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In this Issue

Captive Breeding and Conservation of Lion-Tailed Macaques

by

Donald G. Lindburg and Laurence Gledhill

The macaques comprise a genus of some 13 to 20 species of monkey which, with one exception, are distributed throughout southern Asia from Afghanistan to Japan. *Macaca silenus*, the lion-tailed macaque of southern India, is one of two species of macaques believed to be in danger of extinction in wild habitat. While wild populations have been in decline, zoo-living lion-tails are thriving. At issue is the nature of future interactions between field and captive conservationists which will best serve the long-term future of the species.

Status of Wild Populations

Lion-tails are confined to tropical rain forest habitat in India's Western Ghats (mountains). Reduction of this habitat to approximately one percent of the land area in the region is the major factor placing the species in jeopardy today (Kumar 1985). In addition, the remaining forest is badly fragmented by the intrusion of roads, plantations, agriculture, dams, and industrial projects. According to Kumar (1987), nearly half of the wild population is dispersed in patches of forest under 20 km^2 in size. In some areas, the species is under further pressure from hunting (Karanth 1992). Since extinction rates are likely to increase in small fragmented habitats (MacArthur and Wilson 1967), the number of lion-tails left in the wild is not nearly as critical to their future survival as is the isolation of groups in disjunct patches of forest and the decline in forest quality.

That the future of the lion-tailed macaque is tied to its rain forest habitat is unquestioned (Green & Minkowski 1977; Kurup 1978; Vijayan 1985). This point was dramatized when Silent Valley National Park came under threat from efforts by the State of Kerala to construct a hydroelectric dam in the early 1980s, a project that would have inundated most of the remaining lion-tail habitat in the area. A major effort by Indian conservationists and pressure from the Central Government in New Delhi eventually killed the project (Anonymous 1985). It might be assumed that the protracted fight over the future of Silent Valley, and consequent attention focused on the lion-tailed macaque, would have created local familiarity with the species and its plight. Yet, Karanth (1992) reports that in the neighboring state of Karnataka, few foresters knew that lion-tails existed in their areas and almost no one considered them of conservation interest. Indian primatologists have repeatedly stressed the importance of educational efforts at the local level as an essential part of conservation programs for the species (Joseph 1985; Kumar 1985; Vijayan 1985; Karanth 1992).

Captive Programs

Zoos have played an important role in focusing attention on lion-tails through publication of a studbook and formation of captive breeding programs (Gledhill 1983; Heltne 1985). In addition, virtually all of the research on the biology of the species in captivity has been carried out on zoo collections (e.g., Shideler et al. 1983; Lindburg et al. 1989). In 1970 the American Association of Zoological Parks and Aquariums (AAZPA) took steps to regulate future importations in light of the declining wild population (Hill 1971). However, an analysis of studbook records (Lindburg & Forney in press) indicates that, even before this action, imports to North American zoos had ended, and an upturn in the number of captive births that began in the 1950s has continued unabated until recent times (Figure 1).

There is no evidence of a major breakthrough which has contributed to the improved breeding performance of captive lion-tails. Growth of the captive population seems to have been the result of intensified effort and improved management by a relatively small number of zoos, resulting in increased rates of natal recruitment and survivorship. For example, the Assiniboine Park Zoo in Winnipeg, Canada, produced 100 infants between 1966 and the end of 1991 (Gledhill 1992), a number greater than the total captive North American population in 1970 (89 individuals, Hill 1971). Increasing the size of individual collections from breeding pairs to multi-female groups may also have played a role by producing cohorts of infants which in turn resulted in earlier weaning and the subsequent rebreeding of dams. In addition, mortality during the first year of life declined from nearly 50% in the early 1960s to around 20% in the 1980s (Lindburg & Forney in press), suggesting improved management of the aggressive behavior of adults.

It was nevertheless the case that in 1982, when an international symposium was convened at the Baltimore Zoo (Heltne 1985), the belief that the species was on the brink of extinction was widely shared. It is clear in retrospect that the captive population was fairly secure in 1982, and better information, i.e., a completed studbook, would have led zoos to foresee the rapid population growth that would take place during the 1980s. The captive population in fact doubled during this decade (Gledhill 1992), and zoos that had been investing heavily in captive propagation found themselves suddenly dealing with a saturation of available space and a substantial surplus population.

Species Management Plans

Since approximately 1988, the North American Species Survival Plan (SSP) has stressed contraception in order to reduce the birth rate (evident in Figure 1), while continuing to emphasize genetic and demographic issues. Social and behavioral aspects of captive

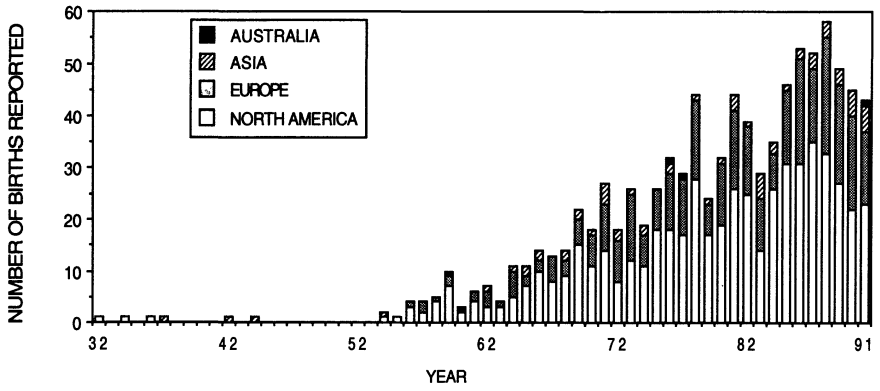

Figure 1. Births of captive lion-tailed macaques as recorded in the International Studbook to the end of 1991.

