Issues and Options Related to Management Of Silver Springs Rhesus Macaques

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BACKGROUND

The Silver River is a 11.2 km watercourse in Marion County, Florida that originates at Silver Springs and empties into the Oklawaha River. Silver Springs, a large limestone artesian spring, and the Silver River have been tourist attractions for more than a century. The Silver River and its associated floodplain also have been the home of free-ranging Asian rhesus monkeys (Macaca mulatta) for over fifty years.

Ecology of Rhesus Monkeys

The ecology of rhesus monkeys has been well-studied (Altmann 1962, Koford 1965, Southwick et al. 1965, Neville 1968, Lindberg 1971, Wolfe and Peters 1987). Rhesus monkeys are diurnal animals. During the night they sleep in trees and during the day they forage, travel, rest and engage in other activities within a group. The diet includes fruits, leaves, flowers, seeds, barks, and insects. Rhesus monkeys are not known to be vertebrate predators (Wolfe and Peters 1987).

Rhesus monkeys perform their daily activities within stable, social groups called troops. A troop is composed of adult males and groups of genetically related females. Mating is opportunistic. Males are usually dominant over females. Rank in females is based on the matrifocal unit so that one female and her offspring are dominant over another female and her offspring. Rank in males is based on such factors as age, residency time in a troop, fighting ability, and associations with females.

Females reach puberty at 3 years of age and stay in their natal troop all of their adult lives unless the troop fissions

(divides into two troops). Males reach puberty at 4 years of age and usually leave their natal troop at that time and become solitary or join another troop. During the mating season, solitary males associate loosely with a troop to engage in mating opportunities, but during the rest of the year they are nomadic. Macaque population studies have shown that an immature to adult ratio of 0.50 is necessary for long-term population maintenance (Southwick and Siddiqi 1977).

Release of Silver Springs Monkeys

The first written reference to the monkeys at Silver Springs was found in the November 11, 1938 issue of the Ocala Banner which stated that a male rhesus had been shot and killed in nearby Anthony, Florida. The male was reported to be the head monkey of Silver Springs and had left behind 5 others.

No records document the release of the monkeys although it is generally believed a Colonel Tooey was responsible. Colonel Tooey was manager of the Silver River Jungle Cruise boat ride in the late 1930's. He apparently released a small number of rhesus monkeys on an island in the Silver River at that time to improve business. Tooey had the erroneous belief that the animals could not swim and would remain on the island. They subsequently swam off the island but were encouraged to remain in the area by frequent feedings from Jungle Cruise boats. An additional 6 rhesus monkeys were released by Tooey on the north side of the river in 1948, and the colony became well-established.

Growth of the Population at Silver Springs

The first scientific investigation of the Silver Springs monkeys was conducted in 1971 by William Maples and his student, Michael Hutchens, both from the University of Florida. The most reliable census available at that time, performed in 1968, indicated a total of 78 monkeys (Maples et al. 1976). That population estimate, and most of the ones that have followed, were based on the troops inhabiting the north and south banks of the river near the headwaters (Figure 1).

Southside Troops. Maples and several students, including Elizabeth Peters, began a long term study of the monkeys on the south side of the river in 1976. The monkeys consisted of one troop which then fissioned. As a result of the fissioning, there were two troops: the S-troop composed of 22 individuals and the L-troop composed of 7 individuals (Peters 1983). L-troop moved downriver and most were later trapped and removed from the area (Wolfe and Peters 1987).

Linda Wolfe, a University of Florida researcher, began making observations of the southside troop in 1980. She reported 65 monkeys including 13 reproducing females at the end of 1982 (Wolfe 1986). Over a 3-year period (1980-83), the reproductive rate for southside females averaged 82% (Wolfe 1986). A 1986 census by Wolfe indicated 100 monkeys in the southside troop, a four-fold increase from 1976 (Wolfe and Peters 1987). The adult sex ratio was one male to 2.4 females and 57% of the population were juveniles (Wolfe and Peters 1987). Five adult females were

sterilized by hysterectomy in December, 1986, in an effort to control population expansion. Also at this time, 59 monkeys were removed from the area without the knowledge of the management at the Silver Springs tourist facility. Annual census figures from 1987 through 1990 indicated the S-troop population rose from 52 in 1987 to 57 in 1990. The reproductive rate averaged 63%. The sterilization program continued through 1990 with a total of 20 monkeys sterilized (both south and north troops). Sterilization was performed by the University of Florida College of Veterinary Medicine.

