

MARKING TECHNIQUES FOR BLACK BEARS

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Abstract: Ear tagging and lip tattooing techniques were evaluated from 172 and 91 recaptured black bears (*Ursus americanus*), respectively. No significant differences ($P < 0.5$) in tag losses were detected between metal (21%) and plastic (17%) roto cattle tags. The use of 2 metal tags may increase the chance of long-term retention of these more durable tags. Tattoos exhibited good durability and legibility when properly applied on the smooth part at the side of the upper lip close to the gum. Multiple marks (2 ear tags, lip tattoo, and recording natural markings and abnormalities) should be used and the marks should be properly applied to maximize the chance of identifying bears over extended periods. Procedures for applying marks, factors associated with loss of marks, correction for loss of marks, tag return success, color coding techniques to delineate sex, nuisance history, and area of capture, and reobservation of marked bears are discussed.

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Marking techniques are one of the most fundamental and important aspects of studying any wildlife population. Animals must be marked to evaluate management actions such as relocation and reintroduction and to gather population data such as mortality and density. Most studies dealing with population estimation assume no loss of marks and marked animals must always be recognized; if marks are lost, the population will be overestimated (Tanner 1978:32).

Erickson (1957), Black (1958), and Stickley (1961) demonstrated that ear-tagging black bears with metal livestock tags was a satisfactory marking technique but tag loss was variable and small sample sizes prohibited evaluation of tag durability. Secondary marks such as toe-clipping (Erickson 1957) and tattooing the inside of the ear (Stickley 1961) proved unsatisfactory. Grizzly bears (*Ursus arctos*) were successfully color marked with plasticized polyvinyl chloride tape inserted through the ears and hide on the back of the neck (Craighead et al. 1960). Lentfer (1958) described marking polar bears (*Ursus maritimus*) with metal and nylon ear tags, tattoos on the upper lip, right axilla, and groin, and colored neck collars.

Durable markers are especially important for bears because they are such long-lived animals and long-term studies are often necessary. Bears also exhibit a high degree of manual dexterity (Bacon 1973:46) and intra-specific aggression which may affect endurance of marks and therefore marking procedures. Our objectives were to (1) evaluate retention of marks, (2) describe marking techniques used for black bears in Tennessee, and (3) formulate recommendations for marking bears based upon 10 years of marking data.

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METHODS

This study was conducted primarily in the northwestern quarter of the Great Smoky Mountains National Park (GSMNP or Park) and the Citico watershed of the Tellico Wildlife Management Area within the Cherokee National Forest (CNF) in Sevier, Blount, and Monroe Counties, Tennessee. Most of the area is mountainous and characterized by diverse forest and dense understory vegetation, including mountain laurel (*Kalmia latifolia*), rhododendron (*Rhododendron* sp.), blueberries (*Vaccinium* sp.), and huckleberries (*Gaylussacta* sp.)

Bears were captured in Aldrich foot snares, barrel traps, culvert traps, or by free-ranging capture techniques, immobilized with intramuscular injections of Etorphine or Phencyclidine hydrochloride, ear-tagged, and lip tattooed. Ear tags used were plastic roto cattle tags (Nasco Co., 901 Janesville Ave., Ft. Atkinson, WI 53538), colored (red, blue, orange, and yellow) metal cattle tags, and uncolored (silver) monel metal cattle tags (National Band and Tag Company, 721 York St., Newport, KY 41072). One plastic roto tag was used in each ear from 1970 to 1975. In 1976 and 1977 1 plastic roto tag and 1 monel metal tag were used and in 1978 and 1979 1 monel metal and 1 colored metal tag stamped "Reward Forestry Dept. UT. 974-7126" were used. Metal tags were dipped in polyurethane to improve color retention and reduce the metal-flesh abrasion. All tags were individually numbered and color coded. Manual hog tattoo pliers with interchangeable numbers and paste ink were used to apply lip tattoos (Nasco Co., 901 Janesville Ave., Ft. Atkinson, WI 53538).

RESULTS AND DISCUSSION

Ear Tag Losses

Ear tag losses were evaluated from 172 recaptured bears (Table 1). The incidence of tag loss (absolute percentage of tags lost and the percentage of bears that lost at least 1 tag) was not significantly different ($P > 0.5$) between metal (21%, 21%) and plastic roto (17%, 20%) tags. Metal and plastic roto tag comparisons on the same bear also indicated equivalent loss rates (Table 1).