management have been of more recent concern, with discussion given to such matters as minimum group size, socially induced trauma related to inter-institutional transfers, and effects of reduced size of age cohorts on infant socialization. Current SSP directives call for the use of vasectomized males in exhibit groups to promote social stability and to provide immature members with exposure to adult sexual behavior, while simultaneously avoiding unneeded pregnancies. Genetically valued males that are designated for breeding are now moved between institutions and placed into off-exhibit areas for short-term pairing with highest priority females. This strategy calls for removal of females from their natal units during estrus for pairing, but is a procedure that is less traumatic than periodic introduction of a new breeding male. Under this migrating male plan, some underrepresented males may in fact be moved to more than one institution for breeding.

The disadvantages of this approach are increased handling and transport of breeder males within and between institutions, and reliance on external indicators for predicting the most propitious time for pairing. Fortunately, the discovery that females repeatedly utter proceptive vocalizations between menstruation and ovulation (Lindburg 1990) provides staff with a less ambiguous indication of impending sexual receptivity, and facilitates pairing decisions. The added social maneuvering required by this plan nevertheless increases the workload of staff and the potential for delays in conceptions compared to situations in which breeding males are continuously present.

Inevitably, the maintenance of zero population growth in small demes results in several undesired outcomes such as production of surplus males, the potential for females to fulfill their genetic quotas while still fairly young and thus becoming surplus to the breeding endeavor, and a significant reduction in size of the younger age classes from efforts to equate birth rates with mortality rates for the population as a whole. These concerns will require intensive management of the reproductive process to diminish any potentially deleterious effects.

The foregoing problems in population management are further exacerbated by a decision made in 1991 to scale back the existing SSP population to a base group of 78 individuals in order to improve prospects of maintaining the genetic diversity of the original population. This base would then gradually grow to an upper limit of about 200 individuals. Given that there are 176 individuals alive today, this decision results in designation of about 56% of the existing population as surplus. An increased effort at placement of surplus individuals in zoos in Asia and Europe cannot be a panacea in light of the trends toward global management of lion-tails as a single captive breeding population. The ways in which zoos will manage this surplus population to extinction remains as an unresolved issue. From these considerations, it is evident that the lion-tailed macaque management group has moved beyond the more typical concerns with increasing reproduction, and is in the forefront of contending with several fairly new and problematic aspects of steady-state propagation.

The space available to any zoo-living species is rarely allocated on the basis of a rationally determined need. More charismatic types fare better than

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A forum for information exchange on endangered species issues
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Cover: Female lion-tailed macaque (*Macaca silenus*) with young. Photo by Ron Garrison. Zoological Society of San Diego.

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those with limited public appeal. Although lion-tails are regarded as among the phenotypically more attractive mammals, as macaques they share with others of their genus a highly manipulative and somewhat aggressive nature. The levels of veterinary care and exhibit maintenance required are therefore factors which limit their prevalence in zoological collections.

Space for captive lion-tails is currently in decline. About one quarter of the zoos which exhibited the species during the 1980s have taken steps to phase out their collections. One factor is the discovery that some lion-tails, like other *Macaca*, have antibodies to *Herpes simiae* (commonly referred to as B-virus), a virus which is relatively inconsequential for the health of macaques but is often fatal when contracted by humans. Fortunately, humans appear to have very low susceptibility to B-virus, and in well documented cases transmission has been predominantly via injuries from animals or contaminated laboratory paraphernalia (Palmer 1987). No clinical cases of disease in lion-tails have ever been documented, nor have any zoo personnel ever been known to become infected with the virus. Risks to caregiving staff would therefore appear to be extremely low. Nevertheless, lacking experience in dealing with viral agents, some zoos have recently opted to remove lion-tails from their collections out of fear for staff safety.

The perception that the captive population is now relatively secure could also be a factor affecting the space allocated to lion-tails. From a publicity standpoint, reproductive breakthroughs leading to increasing the birth rate in captive populations have greater appeal than maintenance of taxa that are relatively secure, albeit endangered. Redirection of limited space to species thought to be in greater need of succor may, without adequate concern for its consequences, work to the disadvantage of lion-tails and other species which have responded well to the efforts invested in them.

Reintroductions

The transfer of captive-born and reared lion-tails to secure rain forest habitat in India is a concept which has arisen in discussions at each of three international symposiums on the status and conservation of lion-tails. A working committee on wildlife management which included 8 participants from India recommended to the Baltimore Symposium in 1982 "the development of technologies for reintroduction, and the use of zoo animals for this purpose" (Heltne 1985, p. 376). In addition, implicit in a recommendation for establishment of 4 to 5 free roaming groups at sites in North America was the notion that one or more groups so maintained would be good candidates for future reintroduction.

Lion-tailed macaque (*Macaca silenus*) at San Diego Wild Animal Park. Photo by Craig W. Racicot. Zoological Society of San Diego.