Recent census figures taken in October, 1993, show approximately 52 individuals in S-troop: 5 adult males, 19 intact and pubescent females, 5 sterilized females, and about 23 juveniles and infants (Linda Wolfe, per. comm.). The S-troop population has stabilized in recent years due to the sterilization program and the continued removal of monkeys from the area.

Northside Troops. Peters surveyed the monkeys on the north side of the river in 1981 and found 2 troops in excess of 50 monkeys each and several solitary males. One group (C-troop) was thought to have fissioned from the other (M-troop).

Wolfe expanded her work to include the northside troops in 1983. It was estimated that M-troop was composed of approximately 250 individuals and C-troop 32 individuals. Florida Leisure Attraction, Inc., the owners of the tourist facility at Silver Springs, under pressure from the Florida Game

and Fresh Water Fish Commission (GFC), trapped 217 monkeys on the north side of the river in 1984, and sold them to Buckshire Corporation, an animal supply company. An unsuccessful attempt was made in 1985 to transfer about half of the remaining M-troop monkeys to the south side of the river. These monkeys returned to the northside. Most were retrapped in 1986 along with some members of C-troop and sent to a zoological park in Missouri. A 1987 census for the northside monkeys indicated one troop of 34 individuals. The population rose to 70 individuals in 1990. The reproductive rate during this period averaged 68%.

A recent census, conducted in October, 1993, showed approximately 68 individuals on the northside: 5 adult males, 17 intact adult and pubescent females, 9 sterilized females, and approximately 35 infants and juveniles (Linda Wolfe, per. comm.). The northside monkey population has remained fairly stable in recent years for reasons similar to the stabilization of S-troop.

Current Distribution. Definitive information on rhesus monkey distribution is lacking. In a Department of Natural Resources[1] (DNR) memorandum from Pearson to Parenteau (April 23, 1990), approximate locations of rhesus monkeys within Silver River State Park were specified (Figure 2). These locations were based on sightings and tended to be near roads and the Silver and Oklawaha Rivers. Possible locations of rhesus monkey troops

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[1]The Department of Natural Resources was merged with the Department of Environmental Regulation by the 1993 Florida Legislature to form the Department of Environmental Protection, effective July 1, 1993.

outside state park lands were not given.

Human Contact with Monkeys

Rhesus monkeys have been maintained at Silver Springs through supplemental feeding from either boat operators on the river or food stations set up by the tourist attraction management. Supplemental feeding aided the expansion of the population and when done from boats, it increased human contact with monkeys.

The proliferation of rhesus monkeys has resulted in numerous reports of them outside the Silver Springs Attraction property, both along the Oklawaha River and in the Ocala National Forest, east of the Oklawaha. An accurate count of monkeys in these areas has not been made. Maples stated in 1976 that sightings ranged from 11 miles north of the junction of the Oklawaha and Silver Rivers to 18 1/2 miles south. According to a 1982 Marion County Health Department document, sightings of independent monkeys had been reported with regular frequency since 1977 as far as 25 miles from the Silver Springs Attraction. An April 23, 1990 DNR memorandum also stated there had been a report of monkeys 12 miles north of the Silver River/Oklawaha confluence. Additional sightings of rhesus macaques have been reported in Pierson, 70 miles by river from Silver Springs, Eureka, 25 miles from Silver Springs, and Deland, over 100 miles from Silver Springs (Kyle Hill memorandum, August 23, 1984). The origin of these macaques has not been established, and they may or may not have originated from the Silver Springs population.

Nuisance reports of free-ranging rhesus macaques from 1977-84 were compiled by Kyle Hill of the GFC in a memorandum dated August 23, 1984. These included several reports near Conner Landing off Highway 314 on the east side of the Oklawaha River. L. R. Peoples stated macaques raided and destroyed his orange grove near Conner Landing in 1983 and continued to roam his neighborhood in 1984. Gail Lively, park supervisor of the county park picnic area off Highway 40, reported several interactions between humans and rhesus macaques at the picnic area. One involved a rhesus grabbing a young child to obtain food. The child was scratched and bruised. Wayne King, a Law Enforcement Officer with the GFC, reported he destroyed a macaque in his backyard in Fort McCoy in 1976. L. J. Hall stated in 1983 that macaques were seen in a squash field west of Highway 441 off Martin Anthony Road near IFAS Horticultural Farm. Three incidents of nuisance macaques were reported in 1984 at the picnic area near Gores Landing off Highway 315. Additional nuisance and human injury events were listed.

