Wildlife Conservation
and the
Applications of Technology

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"Biodiversity contains the accumulated wisdom of nature and the key to its future"  
(Meffe, 1997, p.31).

"Scientists have a clear responsibility to society to lend their knowledge and expertise to the..... goal of biodiversity preservation"  
(p.25).

Technological developments play a significant role in the attitudes and events that both advance and hinder the cause of conservation. Because of technology's dual role, its effectiveness in promoting conservation is frequently not easily apparent. The massive negative effects of technology, which have damaged and destroyed so many environs and individual species, are highly publicized, leading to the perception that technological development is in total opposition to the active conservation of wildlife. However, this versatile and rapidly developing discipline has a multitude of applications that not only provide immediate benefits for animals and the people who work with them, but can ultimately advance the goal of conservation.

In the past few decades, conservation has become a prominent issue in international and political arenas. The destruction of South American rainforests and coral reefs in the Caribbean, and the protection of the threatened Northern Spotted Owl in the Pacific Northwest, preservation of worldwide whale populations and other species have not only helped spark ecological awareness among the public, but have also generated bitter controversy between groups with opposing goals, such as developers and industry, animal rights activists, and conservation biologists. Different views and attitudes towards wildlife conservation seem to be as varied and numerous as the people involved, whether listening to the engineers and biologists who designed a fish ladder to minimize the ecological impact of a dam, the fisherman who wants the destruction of the sea lions that eat the salmon waiting to climb the fish ladder, or the activist who wants to solve the
problem immediately by blowing up the dam itself.

Technology is important to the conservation effort as a whole because of its position as a powerful positive tool that can be, and is, used not only by researchers and scientists seeking to help endangered species, but it is often the catalyst which puts these species in a threatened situation in the first place. The multiple aspects of technology have far-reaching implications for the future of wildlife conservation, in both positive and negative ways. In spite of intentional and incidental misuses of this discipline, technology also has the potential to contribute greatly to the cause of preserving the diversity of the world’s animal populations.

One reason for this positive impact is that high-tech devices and new techniques enable wildlife managers to better understand the animals’ life cycles, thereby allowing them to decide what kinds of conservation measures will help the animals most (Tyson, 1997, p.55). By using technology to learn where the animals go, what they do, and what is killing them, conservationists can better know where to focus their efforts (Kronenberg, 1997, p. D1; Fenton, 1997, p.13). In order to do this kind of research, scientists take advantage of new technologies. In fact, the conservation movement profits both directly and indirectly from technological advances.

**Direct and Indirect Benefits**

Direct benefits for both the researchers and the animals being studied are realized in a variety of ways. Scientists doing research of this type certainly have an easier job than their predecessors, as a result of electronic equipment and biochemical techniques. For example, volunteers studying condors at the Sespe Condor Sanctuary in California climbed peaks in Los Padres National Forest for years to gauge the condor’s population and behavior, but satellite telemetry has now removed the need for that time-consuming and dangerous process. Michael Wallace, the curator of conservation and director of the condor program at the Los Angeles Zoo, developed a lightweight, aerodynamic transmitter that can be clipped to a condor’s wing, rather than mounted on a pack strapped to the bird’s back. Since the signal from the transmitter can be heard for more
than 100 miles in ideal conditions, field biologists find that keeping track of the surviving birds is much simpler and more effective now (Kronenberg, 1997, p. D1).

Earth Search Sciences Inc., an Idaho-based company, recently sent a state-of-the-art remote sensing probe, which operates for less than the cost of existing satellite technology, to help gorilla researchers in Rwanda. This country’s borders have been recently opened after being blocked for the last several years by civil war, and scientists are eager to census Mountain Gorilla populations, which “numbered only about 600 at last count.” Deforestation, availability of cover, forage, and water, and the impact of poaching will also be assessed by Probe-I, which “analyzes light waves reflected from ground objects to produce hyperspectral imagery” (Warbis, 1999, p. B3). Obviously, this technology will have profound impacts for researchers trying to estimate the extent and importance of these factors while working on the ground.

Rather than attempting to keep elaborate pedigrees and family records to determine the degree of relatedness between animals in small, isolated populations, researchers now have another option. Because rare animals reintroduced to the wild are prone to harmful mutations and the expression of lethal recessive genes due to inbreeding and a lack of genetic variation, keeping the gene pool diverse enough within the population to prevent this tendency is vital. Modern gene mapping technology allows scientists, such as Gene Rhodes, a geneticist at Purdue University, to decide when more animals need to be brought in to expand the pool of available genes (“Rare Animals Benefit from Biotechnology,” 1999, p.7).

Bat detectors, instruments that show the “often inaudible echolocation calls of bats to human observers in visual or acoustic modes,” may help supersede the need to capture specimens in order to identify new species. Monitoring the echolocation calls has proved so effective, in fact, that three species of bats have been added to the list of Scottish mammals. In addition, studies of calls have newly revealed the presence of a cryptic subspecies of *Pipistrellus pipistrellus*, one of the “most common and best studied bats in the world” (Fenton, 1997, p.2).
Scientists at Dartmouth University have developed a process that uses special lasers to search for stock-specific ‘fingerprints’ inside the ear chambers of cod, to help them track and monitor autonomous fish stocks (Jackson, 1998, p.19). Some engineers at the Massachusetts Institute of Technology’s Center for Fisheries Engineering Research have even designed a robotic kayak that can take over some of the duties of marine scientists (Nobbe, 1998, p.16).

While these technologies help researchers, some new equipment and techniques immediately help the animals themselves. Badger-baiters in England are being convicted with the help of a chemical fingerprinting system applied to the animals’ coats (Nobbe, 1998, p.14). Rangers in the Kenya Wildlife Service use Global Positioning System equipment, fitted to giant collars, to protect the elephants from ivory poachers by monitoring them via laptop computers. (The GPS is a satellite network that allows precise determination of location through a triangulation process) (“Satellite Spotlight: Pachyderm Patrol Prevents Poachers,” 1998, p.1). The Russell B. Aitken Sea Bird Colony, which opened two years ago at the Bronx Zoo/Wildlife Conservation Park, is housed in a specially designed tensile structure, engineered by Frei Otto, a famous German architect (Louie, 1997, p.1).

Even an item as seemingly unrelated to wildlife as Viagra® may lift some of the pressure off species such as tigers, rhinos, and civets, which are killed for the sake of making potions from their reproductive organs and horns, a traditional Asian treatment for impotence. Because these potions are expensive and not scientifically proven, Viagra® may help replace this more common folk remedy. This event would spare a great many endangered animals, and tigers especially, since “trade in tiger parts is killing more of the beasts than the destruction of their forest habitat” (“Science and Technology: Why Rhinos Recommend Viagra,” 1998, p.76).

In many cases, however, the available technology is not sufficient to accomplish what scientists would like to do. Biologist David Anderson, along with a team from Wake Forest University, is studying the food gathering habits of albatrosses in the Hawaiian Islands. The project uses battery-powered satellite transmitters to track the birds’ foraging
routes in order to pinpoint factors behind the decline in the albatross population over the last thirty years. The drawback to this technique lies in the need to catch the avian subjects after researchers are done gathering data, in order to remove the expensive transmitters. This is complicated by the fact that satellite updates only come once an hour, leaving a wide window of time for the birds to slip on and off the islands, and the task becomes impossible once the transmitter batteries die (Glassman, 1998, p.9D).

Scientists researching sea turtles are in a similar situation of needing more technologically advanced equipment. Satellite telemetry utilizing polar-orbiting weather satellites has proven to be useful for biologists studying Leatherback turtles, but they are already working on a better solution to trace the turtles' ocean-spanning migrations. The answer may lie in the GPS, or Global Positioning System. The transmitters communicating with the weather satellites require the turtles to stay on the surface for at least five minutes to get a solid fix on their location, but the GPS unit needs less than twenty seconds. Since Leatherbacks typically surface for only a few minutes, this would represent a significant advantage (Tyson, 1997, p.59).

This technological shortcoming does not, however, neutralize the efficiency of the variety of other devices and techniques used by turtle researchers. An ultrasound probe passed across the skin over a female's uterus reveals whether she has "mature ovaries bearing pre-ovulatory vitellogenic follicles," which indicate whether she will return later in the season to lay more eggs. Other technologies to help with monitoring turtle reproduction are becoming more common, as well. Passive Integrated Transponders, or PIT tags, are glass-encapsulated microchip identification tags which are injected into the shoulder muscles of nesting turtles, so they can be positively identified with the use of a hand-held scanner when they return. Microprocessor-controlled time-depth recorders measure dive depth and duration, ascent and descent rates, and surface times (Tyson, 1997, p.55-58).

Even developments that are not directly related to wildlife conservation can prove beneficial to this cause. One way that technological progress can indirectly assist wildlife is by adapting techniques developed for other disciplines. Biologists are now using gene
sequencing technology, a spin-off from the Human Genome Project, which is now inexpensive enough to use in wildlife management ("Rare Animals Benefit from Biotechnology," 1999, p.7). As geneticist Oliver Ryder states, "It's incredible that billions of dollars are being put into the Human Genome Project, and yet until we understand how different we are from the chimpanzee and the gorilla, we won't even know what's human about the human genome. Every time someone gets some interesting new gene, they want to understand how it evolved" (Fordahl, 1996, p.1).

As a result of this kind of interest, wildlife researchers can use some of the same tools as scientists studying humans. The Perkin-Elmer pharmaceutical company even donated a gene sequencer to the San Diego Zoo's Center for Reproduction of Endangered Species, so the center can "examine the genes that give animals certain characteristics, and help identify lineage." Ryder and other geneticists at the center are using this equipment to start a program for wildlife that is similar to the Human Genome Project (p.2).

**Land Management**

Land management is another important example of the principle that different kinds of research not directly related to wildlife can help conservation. This is demonstrated by a 'sustainable development' forestry method initiated in the Palcazu Valley of Peru. Instead of using the slash-and-burn technique to clear-cut large areas of rainforest, strips about 30-40 meters wide are cleared. This opening in the canopy allows light to penetrate, which in turn allows saplings to grow rapidly. By the time the canopy begins to close up again, the gap is "filled with small trees, shrubs, and herbaceous plants." Not only does this help support local foresters, but these now resource-rich areas encourage foraging and seed dispersal by birds and other animals, as well as preventing major habitat loss (Meffe, 1997, p.397). In fact, this method has proved to successful that it is now being tested in Bolivia, Costa Rica, and Papua New Guinea, as well (p.608).

**Accidental Misuse of Technology**

Unfortunately, well-meaning scientists' use of technology sometimes proves harmful. Another program to help the recovery of sea turtles has generated controversy
for this reason. The ‘Head Start’ project involves collecting newly hatched Hawksbill turtles, and raising them in tanks for the first two years of their lives. The rationalization for this course of action is that only one in 1,000 wild sea turtles survives to adulthood. Since most are "caught by fishermen or eaten by birds, crabs, sharks, barracudas, or other predators," protecting the babies by keeping them in tanks during this vulnerable period seems very appropriate (Jones, 1999, p.A6).

However, some sea turtle experts, such as Scott Eckert, who works at Hubbs-Sea World Research Institute in San Diego, feel that Head Start is only making the situation worse. His objection is based on the theory that during the first few days after hatching, baby turtles swim offshore and acquire a kind of internal compass using the earth's magnetic field. This helps them navigate back to the same beach they hatched on, after the Hawksbills reach maturity some twenty-five years later. By keeping the turtles in tanks, they are denied this crucial imprinting step. In addition, the captive turtles have a high likelihood of becoming infected with diseases while in the tanks, which they could spread to wild turtles after being released (Jones, 1999, p.A6).

A similar project, working with Kemp’s Ridley sea turtles, between 1978 and 1988, seems to have recognized and coped with at least one of these problems. With the premise that young turtles “imprint on the sand and water of their natal beach,” Kemp’s Ridley eggs were incubated in sand from Padre Island National Seashore in Texas. They were released on the beach at Padre Island after hatching, and allowed to swim in gulf waters for a few minutes. They were then recaptured and raised for nine to eleven months, before being permanently released in the Gulf of Mexico. Biologists marked the hatchlings by implanting a light colored section of the turtle’s lower shell into the darker carapace, in a location that indicated the year of hatching. In 1996, the first “headstarted” ridley was found nesting on the Padre Island beach, ten years after being released (Weber, 1997, p.33).