By the time of the second symposium in 1986, reintroduction was a major topic of discussion. Although attended by only one representative from India, a synopsis of his remarks was published in a subsequent newsletter as follows: "Dr. Kurup concluded his presentation by stating that the Indian government had instructed him to relay to our SSP that when there is no further need for our surplus lion-tailed macaques in the world captive population, that they were willing and able to accept them for re-introduction and that there was habitat available for reintroducing them" (Gledhill 1986, p.2). Within three years of this meeting, the Zoological Society of San Diego had constructed a 3/4 acre corral with the objective of preparing a candidate group for return to wild habitat. During this same period the Bronx Zoo was making plans to release a candidate group on St. Catherine's Island in the southeastern US, and attained this goal in July, 1991. The San Diego group had been transferred to the US in 1983 from the Centre d'Acclimatation Zoologique de Monaco, where it had been founded in 1963-65. Except for the removal and introduction of breeding males, this group has therefore been intact for over 25 years, and may be unique among captive groups in terms of generational depth and social organization. The St. Catherine's group, on the other hand, is free-ranging and is therefore uniquely situated for observations of ranging and natural foraging, and for responses to being radio-collared. Both situations could theoretically offer certain advantages in preparing lion-tails for a return to wild habitat.

The value of reintroduction as a conservation tool had receded into the background by the time of the 1990 symposium in San Diego. Representatives in attendance from India, Germany, Japan, and England discussed the pros and cons of reintroductions at several points in the program, and did retain this approach as one element in a 5-year action plan. However, habitat protection and support for zoos in India were the measures given highest priority.

In the decade since the Baltimore symposium, it has become apparent that reintroduction as a conservation strat-

egy for lion-tails is not for everyone. A frequently voiced objection is that it is a non-judicious use of precious conservation resources. For example, Karanth (1992) states "The annual cost of employing 50 additional guards to strictly protect a 250 km^2 area harboring about 250–500 wild macaques is about $30,000. A single, well designed and executed scheme to introduce a dozen captive-bred lion-tailed macaques successfully is likely to cost five times this amount" (p. 40). Although zoos are in agreement that habitat protection should have highest priority in conservation efforts, very few are in a position to transfer funds to projects outside their communities unless they are extensions of zoo-based programs. According to the current AAZPA directory (Boyd 1992), about 71% of the accredited North American zoos accept tax revenues from governments to support their activities, and are therefore severely constrained in how their funds are spent. Many of the remainder are small, community supported entities that are chronically short on revenues. The notion that zoos have vast sums of money which could be made available for habitat protection is a myth. It is unrealistic for scientists in foreign countries and for critics of zoos at home to hope that significant financial aid will flow out from zoos to save wildlife habitats around the world.

At the same time, reintroduction is the dream of many a zoo biologist. It is often held out as the capstone of zoos' efforts to rescue species from the brink of extinction. Its power in providing a rationale for holding wild animals captive, most would agree, is substantial. And to the public mind, including the media, reintroduction is a logical sequel to captive breeding efforts. It is one more manifestation of the "can do" confidence in human ability to manage the planet.

Somewhere in between the idealized dreams of zoo partisans and the worries of the field biologist falls the need to embrace approaches that will truly benefit lion-tails, whether directly or indirectly. Until an analysis of the situation in the wild is completed, it may be premature to try to define those approaches. However, the possible existence of a wild population of 3,000 individuals probably precludes actions aimed at major augmentations with captive-born stock. Should it turn out that no direct benefit would be realized, advocacy of reintroductions could nevertheless proceed on a basis that the first author has elsewhere defined as *experimental* (Lindburg 1992). An experimental reintroduction is just that—an experiment conducted according to rigorous scientific protocols for the knowledge to be gained. This is knowledge that falls into what Reading et al. (1991) have termed the "biological/technical" aspects of the reintroduction paradigm, including autecology, population and community ecology, habitat considerations, and the techniques to be used in preparing and releasing individuals. Enough experience with reintroductions of mammals is now in hand to demonstrate that they are invariably complex, require extensive planning, and often have low success rates (Caldecott and Kavanagh 1983; Griffith et al. 1989). An experimental reintroduction is one that generates knowledge that is banked against a future time of need, or for the benefit of other, related taxa. It is not need-based in the sense that the immediate future of the wild population requires it. However, it takes advantage of the opportunity to act at a time when captive animal resources are plentiful. It avoids waiting until high-risk crisis situations develop to acquire the essential information. As noted by Griffith et al. (1989), the lower success rate in reintroducing endangered or rare species favors reintroduction as a strategy "long before it becomes a last resort for these species—before density has become low and populations are in decline" (p. 479).

Not to be slighted in advocating experimental reintroductions is the potential for drawing attention to the plight of the wild population itself, both internationally and locally, as has occurred, for example, in the case of the golden lion tamarin (Beck et al. in press). Few conservationists are likely to name the lion-tailed macaque as one of India's most endangered mammalian species. And, as noted earlier, awareness of its status as an endangered component of India's rain forest ecosystems is grossly deficient at the local level, even among forestry personnel.