The GFC documented a total of 23 monkey-human incidents resulting in human injury and 8 incidents where no injury was recorded during the period 1977 through 1984. Of the 23 incidents, 6 were cases reported to the Marion County Health Department. All 6 cases were provoked, and no one tested positive for rabies. The GFC has not attempted to keep track of monkey-human interactions since 1984, and there have been no additional reports at the Marion County Health Department since

that time.

Rhesus Management Agreements at Silver Springs

The expansion of the rhesus population at Silver Springs and the resulting monkey-human incidents led the GFC to require by law certain management policies of Florida Leisure Attractions, Inc. The requirements were specified in a September 24, 1984 document by the GFC and still currently apply. The following 5 points were listed:

1. Silver Springs management will take all necessary steps to retain the rhesus population totally within Silver Springs' property boundaries. This is to be accomplished by an overall reduction in the number of primates on Silver Springs' property through humane capture methods.

2. Silver Springs will capture all the rhesus macaques of the "Canal Troop" which range from Silver Springs' property to the Sharpes Ferry area and all rhesus macaques on the north side of the Silver River (Troops M and C).

3. Silver Springs will capture any other macaques that have or may venture off the Silver Springs' property.

4. The "South Side Troop" of rhesus macaques may remain unconfined on the property of Silver Springs, south of the Silver River. A program will be initiated by Silver Springs to retain the monkeys on its property. Such program is to include daily supervision and feeding at designated stations with periodic culling of the population as may be necessary to ensure that all rhesus macaques remain within the property.

5. Disposition of the monkeys captured will be the responsibility of Silver Springs and may be accomplished by any legal methods. The Humane Society of the United States and other groups may be offered the opportunity, at the option of Silver Springs, with locating appropriate facilities in which to place these animals. Any such facilities must be approved by the Commission, if in the State of Florida, or by other appropriate authority if in other states.

Compliance with the above points currently has not been achieved.

Florida Leisure Attractions, Inc. sold properties to the

state in 1987 that were east of the attraction and south of State Road 40 to Sharpes Ferry road, and east to the Oklawaha River. This property was acquired by the state's CARL Program, and placed under the DNR, Division of State Parks and Recreation as a state park. Florida Leisure Attractions, Inc. maintained property on both sides of the Silver River adjacent to the main spring.

Florida Leisure Attractions, Inc. entered into an agreement August 18, 1987 with the DNR regarding free-ranging rhesus macaques. This agreement is still in effect and involves the following:

1. The Division of State Parks and Recreation is responsible for notifying Florida Leisure Attractions, Inc. (The Attraction) of the presence of rhesus macaques on state property.

2. The Attraction is to initiate capture procedures within 48 hours.

3. The Attraction is to take reasonable steps to maintain the monkeys on attraction property.

4. The Attraction agrees not to feed the monkeys on state property.

5. The Attraction agrees to tattoo and sterilize any monkeys caught on state property.

6. The Attraction agrees to monitor the monkey populations for any potential health or disease problems.

7. The Attraction assumes all responsibility for disposition of captured monkeys in conjunction with population management programs.

Limited trapping was attempted by The Attraction; however, no monkeys were reported to have been caught.

The state purchased the remaining property owned by Florida

Leisure Attractions, Inc. in December, 1993. As part of the purchase agreement, The Attraction signed a 15-year lease with the state for the continued management of the land.

ISSUES

The free-ranging rhesus macaque population has created several issues for the agencies responsible for managing Florida's wildlife and other natural resources. Insufficient data have resulted in many uncertainties surrounding these issues. Presented in order of clarity, the issues include 1) the implication of protecting an exotic (non-native) species on state-owned land, 2) public reaction to management decisions, 3) compliance with the United States Department of Agriculture (USDA) Animal Welfare Act, 4) human health concerns, 5) liability to the state should an incident resulting in human injury occur, and 6) the environmental impact of the monkey population.