A more familiar example took place in Seattle, Washington, where the Army Corps of Engineers installed a kind of ‘water slide’ to help salmon smolts traverse the Ballard Locks, to get out of Lake Washington and into Puget Sound. The drawbacks of this
method came to light during the slide’s trial run. One biologist and board member for the Washington Environmental Council, Fred Felleman, called the slide a “pez dispenser” for predators, as sea lions and sea gulls gathered below the locks to “feast on the young fish as they poured over the dam.” A majority of those smolts that were still diverted into the locks, however, ended up “so battered they were almost certain to die.” The Corps of Engineers apparently had ideas involving strobe lights and water sprays to help direct the fish, and scare away the sea gulls, but their budget was running low (Doughton, 1996, p. A1).

Adult salmon trying to travel the other way over the locks, into Lake Washington to spawn, encounter a similar problem. The “poorly designed, haphazardly operated” fish ladder creates a backlog of Steelhead milling around the lower entrance. Roving California Sea Lions quickly discovered this “floating buffet table,” and biologists in the mid-1980s estimated that up to 60% of the Steelhead were being eaten by the sea lions. During the same period, “the Steelhead run dropped from nearly 3,000 fish to less than 100.” Even the fact that the five “most predatory sea lions” were shipped to Sea World in 1996, won’t solve the problem of dwindling salmon, a problem caused in large part by the very fish ladder that was intended to neutralize the effects of the construction of the dam (p. A1).

**Mixed Harm and Benefit**

Often, human encroachment has mixed results for the area’s animal residents. Increased urbanization has produced streetlights, mowed fields, and garbage dumps, all of which attract concentrations of insects that provide feeding opportunities for some species of bats. At the same time, however, logging operations reduce the number of roosts available, and many bats are extremely susceptible to pesticides used in agricultural areas. In many areas of animal-related science, it is difficult to determine whether the net effect of changes by humans is positive or negative (Fenton, 1997, p.8).

One incident in the Florida Keys National Marine Sanctuary also simultaneously involved both damage and benefit to local wildlife. A 613-foot container ship, the Contship Houston, went aground on a coral reef, crushing and breaking corals in a 400-meter swath. In reparation, the owners of the ship purchased radar transponder beacons,
mounted along the Florida reef tract, which emit unique signals and warn ships when they are nearing a reef. This will reduce the likelihood of future navigational errors, but cannot replace the destroyed segment of fragile, threatened coral reef ("New Navigation System to Protect Keys Coral Reefs," 1999, p.96).

Another example of a harmful situation being turned around to benefit conservation research involves Harbor Porpoises. These animals are imperiled throughout their range by gillnet fisheries, anchored to the sea floor to catch bottomfish. In addition to gillnets, the porpoises also get trapped in herring weirs, but unlike gillnets, weir entrapment is not fatal for them. Weir fishermen and several conservation groups have developed an effective protocol for releasing these animals, and some of the porpoises are equipped with electronic tags before being set free. Data from the time-depth recorder tags have shown that porpoises “can and do dive to the depths at which gillnets are set, during both the day and the night. This refutes the idea that they are only at risk of entanglement when the nets are being set or hauled” (Westgate, 1998, p.70). Thus, some of the same hazardous fishing equipment may allow scientists to determine the most effective conservation measures for these animals.

**Harmful Uses of Technology**

In spite of the fact that some harmful technology is partially redeemed through other, more helpful applications, the impact of some ‘bad technology’ should not be disregarded. Some fishing techniques, for instance, are far too efficient. Technologies that enable fishermen to trace and catch more fish are actually “helping to deplete valuable natural resources. The numbers of swordfish have dwindled so low that fishermen in the Atlantic can no longer find them” (Chivers, 1998, p.36).

**Pesticides**

Pesticides may help crops, but some, such as DDT, have had tragic consequences for wildlife. The food chain spread the deadly chemical far beyond the insects it was supposed to control. As small birds and rodents ate affected insects, and grains treated with DDT, they built up concentrations of the chemical inside their bodies, which then began building up inside the bodies of the raptors that preyed on them. No one realized
that the effects of DDT in raptors resulted in the production of thin-shelled eggs that broke under the weight of the incubating parents (Williams, 1998, p.72).

By the time that this was discovered, it was almost too late for some species. DDT was banned in the U.S. in 1972, but by then the populations of Bald Eagle, Brown Pelican, and California Condor were decimated, and only 39 pairs of Peregrine Falcons remained in the lower forty-eight states. It was only a few years ago that the Peregrine was removed from the Endangered Species list, and the Bald Eagle is scheduled to be removed in July of 2000. These success stories, however, are thanks to the persistent reintroduction efforts of a diverse group of institutions and people ("Peregrine Falcons Could Fly Off Endangered Species List," 1998, p.1; "Eagle Soars to New Status," 1999, p. 11). DDT residues have even been found in penguins and other Antarctic birds, which proves that pollutants can and do have widespread effects, indiscriminately affecting "biotas far removed from their points of application" (Sutherland, 1998, p.67).

Because of the global use of many pesticides, along with the fact that many can be transported in air or water currents, or in the bodies of migratory animals, "few parts of the globe are still entirely free from their effects" (p.67). This problem is exacerbated by the longevity and persistence of some chemicals, and the potential for synergistic interactions. For example, the half-life of DDE (the main metabolite of DDT) "has been variously calculated at between 12 years in some cultivated soils, and 57 years in some uncultivated soils" (p.73). Synergism takes place when one chemical "activates another, or slows its detoxification," such as when "prochloraz fungicides accentuate the effects of organophosphate insecticides on birds" (p.75).

While most herbicides are not cumulative in the bodies of animals, their effects often are. Some British species such as the Linnet and the Grey Partridge have declined as a result of decreased food availability. The partridges' young chicks feed on insects sheltered by broad-leaved weed species, which "are now absent from modern cereal fields." Linnets "once fed extensively on weed seeds......but after thirty years of herbicide use, the seeds have now almost disappeared from the soil of cereal-growing regions" (p.
80). This lack of available food threatens to impose serious consequences for the future of these species.

**Pollutants**

Another wide-impact effect of pollutants is the acidification of wetlands, caused by sulfur dioxide in the atmosphere. ‘Acid rain’ has a negligible effect on well-buffered soils, but can drastically lower the pH of streams, lakes, and poorly-buffered soils. As a result, “toxic metals move from soil to waters, becoming generally more available to plants and animals, while calcium and magnesium become less available. Invertebrate and fish populations decline, which lead to a decline in the bird populations that depend on them” (p.81). The end result “is a sterile ecosystem capable of supporting only a limited range of species……this problem is particularly severe in parts of eastern North America and northern Europe” (p.81).

Other pollutants may be more incidental, but still have significant impacts. For instance, the wrecking of oil tankers “often causes local catastrophic losses involving many thousands of birds” (p.77). The oil spill from the Exxon Valdez in Prince William Sound, Alaska, is the biggest tanker incident of recent years. Some 30,000 dead birds washed ashore within six months, but total casualties were estimated at between 100,000 and 300,000. In addition to the obvious effects on seabirds, oil spillage also damages invertebrate populations. These can take years to recover from the consequences, and the toxic dispersants and detergents used in the clean-up can lengthen the recovery time (p.77).

**Deforestation**

Deforestation is also a significant problem, because the loss of habitat often leads to the extinction of highly specialized species. Although any destruction of habitat is serious, damage sustained by tropical rainforests is most critical. This is because tropical forests, such as those in South America and Southeast Asia, are often what biologists term “hot spots,” or areas with unusually high numbers of species endemic to the region. For example, a rainforest may have several hundred species of trees per square kilometer, with corresponding populations of interdependent insects and animals, while a temperate forest
harbors only a few dozen, at most (Meffe, 1997, 105). In fact, “more than half the world’s terrestrial species can be found on the six percent of Earth’s surface covered by rainforests” (Simpson, 1999, p.67). Because of this, any significant area of rainforest destroyed will most likely result in the permanent loss of many animal species.

Zookeeping

To meet the need for preserving these threatened animals, zoos are continually reshaping the technologies of animal care and habitat design, along with implementing conservation programs. This is a recent development, however, because most North American zoos have undergone revolutionary changes only during the last 30 years or so. Before the mid-1970s, a “stamp collection” mentality was evident-- most zoos were “content to have one specimen of everything interesting,” either “collected from the wild, or bought from other countries or zoos” (Westley, 1996, p.145; Kennedy, 1987, p.66). The animals were usually kept in solo concrete cages with a bedroom area in the back, which was hosed down once a day. This method of animal care later came to be known as the “fire hose syndrome” (Westley, 1996, p.146).

When compared with modern zoo operations, this ideology seems very primitive. Previously, only the fitness of the individual zoo specimens was focused on, but through the changing perspectives, the health and well-being of entire species populations became stressed instead (p.147). In the same way, the zoo’s emphasis has switched to “breeding animals to ensure resilience and continuity of the captive and wild populations as a whole” (p.145). More animals of fewer species are kept, and the zoo’s balance of power underwent a shift, with keepers losing status and scientific experts gaining more influence, in order to accommodate captive breeding efforts (p.146).

Habitat

This new method of zookeeping has wide-ranging implications. For one thing, the concept and production of habitats has been entirely redesigned. Now, zookeepers, biologists and zoologists, horticulturists, engineers, marketers, and education specialists all work together to design exhibits that not only appeal to visitors, but incorporate natural
habitat displays and groupings of animals in order to meet their social and psychological needs (p.147).

An article covering Seattle’s Woodland Park Zoo’s centennial celebration remarked on the “transition from small, sterile cages to bigger, more natural spaces for animals. The bears now wander through caves and streams, while the wolves hang out in a small forest” (“Zoo’s Century of Changes,” 1999, p. B8). Imitation tree trunks are made by taking latex impressions of tree trunks, then casting them in plastic, or other synthetic materials. The Snow Leopards at Point Defiance Zoo and Aquarium have a large, heated rock to bask on in cold weather, strategically positioned next to a viewing window (Gaspari, 1999).

**Nutrition**

More emphasis has been placed on the scientific development of diets, as well. Nutrients are now analyzed to ensure that each animal’s needs are met. Although many zoo residents receive their animal protein through mice, ground horsemeat or live mealworms, some natural diets must be substituted for because of feasibility. In these instances, equivalent replacements have been developed. For example, it would be extremely difficult for Point Defiance to feed its Aardvarks the many pounds of termites they would consume daily in the wild, but the mash they eat instead provides the same nutrients. Most zoos would have problems obtaining tree sap for their marmosets, and other animals with similar nutritional needs, but fortunately, marmoset jelly is now available (Gaspari, 1999).

**Genetic and Hormonal Techniques**

The zoo’s new mission reflects not only a changing mindset, but new technologies as well. A deeper understanding of genetics, and the accompanying techniques and capabilities, followed the evolution of biology and zoology as scientific fields, and shifted the zoo’s focus (p.145). Due to their access to “exotic and diverse biological resources,” zoos find themselves in “a unique position to contribute to conservation of genetic resources for the future” (Meffe, 1997, p.196). One way to do this is reminiscent of the movie *Jurassic Park*. Through gene banking and cryopreservation of germ plasm, genetic
material from animals that may soon be extinct is kept available for scientists in the future to resurrect, using yet-to-be developed equipment and techniques (p.196).

Nonetheless, zoos apply genetic techniques on a day to day basis as well, in order to make use of pedigree management, which has been referred to as “the most powerful tool available for efficient retention of genetic diversity” (p.197). When properly applied, this can reduce genetic drift, founder effects, inbreeding, and selection to a minimum, conserving the genetic variation within a small population. This is accomplished by pairing least-related individuals, and “avoiding inappropriate admixture of gene pools” (p.197).

Since the sampling necessary to use these methods “often necessitates killing individuals,” or at least capturing and handling them, which can cause injury or trauma, using these technologies frequently causes a dilemma (p.198). However, even newer techniques have been developed which help solve these problems. For example, scales or slime from fish, hair from mammals, or even epithelial cells recovered from feces can be used for genetic analysis (p.198). At Point Defiance Zoo, one feather sent to the laboratory takes care of sex determination in Bali Mynahs, an extremely rare bird on the Species Survival Plan list (Gaspari, 1999).

At an early point during the Red Wolf recovery effort, scientists collected as many individuals as possible from the wild, in order to raise them in safety and bolster low population numbers before reintroducing them. However, researchers found that many of the animals were the products of interbreeding with coyotes, so genetic testing was required to determine which ‘wolves’ were actually pure-blooded. Once the population base was established, artificial insemination was used for breeding, rather than transporting animals and risking injury or illness (Gaspari, 1999).

Although genetic techniques are important, other new procedures are being developed too. The Center for Reproduction of Endangered Species at the San Diego Zoo even originated a method to determine the reproductive status of apes, using hormone analysis of urine samples rather than blood samples. This method is now used not only for apes, giant pandas, and other species as well, but also for humans (Fordahl, 1996, p.2).
Hormone implants are used to control breeding in some animals, such as Red Wolves and some primates. The slow dose of hormones keeps the female from undergoing her reproductive cycle. This prevents unwanted breedings with closely related males, or too many consecutive pregnancies which might overtire the female, but without the stress of confining her in a small, separate area (Gaspari, 1999).

