Ear Tags Versus Passive Integrated Transponder (PIT) Tags For Effectively Marking Deer Mice

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Abstract

We examined whether passive integrated transponder (PIT) tags were a more effective marking technique for a long-term population study of deer mice (*Peromyscus maniculatus*) than ear tags. We compared the number of PIT tags lost to ear tags lost in a population of individuals that received both types of markers. A total of 194 deer mice received both PIT and ear tags and 56.7 percent of these animals were recaptured at least once during the study. We found that PIT tags performed poorly as a marking technique for a mark-recapture study of deer mice using our methods of implantation. The percentage of recaptured individuals that lost PIT tags (31.8%) was significantly higher than the percentage that lost ear tags (8.2%). We recommend further study to determine if alternative tag placement techniques may increase PIT tag retention in this species.

Key words: ear tags, marking techniques, *Peromyscus maniculatus*, passive integrated transponders, tag loss and retention

Introduction

Many studies of animal population biology require repeated, accurate identification of individuals (Schooley et al. 1993). Numerous marking techniques are available for different groups of animals. Attaching small metal or plastic ear tags stamped with a unique number to the lower inner region of the ear is a commonly used method to mark small mammals. Although ear tagging is relatively easy and inexpensive, tags can be lost as a result of infection, wear, grooming, or fighting (Hubert et al. 1976, Alt et al. 1985), and numbers on ear tags may be misread because of their small size.

Passive integrated transponder (PIT) tags offer a relatively new animal-marking device. PIT tags consist of an electromagnetic coil and a microchip that emits a signal when excited by electromagnetic energy. The transponder chip is programmed with a unique alpha or numeric code and only activated when energized, which makes the life of the marker virtually indefinite (Nietfeld et al. 1994). PIT tags are implanted subcutaneously using a modified syringe applicator. They have been used on a variety of small mammal species with a generally high rate of tag retention (> 90%). Species include ground squirrels (*Spermophilus townsendii*) (Schooley et al. 1993), voles (*Microtus* sp.) (Harper and Batzli 1996), big brown bats (*Eptesicus fuscus*) (Barnard 1989), ferrets (*Mustela* sp.) (Fagerstone and Johns 1987, Morley 2002), and house mice (*Mus musculus*) (Rao and Edmondson 1990). The use of PIT tags might also reduce the frequency of misreading tags especially when using a PIT tag reader with data memory. The primary disadvantage of PIT tags is their high cost; currently (2005) PIT tags cost ~ $5/unit.

We attempt to determine the most effective marking technique for a long-term population study of deer mice (*Peromyscus maniculatus*) by comparing the number of lost PIT tags versus ear tags in a population of deer mice that had received both types of tags. Although deer mice are among the most widely distributed mammals in North

America (Baker 1968), we could find no published data on the field use and retention of PIT tags in this species. This study was part of a larger study of deer mouse behavior in peridomestic populations and hantavirus transmission within those populations.

Methods

Our study was conducted from May 2002 through September 2003 near Gregson, Silver Bow County, Montana. Vegetation at the study site was mainly big sagebrush (*Artemisia tridentata*) and bitterbrush (*Purshia tridentata*) with scattered willows (*Salix* spp.) and Douglas-fir (*Pseudotsuga menziesii*).

We live trapped deer mice on a 100- x 100-m grid containing 100 trap stations with trap stations located 10 m apart. At each trap station we placed a non-folding aluminum Sherman trap (8 x 9x 23 cm, H.B. Sherman Trap Co.) baited with oatmeal and peanut butter and provided each trap with polyester bedding. Traps were set for three consecutive nights twice/month from May through August, and for three consecutive nights/month from September through April.

Traps were opened each evening and promptly checked the following morning. Traps containing animals were transported to a central location for processing. We recorded species, body mass, sex, age, reproductive condition, and location of capture. Deer mice were then ear-tagged with monel #1005-1 tags (National Band and Tag Co., Newport, KY). After ear tagging, we implanted subcutaneously a 12-mm, 134.2-kHz PIT tag (Biomark, Inc., Meridian, ID) between the shoulders of each deer mouse. We used a 12-ga needle attached to a plastic syringe to implant each tag. Tags, needles, and syringes were sterilized with Nolvasan solution (Fort Dodge Laboratories, Fort Dodge, IA) prior to use. We used a hand held reader to verify that PIT tags were functioning after implantation, recorded ear-tag and PIT-tag numbers, and released each animal at the point of capture.

We determined loss of ear tags by looking for ripped pinna on all animals captured and estimated both PIT tag and ear tag loss as the percent of mice known to have lost tags. We used a hand-held reader to determine if previously implanted PIT tags were still present in recaptured animals. Recaptured individuals that gave no response to the hand held reader were palpated to determine if tags were present but not functional. We could not determine the exact time of loss of tags because not all animals were captured during every session of trapping. Instead we determined the range of time of retention for each lost tag bounded by the last day the tag was known to be present (minimum) and the 1st day we discovered the loss of a tag (maximum). All recaptured animals that lost tags were retagged. A sign test (Zar 1984) was used to compare the number of lost pit tags versus the number of lost ear tags among males, females and all animals combined.

Results

A total of 194 animals received both PIT and ear tags, and we recaptured 110 of these animals at least once during the study (Table 1). Three animals (2 females, 1 male) could not be identified positively because they lost both PIT and ear tags. Loss of PIT tags was higher ($P < 0.05$) than loss of ear tags for males, females, and all animals combined (Table 1). The mean minimum and mean maximum length of time that individuals retained PIT tags before loss ranged from ~ 8-35 days in females and 3 - 26 days in males.