Exotic Species

The presence of an exotic species on state-owned land is antithetical to the State of Florida's philosophy of natural systems management. The objective for management of state lands by the Division of Recreation and Parks (currently within the Department of Environmental Protection) is the "restoration and maintenance of natural communities, as much as possible, to the state which prevailed according to scientific knowledge, before the changes wrought by the arrival of Europeans" (Florida Department of Natural Resources, Division of Recreation and Parks 1992:1). This is implied in Chapter 258 of the Florida Statutes:

"It shall be the policy of the Division of Recreation and Parks: to acquire typical portions of the original domain of the state which will be accessible to all the people, and of such character as to emblemize the state's natural values; conserve these natural values for all times . . ." The Department of Natural Resources, Division of Recreation and Parks has adopted a specific resource management policy which states that "exotic animals compete with or impact native organisms and must be removed" (Florida Department of Natural Resources, Division of Recreation and Parks 1992:3). The legal authority to control other exotics (Title 39, F.A.C.) could be jeopardized if free-ranging rhesus monkeys are permitted to remain on state-owned land.

Public Reaction to Management Decisions

The citizens of Marion County have strongly favored the continued existence of rhesus monkeys at Silver River. Over 11,000 people have signed petitions in support of the monkeys. The Ocala Star Banner published a request on May 25, 1992 for responses to the question "Do you want free-ranging monkeys to stay along the Silver River?". Of 625 people responding, 615 answered yes.

Friends of the Silver River Monkeys, an activist group formed in response to the threat of eliminating the monkeys by euthanasia, sent a Brief in Support of the Silver River Monkeys on July 10, 1992 to the Department of Natural Resources. It was the position of this group that the rhesus population enhanced

the Silver Springs area and human health concerns were minimal. Eradication of the population was opposed.

Health and Liability Concerns

Herpes B. The simian herpes B virus (Herpesvirus simiae) was discovered in the free-ranging rhesus population at Silver Springs Attraction in January, 1992. Four of the 7 individual monkeys tested were found to be positive for the virus. Another 8 individuals out of a group of 22 tested positive after initially testing negative in March, 1992. Twelve (41%) from a total of 29 trapped rhesus monkeys on these two occasions tested positive for the virus.

Herpes B virus is endemic in Old World monkeys, and most prevalent in rhesus macaques. It produces an illness in rhesus monkeys resembling that associated with herpes simplex virus infection in humans. The virus may remain latent in the monkey host and may reactivate spontaneously or in times of stress, resulting in shedding of the virus in saliva and genital secretions (Janda et al. 1990). Serologic studies of adult free-ranging rhesus macaques have detected B virus antibodies in 72% to 100% of those tested (Shah and Southwick 1965, Shah and Morrison 1969, Zwartouw 1984, Weigler et al. 1990).

All known cases of virus transmission have occurred in laboratory settings, most by exposure to contaminated monkey saliva through bites or scratches. One transmission, however, took place from contact with contaminated cell cultures, another when cleaning a monkey skull, and another from applying skin

cream to a person's B-virus lesions when the victim's own fingers had a dermatitis infection. The cause of one case could not be traced to an injury.

More than 80% mortality has been reported for the 32 documented cases of herpes B virus infection in humans (Scinicariello et al. 1993). Survivors not treated with acyclovir, the antiviral agent of choice, have reported significant neurological deterioration. Favorable outcomes were noted when treatment was given before the onset of severe central nervous system involvement (within days to weeks after infection) (Scinicariello et al. 1993). Acyclovir treatment must be maintained for the life of the patient. There has been no vaccine available to date.

There have been no reported cases of B-virus transmission to humans by free-ranging monkeys. However, in southern Asia, where rhesus colonies live within human communities, there is no surveillance for Herpes B infections, and it may be incorrect to infer that transmission has not occurred (W. Gary Hlady, Deputy State Epidemiologist, letter to Alexander dated May 15, 1992). Nevertheless, the chances of acquiring Herpes B appear to be very low. Although prevalence of the disease may be as high as 100 percent in adult rhesus monkeys, under normal conditions, it is dormant. The incidence of laboratory rhesus monkeys shedding the virus is reported to be about 2% (Keeble 1960). Such information for free-ranging rhesus monkeys is lacking.

B virus transmission to visitors at Silver Springs would

require a bite or scratch by a monkey that is shedding B virus at the time of the incident. The potential hazard to humans of B virus infection is extremely low. However, should infection occur, the outcome likely would be severe. For this reason, the Deputy State Epidemiologist advised in a February 20, 1992 letter to Florida Leisure Attractions, Inc. that monkey-human contacts be minimized.