Finally, introductions of any kind, including experimental ones, open up a seldom used opportunity for zoos to become more directly involved in saving wild habitat. A handful of zoos have succeeded, through careful cultivation of urban based citizens of means, in directing funds into reintroduction efforts. To encourage this prospect, there is a need for captive breeding programs to be more forthright about goals, i.e., whether for long-term maintenance in captivity as a hedge against a future crisis, or to more directly benefit conservation efforts through eventual transfer to wild habitat. In the latter case, it is imperative that funds for the protection of wild habitat be built into budgets at the time breeding programs are initially formulated.

In October, 1993, India will host the fourth international symposium on the lion-tailed macaque. At that time the Captive Breeding Specialist Group of the IUCN will conduct a population habitat viability analysis (PHVA) for the species, in expectation of outlining critically needed action steps. Without question, the highest priorities will be aimed at preserving the remaining wild population. How best to do that is more debatable. Programs that would couple habitat protection more tightly to captive breeding efforts both within and outside of India would, in our judgement, foster a greater sense of partnership in conserving lion-tails and bring added resources to bear on that effort.

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State License Plate Programs for Endangered Species and the Environment

by

Ron Beech

License plates have been around since 1901, when New York became the first state to require automobile registration. At the same time, Chicago introduced stickers signifying the car owner's status as a banker or doctor or affiliation with a club and organization. Later these stickers were mounted above license plates (Dixon 1991). The major purposes of plates are to identify automobiles, generate revenue and enforce traffic laws. Of the three purposes, the most valuable is the money that is generated for state budgets.

In the early 1970s, California and Washington pioneered the idea of using some money collected from license plates to fund projects that help the environment and protect nongame species. Anyone who purchased a personalized plate (which is a license plate that includes a combination of letters and numbers chosen by the motorists) contributed additional fees to a special fund for environmental protection.

Most state wildlife protection programs do not take advantage of this possible revenue source. Moreover, due to skewed allotments in funding between game and nongame species, many states could benefit from special license plate programs. For example, in Michigan, where there are 522 nongame species and only 114 game species (excluding invertebrates), the game species receive approximately 98% of the department's budget, and only 2.2% of the department employees are devoted to nongame species. The nongame program survives on federal money and funds from the state income tax check-off program.

Unfortunately, check-off programs have become a declining source of revenue for most states. Poor marketing efforts and increased competition from additional check-offs on tax returns has significantly reduced revenue. In response to this, there has been a rush to offer vanity license plates displaying images related to a cause; that cause then benefits from the money raised. For example, Florida has two plates: one that displays a manatee and the other a panther. Such programs have flourished over the past two or three years.

This article highlights unique aspects of the license plate programs in Maryland, Connecticut, Virginia, Florida, California, and Washington. (Idaho and Indiana have just recently developed programs.) The article covers a sample of the issues to consider in legislation development, program design, and implementation.

All environmental license plate programs require a motorist to make a contribution in addition to the existing registration fee. Most of the additional money collected goes directly to the cause that is represented by the image on the special plates. The state's Department of Motor Vehicles (DMV) often receives a percentage of the additional fees to cover administrative expenses and the costs of manufacturing the special plates.

State governments rarely offer citizens an opportunity to contribute money to a program that benefits the entire state. The license plate programs are popular because they are voluntary and directly reward the motorist for his or her contribution. In the end, the state receives a source of revenue to protect the environment, and the motorist can display a tag which shows his or her support of an environmental cause.

Maryland

The Great Blue Heron is found in many wetlands that surround the Chesapeake Bay. It is the centerpiece of a very attractive plate that has sparked the interests of over 360,000 motorists in Maryland. Each of these motorists has paid a one-time fee of $20.00 to display the plate on their car. Maryland's pricing structure is different from states that collect an annual fee that results in a regular source of revenue. Ten dollars of the Maryland fee covers the Motor Vehicle Administration's (MVA) expenses and the other half is deposited in the Chesapeake Bay Trust.

The Trust was established in 1985 to promote public and private partnerships that protect and restore the Bay. The legislature requires that Trust grant applications must relate to these objectives: 1) preserve water quality and habitat, 2) restore aquatic and land resources, 3) result in the publication or production of educational materials. In the past, the administrative cost of managing the program was paid by the state agencies that worked with the Trust. Since the program has been such a successful fund raiser, it will probably be self-supporting in the future (Rick Leader, pers. comm.).

The specific purposes of funds collected from the license plates is not defined. Only guidelines are offered that require the state to use plate revenues for a "geographical, historical, natural resource or environmental theme which the plate commemorates" (MD Transportation Code Ann. 1991). The state is allowed to select a nonprofit organization and develop a description of fund uses. Surplus funds must be distributed to a nonprofit organization rather than be transferred to a state agency (MD Transportation Code Ann. 1991).

This is the only state to incorporate

a limit on the number of speciality plates

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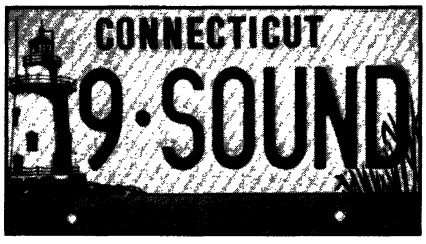
and a time frame of plate issuance. Only one specialty plate can be issued for a fixed period of two consecutive years. This has been advantageous to the Chesapeake Bay Trust. The Bay plate is the first and only plate issued for the benefit of the Trust and the legislature recently granted a two-year extension of this privilege.