**Record-keeping**

With the primary emphasis switching to breeding for preservation of species, "'behind-the-scenes' activities became more important than the exhibits themselves.” Zookeepers are now required to “develop new skills in monitoring their animals, so that they could advise when they are ready for breeding, and keep much more careful records of data on individual animals. Every day when the keepers are doing their sections, they have to fill out a report sheet that lists births, deaths, behavior, illnesses, treatments, transfer- everything that might be considered pertinent down the road” (p.Westley, 1996, 148).

**Misunderstanding of Zoo’s New Role**

Another factor in the rising importance of captive breeding is that zoos want their stocks to be self-sustaining. This not only helps increase the numbers of certain species, making them less rare, but also protects native populations by reducing the need for zoos to acquire animals from the wild. In light of the fact that in the past, zoo collecting put pressure on species such as the Mountain Gorilla, this idea takes on new significance (Hearn, 1985, p.222, 60).

Of course, this change in purpose did not occur all at once. During the transitionary period in the mid-1980s, the new methods were often misunderstood, even by the people most closely involved with the animals and the zoos. D. M. Jones, speaking about the care of exotic animals at the Zoological Society of London’s 1984 symposium, criticized the trend toward natural exhibits with social groupings of animals. He stated, “The result may be aesthetically pleasing, but very often, in order to provide enough animals for the visitors to see them, the stocking rates are unnaturally high and the appearance of the ‘habitat’ is difficult to maintain in pristine form. The risk of parasitic and
bacterial disease increases and in many instances the animals are difficult to catch for movement or routine care” (p.91).

At the same symposium, speakers made predictions about the future of zoos. One researcher did identify cellular and genetic manipulation as an important force in conservation, but claimed that the principle of chimerism (combining the cells of two or more animals) would soon be used to “overcome species barriers in embryo transplantation.” While it is true that transgenic mice with a few human genes have been produced, cross-species births are probably still much farther in the future than scientists in the 1980s imagined (p.123).

Inter-zoo Cooperation

At least one prediction from this time period has proven correct, however, concerning inter-zoo cooperation. Roger J. Wheater, of the Royal Zoological Society of Scotland, foresaw “the creation of national studs for exotic species…..[this would] develop and test new techniques and would provide the infrastructure to coordinate area programs, and participate in international ones” (p.111). While Dr. Wheater might not have gotten all the details straight, he did recognize the vital role that interaction and teamwork by zoos on an international level would play.

In order for the conservation breeding of rare species to be successful, it is absolutely necessary that zoos operate in collaboration, rather than in competition with each other. During the Zoological Society of London’s 1964 symposium, it was noted that zoos showed great reluctance to “part with individual animals of high exhibition value to be sent elsewhere for breeding. Moreover, surplus animals would tend to be sent to the highest bidder rather than to the place where the animals could contribute most to improving the captive breeding potential of the species” (p.66). However, the “‘biggest collection syndrome’ has given way to breeding success as the measure of achievement” (p.66). Especially in North America, zoos “are moving….with astounding speed, toward a framework in which they pool resources to maximize the breeding potential of a particular species” (Westley, 1996, p.148).
Species Survival Plan

One such collaborative program is the Species Survival Plan, or SSP, developed by the American Zoo and Aquarium Association. A central coordinator for each particular species keeps the information provided by cooperating zoos in the “form of a studbook, and makes decisions on which animals should be moved to which zoos on the basis of genetic information.” These free-of-charge breeding loans are a condition of SSP participation (p.148).

As a whole, the SSPs “aim to achieve specific goals for the extent of preservation of genetic diversity over defined time periods.” Typically, these goals are to preserve “90% of average heterozygosity over 100 years” (Meffe, 1997, p.197). Using the small number of animals available for breeding in the zoo populations, zoos try to maintain a species’ gene-pool resources as efficiently as possible, in order to “allow more threatened and endangered taxa to be represented in such programs” (p.197). To this end, zoos utilize the genetic techniques discussed previously, such as gene mapping.

In addition to this, however, another form of technology that tends to be taken for granted is very important as well. Computers and modern telephone and email systems make possible the success of such programs as this. For example, the SSP coordinators can communicate instantly with keepers and experts at other zoos regarding specific individuals’ condition and readiness to breed. Also, they use a computer program to determine which animals should be bred to each other, based on their degree of relatedness (Gaspari, 1999).

Reintroduction

Of course, the final goal of any breeding program for endangered species is to reestablish them in the wild. One reintroduction program currently in progress is the effort to restore the Golden Lion Tamarin population in Brazil. Tamarins at the Brookfield Zoo in Chicago, Illinois, and the Los Angeles Zoo as well, are participating in a “boot camp” to help prepare them for life in the wild. Family groups are turned loose on wooded zoo property to help them learn to climb and forage. To make sure that their keepers can
follow them while outside, the tamarins in Los Angeles wear transmitter collars (Kronenberg, 1997, p. D1; Goering, 1997, p.1).

While reintroduction can be an effective method of reestablishing a species—Peregrine Falcons are an example of brilliant success—it is not the final answer to the problem. “Species can’t be brought back from the brink of extinction one by one” (Claggett, 1997, p.107). Instead, entire ecosystems must be protected, or the number of species needing assistance will only keep on adding up. Because of the limited amount of animals that zoos can help, they cannot rely only on breeding and reintroduction as methods of conservation.

Conservation Education

If half of the zoo’s mission is captive breeding, the other half is conservation education. A report by the President’s Committee of Advisors on Science and Technology concluded last year that “the key to saving biodiversity is to increase knowledge about it” (Kaiser, 1998, p.973). The importance of doing so takes on even more significance with the realization of the public’s misperception of wildlife, and their impression of wilderness itself. Here, too, technology has a major role in either perpetuating or correcting these misapprehensions.

Digital technology in photography and video production have contributed greatly to the “wildly skewed...mass market depiction of ‘nature’” (Beam, 1998, p. E1). Walt Disney’s “The Living Desert” existed in a California Studio, and some photographers shoot ‘wildlife’ in zoos, using computer software to erase “troublesome details like fences, or children slobbering over cotton candy.” Wildlife video teams have the “standing instructions of “hatch ‘em, match ‘em, and dispatch ‘em”.” No one wants to see what wild animals actually do all day, but rather what we think they do, which is much more exciting (p. E1).

Fortunately, technology can also be used to counteract this type of viewpoint by educating people. Increased public knowledge will result in consequent support for the development of “appropriate environmental management and conservation policies....and foster a conservation ethic that will enable people to responsibly steward natural
resources” (Sutherland, 1998, p.237). Helping people relate to wildlife through understanding and interaction is the best way to produce interest in ecology and the environment, and thus produce practical conservation.

Something as simple as television nature programs or a slide presentation can help accomplish this, but new technologies can be even more effective. To this end, Zoo Atlanta and the Georgia Institute of Technology have created a virtual gorilla exhibit, which allows visitors to interact with the animals. The visitors wear special binocular headgear, which takes them into a ‘forest’ as a young member of a gorilla family. Depending on the gestures made, using videogame-like controls, the “simulated adults react with annoyance, submission, relaxation, agitation, or restlessness” (Wilson, 1998, p. 16).

A display in Oregon involved pushing a button for a trained response by the animal, but this proved to be very controversial. At Point Defiance Zoo and Aquarium, visitors often cannot find the inhabitant of the scorpion exhibit. By pushing a button, they don’t get to see a trained scorpion, but rather a black light comes on, which makes the small invertebrate glow brightly. This not only provokes interest, but demonstrates the scorpion’s successful camouflage, and one of its unique abilities as well, without degrading the animal. Although electronic displays certainly attract visitors, budget is a limiting factor for most zoos. In many cases, however, short videos next to the animal exhibit prove to be an effective device (Gaspari, 1999).

Internet technology creates a myriad of new educational possibilities, as well. As a result, David Anderson’s Albatross Project, which was discussed previously, is accessible to schoolchildren across the country. Classes can track the birds on grid maps, using coordinates posted on the web, or daily e-mail updates. An estimated 10,000 students have tracked the record-setting bird on-line at Anderson’s website (www.wfu.edu/albatross) since the project began in 1997 (Glassman, 1998, p.9D).

Computer games provide another approach to ecological education. Maxis’ SimSafari* allows players to “manage a game park, maintaining a well-balanced ecosystem populated with lions, elephants, rhinos and dozens of other species of animals
Public Attitudes

The importance of knowledge about wildlife and conservation is easy to recognize, in light of the fact that there may well be a direct relationship between knowledge and attitudes, and thus behavior. In a 1994 study, Stephen R. Kellert conducted a survey by the means of personal interviews with randomly selected individuals in the United States, Japan, and Germany, in order to determine “attitudes, knowledge, and behavior towards wildlife and its associated natural habitats” (Manning, 1994, p.166). Allowing for cultural differences, Germans scored the highest on the ‘knowledge of animals’ scale, followed by Americans, and then the Japanese.

Not surprisingly, “the German sample not only had relatively high humanistic and naturalistic attitude scores, but also obtained very low scores on the utilitarian and dominionistic scores, particularly in comparison with the Japanese.” The American public’s views appear “generally less consistent or extreme,” perhaps as a result of the “considerable heterogeneity and diversity of American society.” In consequence, while Americans are much more likely to have participated in hunting or fishing, they are also more likely to have gone birdwatching or be a member of a conservation society. Not intending to disparage the Japanese culture or people in general, “Japan has been prominently criticized for its damaging whaling practices, harmful exploitation of wildlife products, destructive high seas drift net use, excessive exploitation of tropical forests, and so on” (Manning, 1994, p.171,173,180).

In fact, Japan has been petitioning the Convention on International Trade in Endangered Species (CITES) since 1994 to remove the Minke Whale, Bryde’s Whale, and possibly other species from the international endangered species list. Norway joined the call in 1997, but U.S. delegates fear that approval by CITES would allow countries to
trade in whale meat. This concern may seem to be needless, considering that the U.S. removed the Gray Whale from its national endangered species list when the population rose above 22,000, while the Minke Whale is now up to 1.4 million individuals worldwide ("Japan Seeks Resumption of Whaling," 1999, p. A17).

However, even though the deaths of a few Minke Whales shouldn't have a significant impact, it is in question whether commercial whaling would be carried out responsibly. In addition, people purchasing whale meat and other products at the store might not take the issue of whale conservation very seriously, even though Humpback and Bowhead Whales remain endangered, with populations of around 7,000 or 8,000 individuals, and the Blue Whale population hovers at only 1,000 (p. A17).

It appears that changing people's attitudes is the most important thing we can do to help conservation, and that technology can help us accomplish that through education. Of course, educating the general public about ecological concerns is good, but a significant portion of damage comes from the smuggling and poaching by indigenous people, to fill the demand created by ardent collectors in Germany, the USA, and Japan. (p.61). The same technological advances and new capabilities that allow zoos to keep and breed rare species with special environmental needs regarding temperature, humidity, diet, etc., allow private collectors and pet owners to do the same thing, encouraging the smuggling and exploitation of wildlife.

**Smuggling and Poaching**

In fact, not only is the illegal trade in living and dead wildlife for "trophy hunters, pet enthusiasts, and devotees of traditional medicine....roughly equal to that of smuggled weapons," but "very few nations do anything about it" (Claggett, 1997, p. 54). Undoubtedly, the criminals who forge paperwork and actually export the animals are only "out to make a buck," but the local people at the beginning of the process are a factor too (p.67). For example, Radiated Tortoises from Madagascar are gathered and sold by impoverished natives to smugglers who take advantage of them. The tortoises can sell for as much as $10,000 in the States, but a villager who sells them to the smugglers receives
the equivalent of $4 each, and the men who capture the animals get only about thirty cents for a tortoise (p.68).

One Madagascan tortoise-catcher, when asked if the protections on tortoises made sense, summed up the dilemma.

“For 51 of my 53 years I have been a fisherman here. Now the fishing has gotten too hard, and I am growing too old. It is far harder work than collecting tortoises. But collecting tortoises is far more risky. Still, I have to. I have to eat. I have to feed myself and my family, and the fishing has been nearly used up. Along the beach now, the tortoises are becoming hard to find. They are being depleted like the fishing. To me, [the World Wildlife Fund] has the problem backward- let the tortoise live, so I can starve. The tortoises are here, and I have to eat. That is all I need to know” (p.66).