Additional Health Concerns. The ability of rhesus macaques to carry other diseases transmittable to humans is well-documented (Brack 1987), although there is no evidence that anyone who has had contact with the monkeys at Silver Springs has contracted a disease from them. Wolfe and Peters (1987) reported that at least 70 monkeys had been tested for TB and all tested negative. The Centers for Disease Control also had no reports of rabies in unvaccinated monkeys in the United States (Wolfe and Peters 1987).

Human injury may result from encounters with rhesus monkeys. Historically, humans and monkeys at Silver Springs have actively sought out each other and encounters have been frequent. Although rhesus macaques lack claws, males have large canine teeth capable of inflicting damaging bites. Rhesus monkeys typically respond to the approach of humans by fleeing. However, when they feel threatened they may become aggressive. Simply staring at a rhesus monkey may cause it to become aggressive. Most aggressive behavior is noncontact (Teas et al. 1980).

Animal Welfare Act

The USDA brought action against Florida Leisure Attractions, Inc., for violations of the Animal Welfare Act in 1992. Florida Leisure Attractions, Inc. displayed numerous exotic species and was classified as an "exhibitor" [" . . . any person (public or private) exhibiting any animals, which were purchased in commerce or the intended distribution of which affects commerce, or will affect commerce, to the public for compensation, as determined by the Secretary. This term includes carnivals, circuses, animal acts, zoos, and educational exhibits, exhibiting such animals whether operated for profit or not . . ." (Code of Federal Regulations 1993:3)]. All their exotics, including the free-ranging rhesus monkeys, were listed as exhibit animals, therefore care guidelines specified in the Code of Federal Regulations applied to the monkeys as exhibit animals. These were described under Title 9, Part 3, Subpart B - Specifications for the Humane Handling, Care, Treatment, and Transportation for Nonhuman Primates. The regulations included that they be fed and housed in an appropriate housing facility and receive proper veterinary care. The USDA stated that under no circumstances would free-ranging rhesus monkeys be permitted at Silver Springs Attraction (Dr. Richard Overton, USDA, per. comm.). Compliance with the Animal Welfare Act was sought by February, 1993 but has not been achieved to date.

The Silver Springs State Park, on the other hand, has not exhibited animals by the above definition. Therefore, they have

not been classified as an exhibitor by the USDA, and the free-ranging rhesus monkeys do not fall under the guidelines of the Animal Welfare Act. The state has been instructed by the USDA to separate humans from the monkeys on state-owned land in order to maintain such status.

Environmental Impact

Rhesus monkeys are predominately vegetarian, utilizing a wide-range of plant parts, including leaves, stems, twigs, bark, fruit, buds, roots, and seeds. Insects are also consumed, and reports exist of rhesus monkeys occasionally eating eggs (Malik and Southwick 1985). The monkeys at Silver Springs, however, have never been noted to do so (Sarris 1980). Sarris (1980) observed Silver Springs rhesus monkeys foraging and determined 94% of the feeding bouts involved plants, 5% involved the consumption of soil, and less than 1% involved insects. The Silver Springs monkeys demonstrated a substantial amount of dietary flexibility, utilizing 48 species of plants and the full-range of plant parts (Sarris 1980). Wolfe and Peters (1987) speculated that the dietary flexibility of the rhesus macaques minimized competition for plant resources with native species.

Food habit studies conducted in South Asia have shown the behavioral adaptability of rhesus monkeys. Lindburg (1976) found that rhesus relied almost exclusively on natural forest vegetation, consuming over 100 species of plants in their diet. A study of rhesus food habits in an agricultural area, by contrast, showed that only 7% of their diet came from natural

sources and 93% from human sources (Siddiqi and Southwick 1980).

No scientific studies have been conducted to assess the environmental impact of the Silver Springs monkeys. Predation and habitat changes are the most often cited mechanisms of impact of exotics on native species (Lodge 1993). Although predation may not be significant with the monkey population, selective harvesting of flora, changes in species composition in invaded floodplain plant communities, and competition with native herbivores and frugivores may be significant and should be addressed. Specific concerns include possible interference with bird nesting and the effect of downed limbs brought about by troop movements.

MANAGEMENT OPTIONS

Management options for the Silver Springs free-ranging rhesus macaque population range from removal to active maintenance of the population in situ. Selection of a management option is dependent upon which issues are perceived to be true problems. Management options are presented along with their effectiveness in dealing with issues previously described.