Besides regular plates, 998 limited edition plates were produced. They include a selected combination of numbers and BAY spelled out in a special green lettering. There was high administrative overhead associated with these special plates in comparison to the small effort required to sell the other 360,000 plates. However, the public relations benefit of these plates is very important. When the program began, the press gave the special plates much attention (Rick Leader, pers. comm.).

Connecticut



The governor of Connecticut, Lowell P. Weicker Jr., successfully supported a bill to offer residents special license plates for their cars. It passed through the legislature during one session and was signed into law on May 27, 1992. The success of programs in Florida and Maryland helped rally support for Connecticut's program. The focus of the plate is the preservation of the Long Island Sound. Plates will be available in January of 1993 (Connecticut DMV 1992a).

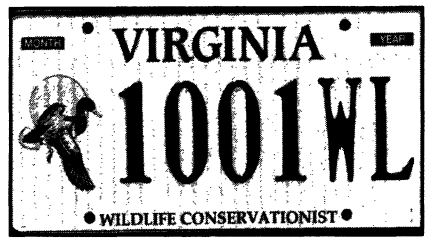
Implementation of programs has been most successful, in states such as Connecticut, where the governor took a leadership role in passing the legislation. The governor can send a clear signal to all of the state agencies that must participate in the implementation process. In Connecticut, the Departments of Motor Vehicles, Environmental Protection, Corrections (location where plates are manufactured) and Transportation were involved in planning different aspects of the program. Fees for the special plates were not established in the legislation. This is appropriate because the costs of developing and managing a plate program cannot be calculated accurately until the legislation becomes law. Connecticut's Commissioner of Motor Vehicles has the authority to set the fee once the cost of plates are decided.

The Sound plate will sell for a one time fee of $50.00. If the driver's current letters or numbers are transferred from an existing tag, then the one time fee is $70.00. The entire amount is deposited directly to the Long Island Sound Fund, which was created through the legislation. Fifteen dollars of the money collected from each plate will be paid to the DMV for reimbursement of program expense. The remaining portion will go toward programing efforts as defined by the legislation. Contributors may be eligible for a federal tax deduction for their contribution, since the Fund is a nonprofit organization.

The legislation does not refer to the subject of marketing. However, the DMV is doing an excellent job of introducing the new plates. The DMV has been soliciting large corporations and those involved in marketing and public relations to volunteer time and money to make the program a success (Connecticut DMV 1992b). This approach ensures that money from the Sound Fund is not used to pay for marketing expenses. Most important, marketing and advertising professionals bring their experience to the process.

There are many innovative examples of how the DMV has marketed the program. One of the unique approaches is an 800 number that is available to receive information about the plates. To ensure that motorists see the plates, Sound plates are replacing regular plates on state and municipal vehicles. In conjunction with the plates, the vehicles will display a bumper sticker showing the plate and the message "Order Yours Today 1-800-CT-SOUND." This same message and design is on a 3 1/2 X 1 1/4 inch sticker that is being placed on DMV mailing envelopes and letters. These marketing efforts ensure that motorists will receive repeated exposure to messages about the Sound plates (Connecticut DMV 1992b).

Virginia



The Virginia Department of Game and Inland Fisheries (VDGIF) faced a budget crisis in 1991. The VDGIF received $5,000,000 less from the state than it had requested. After an initial study of alternative sources of funds, a license plate program was determined to be effective, partially because of the success of Maryland's Chesapeake Bay plate. The general assembly passed legislation to allow a special plate that depicts a mallard duck with the words "Wildlife Conservationist" beneath the plate identification numbers. The purchaser of a plate can choose a combination of six letters or numbers (Winegar 1991). As of August of this year approximately 2900 plates have been sold (Redding 1992).

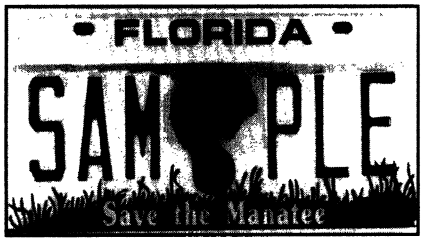
This program was easy to start in Virginia because they already have a plate program. Therefore, the legislature approved the additional plate with only three or four sentences of legislation. Unfortunately, competition for Virginia's drivers is greater than any other state in the nation. There are approximately 200 plate options available and 580,000 vehicles; one out of every eleven cars has already purchased a special tag (Redding 1992).

In Virginia, the DMV has a lucrative arrangement. Their fees are extremely high compared to any other state. The first $25,000 of sales goes to the DMV: each plate costs an additional $25.00 annually, and proceeds from the first 1000 sold are deposited with the DMV. Remaining plate sales are split 60:40. Annually, $10.00 is received by the DMV and $15.00 is deposited with the VDGIF. The portion received by the

DMV helps pay for the costs of producing a color plate and administrative expenses (Trunham 1991). Based on current sales, the VDGIF will receive $43,500 annually and the DMV will receive $29,000. A few of the first 1000 contributors have found it troubling to discover that their fee is underwriting the DMV instead of wildlife programs.

