USE OF A HAIR-SAMPLING TUBE TO DETECT THE SAN JOAQUIN KIT FOX

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Surveys for San Joaquin kit foxes (V*ulpes macrotis mutica*) have been conducted using live traps, track plates, scent stations, automated cameras, physical observations, and spotlighting (Orloff et al. 1993, Ralls and Eberhardt 1997, Clark 1999, Warrick and Harris 2001). The San Joaquin kit fox is a federally listed endangered and California-listed threatened species occurring from the central to southern San Joaquin Valley in California (U.S. Fish and Wildlife 1998). Effective survey techniques are necessary to determine the presence of kit foxes in specific locations.

Hair-sampling tubes have been used successfully to survey for mammals by collecting guard hairs (Suckling 1978, Winnett and Degabriele 1982, Scotts and Craig 1988). Such tubes commonly employ polyvinyl chloride (PVC) pipes that are baited to attract animals. Hair tubes are constructed to target particular species. The entrance must be small enough such that animals entering the tube come in contact with the hair sampling mechanism (typically a brush or sticky tape) within the tube. Identification of samples is based on hair characteristics or genetic analysis. Lindenmayer et al. (1994, 1999) successfully used hair tubes to collect samples from red foxes (*V. vulpes*), dogs (*Canis familiaris*), and other animals. Our objective was to determine whether hair tubes could be used to obtain samples from San Joaquin kit foxes.

Hair-sampling tubes were made from 15.2-cm diameter PVC pipe (7-mm wall thickness), 60.9 cm long. Black PVC pipe was used to aid in camouflage. Hair-sampling tubes were secured to the ground surface by driving two standard gutter nails (20 cm long) at the bottom of each entrance through a pre-drilled hole. Two 2.5-cm diameter holes were drilled on top of the unit for tying bait (Figure 1). After the tube was baited, duct tape was placed over the upper holes to prevent access to the bait from outside the tube. Double-sided tape or doubled-over duct tape was placed at both entrances for guard hair capture. Guard hairs are the target hair type because they are easily pulled out and are relatively easy to identify based on macroscopic characteristics (Stains 1958).

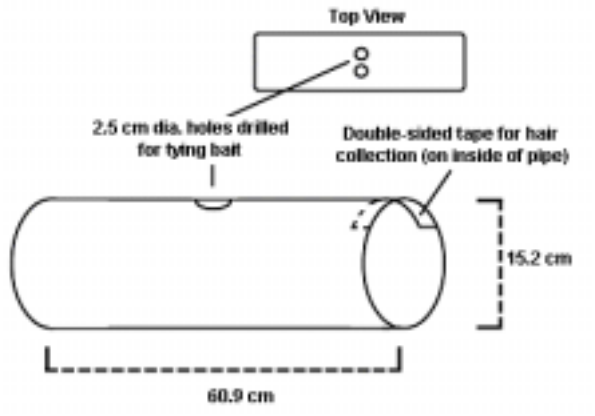

Figure 1. Diagram of hair-sampling tube used to collect hair samples from mammals.

For 20 days each between 10 February and 1 March and between 1 and 20 April 2000, 15 hair-sampling tubes were baited with bacon and placed along potential San Joaquin kit fox travel routes on 2 study sites in Merced County, California. Tubes were checked each day, rebaited, and if hairs were present, the tape was collected and new tape placed on the tubes. Tape collected from hair-sampling tubes was placed in individually labeled plastic sample bags, assigned a sample number, and placed in storage until hairs were removed for identification. Guard hairs were carefully removed from tapes using fine-pointed forceps and placed in clean petri dishes. Each hair sample was washed using ethyl alcohol to remove exterior contaminates such as dirt and debris. Hairs were stained using Prussian blue (ferric ferrocyanide) and left to dry for approximately 30 min. Staining the hairs with Prussian blue aided in the observation of the cuticular scales. Hairs were identified using a stereo microscope by comparing cuticular scale patterns with known voucher specimens and using hair keys (Mathiak 1938, Mayer 1952, Stains 1958). Hairs were then placed in individually labeled vials filled with ethyl alcohol for storage after identification.

San Joaquin kit fox guard hairs were successfully sampled at both sites on 8 occasions. Other species sampled were desert cottontails (*Sylvilagus audubonii*), black-tailed jackrabbits (*Lepus californicus*), and striped skunks (*Mephitis mephitis*). The hair-sampling tube design we tested proved effective in obtaining samples from endangered San Joaquin kit foxes and hairs from 3 other species. Hair tubes are relatively inexpensive to build and deploy, and they appear effective in verifying presence of kit foxes. Using this technique, DNA sampling is possible from the guard hairs if the follicle is intact and not contaminated (Foran et al. 1997), and if an adequate number of hairs is collected (>20, Jesus Maldonado, Smithsonian Institution, personal communication).

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LITERATURE CITED

Clark, H. O., Jr. 1999. An animal track casting method using dolomite, sand, and spray adhesive. California Fish and Game 85:138-139.

Foran, D. S., K. C. Crooks, and S. C. Minta. 1997. DNA-based analysis of hair to identify species and individuals for population research and monitoring. Wildlife Society Bulletin 25:840-847.

Lindenmayer, D. B., R. B. Cunningham, C. F. Donnelly, B. E. Triggs, and M. Belvedere. 1994. Factors influencing the occurrence of mammals in retained linear strips (wildlife corridors) and contiguous stands of montane ash forest in the Central Highlands of Victoria, southeastern Australia. Forest Ecology and Management 67:113-133.

Lindenmayer, D. B., R. B. Cunningham, R. D. Incoll, M. L. Pope, C. F. Donnelly, and B. E. Triggs. 1999. Comparison of hairtube types for the detection of mammals. Wildlife Research 26: 745-753.

Mathiak, H. A. 1938. A key to hairs of the mammals of southern Michigan. Journal of Wildlife Management 2:251-268.

Mayer, W. V. 1952. The hair of California mammals with keys to the dorsal guard hairs of California mammals. The American Midland Naturalist 48:480-512.

Orloff, S. G., A. W. Flannery, and K. C. Belt. 1993. Identification of San Joaquin kit fox (*Vulpes macrotis mutica*) tracks on aluminum tracking plates. California Fish and Game 79:45-53.

Ralls, K. and L. L. Eberhardt. 1997. Assessment of abundance of San Joaquin kit foxes by spotlight surveys. Journal of Mammalogy 78:65-73.

Scotts, D. J. and S. A. Craig. 1988. Improved hair-sampling tube for the detection of rare mammals. Australian Wildlife Research 15:469-472.

Stains, H. J. 1958. Field key to guard hair of middle western furbearers. Journal of Wildlife Management 22:95-97.

Suckling, G. C. 1978. A hair sampling tube for the detection of small mammals in trees. Australian Wildlife Research 5:249-252.

United States Fish and Wildlife Service. 1998. Recovery plan for upland species of the San Joaquin Valley, California. Region 1, Portland, Oregon, 319 pp.

Warrick, G. D. and C. E. Harris. 2001. Evaluation of spotlight and scent-station surveys to monitor kit fox abundance. Wildlife Society Bulletin 29:827-832.

Winnett, G. and R. Degabriele. 1982. A hair sampling tube for the detection of small and medium-sized mammals. Australian Mammalogy 5:143-145.