Remove the monkeys

The rhesus macaques at Silver Springs may be removed by either euthanasia, sterilization, or relocation (or a combination).

Euthanasia. Euthanasia may be humanely accomplished by veterinary injection of an appropriate tranquilizer, followed by injection of sodium pentothal. Macaques have been successfully

captured by the use of bait traps, although Silver Springs trappers have stated they will learn to avoid traps (Tuck Lundy, per. comm.). Capture followed by injection may prove to be successful initially, however, the capture success rate is likely to decline over time. Additional means of euthanasia, such as darting, could be considered in order to remove the entire population.

Euthanizing the rhesus population offers many advantages. The state mandate against non-native species on state-owned land would be enforced through this action. Once euthanasia is accomplished, human health concerns, such as injury and herpes B transmission, would be eliminated. Liability for injury, disease transmission, or property damage would no longer be an issue. Animal Welfare Act violations at Silver Springs Attraction would be resolved. Environmental damage that may be occurring with the presence of the monkeys would no longer occur. This option would be one of the least expensive to implement.

Problems are associated with euthanasia. The principal concern would be opposition from animal rights groups and citizens of Marion County. The rhesus colony at Silver Springs provides a unique viewing situation for American tourists, and may contribute to the financial well-being of Marion County. Also, if the population were removed, scientific research opportunities would no longer be available. Two dissertations and several published papers exist from research on the rhesus colony at Silver Springs. Lastly, euthanizing the entire

population may not be possible. While the majority of the population may succumb to trapping or darting, a distinct possibility exists that a few monkeys would remain and continue to reproduce in the Silver Springs area. Diligence and careful monitoring will be required to eliminate the population over time.

Relocation. Relocation of the rhesus would require an acceptable facility. Dr. Michael Hutchins, Director of Conservation and Science for the American Association of Zoological Parks and Aquariums, has stated that it is highly unlikely any AAZPA institutions would accept these animals. Three reasons were given: 1) the rhesus are of unknown genealogy; 2) they are not on the AAZPA high priority lists for captive breeding programs; and 3) the rhesus population is known to carry the herpes B virus. Private individuals cannot possess rhesus macaques without a license from GFC which requires 1,000 hours and 1 year experience with Class 2 primates. Other relocation facilities would use rhesus for breeding of laboratory animals or directly for animal research. Relocation offers the same advantages and disadvantages of euthanasia.

Sterilization. Another approach to eliminating the population is to remove their reproductive potential through sterilization, yet allow the sterilized animals to remain and live out their lives as free-ranging monkeys. Due to promiscuous mating in rhesus monkeys, this would be best accomplished through female sterilization (Linda Wolfe, per. comm.).

As with euthanasia and relocation, sterilization would enforce the state mandate against non-native species. Sterilization also is viewed by the Friends of the Silver River Monkeys as a more humane method of removal than either euthanasia or relocation (Tish Hennessey, Friends of the Silver River Monkeys, per. comm.)

Several issues would need to be addressed if a decision to sterilize the population is made. Human health and liability concerns remain for the life of the population, as do Animal Welfare Act violations. Release of monkeys after sterilization would not comply with State Law (Title 39, F.A.C.) nor a DNR policy stating that "exotics are not to be introduced (planted or released) in a park" (Department of Natural Resources, Division of Parks and Recreation 1992:2). Complete sterilization of all females may not be feasible. Those that can not be captured would continue to reproduce, so this option may not fully accomplish what would be intended.

Manage the Population

An alternative to removing the rhesus population from the Silver Springs area would be to manage them in situ. Two basic management schemes present themselves. The first is to retain current practices (feeding stations at Silver Springs Attraction, warning signs to reduce human-monkey interactions). While Friends of the Silver River Monkeys and citizens of Marion County may be in support of this decision, it fails to address issues previously described. Expansion of the population (likely

without some removal and with continued food provisioning) would intensify those concerns, and require action at a later date.

If the issues associated with this population are to be addressed, an active management plan must be developed. The following practices may be employed, either solely or in combination.

Monitor the Population. If long-term management of the population is to be undertaken, information on population dynamics and environmental impact would yield more informed management decisions. On-going monitoring programs would ascertain the status of the population through time and its effect on the environment.

Reduce Population Levels. Reduction and maintenance of a reduced population through euthanasia, relocation, and sterilization diminishes the potential for human-monkey encounters and the likelihood of injury, property damage, or disease transmission. It retains the population for tourists and potential research opportunities. Friends of the Silver River Monkeys and Marion County residents would not oppose this practice if sterilization was the method selected to reduce the population (Tish Hennessey, Friends of the Silver River Monkeys, per. comm.).

