ends to get caught on, which may snag the keeper or the keeper's clothing. This may in turn cause the keeper to lose their balance and fall. Larger mesh fences, such as the open wire types, will become stretched and distorted, increasing the chance of injury or opening escape routes for the animals. Even stepping over lower landscape ropes or chains can become dangerous. A misjudged trip may result in a fractured wrist. Use established access points, even if it requires a short walk.

In cold weather avoid handling metal locks with damp or sweaty hands, as skin may stick to the frozen lock and be painful to remove. Service the locks before the onset of cold weather. If possible, the lock should be protected with flaps of rubber (e.g. sections of old inner tubes or acrylic sheets) to stop rain or snow from entering them and freezing their moving parts.

If a keeper is working in a cold climate with frequent ice buildup, they should ensure that there is a good supply of sand, salt, or other ice- melting compounds

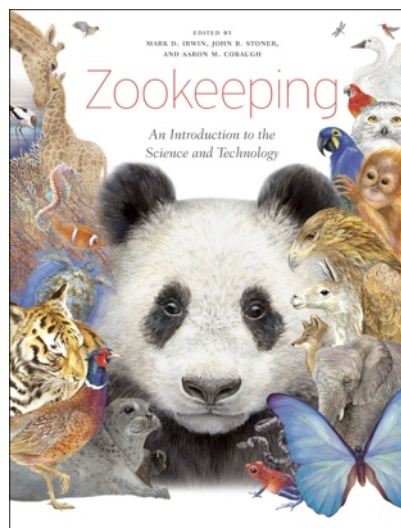
available for their safety. Numerous attachments are also available for boots, to help minimize the risk of slipping.

A keeper should use hand wash stations in work areas and make sure that they are kept supplied with towels and soap as needed. Carrying a small bottle of hand sanitizer is also recommended for in-between cleanings. One should take advantage of any shower facilities and changing rooms that the zoo may offer. Work clothes should be left at work when possible, but if the keeper is responsible for cleaning them at home, they should be kept separate from other clothes.

The keeper should adjust parts of the daily routine to avoid repetitive physical movement and its associated consequences. Practice in changing hands when sweeping, shoveling, or raking, for example, will enable the keeper eventually to become competent with either hand. Keeping is a very physical occupation and whenever possible, the keeper should get into the habit of warming up and stretching before starting a physical task.

### **SUMMARY**

This material only scratches the surface of the knowledge that a keeper will need to carry out the daily routine. These are just fundamentals of the job. Requirements will change and vary between facilities, between work areas within the facility, and between groups of animals, and even between individual animals. The wonderful thing about the zoo keeping profession is that the keeper will never stop learning. They can continue to develop professionally and pass on techniques during their career and even after they retire. One should make sure that the animals' needs are addressed and that any changes are in their best interest.



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