We retagged individuals that lost either a PIT or ear tag. Nine individuals were given new ear tags of which four were recaptured; one secondary ear tag was lost (25%, not included in Table 1). Thirty-five individuals were given new PIT tags of which 25 were recaptured; five secondary PIT tags were lost (20%, not included in Table 1). Four of five individuals given a third PIT tag also lost the tag.

Our rate of ear tag loss (8.2%) was comparable to those reported for other small mammal species (Table 2), i.e., a reported average loss rate of 9.9 percent (range 2.2-15.0%). Our PIT tag loss rate of 31.8 percent was considerably higher than those reported

Table 1. Number (percent) of deer mice tagged and recaptured in Montana from May 2002 through September 2003, losses of passive integrated transponders (PIT) and ear tags, and minimum and maximum number of days (X ± 1 SE) PIT tags were retained before loss. *P* values are given for sign tests of PIT vs. ear tag losses.

			No. Tags Lost				Days retained before loss	
Sex	*Tagged*	*Recaptured*	*PIT*	*Ear*	*Both*	*p*	*Minimum*	*Maximum*
Female	89	52	16 (30.8)	5 (9.6)	2 (3.8)	0.026	8.3 + 3.9	34.9 + 14.4
Male	105	58	19 (32.8)	4 (6.9)	1 (1.7)	0.003	3.4 + 2.1	25.8 + 7.7
Total	194	110	35 (31.8)	9 (8.2)	3 (2.7)	< 0.001	5.6 + 2.1	29.8 + 7.5

for other small mammal species (Table 2). The average PIT tag loss rate in other small mammal studies was 4.6 percent (range 2.6-8.7%).

Discussion

In our study, ear tags provided a better long term marking technique for deer mice than PIT tagging. Ear tag loss was much lower than PIT tag loss for both male and female deer mice. In addition, ear tags are inexpensive and relatively easy to apply, and application requires minimal training of personnel. However, ear tags can be misread due to their small size, and one can expect difficulty in restraining mice in order to read tag numbers (Nietfeld et al. 1994). To limit misreading tags, animals can be tagged in both ears with unique tag numbers, forming a cross-reference to check for errors. However, the additional time and handling of animals may not be justified in some studies. For example, studies involving threatened or endangered species may require minimal handling to reduce the chance of induced stress or mortality.

PIT tagging may reduce or eliminate handling time as they can be read remotely or quickly when animal is captured and the equipment used is functioning properly. Morley (2002) found that the time required to read ear tags of wild ferrets (*Mustella furo*) averaged 43 sec, whereas scanning an animals PIT tag required <5 sec. Stoneberg (1996) developed methods to read implanted black-footed ferrets (*Mustella nigripes*) remotely. However, we do not feel that reduction in handling time outweighs the high rate of tag loss that we experienced. PIT tags injected with a 12-ga needle left a relatively large injection site through which the tag could slip back out suggesting some of our PIT tag loss likely occurred before the implant wound healed. Schooley et al. (1993) and Harper and Batzli (1996) also found that tags with short retention times might have been lost through fresh implant wounds. Although they did not try it, Williams et al. (1997) thought that applying liquid suture to the wound left by the needle might increase tag retention. Williams et al. (1997) also recommended squeezing the injection site for several seconds after withdrawing the needle to reduce tag loss.

Although we encountered a high rate of PIT tag loss, all PIT tags retained by deer mice remained operable. Other studies have reported high failure rates for retained PIT tags. In a study of wild badgers, Rogers et al. (2002) reported a PIT tag failure rate of 6.9 percent. Fagerstone and Johns (1987) reported a 30.4-percent failure rate in their work with domestic ferrets (*Mustela putoris furo*) although this included lost PIT tags as well as tags that remained in place but had become inoperative; they identified a design problem in their PIT tags that caused the tags to short circuit and fail prematurely, which was subsequently addressed and eliminated most tag failures.

In conclusion, we found that PIT tags performed poorly as a marking technique for a long-term mark-recapture study of deer mice using our methods of implantation. We are currently examining if use of topical tissue adhesive to suture the implantation wound might increase PIT tag retention. Placement of PIT tags between the shoulder

Table 2. A summary of the percentage of PIT tag and ear tag loss in this study compared to published small mammal studies by species

Author(s)	Species	% tag loss	
		PIT	Ear
This study	*P. maniculatus*	31.8	8.2
Harper and Batzli (1996)	*Microtus ochrogaster*	4.8	11.6
Harper and Batzli (1996)	*M. pennsylvanicus*	5.1	9.6
Krebs et al. (1969)	*M. ochrogaster*	---	2.2
Krebs et al. (1969)	*M. pennsylvanicus*	---	5.1
Wood and Slade (1990)	*M. ochrogaster*	---	16.0
Williams et al. (1997)	*Dipodomys ingens*	2.9	9.1
Williams et al. (1997)	*D. heermanni*	2.6	11.1
Williams et al. (1997)	*D. nitratoides*	8.7	15.0
Schooley et al. (1993)	*Spermophilus townsendii*	3.4*	---
Rao and Edmondson (1990)	*Mus musculus*	5.0*	---
Bias et al. (1992)	*M. musculus*	---	9.5

* Includes losses and retained tags that stopped functioning.

blades is common and often recommended because the skin of head and neck is loose allowing easy insertion of the transponder and nerves are not prevalent. However, tag retention has been affected by site of implantation (Gibbons and Andrews 2004). Thus, we are also considering other implantation locations, such as the abdomen.

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