Clearly, the world’s animals cannot and will not be conserved at the expense of its people. A balance must be found, and it is quite possible that this may come through technology and the help of more developed nations. While poor people are felling their rainforests and eating or selling local wildlife to generate much-needed income, they do understand that they will only be hurting themselves when all the rainforests are gone and the animals dead. Certainly, they would accept a viable alternative if one was available, but they cannot afford to stop, even with the realization that they are cutting off their own feet. “In the long run, people in the developing tropics will be able to act as strong stewards only when they too earn enough money to care about conservation” (Simpson, 1999, p.70).

**Conservation Programs Benefiting People In Developing Countries**

The technology available to developed countries can, by helping these impoverished people, produce effective conservation. “By establishing and enforcing local people’s rights of ownership [in natural resources], their incentives for wise management of such areas will be strengthened” (p.69). By ensuring that economic activity “increases the ability of the local people to reap some of the value,” conservation will be promoted much more effectively than if outsiders come in and merely tell the people that certain
trees and animals are off-limits. If the local people have a stake in conservation, “they are the ones most likely then to continue to try to preserve the local landscape” (p.69).

One program, the Communal Areas Management Program for Indigenous Resources (CAMPFIRE), gives villagers in the Zambezi valley of Zimbabwe the right to manage local wildlife. Since villagers can often “earn more by selling hunting concessions to foreigners,” they have an incentive to protect the animals from poaching, and to “manage them in a sustainable fashion” (p.70). One member of a village wildlife committee stated that “Ten years ago, we liked the animals, of course. But now we like them more because we are getting money for them” (Claggett, 1997, p. 155). Since CAMPFIRE started, community attitudes have changes, and the poaching problem is reduced.

Ecotourism

The theory of ecotourism originated along the same lines- to “enable people in the developing world to earn more by preserving nature than by using it up” (p.159). Although ecotourism has not been universally successful, it does have some good attributes. In Baja California, environmentalists persuaded commercial fishermen and whale hunters to “roll up their nets and roll out the red carpet” for tourists. As a result, “groupers, lobsters, and scallops proliferated, and gray whales continued their comeback from extinction’s edge” (p.160). Although whale counts have dropped in Argentina’s Valdez, where tourist boats have been known to separate mothers and calves, 20,000 visitors were expected in the 1996 season.

In Costa Rica, which “embraced ecotourism early and earnestly,” hotels and restaurants “dot the jungle,” sometimes displacing squirrel monkey habitat. Manatees living in the rivers and lagoons behind Tortuguero are injured by the propellors of speedboats “rushing tourists....to see the last nesting beach of the endangered Green Sea Turtle” (p.160). Nevertheless, “even if whales are harassed by tourist boats and turtles can’t breed in peace, the animals are now better off than when they were destined for blubber factories and jewelry shops.” Costa Rica is devising ways to “minimize environmental damage and let visitors enjoy nature without trampling it” (p.161).
Although tourism in Baja Mexico’s Magdalena Bay took in $4.7 million in 1994, only $33,000 of that found its way into local salaries and businesses, with the rest going to tour companies. One environmental activist complained that “ecotourism doesn’t leave much for the locals except low-level jobs” (p.160). However, instead of “pronouncing ecotourism a failure, governments and guides are trying to reform it” (p.160).

While ecotourism may not be the exact solution, it is on the right track. Wealthy Americans and Europeans cannot reasonably expect people living in ecologically diverse places to remain poor and backward, just for the sake of "preserving nature." Neither, of course, will overdevelopment serve the cause of conservation. Judicious and well-planned development will, however, serve both ends. Indigenous people will have a higher standard of living, and will thus have more motivation to protect wildlife and the environment. Biodiversity will be conserved, and all the parties concerned will be happy.

**Conclusion**

Thus, while technology has many applications to conservation, both positive and negative, it is not the final answer to the problem. Misapplied technology can be very harmful to species and to individual animals, but it can also be a very important factor for conservation in a variety of ways. Technology can help researchers learn more about animals' life cycles, it can help protect animals from poachers, help zoos' captive breeding efforts achieve success, and generate support for conservation through education of the public. Most importantly, it can help put the poor indigenous people who hurt local wildlife in a position where they don't need to do so anymore. Technology does not provide the ultimate solution to the world's environmental problems, but it is a tool that can build the path to bring us there.
Internship Journal

Point Defiance Zoo and Aquarium
Tacoma, Washington
Today I began my internship at Point Defiance Zoo and Aquarium. I will be working with the keepers in World of Adaptations, the area containing birds, reptiles, small primates, and various other small mammals and invertebrates. My task will be to assist and observe the keepers, and also observe the veterinarians as they care for and work with the animals in Adaptations.

I arrived at 8:00 am. After being met and let in through the front gate by Margaret Gaspari, the keeper who had interviewed me for the position, we sat down to discuss the details of the internship. When the paperwork was finished, Margaret gave me a tour of the building. Some exhibits that were of special interest to me were the Bali Mynahs, which have a chick in the nest, and the Tiger Quolls, which can be fairly dangerous, due to their bold and aggressive natures, despite being only slightly larger than some housecats.

Once the tour was taken care of, I was assigned to read several sections of the operations manual for World of Adaptations. This was so I could become familiar with emergency procedures, some elements of animal maintenance, and to gain an idea of the process of “enrichment” for the zoo’s inhabitants. Although interns and volunteers are not allowed to handle venomous reptiles, such as the Northern Pacific Rattlesnake and the Gila Monsters, I was shown the first aid and snake bite kits, and was told the protocol to follow in case of snake bite.

In learning about animal enrichment from the manual, I found it very interesting that enrichment is provided for nearly every single species residing in World of Adaptations. Some species, like the Golden Lion Tamarin and the Kakariki parrots need a great deal of variety and entertainment, but even the Australian Walking Sticks have the branches in their enclosure changed regularly to provide stimulation. Enrichment comes in many different forms, from a new method of distributing food, to rearranging the exhibit’s “furniture,” to placing scent-giving flowers in the enclosure with the animal. For some of
the reptiles, the shed skin from a different individual is placed with the animal, in order to simulate situations that would take place in a natural environment.

Overall, I was very impressed. Point Defiance has an organized and efficient system of providing care, in which the welfare of the animals is second only to the safety of the zoo staff and the visitors. This impression was reinforced by the people I will be working with during the summer, who showed themselves to be very friendly, caring people, who are at the zoo because they want to work with and help the animals.

Wednesday, May 20, 1998 8:00 am - 12:00 pm

Today was more interesting, because I had the opportunity to participate in hands-on activities. When I arrived, I was put to work counting frozen mice into zip-loc bags. After this was done, I weighed out 2 ounces of mice in combination with ground horsemeat for the Tiger Quolls. Then, I cut apples, oranges, and bananas into large chunks and strung them on wire hangers, along with grapes, to make fruit kabobs for the Rosettus and Short-Tailed Fruit Bats.

With the morning diets taken care of, I was brought to meet the Prehensile-Tailed Porcupines, the Agoutis, and the Titi Monkeys, housed in a mixed exhibit. One of the porcupines smelled the fruit on my fingers, and leaned down to get a better look. Later on, up in the holding room, I assisted with cleaning the tank containing the juvenile Poison-Dart Frogs. This necessitated catching the young frogs by hand and placing them in a large jar, then disinfecting and refilling the tank with aged water.

In the process of caring for the animals in the holding room, one of the quarantined Short-Tailed Fruit Bats escaped into the room. Since the woman who was training me is very short, I netted the bat, and she returned it to its cage. However, I was not allowed to touch the bat, because of liability concerns over rabies on the zoo’s part.

By this time, the zoo was almost open, so the Adaptations staff went down
to view the newly arrived Koalas from the San Diego Zoo before the public came. The Koalas were inactive, but seemed to be comfortable in their exhibit. The keeper who had traveled with them from San Diego informed us that the animals are much smaller than some types of Koalas. For example, Koalas from Victoria are not as large as Queensland specimens.

Later, Margaret went to check on the Bali Mynah chick. The keepers were concerned, because these mynahs are an endangered species, and this pair had become aggressive and killed their last chick because it hadn't fledged quickly enough when they wanted to start another clutch. The staff has been monitoring this most recent chick very closely, and it appeared that the parents had stopped feeding it. So, Dr. Holly and the Senior Keeper, Larry, had left orders for the chick to be pulled from the nest.

Although the chick was not as developed as had been expected, Margaret pulled the young mynah anyway. She called and double-checked with Dr. Holly, who confirmed her decision, because the chick was already close to fledging. The juvenile bird was set up in a large cage with an improvised nest in the corner, warmed by a heat lamp. A garbage bag was taped around the back of the cage to prevent drafts. The chick was initially upset, but quickly calmed down. Every precaution was taken, because Bali Mynahs are on the SSP (Species Survival Plan) list, and are thus very valuable birds.

Monday, May 25, 1998 8:00 am - 12:00 pm

I helped clean several exhibits today. First, I worked with Lisa, a long-standing volunteer, to take care of the Agoutis, Titi Monkeys, and Prehensile-Tailed Porcupines. To start with, we removed the old food and water dishes. Then, we raked up all the feces and pieces of food on the floor of the enclosure. We washed the windows, hosed off the steps, and replaced the food and water. The male porcupine was eager to be fed, and he kept leaning towards us as we cleaned. One time he did this while I was turned away from him, and he surprised me when I turned back around and saw him right next to me!
After this job was completed, Lisa and I set to work in the bat cave, containing the zoo’s collection of Short-Tailed Fruit Bats. Once again, we started by removing the fruit kabobs, meat pans, and water. Even though these are fruit-bats, protein in the form of canned marmoset diet and grated horsemeat is provided to replace the insects and other high protein foods that would be eaten in the wild. We then used a hose and scrub brushes to clean the guano from the floor of the cave.

While hosing the cave, I noticed that the drain was plugged. I was wearing rubber gloves, so I reached in the drain to clear it out. What I found was the body of one of the bats, which was subsequently sent to be necropsied.

As a result of this experience, I realized that things like this can happen in any zoo or other animal-care facility, no matter how well-maintained it is. I have seen that Point Defiance is run very carefully and efficiently, with dedicated, caring staff. However, some animal fatalities are impossible to prevent. Fortunately, the fruit bats are not as critical as some of the endangered species residing in Adaptations.

**Wednesday, May 27, 1998**

8:00 am - 12:00 pm

I spent most of my time today being orientated in caring for more of the animals. Sara, who is at Point Defiance as a work-study student from the University of Puget Sound, showed me the procedures for cleaning up after the animals in the holding area. This is the room where the juvenile Poison-Dart Frogs, juvenile Gila Monster, quarantined Short-Tailed Fruit Bats, Eastern Box Turtles, and a Blue-Tongued Skink are kept, along with other animals that need to be temporarily removed from their exhibits.

I helped prepare daily diets by making fruit kabobs for the bats, and by picking mealworms and waxworms out of the worm-buckets. Since everyone was in a slight hurry, it would have been more trouble than help for them to try to teach me other parts of diet-preparation at the time.

Sara and I were then shown the protocol for caring for the amphibians and
reptiles in the Aussie Discovery Center in the Education Building. The Cane Toads, Bearded Dragons, and Frilled Lizards in the Discovery Center are fairly easy to take care of, but everything that is done for them has to be documented carefully. That is because this exhibit is new, and the animals are still under quarantine.

Afterwards, Larry, the Senior Keeper, suggested that I walk through the public display area of the Adaptations building, memorizing the information on each species, which is posted next to each exhibit. This information will be very useful when I take certain animals out to meet the public later on, or for answering questions as I walk through the public areas. One interesting fact I learned is that young Emerald Tree Boas can be born red, yellow, or green, even though they all mature to the emerald green color that gives them their name. Also, I found that Tiger Quolls are the largest native predator in Australia, and second only to the Tasmanian Devil on Tasmania.

Friday, May 29, 1998 8:00 am - 12:00 pm

Today marked the final step in graduating beyond merely watching or assisting in animal maintenance. Since I have observed the animals in the holding area being cared for twice, I was allowed to do it myself, with a staff member watching me. I changed the water of the Blue-Tongued Skink and the juvenile Poison-Dart Frogs, fed and misted the froglets with aged water, removed the old food from the bats and changed their water, did the same for the Pinhead Crickets, and changed the water of the Box Turtles. Since the female Tree Shrew recently had her babies, the male is being kept in the holding area to prevent aggression. He is extremely flighty and excitable, so I changed his food and water very carefully.