Since the DMV receives 100% of the revenue from the first 1000 plates, they have a strong motivation to encourage additional plate styles. In fact, they design their own plates that compete with those that benefit charitable causes. The DMV recently issued two tags that cost an additional one-time fee of $10.00 versus the annual renewal of $25.00 for VDGIF's plate. The plates display a red cardinal and a mountain-to-seashore skyline. Within the first month, they sold approximately 100,000 plates. The VDGIF is in the process of developing additional plate designs to offer more choices and thus compete with the DMV and nonprofit organizations.

Florida



Wildlife began to reap the benefits of image tags in Florida in 1990, when a plate was introduced that featured the manatee. In 1991, this was expanded with the introduction of a panther plate. These were the first plates in the United States that made wildlife the theme of the plate design. Over 181,000 manatee plates have been sold. The annual renewal fee is $15.00, plus a processing fee of $2.00. The entire renewal fee goes to environmental protection efforts. Approximately 56,000 panther plates have been sold at an annual renewal fee of $25.00 and a $2.00 process fee.

Florida's choices of images for their plates were wise selections. Both the manatee and the panther have been the subject of many news stories. Residents are aware of these species and the problems they face. Once this awareness is established in the mind of potential purchasers it makes the selling process much easier.

Not only must the correct animals be selected, but the design of the plate must be attractive to motorists. In early 1993, a new panther plate will be introduced because it was found that a poor design contributed to the lower sales of the panther tags (Leslie Allen, pers. comm.). Another factor that may have contributed to lower sales is the difference in prices between the panther and manatee plates. The panther plate costs an additional $10.00 per year.

Florida's DMV contributes the highest amount of money of any state to the causes for which the plates are sold. They charge an administrative fee of $2.00 per plate and when a motorist orders a plate he must pay a one time fee of $10.00. The fee covers the cost of the plate. This pricing structure ensures that the programs profit instead of the DMV.

The distribution method for funds collected is similar to Maryland and Connecticut. Trust funds have been established to collect and distribute the money. However, Florida's system is different because more than one trust fund receives funding. The panther funds are distributed between three funds: 1) Florida Panther Research and Management Trust Fund which receives 50% of receipts, 2) Save Our State Environmental Education Trust Fund receives 25%, and 3) Florida Communities Trust Fund receives 25%. The manatee revenue is divided equally between the Save the Manatee Trust Fund and Save Our Environment Education Trust Fund. The approach ensures that money is spent on education and programs that deal directly with research, protection and recovery.

Florida is the only state to require an annual audit of fund expenditures. This is a fiscally responsible approach to money management and it insures the integrity of the environmental image plate programs.

California

In 1970, an innovative program began in California. The Environmental License Plate Fund was established by the state legislature. The Fund does not rely on special plates that display wildlife or natural scenes, but receives revenues from drivers that choose "personalized" license plates over the standard plate. The personalized plate can display letters, numbers or a combination requested by a motorist. The motorist pays an additional one time fee ($40.00) and an annual renewal fee ($25.00) for the plates. The program is successful. Much money is raised that would otherwise not be available to protect the environment. Revenues are deposited into the California Environmental License Plate Fund. In 1991, the revenues were approximately $34,000,000. This was the net amount available for expenditure after the DMV received reimbursement for all costs associated with the sale and production of each plate.

The DMV manages the distribution of personalized plates and collects the additional annual fee of $40.00. To ensure that the reimbursement accurately reflects expenses, the DMV must certify all administrative expenses associated with the personalized plate disbursement.

The funds are available to: state agencies, state boards or commissions, nonprofit environmental and land acquisition organizations, cities, counties, districts, the University of California and private research organizations. A grant application can be completed for a project that has a clearly defined benefit to the people of California and meets one of six criteria. The criteria include a broad range of activities from the control and abatement of air pollution to protection of nongame species and endangered plants.

To market the program to motorists, a detailed brochure is distributed. The brochure describes the purpose of the Fund, the types of projects on which it can be used, and examples of existing projects. Realizing that advertising is an essential component to optimizing revenue, the legislature passed amendments

in 1991 that allow money to be set aside from the $40.00 fee to increase the public's awareness of the environmental license plate program. Up to fifty cents can be set aside from the sale of each plate. The money can be used for advertising on radio, television, newspapers and billboards.

Washington

As in California, Washington has only personalized license plates rather than special plates. In 1973, the people of Washington voted on and passed a bill to credit the funds from the sale of personalized plates to protect, preserve and enhance nongame wildlife and aquatic life resources. The $40.00 annual fee has generated approximately 4.5 million dollars over the past two-year period (John Pierce, pers. comm.). This is the only source of revenue for the nongame wildlife program.

All revenues are regularly deposited by the DMV into the State Wildlife Fund. This is not a separate account; it includes revenues from many sources including rentals, sales of licenses, permit tags and stamps, fees for materials produced by the DVM and several other sources. Other states have separate accounts to manage the income generated from the sale of plates. The DMV is reimbursed for all costs associated with the sale of plates. Reimbursements of fees are made by appropriations from the legislature; if excess amounts are appropriated they must be returned to the State Wildlife Fund.

The legislation declares that wildlife resources should be protected, preserved, perpetuated and enhanced to benefit the general welfare of the state's inhabitants. This includes, but is not limited to: song birds, rare and endangered wildlife, aquatic life, specialized-habitat types, unclassified marine fish, shellfish and marine invertebrates (Wash. Rev. Code Ann. 1987). The vague wording leaves many loopholes for projects that may stretch the meaning of the legislation. The act does not specify how funds should be spent to achieve the purposes of the legislation or what criteria should be used to decide upon expenditures. Also, the legislature does not require feedback on how funds were used throughout the year.