Comparisons of metal and plastic roto tags (1 in each ear) showed that plastic tags exhibited better retention over shorter time periods ($\bar{X} = 1.2$ years, $R = 1.0 - 2.0$) and metal tags over longer time periods ($\bar{X} = 2.2$ years, $R = 2.0 - 3.0$) (Table 1). Metal tags were more durable than plastic tags which deteriorated over time, became brittle, and were easily broken or lost. However, minor ear infections and irritations caused by the constant pivoting movement of metal tags may also increase the chance of tag losses. No infections were noted in association with plastic tags. Irritations from metal tags, which completely overlap the edge of the ear, may cause bears to scratch their ears thus increasing the chances of hanging a claw in the tag and tearing it out. Antiseptics in the form of topical aerosols are readily available and easy to apply; their use may decrease irritation and infections and result in fewer tag losses. The use of 2 metal tags (1 in each ear) may have a greater chance of avoiding short-term losses associated with irritations and insure long-term retention of these more durable tags.

The loss of ear tags was not significantly different between males and females ($P > 0.5$) or wild and panhandler (nuisance) bears ($P > 0.1$) (Table 2). Subadults lost fewer ($P < 0.05$) ear tags than adults, but this was likely related to subadults being recaptured over a shorter time period ($\bar{X} = 0.8$ years, $R = 0.1 - 3.0$) than adults ($\bar{X} = 1.1$ years, $R = 0.2 - 4.0$). Also, significantly fewer subadults were recaptured than adults, probably due to the dispersal patterns of subadults (Johnson and Pelton 1980). No tag losses were recorded for 18 recaptured subadult females indicating that this group may not experience as many losses associated with intra-specific aggression as other sex and age classes. Torn and chewed ears were common, especially among males.

Ear Tagging Procedures

A lack of strong differences in ear tag losses among sex and age classes and wild and panhandler bears indicated that incorrect application of tags may be the most important factor influencing retention of tags. The ears should be pierced prior to tag application to insure that the locking mechanisms of tags line up correctly before final closure and reduce the chance of fitting tags too tightly due to excessive plier pressure. Ear tags that pinched or chafed the ears of cottontail rabbits (*Sylvilagus floridanus*) caused tissue necrosis and increased tag losses (Brady and Pelton 1976). There would also be less chance of pinching tissue into the locking mechanism if the ears are pierced. A leather punch (or knife) was used in the present study to make the tag hole.

The tags were placed at the base of the ears on the trailing edge (Fig. 1). The base of the ears have thicker cartilage and if the tags are properly attached in this area they exhibit better retention. The tips of the ears are often torn and should be avoided. Tags should not be applied so that a large loop extends past the edge of the ear thus increasing the chances of hanging a claw or branch in the tag and tearing it out. However, care also should be taken not to pinch or constrict the edge of the ear. The trailing edge of the ear probably affords more protection to tags than the leading edge. An antiseptic should be applied to reduce ear infections and irritation. Correct application can maximize retention of marks but losses cannot be totally eliminated because of fights between bears, removal by the bear, possibly associated with irritations and scratching, and snagging in dense vegetation.

Ear Tag Returns

The average annual percentage of ear tag returns (other than recaptures) was less than 3 percent. The use of a reward (\$10) for the return of ear tags, since 1978, did not significantly increase the return rate. High survival rates for bears in the interior of the Park (Beeman 1975:147-148), high levels of illegal hunting in and around the Park and the CNF, and an average legal harvest of only 16 bears per year in Tennessee probably accounted for low tag returns. The reward system for ear tag returns has been used for only 2 years but the reward system should increase the return of ear tags as the proportion of bears in the population with reward tags increases. Black (1958) and Stieckley (1961) demonstrated the value of ear tag returns to assess mortality of black bears in New York and Virginia, respectively.



Fig 1. Location of ear tags on black bears.

Table 1. Ear tag losses for black bears in Tennessee.

	Sample size	Tags lost (No./Percent)		
		Both	One	None
Tag type applied:				
2 plastic roto	121	12(9.9)	17(14.1)	92(76.0)
2 metal	14	1(7.1)	4(28.6)	9(64.3)
1 plastic and 1 metal	37	1(2.7)		24(64.9)
plastic			6(16.2)	
metal			6(16.2)	
Avg. time period (yrs/range):				
2 plastic roto		2.3(1.0-4.0)	1.5(0.1-4.0)	0.8(0.1-4.0)
2 metal		1.0	0.6(0.1-1.0)	0.9(0.1-3.0)
1 plastic and 1 metal		3.0		0.8(0.2-2.0)
plastic			2.2(2.0-3.0)	
metal			1.2(1.0-2.0)	

Table 2. Ear tag losses for different classes of black bears in Tennessee.