I helped prepare diets for the day by making the bat kabobs, crumbling the marmoset diet for the bats, and picking out large and small mealworms and waxworms for the Pygmy Marmosets, Golden Lion Tamarin, Opossum, Tree Shrews, and Bali Mynahs.
Afterwards, I was orientated in maintaining some of the other exhibits. I was allowed to handle the Sinaloan Milksnake while his water was changed and the plants in the exhibit were misted. The White’s Tree Frogs were given live crickets, and they were also provided with new drinking water. Like the Poison-Dart Frogs, these frogs are given aged water, so any chlorine and other chemicals that may be present will evaporate out of the water. This is important, because amphibians, having somewhat permeable skin, are very sensitive to chemicals and impurities. The Tree Frog exhibit was then misted with aged water.

Continuing my orientation, I watched as the Katydid and Walking Stick eggs were misted, and the adult crickets and Walking Sticks were fed and watered. The Katydid eggs are dated from September to December 1997, but there are currently no juvenile or adult specimens. Apparently, the eggs can remain dormant for extended periods of time. On the other hand, the Walking Stick population varies from 1-inch juveniles to 6- and 7-inch adults. These insects devour several large blackberry branches every day! Although the young of both sexes are very fast, and the adult males can fly, the adult females move slowly enough that they are sometimes taken out of the exhibit and used for education and outreach to the public.

Then, I watched the daily protocol concerning the Naked Mole-Rats. These African rodents are extremely sensitive to viral, bacterial, and chemical agents, as well as environmental disturbances and fluctuations. The social structure of these burrowing animals is similar to that of the Honeybees, with the queen Mole-Rat having the sole responsibility of reproducing for the colony. Although our queen recently had 9 babies, all but one have died so far, in spite of the extreme care that was taken of them. They cannot be hand-raised, however, because of their sensitivity to environmental factors.

This sensitivity also influences the maintenance procedures for them. Disinfectants cannot be used in their vicinity, so a pan of water is placed inside the door, for the purpose of washing the soles of shoes of the people entering the exhibit with the Mole-Rats. All of their food and water must be washed in distilled water.
Different "rooms" in the exhibit are designated by the Mole-Rats as feeding, sleeping, and defecating areas, which makes cleaning easier. Soiled shavings and old food are removed, checking carefully for baby Mole-Rats, and new food is put in. A nebulizer is refilled with distilled water to maintain humidity levels, and the floor is swept clean of shavings. Disposable gloves are worn while preparing food and cleaning the "rooms" of the exhibit itself. Outside contamination is avoided whenever possible. Although as an intern, I won't be able to clean their exhibit, I will be able to prepare their diet in the future.

Monday, June 1, 1998

Today was exciting, because I got to work with some animals that I hadn't worked with before. I started out by helping Margaret, a keeper, with the Tiger Quolls, Opossum, and Rosettus Bats. Because the Quolls are dangerous, they have to be shifted between the exhibits and their holding areas before the enclosure can be cleaned. Each Quoll is kept separately, to prevent them from injuring each other. Although they are not much bigger than a large cat, Quolls are bold and aggressive predators.

After the water had been changed and the fecal matter in the Quoll exhibits had been removed, and some crickets released into the area, the animals were shifted into the exhibits to allow Margaret and I to clean the holding areas. The old food was removed, and the shavings were swept back from the door.

Virgil, the Opossum, was easier to care for. He is handled frequently, and is often used as an outreach animal. The Rosettus Bats were originally obtained to be companions for Tut, our resident male Rosettus. Because these bats are very common, Tut has been vasectomized to keep him from contributing to the current population, so that eventually the zoo will have room to help a rarer or more endangered species of bat. One of the two newer Rosettus turned out to be a male, so he is waiting for a vasectomy before he and the female can join Tut.
I also received some good news today- the Bali Mynah chick is perching, and eating on his own! I helped collect blackberry branches, a small piece of fir branch, and fern fronds for the Walking Sticks and crickets. Extreme caution must be used when changing the blackberry branches in the Walking Stick exhibit, because if any of these voracious insects were inadvertently thrown out with the old branches, they could have a major ecological impact. Thus, the branches that are removed from the exhibit are chopped into 2 or 3 inch lengths, put into bags, and frozen for 48 hours before disposal. Hair and clothing are also checked carefully before leaving the area, to ensure that no small hitchhikers are taking advantage of a free ride!

Wednesday, June 3, 1998 8:00 am - 12:00 pm

I did basically the same things today as Monday, except that I did most of it myself, supervised by Senior Keeper Larry. I did the South hallway (Quolls, Opossum, Rosettus Bats), the “Satellite” area (Bali Mynahs, Kakarikis), and helped get blackberry branches for the Walking Sticks.

While caring for the Quolls, I learned the importance of developing a routine, and visually confirming the presence of the animal before entering an enclosure. Although Larry is normally a very organized, careful person, talking to me distracted him enough that he started to walk in with Remus, an aggressive Tiger Quoll, before shifting him into the holding area! Although the animal did not escape, and did not attack Larry, the possible implications show very clearly the importance of always double-checking before going into an enclosure.

Working with the Kakarikis, which are small, New Zealand parrots, was fun, because parrots are my favorite animal. Although these ones are not tame enough to take food from someone’s hand, I hope to have the opportunity of working with them enough to gain their trust.
Friday, June 5, 1998

8:00 am - 12:00 pm

Today I graduated from working under direct supervision to working on my own. Sara, a work-study student, checked what I had done after I finished the animals in the upstairs holding room. I am almost to the point where I can work by myself with the “Satellite” area as well. Probably I will have progressed to working on my own there by next week.

Right before the zoo opened to the public for the day, I discovered a squirrel that had come in the building. It was on one of the cobblestoned “pillars” in the Adaptations building, and was terrified by my presence; racing around the pillar, falling off, and climbing back up again. We had to herd it out of the building using a broom, for fear that it would be frightened by the many children, fall on one, and perhaps bite the child.

I went outside with Karen, a keeper, when she brought Vader the Raven out for education with the public. As I learned, it is important when someone asks a question about an animal, to give them more information than they asked for. For example, if someone asks, “What kind of bird is that?,” Karen might reply, “Vader is a Raven. He is 8 years old, but Ravens can live to be about 40.” This keeps the audience interested, sparks other questions, and provides information that the listeners might not know to ask about. If someone asks, “Is that a Crow?”, the reply could be given, “No, this is a Raven, but Crows and Ravens are very closely related. The way you can tell the difference is that Ravens are two to three times as large, have larger, heavier bills, and have diamond-shaped tails, while Crows’ tails are fan-shaped.”

In the future, it will probably be one of my responsibilities to take some of the animals outside for education and to meet the public. Obviously, some animals are more suitable for this than others. Virgil the Opossum is frequently used as an education animal, and sometimes one of the Aardvarks, or the Ball Python.
Monday, June 8, 1998

8:00 am - 12:00 pm

I worked today on the Upstairs holding area, the South hallway, and the Kakariki exhibits. The animals in these areas are the same ones I have been working with, but this time I finished the caretaking on my own, with a keeper checking after I had finished. Thanks to the thorough job the staff had done in training me, everything went like clockwork!

One interesting thing I learned, however, is that Poison-Dart Frogs are not, as I assumed, only poisonous if they are eaten. Since we handle the juvenile frogs, I reasoned that they must not be dangerous to touch. What I learned is that in their natural environment, these frogs eat Fire Ants, and the poison from the ants is concentrated and secreted through the skin of the frogs. However, when Fire Ants are not included in the diet of Poison-Dart Frogs, the frogs are not dangerous to handle in the least. Because these frogs' diet at the zoo consists of fruit flies and juvenile crickets, they do not pose a threat to their caretakers.

Wednesday, June 10, 1998

8:00 am - 12:00 pm

Since more people than usual were working today, we were able to be more thorough and spend extra time on the animals. Once again, I did the South hallway with the three male Tiger Quolls, Rosettus Bats, Opossum, feeder Gerbils, and feeder crickets.

Normally, some crickets are tossed into the Quoll exhibits as extra inducement to move when they are being shifted, so their night-holding area can be cleaned. However, since we were running low on crickets, one of the Quolls got waxworms instead.

Wednesday is the day that the Opossum enclosure gets deep-cleaned, so I did that as well. Deep-cleaning involves removing all the old shavings, hosing off the floor, the climbing branches, and the sleeping-box, spraying them with the disinfectant called Unicide, rinsing them, and allowing them to dry before putting new bedding down.
Adaptations received a new shipment of crickets and worms in the late morning, so the new arrivals were put in with the few remaining from before. For the worms, the sawdust was sifted, removing the shed skins and the dead worms before adding the new ones. Since the dead crickets are removed daily, the new crickets were merely released into the cricket container.

Dr. Holly Reed, one of the zoo’s veterinarians, came by to discuss the Tawny Frogmouths, a large Australian and Asian bird in the whippoorwill family. Dr. Reed had palpated the keel of the female Frogmouth, and she decided that the bird’s diet should be reduced slightly. Also, one of the keepers had noticed a bruise on the thigh of the male. However, this had cleared up by the time Dr. Holly examined him.

On a happy note, Rich found a fragment of an eggshell while cleaning the Bali Mynah exhibit, so we are all hopeful that there is another chick in the nest.

Friday, June 12, 1998 8:00 am - 12:00 pm

There were not many people working in Adaptations today, so I helped Sara, the work-study student from the University of Puget Sound. I made the bats’ fruit kabobs and crumbled the canned marmoset diet for them. Then, I cleaned the bat cave. It’s a good thing that I like bats, because whenever I moved to the other side of the cave, they flew all around me. These bats are Short-Tailed Fruit Bats, so they are about the size of large mice.

Afterwards, I stood in the public hallway and answered questions while Sara worked on crate-training the Titi Monkeys, and then the Prevost’s Squirrels. Many people were surprised to learn that pieces of fig newton are used as the bait inside the animal-crates.

Finally, Sara and I prepared the diet for the Naked Mole-Rats. This includes chopping up various fruits and vegetables, and also mixing up some baby cereal. The first time, we added too much water, so we had to make up some new cereal.
Some exciting news is that the Eagle-Owl is arriving today. Unfortunately for me, its flight did not come in before I had to leave. However, I will certainly try to go see it down in quarantine in the health-care building on Monday!

Monday, June 15, 1998

Once again, I did the South hallway and the Satellite area. I tried again today to get the Kakarikis to take sunflower seeds from my hands. The birds would approach within a few feet, but were hesitant to come nearer. When doing the Bali Mynahs, I had to weigh out 40 grams of assorted worms for them, because of their new chick. Since the Emerald Tree Boa hasn’t eaten all month, Randy, a part-time keeper, tried feeding her a Gerbil, but she refused to eat it. Randy decided to heat up the Gerbil and try again later.

The female breeder Gerbil has had another litter of babies. They were sired by one of her young from the last litter, that evidently were not separated from her soon enough. Although inbreeding is not a good idea, it isn’t that big of a deal in this case, because the babies will be fed to the snakes anyway.

* After finishing daily maintenance for the animals, I helped Jill, another work-study student from Pacific Lutheran University, to get deliveries for morning “breakout.” This entails bringing a hand-cart up to the storage barn and carrying back the boxes of fresh fruit and produce required for diets for two days. While we were up in the storage barn area, we stopped at the health care building to see the Eurasian Eagle-Owl. It was much the same shape as a Great Horned Owl, although it was bigger, and the eye color and feather patterns were different. Overall, it was a very impressive bird!
Besides doing daily animal maintenance, I had the chance to have a discussion with Margaret today. I had been wondering about something I had read, so I asked her about it. On the sign outside the Quoll display, it mentioned that Tiger Quolls were the largest native predators on the Australian mainland, and second only to Tasmanian Devils on Tasmania, but after thinking about this, I wondered where animals such as Dingoes and Tasmanian Wolves would be classified. Margaret informed me that Tasmanian Wolves are officially extinct, although unverified sightings have been reported in recent years, and that Dingoes are considered to have been imported by the Aborigines several thousand years ago, and thus are not native to Australia.

Margaret also questioned me regarding my knowledge of snake behavior. Such as, if a snake’s eyes are cloudy, it is going to shed its skin soon, and its temper will be irritable and unpredictable. However, I did not know that a snake in this situation is said to be “blue.”

While cleaning the Upstairs holding area, I helped re-sort the juvenile Poison-Dart Frogs according to size. Although they had originally been separated by size into two tanks, they had grown at different rates, and it needed to be done again. Some of the smaller ones weren’t getting enough food. With the small ones and the larger ones in different tanks, this competition should be reduced.

Next, I helped Sara get browse for the Kakarikis and squirrels. We went outside the gate and cut fresh Alder branches to place in the exhibits. We had to be very careful to only cut Alder, and not get Rhododendron or other poisonous plants by mistake. Margaret said that one of the volunteers once cut Rhododendron, which made the Prehensile-Tailed Porcupine very sick. When Sara and I brought the Alder back, Larry checked it to make sure that it was all the right kind of tree.