The DMV is in the process of establishing a brochure for the personalized plates, but they have not developed any advertisements in the past (Cheryl Moore, pers. comm.). However, the Department of Wildlife includes information about the license plate program on their literature, including publications concerning hunting and fishing licenses.

Implementation Issues

Several considerations are common to the state license plate programs reviewed in this article. They include: plate design and wording, revenue, pricing and distribution of funds, definition of appropriate uses of funds, funds management, competing license plates, decision-making authority, interaction between state agencies, and marketing of plates. The most important of these is marketing.

Most state agencies that deal with environmental issues are not in the business of marketing services or products. Rather, often they issue permits and licenses required by a legislative mandate.

Yet, those involved in a special license plate program must begin to think of the project from a marketing perspective in order to achieve success. After all, the special license plate is a product, just like the millions of other products sold in stores around the country.

None of the states reviewed have taken full advantage of marketing techniques such as market research, product development, product design, packaging, pricing, distribution, promotion, budgeting and campaign monitoring. (Haywood 1987). In the process, they have sacrificed revenues that could have protected wildlife and the environment.

To begin this endeavor, here are several actions to consider. Develop an advisory board that includes top executives involved in marketing, advertising and public relations. Also, require everyone involved with the operations of the program to read several books on marketing. Pay for their tuition to attend college courses on the subject or invite knowledgeable speakers to staff meeting. Once this has occurred, marketing plans can be formed and market research can begin.

Finally, all programs should have an evaluation scheme that tests the marketing plans that are being used. By making evaluation part of the license plate program, it ensures that someone will be asking and answering questions about how effective the public advertising programs are performing.

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Technical Note

Microchip Method for Permanent Animal Identification

by Susan B. Elbin

Marking captive animals to identify individuals has become standard practice in zoological parks, where knowledge of health, behavior, and lineage can provide crucial information for management of individuals and populations.

There is no single marking method that is permanent, unique, inconspicuous, unobtrusive, and easily recorded. At the New York Zoological Park (NYZP, also known as the Bronx Zoo), we often use two different methods to mark a single zoo animal: a relatively permanent marker that is probably not visible at a distance, and one that is not as long-lasting but is visible from afar (Rice and Kalk, in press).

We began assessing the feasibility of using transponders for individual identification six years ago. During the last three years we have been implementing their use in mammals, birds, and reptiles. This technique meets most of the specifications outlined above.

Transponders were invented in the 1970s for use in thoroughbred horses (Andrews 1986) and have been used for wildlife such as black footed ferrets (*Mustela nigripes*), sea otters (*Enhydra lutris*), big brown bats (*Eptesicus fuscus*), fish, and a range of reptiles and amphibians.

The transponder system consists of three parts: a microchip that is implanted (subcutaneously or intramuscularly) with a hypodermic implanter, a scanning wand, and a reading unit. The microchip is sealed in biocompatible glass and is approximately 10 mm in length, about the size and shape of a grain of rice. A copper coil inside the chip generates a unique, unalterable 10 digit alpha-numeric signal when activated by a low-frequency magnetic field signal from an external source. There are over 34 billion possible combinations. Since the chip is passively induced, it could theoretically last the lifetime of the animal.

Advantages of this system include: fast and efficient application, exact and unambiguous identification, ease in registering/recording the ID, and permanence. The code on the transponder cannot be altered.

Although the initial cost of the system seems relatively high, averaging $1000 for a scanner/reader and $6.00 to $10.00 per chip, this cost is minimal in terms of information that is not lost over time (Zulich et al. 1992). One major disadvantage of the system is that the scanner must be held within a few centimeters of the chip in order to scan it. Therefore it is impossible to identify animals at a distance, and often the animal must be "in hand" to be scanned.

Another disadvantage is that different manufacturing companies produce similar systems that are incompatible. A microchip from one company cannot be scanned by a reader from another company.

In an effort to standardize transponder use in zoological parks for captive breeding records, recommendations of one system for use in all zoos have been made to assure inter-zoo compatibility.

At NYZP we have been tracking the longevity of functioning transponders in implanted animals and have documented failures (e.g. implanted animals with non-scanning chips). Transponders have been found to work their way out soon after implantation (Holmstrom, pers. comm.), to produce intermittent signals (Kalk, pers. comm.), and simply to stop functioning. The number of failures is low, averaging about eight percent (Elbin and Kalk, unpubl. data).

Many of the disadvantages of the system can be overcome. One way of dealing with the limited scanning distance is to know exactly where to scan the animal, i.e., standardize the implantation site. Due to the limited read range, it could take a long time to scan an entire animal. For example, we spent over 20 minutes scanning a rock hyrax (*Procavia capensis*) that had been implanted at a slightly different site from our other small mammals.

Agreement on implantation site is critical in a zoo situation, since animals are moved between zoos. At NYZP we have implanted well over 500 individuals representing approximately 70 species of mammals, birds, and reptiles. From our own experience and from recommendations for 117 species from animal experts in other zoos, Elbin (1991) has formulated recommendations for implantation sites.