The primary disadvantage of reducing the population and maintaining it at a low level is that though diminished, the potential for human interaction still exists along with its related problems. Animal Welfare Act violations also are not

addressed through this action, and the state mandate against non-native species is not enforced. Moreover, it may require a great investment in human energy and money over an indefinite time period.

Food Resources. Food resources may be provided to attract monkeys into preferred areas, thus minimizing human-monkey interactions. This reduces the potential problems identified with those interactions. It may reduce any impact on natural vegetation as food sources. This practice, however, fails to fully address human health concerns, liability for injury or damage, Animal Welfare Act violations, and the state exotic species mandate.

Barriers. Another management option available is to construct a barrier to enclose the monkeys. Florida Leisure Attractions, Inc. has proposed building a total enclosure encompassing several acres for the monkeys on their property (Bill Sims, President of Florida Leisure Attractions, Inc., per. comm.). A total enclosure such as this would come closest to eliminating human health concerns without removing the population. It would also address Animal Welfare Act violations. Monkeys would remain as a tourist attraction, and a total enclosure for all the monkeys would enforce the state mandate against exotic species. It would be expensive, however, and the possibility exists that not all the monkeys could be captured and released into the enclosure. Friends of the Silver River Monkeys oppose such an action (Tish Hennessey, Friends of the Silver

River Monkeys, per. comm.). A management plan to deal with population expansion within the enclosure would need to be developed.

A partial barrier would serve to reduce human-monkey contact and those concerns. It would not, however, totally remove those problems, nor would it address the state mandate or Animal Welfare Act violations. Considering the mobility of these animals, a partial barrier would most likely not be effective in the long term.

Public Education. Adverse human interactions with monkeys may be minimized by increasing education efforts which better inform the public of the potential for injury or disease transmission.

Combinations of the practices listed above likely would be required of an effective management plan. The design of an appropriate plan would be guided by the information presented in Table 1.

RECOMMENDATIONS

We feel the central issue facing the state is whether or not to enforce the exotic species policy (see Appendix A). Does the policy have merit and should it be enforced in the case of the rhesus monkeys at Silver Springs? The exotic species policy is based on the principle that non-native species adversely affect native species, thus reducing biodiversity. This principle lacks thorough investigation, however, both specifically in the case of

Silver Springs monkeys and generally for all cases of exotics in Florida.

A decision about the fate of the monkeys should be based on specific ecological data about this population. Therefore, before making a decision, we recommend a study be implemented to examine the environmental impact of the monkey population at Silver Springs. We believe that although there could be a number of impacts, the likelihood is best of successfully testing hypotheses related to detrimental effects on breeding birds and, secondarily, on migrants. We also recommend additional studies to examine the impact of other exotic species in Florida, which would then support or suggest revision of the current exotic species policy. We further recommend that funding for these studies come from sources external to existing conservation efforts.

If additional studies are not feasible or must come from existing conservation efforts, a decision should be based on current knowledge of the impact of exotic species on native flora and fauna. Existing scientific information, though incomplete, would suggest that Silver Springs monkeys could adversely affect native species. Thus, we recommend the exotic species policy be enforced, and the monkeys be eliminated. Removal of the monkeys should be done in the most expedient method possible. A plan requiring an extended time period would likely result in waning interest, failure to fully implement it, and protraction of expensive debate.

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Figure 1. Population estimates through time of rhesus monkey north and south troops near Silver Springs, Florida.

Figure 2. Rhesus monkey population distribution near Silver Springs, Florida (adapted from 1990 DNR map).

Table 1. The effectiveness of each management option in addressing the issues associated with the free-ranging rhesus macaque population near Silver Springs, Florida.

Appendix A. The management recommendation we offered was arrived at through a process outlined in the following decision tree. Since we felt the central issue was enforcement of the exotic species policy, this was the first issue addressed in the decision-making process. Should the policy be enforced? If the question was answered affirmatively, the monkeys would be removed. If the decision was not to enforce the policy, the monkeys would be managed in situ. Lacking additional information, we felt the policy should be enforced and the monkeys removed. Other options and issues were then more easily addressed. The decision tree provided a means to systematically evaluate the options and arrive at a conclusion.