I also took care of the cricket and Walking Stick exhibits with Sara watching. I changed the food and water of the crickets, and removed the dead ones, then misted the Walking Stick exhibit. I misted the Katydid and Walking Stick eggs as well.
I had the opportunity to help with several exhibits that I hadn't worked with before. Today I helped Margaret, and we started with the Aardvarks. We took care of them first, because it is preferable to do their exhibit while they are still asleep. They are not aggressive, and are actually quite frequently taken outside to meet the public, but they can inflict painful scratches if they come up behind you while working in the exhibit, due to their curiosity.

To begin with, Margaret sprayed down and disinfected the holding area, where they are fed a mixture of ground cat chow and Leafeater diet. Previously, they had been fed a diet with large quantities of meat, milk, and eggs, but this was very conducive to contamination and bacterial growth, so the new diet was welcomed by zoo staff. Next, Margaret replaced the soiled Alfalfa pellets in the toilet area, and scrubbed out the water dispenser.

Then, we put the Radiated Tortoises and their food in a large, plastic tub, provided for that purpose. When they were done eating, we put about 1 inch of lukewarm water in, to stimulate defecation of the sand ingested from the exhibit. Margaret informed me that she is considering providing a different substrate, in order to avoid this problem.

Afterward, we cared for the exhibits in the Public Hallway North area, which contains the adult Poison-Dart Frogs, Honeybees, Desert Hairy Scorpion, and California Kingsnake. The frogs and scorpion had their water changed, pinhead crickets were given to the frogs, and the bees were checked, although they are self-sufficient, since they have free access to the outside. The Kingsnake has to be taken care of at the very end of the day, because she is still in quarantine from an infestation of the internal parasite Cryptosporidium, and we wish to avoid infecting the other reptiles.

Next, we went on to the Prehensile-Tailed Porcupine, Agouti, and Titi Monkey exhibit. We had barely begun cleaning, when Margaret spotted a dead, newborn Titi Monkey on the ground. Quickly, she removed it from the exhibit, put it in a plastic bag in the refrigerator, and called Dr. Holly Reed. Dr. Holly came down to Adaptations, and
agreed that it had been stillborn. Adaptations staff had known that the female Titi was pregnant, but weren’t sure how long she had been pregnant, so they didn’t know when she would give birth. When the baby was found, its tail and the placenta had been chewed on. However, this pair has bred successfully in the past, so the stillbirth was hopefully just a chance occurrence, and not signifying a reproductive problem with the female.

Standard zoo procedure in incidents like this is to fill out acquisition, necropsy, and disposition forms. Although I will not be expected to do this, Margaret showed me the forms. In cases where an animal is traded to another zoo, pre-disposition forms are also filled out.

Wednesday, June 24, 1998
8:00 am - 12:00 pm

Today I went over the same things as Monday, except this time, I actually did the tasks on my own, with Margaret watching me, in case I needed help or had a question. Since I hadn't had a chance to see the Tawny Frogmouths being done before, Margaret showed me the procedure. I also got to take care of Vader, the Raven, because I had watched him being taken care of several times before, and I already have experience working with raptors.

While I was disinfecting the Aardvark holding, Margaret pointed out that I had left both the shift door and the door into the hallway open. The Aardvarks were sleeping at the time, but she reminded me that it is important to form good habits concerning animal security and safety.

Next, I helped Jill by cleaning the water dishes of the Tree Shrew and the juvenile Poison-Dart Frogs. I also took care of the Milksnake and the Ball Python. Since the Ball Python is “blue,” or getting ready to shed, I was very cautious when putting my hand in the exhibit with him.

I was then sent to the storage barn to get deliveries. Every two days, Adaptations staff brings down 44 bananas, 10 oranges, 20 apples, 8 carrots, 8 yams, a bag of grapes, 1
each of various greens, and other specialty produce as it is brought in. This is in addition to all the canned and dry processed foods, frozen horsemeat, chicks, rodents, nuts, seeds, crickets and worms that are used for diets every single day.

Margaret told me about a man who called the zoo in the past week, and requested to rent the Aardvarks for $100 or $200, to come eat the ants under his house. Adaptations turned him down for several different reasons. For one thing, the zoo has no way of knowing if the ants had been poisoned previously. Besides this, if the Aardvarks were set loose, they would destroy the area underneath the house in order to get to the ants, and if they decided to take off digging and not come back, we would have no way of retrieving them. Finally, hiring out the zoo animals for profit is unpleasantly similar to exploitation - it violates the zoo’s mission of educating the public and helping endangered species.

Friday, June 26, 1998 8:00 am - 12:00 pm

My jobs for today were scattered all over Adaptations. I did daily maintenance for the adult Poison-Dart Frogs, Honeybees, and Desert Hairy Scorpion in Public Hallway North, to begin with. In Public Hallway South, the Walking Sticks and crickets were routine, but both the Milksnake and the Ball Python had defecated. Also, the python had shed most of his skin. I recorded these incidences in the Daily Management Records. The White’s Tree Frogs require more complicated maintenance, but I took care of them. Two of the four frogs have vision problems, so they need to be hand-fed. To do this, I had to overcome my inhibitions, and catch crickets to give to them. It startled me when the frogs lunged forward, with their front feet on my hand, and gulped the cricket down! These frogs have loose, circular pads of skin on their feet, to help them climb smooth trees. They felt strange on my hand.

Next, I cleaned the South American exhibit of Titi Monkeys, Agoutis, and Prehensile-Tailed Porcupines. Pokey, the hand-fed porcupine, was making a pest of himself while I was working, but I put the hand-held rake in front of his face and firmly
told him "No." After two or three times, he retired to his favorite perch to wait until I brought the food in.

Karen, the keeper in charge of the Raven, then checked me off for Vader, since today was my third time with him. His food, however, is not given in a dish. Since he is so intelligent, Adaptations staff makes a special effort to vary the presentation of his diet on a daily basis, as a form of enrichment, to prevent boredom. Today, I wrapped his pieces of hardboiled egg, dog chow, fruit, and vegetables in pieces of paper towel, then stuck them into egg cartons and paper towel tubes. This challenges him, stimulating creativity in order to gain access to his food.

After this, I prepared the Naked Mole-Rat diets. Since I am allergic to latex, and thus cannot wear latex gloves, I washed my hands very carefully before handling any of the food, and Larry rinsed it in distilled water before giving it to the Mole-Rats. While I was working on the diet, and Larry was cleaning out the exhibit, he discovered that the Mole-Rats had been fighting again, and one was injured. Dr. Holly explained to me a little later that it is completely normal for the females to fight over the right to be Queen, until the existing Queen is dead.

It doesn't help the situation to remove the instigator, because another female will take up the role, continuing all the way down the line. Also, the injured animals cannot be treated medically, due to their extreme sensitivity to smell and external interference. However, Dr. Holly is planning to try medicating them by intubation, in hopes that the smell of the medication would not be detectable then.

When I was done for the day in Adaptations, I walked down to the summer Australian exhibits to see the brand-new Lorikeet display. This interactive exhibit doesn't open to the public until tomorrow, but zoo staff were inside, getting the birds used to coming down and landing on people to drink from little cups of Lory nectar. As a zoo intern, I was allowed to go inside the enclosure.

There are several different species of lories and lorikeets in this exhibit, and three specimens came and landed on me while I was inside. The exhibit includes Black Lories, Dusky Lories, Blue-Streaked and Yellow-Streaked Lories, and five subspecies of Rainbow
Lorikeet. These birds are all young and hand-raised, and they are delightful to watch, as well as have them sit and play on your arms, shoulders, and head!

Monday, June 29, 1998 8:00 am - 12:00 pm

We were shorthanded at Adaptations today, so I didn't get to watch the last section that I haven't seen being done before. Instead, I did Satellite and South hallway. In Satellite, everything went fairly smoothly. The branches in the Emerald Tree Boa exhibit had been rearranged, so she was not coiled near the water dish, allowing me to change her water. Although the Kakarikis still refuse to approach my hand while I am holding out sunflower seeds, I tried a new method this time. I set down their food pan, then crouched down within a foot or so, holding perfectly still. After a few minutes, one of the males warily ate a few seeds before retreating again. I was excited about this progress!

After finishing South hallway, I asked Jill if she would train me for taking Virgil, the Opossum, outside to meet the public. She preferred to let me hold him, because she found it awkward. I soon found out why! When Virgil is nervous or insecure, he grasps your arm or shirt tightly with his dexterous paws, and tries to climb up toward your shoulder. Holding the base of his tail so he felt more secure, I finally found a position where he felt more comfortable and started to relax.

Since Jill and I had read his fact sheet before taking him out, we were ready to go outside. Many people were surprised to find out how soft Opossum fur is, when we let them pet Virgil's back. They commented frequently on how many dead Opossums they see on the side of the road. Jill and I explained that this is the time of year when the juveniles are striking out on their own, and are thus more prone to being hit by cars. Also, the Opossum's natural fear reaction is to freeze and play dead; not run away, like most other animals. Obviously, this strategy is not very effective when the threat is a vehicle, rather than a predator.
Virgil was brought to the zoo a year ago, as a baby that someone found abandoned or orphaned. Unfortunately, Opossums only live 2-3 years, even in captivity, so Virgil is already middle-aged. Some people that we talked to wanted to know if he is related to rats, because of their similar-appearing tails. However, Opossums are not related to rodents. They are North America’s only marsupial, and have semi-prehensile tails, unlike rats. Only juveniles can hang upside-down from branches; adults are too heavy. One woman wanted to see Virgil’s pouch, but I told her that Virgil is a male, and only the females have pouches.

Wednesday, July 1, 1998 8:00 am - 12:15 pm

Today was exhausting! When I came, Larry had assigned Sara to deep-clean the Aardvark exhibit. I volunteered to help, since I had not seen this done before. Well, I found out that deep-cleaning the Aardvarks is a big job! Given, neither Sara nor I were familiar with the task, but it took both of us working together 2 and 1/2 hours to complete it. This is a good example of the not-very-glorified part of zoo-keeping.

Sara and I started by removing the Alfalfa pellets from the latrine. Then, we made up the Aardvarks’ diet and placed it in the holding area. Sara lifted the shift door, then we climbed into the exhibit to wake up the animals. Little did we suspect that we were in for an Aardvark rodeo! The two Aardvarks refused to wake up, even while we shook and gently slapped them, calling to them to wake up. Even after we finally roused them, the struggle had just begun.

In order to move them away from the sleeping area (they persisted in trying to lay down and go back to sleep), and down towards the shift door, Sara and I found ourselves lifting their front legs over obstacles, and shoving them from behind! It was a relief when both Aardvarks moved into the holding area, but even then, the dirtiest part of the job was still ahead of us.
Next, we got brooms, buckets, and dustpans, and attacked the sand which composes the exhibit substrate. Both of us were wearing surgical masks, but the fine particles of sand formed a cloud as we swept, and much of it came inside the mask. Four buckets of sand later, it was time to hose down the walls, floor, and permanent exhibit structures (namely, concrete replicas of termite mounds). Apparently, we hadn’t removed quite enough of the sand, because the drains quickly plugged up. When the drains were finally washed clear, the exhibit was scrubbed with Unicide, allowed to sit, and thoroughly rinsed. Once again, the drains did their utmost to make our job as difficult as possible.

Although Sara and I joked about being allergic to Aardvarks when we both emerged with a terrible (but temporary), asthmatic-sounding cough, as a result of the dust, we both realized something important from the experience. Certainly, many aspects of zoo-keeping are fun, exciting, and fascinating, but one has to take the good with the bad. It is not responsible or realistic to leave the hard, dirty work to others, while only doing the fun tasks. I’m not looking forward to my next Aardvark deep-clean, but I do know that it was a growing experience!

Friday, July 3, 1998

I started out today by doing Satellite. After I finished the mynah exhibit, I heard the Bali Mynah chick in the nest vocalizing, when the female entered the nest box to feed it a mealworm. (This is good news, since the parents had stopped feeding their last chick, forcing zoo staff to pull it from the nest early). Even more exciting for me, however, was what happened in the Kakariki display. Instead of trying to lure the birds down to me by holding seeds in my hands or crouching next to the food pan, I thought of a new strategy.

While I was cleaning, I was encouraged by the fact that the birds were watching me curiously, and were not alarmed by my movements. So, when it was time to give them their food, I held the pan out at arms-length next to a branch. One of the females came
almost immediately and jumped onto the edge of the pan, eating a safflower seed. After a little while, both of the males joined her. I was thrilled!