The use of transponders has been met with widespread appeal. At the 1992 meeting in Kyoto, Japan, a committee from the Convention on International Trade in Endangered Species (CITES) passed a resolution on using transponders, in addition to other methods, to mark all live Appendix I species as well as Appendix I and II animals used in traveling exhibitions. CITES is to liaise with the animal database from the Captive Breeding Specialist Group (CBSG) of the International Union for the Conservation of Nature and Natural Resources. CBSG has already incorporated transponder information into its database. The CITES committee agreed to use the implantation sites recommended by CBSG.

Transponders have been used successfully to mark a variety of individuals. The ultimate power of the system lies in linking the transponder code to the individual animal, and accessing that animal's captive history: health, reproduction, and location. All this can be done efficiently and accurately, and can serve as an important tool in managing endangered species in captivity.

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Book Review

Wild Animals and American Environmental Ethics

By Lisa Mighetto. 1991.
University of Arizona Press. Tuscon, AZ. $17.95 paperback 177 pp.

Reviewed by Clare Ginger

The ongoing debate about our ethical responsibility toward the natural world has been a source of conflict in establishing and implementing environmental policy. Lisa Mighetto's book, *Wild Animals and American Environmental Ethics*, provides historical insight into the perspectives brought to this debate by those who seek the protection of animals.

Mighetto describes the history of ideas and illustrates differences among rationales underlying efforts to protect animals during the last one hundred years. These rationales include the utilitarian perspective of hunter conservationists, the aesthetic concerns of bird lovers, the moral concern for sentient creatures of humanitarians, and the focus on ecological systems by deep ecologists. She shows the interaction and conflicts among these points of view and provides several examples of how they lead to action in the policy arena.

Mighetto's analysis is sound and the ideas she focuses on are interesting. In particular, she highlights the nineteenth-century humanitarians' emphasis on protecting individual animals rather than species and appeal to moral rather than utilitarian arguments. She suggests that they moved the question of animal protection out of the traditional framework of justifying protection based on utility and into a new framework of justifying protection based on moral principles.

The paradox of the humanitarian approach is that many of its advocates humanized animals. Mighetto examines the implications of both this approach and that of utilitarian principles for predators. The application of utilitarian principles led to an ecologically unsound policy of eradicating predators; the humanitarian view did little to provide a basis for questioning the policy and, in fact, may have supported it. She shows how the problems that arose from eliminating predators contributed to a broader understanding of how our actions affect ecological systems. This understanding, in turn, generated a basis for a biocentric approach and the possibility of including both predators and the rest of nature within a moral framework.

As Mighetto notes, the environmental ethics debate is about cultural definitions of our place within nature. It is a debate without end. She has provided a useful synthesis of how changing perceptions of animals have contributed to and are reflected in current iterations.

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Bulletin Board

Wild Bird Conservation Act Signed

The Wild Bird Conservation Act (H.R. 5013) was signed into law by President Bush on October 23, 1992. The Act will restrict imports into the U.S. of wild-caught birds for the pet trade.

The Act provides protection of varying levels, from immediate protection for the most seriously threatened to two tiers of protection depending on whether trade in the species is regulated by CITES (Convention on International Trade in Endangered Species). For Appendix II species (threatened by trade) the Act directs USFWS to identify and list those species subject to effective conservation programs in the country of origin. If a CITES-listed species is not on this list, it cannot be imported into the U.S. one year from the date of enactment. The burden of proof is reversed for birds that are not listed on CITES.

Environmental Enrichment Conference

The Metro Washington Park Zoo in Portland, Oregon, will host the first conference specifically focused on the subject of environmental enrichment for zoo and aquarium animals. The conference is planned for July 16-20, 1993. It will include formal sessions and workshops. The workshops will generate recommendations regarding the use of environmental enrichment in the management of captive animals. Registration is $200 and space is limited. To register write: First Conference on Environmental Enrichment, Metro Washington Park Zoo, 4001 SW Canyon Rd., Portland, OR 97221.

USFWS Chief Visits SNRE

John Turner, Director of USFWS, visited the School of Natural Resources and Environment at the University of Michigan in October 1992. Mr. Turner, an alumnus of SNRE, gave a presentation on the history of the Endangered Species Act, and the status of several endangered species in the U.S. He spent several hours talking one-on-one with students and faculty. The School community has benefited from meeting Mr. Turner, and thanks him for his visit.

Whopping Cranes to be Reintroduced to Florida

USFWS, the Canadian Wildlife Service, and the Florida Game and Fresh Water Fish Commission joined in an effort to reintroduce the endangered whopping crane into Florida. The proposal calls for the release of 9–12 juveniles within the state's Three Lakes Wildlife Management Area. Florida is part of the crane's historic range, but it has not been seen there since 1927 or 1928. A copy of the proposal to reintroduce the cranes can be obtained by contacting USFWS, 3100 University Boulevard South, Suite 120, Jacksonville, FL 32216-2737.

USFWS Endangered Species Technical Bulletin

This issue of the *UPDATE* includes the latest USFWS Endangered Species Technical Bulletin. As always, we include the Bulletin as soon as it is produced and we receive it from Washington.

Announcements for the Bulletin Board are welcomed. Some items from the Bulletin Board have been provided by Jane Villa-Lobos, Smithsonian Institution. The Wild Bird Conservation Act report was provided in part by K.L. Vehrs in AAZPA Communique.

Endangered Species UPDATE

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