	No. lost tags	Percent
Males	30 of 153	19.6
Adults	25 of 123	20.3
Subadults	5 of 30	16.7
Females	17 of 75	22.7
Adults	17 of 57	29.8
Subadults	0 of 18	0
Wild bears	39 of 164	23.8
Panhandler bears	8 of 64	12.5
Adults	42 of 180	23.3
Subadults	5 of 48	10.4

Color Coding

Red ear tags were used to designate nuisance bears, blue for bears captured in the study area in the interior of the Park, orange for bears captured in the study area along the boundary of the Park, and yellow for bears captured in the CNF. The sex of bears was coded by placing the colored tag in the left ear of males and the right ear of females. Color coding has potential for increasing the amount of information obtained from tagging but its value depends largely on the density of vegetation and whether the general public or only qualified personnel are relied upon for observations. Color markers and relatively open habitats facilitated obtaining information on movements, activities, and behavior of grizzly bears (Craighead et al. 1960).

The percentage of color-marked wild bears observed per year by research personnel in Tennessee was consistently below 2 percent. Tagged nuisance bears are readily observed (and often individually identified) along roadsides, picnic areas, and campgrounds but wild bears are shy and secretive and observations are hampered by dense understory vegetation. Early in the study bright-colored vinyl streamers were attached in conjunction with ear tags but high losses and few observations resulted in their discontinuation. Color coding of metal ear tags does not require excessive effort and is routinely done; so if an opportunity does occur, observational data can be collected.

Lip Tattoo

Lip tattoos were evaluated from 91 recaptured bears. Sixty-nine (76%) of the tattoos were legible after an average time period of 1.6 years ($R = 0.2 - 5.0$). Three tattoos were legible after 5 years but fading with time was evident. Thirteen (59%) of the illegible tattoos were applied early in the study before the technique was refined. Tattoos should be placed on the smooth part at the side of the upper lip close to the gum (Fig. 2). Originally tattoos were placed on the front of the upper or lower lip. The front and borders of the lips



Fig 2. Location of the tattoo on the smooth part at the side of the upper lip close to the gum and rough skin on the front and borders of the lip.

are rough and often irregular (Fig. 2) causing the tattoo to display poor legibility and high distortion when placed in this area. Tattoo pliers with revolving heads should be avoided because they are large and difficult to place on the smooth part of the lip.

The average time period (1.3 years, $R = 0.1 - 4.0$) over which illegible tattoos were reobserved was less than the average time period (1.6 years) over which legible tattoos were reobserved. Thus, time did not appear to be as important a factor in tattoo legibility as the location and procedure used in applying the tattoo. Important points in applying the tattoo are: (1) punch deeply, but not deep enough to cause bleeding, (2) vigorously rub in an abundance of ink, (3) because of distortion do not over-stretch the lip to position the tattoo, (4) keep the number system as simple as possible to minimize mistakes, and (5) use ink colors not normally found in the mouth (e.g. masking of red ink with blood). Tattoo distortion may also occur due to growth when applied to young bears, especially cubs. If tattoos are carefully placed on the smooth part of the lip and properly applied, they are valuable insurance against loss of other marks. In this study 6 bears that had lost both ear tags were identified by the lip tattoo. Tattoos also have law enforcement implications; at least 1 illegally killed bear was identified at a taxidermist shop by use of the lip tattoo.

Other techniques for identifying bears

Natural markings such as scars or chest blazes and abnormalities such as teat arrangements or tooth losses were recorded. Chest blazes often changed or disappeared over time. Unique markings proved beneficial in identifying recovered bears on several occasions but the use of natural markings and abnormalities was limited to bears that were "in hand"; such marks were of limited value for identifying bears in the field.

Multiple marks should be used on bears; 2 ear tags, a lip tattoo, and recording abnormalities and any unique natural markings will reduce the chance of misidentification of bears over extended periods. During this investigation, only 6 of 323 (1.9%) recaptured bears were not identified. Multiple marks also facilitate evaluation of marking techniques and allow calculation of a correction factor for the loss of marks in mark-recapture studies (Tanner 1978:51-52).

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