After I finished with Satellite, I was sent up to the storage barn to get deliveries. This included all the fresh produce for diets over the weekend, plus whatever miscellaneous supplies were needed.

Finally, Sara and I began hauling wheelbarrows of beauty bark from behind the building to the mini-amphitheater, and spreading it on the ground. Educational shows will be resuming tomorrow, and Karen is practicing her script. Outreach such as these presentations is a major part of her duties at Adaptations. Karen has a great deal of background experience in this area, due to her former job at Sea World. The shows at Adaptations will concentrate on a Pacific Rim theme.

Monday, July 6, 1998 7:45 am - 12:00 pm

Today I had more opportunities to watch new things. Since the last section I have not yet seen being cleaned is the first half of the Main Hallway, Margaret did that, so I could observe. First of all was Amber, the Golden Lion Tamarin. Her display is not too difficult to maintain- all it requires is picking up the dropped food and the feces, and replacing the food and water. She especially enjoys the mealworms and waxworms she gets, along with the cubes of canned marmoset diet, plus various bits of fruits and vegetables.

Next on the list are the Prevost’s Squirrels, but volunteer staff are not allowed to work with them, because they have no fear of humans, and keepers have been bitten in the past. So, Margaret took care of them, while I cleaned the bat cave. When I was done, Margaret showed me how to care for the Tree Shrew exhibit. This was very straightforward also, except that care must be taken that the female doesn’t escape out the door.
Since I enjoy working with the Kakarikis, Randy saved their exhibit for me, even though he had signed up for Satellite. I noticed that the birds, especially the one female who had eaten from the pan when I was holding it last week, were bolder than I had ever seen before. While I was cleaning, they vocalized, and approached quite near to me, to watch what I was doing.

When I held the pan out to them, however, only the female landed very briefly. So, I put several safflower seeds in my outstretched hand, and slowly held them out to one of the males. I was very excited when he eyed me cautiously, then reached out and took the seeds, one by one, eating them on the spot. I was even more excited when I replaced the seeds, and he matter-of-factly put one foot on my fingers, and leaned over to get one a little beyond his reach. I told Margaret, and she said that I should continue working with them, for the goal of getting them to the point where they would voluntarily sit on a scale.

Wednesday, July 8, 1998 7:45 am - 12:00 pm

Adaptations was more than adequately staffed today, so we all had a little extra time to spend when cleaning exhibits. This was fortunate, because the water pipes were being worked on, so the only water we had available was several garbage cans full. (They had been sterilized, before being filled with water). I volunteered to do Satellite.

Because there was no running water, I did not drain the pools in the mynah and Kakariki displays. Instead, I removed whatever food and leaves that had gotten into the water, and tried to avoid contaminating the water any further. I used a bucket of water and a scrub brush to clean up droppings.

The Emerald Tree Boa was coiled right next to her water bowl, so I couldn’t remove it, but since it was just disinfected yesterday, this is not too important.

The Alder branches in the Kakariki exhibit were dead and withered, so Larry had me throw them on the compost pile and cut new ones. When I put them in the holders, the birds began climbing around in them, and chewing on the small cones.
Even more progress was made, concerning training them to be handled. When offered safflower seeds and cooked corn, at least two of the birds sat on my hands and arm.

The two Mynah chicks had to be pulled from the exhibit, because their parents were attacking them. This is discouraging, but we were watching for it.

Friday, July 10, 1998 8:00 am - 12:00 pm

The Kakarikis and mynahs were first on my to-do list today. I am continuing to make progress in gaining the confidence of the Kakarikis. As far as cleaning goes, I certainly appreciate having running water again!

When I feed the White’s Tree Frogs, it is getting easier to handle the crickets. I was never too squeamish about bugs and creatures like that, but I’m conquering the hesitancy I still had. Soon, crickets will be no problem for me to handle.

I then cleaned the Upstairs holding area. Following that, I cleaned and disinfected the nest boxes that had been removed from the mynah exhibit. Since they have raised three clutches this year, I assume that they are being given a chance to rest and recover.

Scott, a new intern, thought of another form of enrichment for Vader the Raven. He presented Vader’s food in a box with holes cut in it, hanging from the top of the enclosure by a string- rather like a piñata! Vader was cautious at first, but soon felt bold enough to try to get his food out. This sort of challenge is an excellent stimulation for a bird of Vader’s intelligence.

Monday, July 13, 1998 8:00 am - 12:00 pm

Today I finished getting checked off for the first part of Main Hallway. Now I am checked off for all the sections that people who are not paid staff can do. In the tamarin
exhibit, the instrument that measures humidity needed to have more water added. I had forgotten how to do this, but Margaret helped me. The bat cave was smelly and time-consuming, as usual. In spite of this, I enjoy having the bats swirl around my head, and hang from the ceiling within a few inches of me. The Pygmy Marmosets and Tree Shrews were shy, and stayed out of the way while I worked.

I also cleaned upstairs. The fruit flies are getting rather scarce in the vials they are kept in, so it was difficult to get enough to feed to the juvenile Poison-Dart Frogs. They are supposed to have 16 flies apiece, per day. Pinhead crickets can't be fed to them, because the crickets might injure them, due to their small size.

I had been thinking of ways to improve the maintenance for the Kakarikis, so I discussed my ideas with Margaret. I felt that they should be given less seed, and only one or two types of fruit and vegetable each day, which should be cut into larger pieces. This is because the birds prefer to eat the seed first, which is very high-fat, and then pick through the small pieces of produce, picking out their favorite kinds. Since they enjoy chewing on large chunks of food impaled on branches, providing only a few different choices every day will force the birds to eat more of the healthy fruits and vegetables. Margaret was very pleased with my idea of using kabobs, like those given to the bats.

Wednesday, July 15, 1998 8:00 am - 12:00 pm

I did the first part of the Main Hallway entirely by myself today. While I was cleaning the bat cave, a bat flew into my leg, and then lay motionless on the floor. I thought that perhaps it was sick. I was about to go alert a staff person, when I turned around again, and it was gone. It must have merely been disoriented for a moment, then recovered and flown away.

When I finished with the Main Hallway, I talked to Margaret about the Kakarikis again. I had more ideas for their dietary enrichment, such as mealworms or waxworms, and cooked pasta. She said that mealworms had been offered in the past, but the birds had
rejected them. However, she decided to get pasta in the future to offer to both the Raven and the Kakarikis. She also showed me the Enrichment Technique Evaluation forms, and asked me to use them to evaluate the new enrichment methods, as I tried them one by one. Since I hadn’t had a chance to observe the birds with the kabob I gave them on Monday, I should evaluate that, too.

I considered offering another kabob today, but there was no interesting fruit available, so I decided to wait. Instead, I decided to try offering waxworms by hand, because the birds are now accustomed to accepting treats from my fingers. I began by giving a few safflower seeds, as usual. Then, I held out a waxworm. One of the females approached, but then retreated again.

After a few more seeds, I tried again with a worm. This time, the dominant male reached out and took it, and transferred it to his foot. He took one bite, but then dropped it. I persisted, and the next time, he ate the entire worm. The other birds were too wary to take one, but the same male ended up eating three!

Now that the introduction of new foods and various presentations of the diet of the Kakarikis is my official enrichment project, I have to document it. I took the Enrichment Technique Evaluation forms to the Administration offices and got photocopies, then evaluated what I had done.

By this time, I had only half an hour left, so I took Virgil the Opossum outside to meet people. He was a lot calmer today, and did not drool as much. I think that is because today is much cooler than the last time I took him out.

Friday, July 17, 1998 8:00 am - 12:00 pm

By now I am getting a little bit tired of doing the Main Hallway. I don’t really mind, though. Actually, most of the exhibits on the first part of the string are quite fast and easy to take care of, with the exception of the bat cave. Today in the bat cave, I managed to avoid getting myself wet the entire time I was spraying with the hose. However, when I
was nearly done, and was filling up the water pan, I dumped water right down my rubber boot. It was cold!

Sara was behind on getting diets ready, so I crumbled marmoset diet for the bats. Everything else was finished, but she was working on the bat kabobs.

Once I was done with the bats, I worked on my enrichment project with the Kakarikis. I made them a kabob of apple and nectarine chunks, got an enrichment evaluation sheet, and prepared to observe. Unfortunately, I had chosen a bad time. The birds had already been fed, it was nearly time for their afternoon nap, and they had just been given fresh bamboo to play with and chew on. In spite of all this, three of the Kakarikis did briefly taste the kabob, but I think it would be more effective enrichment under different circumstances.

The zoo was closed today for preparations for its largest annual fundraiser, Zoobilee, which takes place tonight. Because of this, it was a good time to do deep-cleans. While the Tree Frog exhibit was cleaned out, the frogs were brought into the central kitchen area in an aquarium to be weighed and examined. The two with eye problems had lost weight. It was interesting to see one of them climb the glass walls of the tank, and be able to see how the loose skin of his belly and “fingers” enabled him to stick to the glass.

Monday, July 20, 1998

I was kept very busy today! First, I cleaned and fed upstairs. The Box Turtles had defecated, but when I checked the whiteboard to see if Dr. Holly needed to do a fecal examination for them, they had already tested negative in April. The Tree Shrew male was very vocal- I don’t know if he was unusually hungry, or just excited. When I was done, Rich informed me that the bats in quarantine could be released into the bat cave.

I brought the cage down to the bat cave and opened the doors, but the bats wouldn’t fly out. After a while, Rich came to check on me, and showed me how the whole
side panel slides off. The bats quickly joined the others in the cave. Then, I sprayed off the cage and left it to soak before scrubbing it out.

I tried enriching the Kakarikis with waxworms again, but I could still only get the one male to eat them. However, I did get the female that has never come to me before to eat out of the food pan while I was holding it. I left the small dish of worms in the display.

Taking care of the adult Poison-Dart Frogs and the scorpion was next on my agenda, followed by getting deliveries. Then, I hauled buckets of water outside to water all the plants and shrubs in the amphitheater.

Jill came with me as I took Slick, the Ball Python, outside to meet people, since it was a warm day. I read his facts sheet, so I was able to tell people that he is adult sized, that he comes from Africa, etc. The most frequently asked question, however, was “Is he poisonous?” This surprised me, because to me, he is obviously a constrictor.

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**Wednesday, July 22, 1998**

8:00 am - 12:00 pm

When I came in today, Larry had already signed me up for Satellite, and helping with diets. I made bat kabobs for Jill, then set off to take care of the mynahs, Kakarikis, Emerald Tree Boa, and Blue-Tongued Skink. Scott was adding more composted soil around some of the plants in the mynah exhibit, so I saved that display for last.

A new shipment of worms and crickets arrived a little later. My task was to pick all the good waxworms out of the bucket, discard the dead ones along with the old wood shavings, and replace them with the new worms and shavings. After a while, Sara began to help me, and we gave the discarded shavings to Vader, the Raven, to pick through and find the worms that we missed.

A spur-of-the-moment show was put on at 11:30, for a group of Tacoma public-school teachers. Virgil, the Opossum, and the Eagle-Owl were brought out, and Karen and Sara talked about them. Karen has named the owl “Claude Hunter.”
Friday, July 24, 1998

It has been a long time since I did South Hallway, but that is what Larry signed me up for today. I had to take down the spider webs in one of the Quoll exhibits. When I walked by the holding, I put the duster up next to the wire, and the Quoll was up there in a flash. He behaved just like a cat playing with a toy, running back and forth.

Then, I went up to the storage barn to get deliveries. The fresh produce had not come on time during the past week, so we had run out of many things, or else had only old, spoiled ones available. So, it was delightful to see that new food had been delivered, and to bring down a variety of fresh fruits and vegetables.

The Kakarikis are still responding fairly well to their enrichment, but it is difficult to work with them when the zoo is open, because people come running up to the exhibit, talking loudly, and scaring the birds. It is still only the purple-banded male that will accept waxworms.

Afterwards, Larry asked me to rotate the fruit flies. There are four sets of seventeen vials containing fruit flies: 2 of breeders, and 2 of feeders. Every week, they are rotated forward, so the depleted feeders in front are moved to the back, and allowed to breed, in order to keep replenishing the supply. I transferred the flies into vials with fresh medium in them, and washed the old ones. In four weeks, these same flies (or rather, their offspring), will be feeders again.

I learned some exciting news today--Adaptations is getting a Clouded Leopard cub. The cub is with Dr. Holly right now, but soon we will be able to visit it, and socialize and handle it.

Monday, July 27, 1998

When I arrived this morning, no one had done rounds yet. So, Margaret assigned me to do this. As I made my way through the building, cleaning the fingerprints and greasy
smudges off the display windows, I also visually examined the animals in each exhibit for unusual behavior, or signs of illness or injury. All the animals appeared to be fine, although the Emerald Tree Boa was coiled on the ground, rather than over a branch. I noted this in the Management Records.

I also completed several sections today: Upstairs holding, Public Hallway South, and Satellite. In the Upstairs area, everything began routinely. However, when I got to the Poison-Dart froglets, I quickly realized that something was wrong. The smallest frog was lying flat on the bottom of the tank. I gently nudged it, and when it did not respond, I hurried downstairs to find Margaret. She confirmed that it was dead, and placed it in a ziplock bag in the refrigerator to show to Dr. Holly. Later, Dr. Holly told us that the cause of death was a severe infestation of worms.

In the male Tree Shrew's holding enclosure, someone had placed several fir branches. The Tree Shrew seemed much calmer than usual, apparently feeling much more protected with the addition of cover. Normally, he races back and forth, disappearing inside his hide-box when the door is opened to change his food and water. Now, he remained curled beneath a branch, and moved much more slowly and quietly into the box when I put my hand into the enclosure. Evidently, it would be a good idea to implement branches into the exhibit plan on a more permanent basis.

The next area I cleaned was Public Hallway South. I hand-fed the White's Tree Frogs their crickets, although we are almost out. The Milksnake had defecated, so I disposed of that. The Katydid eggs appeared slightly moldy, so I sprayed them lightly with 10% bleach solution, as instructed upon the care sheet.

Margaret had signed up for Satellite, but she was working on other things, so I took care of it for her. The Kakariki windows were very dirty, so I cleaned them thoroughly. By the time I was done, I didn't have time to go see the Clouded Leopard cub, up in Dr. Holly's office. Hopefully, I will be able to see it on Wednesday.
Although I hadn’t been aware, this morning had been scheduled by the zoo for a meeting of all zoo staff to discuss the future of the zoo. I arrived just in time to walk over to the meeting with other Adaptations staff. The director outlined an 8 million dollar improvement plan for the next several years, focusing on new exhibits and equipment in the South Pacific Aquarium, Southeast Asia, and Rocky Shores, as well as general maintenance facilities and supplies. I am a little uncertain about where the $8 million is coming from, if it is within the budget, or is special funds. Then he brought up the 35 million dollar bond issue that will be voted on by the people of the region in a few months.

If the bond issue passes, the plan is to almost entirely renovate the zoo. Many of the structures and exhibits, which were constructed as modern and state-of-the-art during the 60’s, 70’s, and 80’s, are no longer acceptable. A more inviting entryway into the zoo, an interactive children’s area, and a new hydraulic gate system in the Beluga pool are included in these plans. People appointed by the Zoo Society are preparing an aggressive advertising strategy to promote the bond issue.

However, on the reverse side, if the bond issue does not pass, the zoo will find itself in dire straights. Having only 1.1 million dollars in subsidy provided by Tacoma’s Park Department annually, and the rest of the zoo’s support coming from private donations and zoo entrance fees, Point Defiance has been operating below budget for years. As the director pointed out, it is not easy to raise funds for maintenance; visitors and potential donors are attracted by new exhibits and programs, but these are impossible to provide without first having visitors and donors. Thus, the zoo may very well face closure in the not-too-distant future, unless a great deal of local support can be generated, and the bond issue passes.

What I found most upsetting was that, whether the bond issue passes or not, no improvements are planned for the World of Adaptations. The facility itself is to be destroyed and replaced by other exhibits, approximately by the year 2005. In spite of this, I wholeheartedly support the proposed changes and new features. Modernizing the zoo
will attract more visitors, but also enable the staff to be more efficient in caring for the animals. Essentially, the zoo will be able to do a better job of fulfilling its mission of education and conservation. I do wonder, however, how much of this grand vision for the zoo will actually take place, and if the budget fails, will the zoo continue on as it has for many years, or would it really close its gates?

Once the meeting was concluded, A.M. maintenance and diets were very much behind schedule. So, I set to work on the sections Sara had signed up for, since she still had to do diets. In Public Hallway South, the Walking Sticks were desperately in need of blackberry. I took a bucket, some clippers, and a pair of thick gloves, and went to cut some. The blackberry patch behind Adaptations had been much depleted since the last time I saw it. Nevertheless, I managed to cut a bucketful of blackberry, ending up with only two or three nasty scratches. I left the bucket of blackberry, with some water in it, behind the Walking Stick exhibit, so someone could put it in later on.

Upstairs, fruit flies were still running low, as well. Larry decided to offer the juvenile Poison-Dart Frogs some pinhead crickets, and observe the results. A few of the frogs ate one or two, most were at least interested, and some were intimidated by the crickets. Larry plans to try again tomorrow with the new shipment of younger, smaller crickets.

At this time, I learned that Karen was heading over to the Administration building to feed the Clouded Leopard cub. I went along, to see him. I was surprised by how small and young he is! Since I don’t have any sick or unvaccinated cats at home, I got to take him out of the kennel and play with him. After a moment, he started chewing on my arm, so I substituted a toy. While I was there, several people stopped by the office to see him. Evidently, he is a very popular addition to the zoo, at least among the staff!
Monday, August 3, 1998  
8:00 am - 12:00 pm

It has been a long time since I have done the second part of the Main hallway, so I decided to do that today. First of all, I removed the Radiated Tortoises from their exhibit to feed them, because they have to be back on display by 10:00. Aardvarks, South America, and the female Tiger Quoll came next. When the Radiated Tortoises were done eating, I put an inch of tepid water in the tub, so they could soak.

Then, I cleaned and fed Vader. Since his food is supposed to be presented differently every day, I put my imagination to work. I wrapped his diet in a paper towel, then put it in a cardboard box. I cut holes in the box, but did not remove the cut out pieces. I only cut on three sides, leaving little “doors.” Once I showed him how the doors worked, Vader quickly caught on to the idea.

After I finished my section, I took Radar, the Sinaloan Milksnake, outside to meet people. He was well-behaved at first, but became excited after a while, so I put him away again. Many people were interested in the similarity between Coral snakes and Milksnakes. Several times, I heard the rhyme, “Red next to black is a friend of Jack. Red next to yellow will kill a fellow.” However, this does not always apply.

Wednesday, August 5, 1998  
7:45 am - 12:00 pm

I was assigned to do Upstairs and Satellite today. Since this is Wednesday, I deep-cleaned the Poison-Dart froglet tanks upstairs. To do this, I removed the frogs and put them in a gallon jar, then scrubbed out the tanks, rinsed the moss, and put new paper towel down. The frogs’ diet has been changed to half fruit flies, and half small pinhead crickets.

In Satellite, as I was scrubbing the Kakariki pool, I noticed movement over to the side of the exhibit. On a second look, it seemed to be a mouse, scurrying from plant to rock! As I watched it, something did not seem quite right. I thought that the small rodent
might possibly be a shrew, because its face did not strike me as being mouse-like, and it also walked differently than most mice I had seen. I told Margaret about the rodent.

Margaret and I could not find it again in the exhibit, but she said that its presence was not something to worry too much about. If the mouse or shrew became too bold, a method of trapping it would have to be found. For now, however, it did not seem to be causing any problems.

Once all the exhibits were taken care of, Sara and I set to work evaluating all the displays on how they could be aesthetically improved. In most cases, more plants would do a great deal toward making the exhibits more attractive. Although for some, we felt that touching up with paint or a different kind of substrate would be better.

After taking notes on all our ideas, we started on some of the easy improvements. In the Pygmy Marmoset display, silk plants were placed to partially hide the food dishes. The Aardvark exhibit received clumps of dried grasses, up along the walls. Sara and I were about to replace the dead plants in the Poison-Dart Frog display, but we could not find a hand trowel.

Friday, August 7, 1998 7:45 am - 11:45 am

This was a very exciting day, because my father got to come with me to the zoo. He could only come for about an hour and a half, but he has been wanting to see what I do here all summer. After I introduced him to the Adaptations staff, I took him on a brief “grand tour” of the exhibits. With this out of the way, we started on the most exciting part.

I showed my dad the Eagle-Owl, and let him pet Virgil, the Opossum. He held Slick, the Ball Python, and tried to feed Vader the Raven some mealworms. My dad was thrilled when he misted the Tawny Frogmouths, and the male started to really get involved in his shower! Then, he touched an Aardvark, helped me clean the juvenile Poison-Dart
Frog tank, and picked up a Radiated Tortoise. Last of all, I showed him how the Kakarikis will fly to me and take food from my hand.

Once my dad had left, I finished cleaning Upstairs, and then did Public Hallway South. While feeding the White’s Tree Frogs, I could only find three frogs, and I thought that perhaps one had escaped! Fortunately, Larry spotted it hiding next to one of the others.

Sara and I went outside to get more blackberry for the Walking Sticks. Blackberry is getting a little hard to find, so we had to search around to find enough. There isn’t any shortage of blackberry itself, it is only that suitable stems for feeding are often out of reach, since the easily available ones have long since been harvested. I watched Sara put the new blackberry in the exhibit, but I find that I am unwilling to put my arms in with the Walking Sticks. I have held one before, but I don’t want one to fall on me!

Before I left, Sara and I changed the water in the Poison-Dart Frog pump, and scrubbed out the recesses in the rock face in the exhibit. On my way out, I stuck my head into Dr. Holly’s office to see the Clouded Leopard cub. He has grown a great deal. Karen says he weighed in at three and a half pounds this morning.

Monday, August 10, 1998 8:00 am - 12:00 pm

I cleaned Public Hallway North and South, as well as Upstairs today. I almost forgot to feed the adult Poison-Dart Frogs, but I remembered when I was feeding the pinhead crickets, so I went and fed them. The Box Turtles’ carpet was dirty and smelly, so I removed it, and washed and sterilized it, replacing it with a clean piece. The female turtle had some feces stuck to the hinge on the bottom of her shell, so I took her to the sink and scrubbed it off.

Next, I asked Jill to teach me the knot used to tie Vader’s jesses to his perch. She brought out a spool of cord, and showed me several times. I practiced for a while, then had Margaret watch while I took care of Vader.
Jill cleaned Odie's exhibit next, our big Burmese Python. I was Jill's backup, ready to run for help if Odie threatened or attacked her, although that seems unlikely. Despite this, it is a good precaution to take.

**Wednesday, August 12, 1998**

Adaptations was overstaffed today, so we did quite a few deep cleans. After I did the usual cleaning and feeding in Satellite, I offered to deep clean the Tree Shrew holding upstairs. It really needed to be cleaned out! I removed the hide-box and branches, swept out all the wood shavings, and disinfected the enclosure with Unicide. While it soaked, I cut fresh fir branches and carried a couple of buckets of shavings upstairs. When the exhibit was ready, Margaret released the male Tree Shrew back in.

As soon as I finished with that, I put away the deliveries, and then started deep-cleaning the Rosettus bats. I removed all the shavings, hosed out the holding, and scrubbed as much of the bat droppings as I could off the wire. Not all of it would come off, so I left it to soften for a while. The male Rosettus finally had his vasectomy yesterday, but he pulled out his stitches, so Dr. Holly needs to examine him again.

Jill and I took Virgil outside for a walk. We let him run around on the ground for a few minutes. Then we took him to the Administration building, because the people who work there enjoy animals, but rarely get to interact with those at the zoo.

A new batch of baby Mole-Rats have been born. Twelve have been counted, and their exhibit has been closed to the public. Hopefully, at least some of these will survive.
Today was my last day at the zoo. I was in charge of Satellite and Public Hallway South. When I was finished, I washed the day’s dishes and put away deliveries. Once all my daily chores were taken care of, I was free to wrap up my business at the zoo.

There were a few points in my journal that I was unsure about, or needed to verify my facts. I got on the computer and looked under the species files of the animals in question. Sara has been updating the manual, so it is all on disk.

I was still unable, however, to find the name of the organism infecting the California Kingsnake. I looked in the manual, in the Management Records, and I asked most of the staff. However, no one that I asked was able to tell me positively what the answer was.

My next step was to track down Dr. Holly and ask her. She was able to tell me that the organism is called Cryptosporidium, and is an internal parasite. I had also wanted to express an interest in interning with Dr. Holly herself next summer, but she informed me that only senior vet students are allowed to do this. My only opportunity to do something of this kind would be to “shadow” her one morning a week. I told her that I was excited about the possibility, and would remain in touch with her during the year.

I was sorry to leave the zoo, but am infinitely grateful for my opportunity to intern here for the summer. I learned many new things, not only about animal management, but about the management of an animal care facility. Above all, I enjoyed working with the animals, handling them, and learning about their requirements. I am looking forward to returning to Point Defiance next year to work with Dr. Holly, if the possibility to do so works out.
Works Cited