Evaluation of Breakaway Radio Collars on Black Bears in Florida

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Abstract. Using radio collars on black bears (*Ursus americanus*) has greatly increased our knowledge of this species. Excessive body growth of collared bears can result in neck injuries from radio collars, however; therefore, techniques have been developed to resolve such problems. Three types of breakaway devices were used on black bear radio collars in Florida. Forty-eight collars (Telonics breakaway, $N = 10$; surgical tubing breakaway, $N = 11$; leather spacer breakaway, $N = 27$) were placed on bears in the Apalachicola and Ocala National Forests. Collar life averaged 163 ± 22 (SE) days ($N = 4$), 185 ± 21 days ($N = 7$), and 399 ± 48 days ($N = 10$) for surgical tubing, Telonics, and leather space types, respectively. Collars with leather spacers lasted significantly longer ($P < 0.001$) than other collar types. No neck injuries were observed during the study.

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Radio telemetry is a standard research technique for studying various facets of black bear life history. But the technique carries risks because body growth can cause collars to become too tight, resulting in neck abrasions. This risk has been addressed in various ways. In climates where bears enter a deep winter torpor, researchers change collars in dens. Thus, the collar is worn for no more than 12 months. Expandable collars (Kolz and Johnson 1980, Strathearn et al. 1984, Jackson et al. 1985, Elowe 1987) also have been used to prevent neck injuries to collared animals. Neck injuries also can be prevented by using breakaway mechanisms that cause the collar to drop off the bear's neck after some time interval.

In the southeastern U.S., hibernating bears in ground nests tend to flee upon approach (Hellgren and Vaughan 1989, Wooding and Hardisky 1992),

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and capture in elevated tree dens is not possible. This leaves breakaway collars as the method of choice. Hellgren et al. (1988) addressed this by using cotton spacers, and found that they deteriorated rapidly in a southeastern wetland. Lombardo (1993) used leather spacers, but longevity data was not reported. Here, we report our observations of 3 breakaway designs used on black bears collared in Florida.

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Methods

Black bears were trapped in Ocala National Forest from May 1985 to May 1988 and in Apalachicola National Forest from December 1990 to June 1992. Climate was characterized by hot, humid summers and mild winters. Rainfall averaged 127–149 cm annually (Winsberg 1990).

The first type of breakaway design tested was the commercially manufactured Telonics Model 500-CB-3 breakaway collar (Telonics, Inc., Mesa, Ariz.). The breakaway section of this collar consists of 2 pieces of latex surgical tubing (approximate outside diameter and wall thickness were 0.95 and 0.32 cm, respectively) enclosed in a tough, tight-fitting plastic casing (Fig. 1 A). After being exposed to the weather for a period of time, the tubing becomes brittle and weakens, eventually breaking. In hope of lengthening collar life, we wrapped the casing with duct tape. Ten bears (1 F, 9 M) were fitted with these collars. Weights of collared bears ranged from 32 to 136 kg.

A second breakaway design also depended on surgical tubing. The commercially manufactured Telonics Model 300 was modified by using tubing (similar dimensions as above) to tie the ends of the collar together (Fig. 1 B). Electricians' tape was then wrapped around the tubing to keep it from snagging on brush. This design was used on 11 collars. Fitted bears (8 F, 3 M) weighed from 20 to 77 kg.

The third breakaway design was a piece of vegetable-tanned cowhide (0.5 cm thick, 10- to 15-cm lengths) riveted to the outside of a severed, Telonics Model 500, static radio collar (Fig. 1 C). We used moderate quality belly leather. The collar was severed (to provide a breakaway point) on the side opposite the fastening hardware, being very careful not to cut the antenna. Steel pop-rivets 3–6 mm in diameter (1/8 and 1/4 inch) were used to fasten the leather breakaway spacer to the collar. Aluminum rivets were used on one collar. Steel rivets, that were soaked in acetic acid for 5 minutes or had plating ground off of them, were

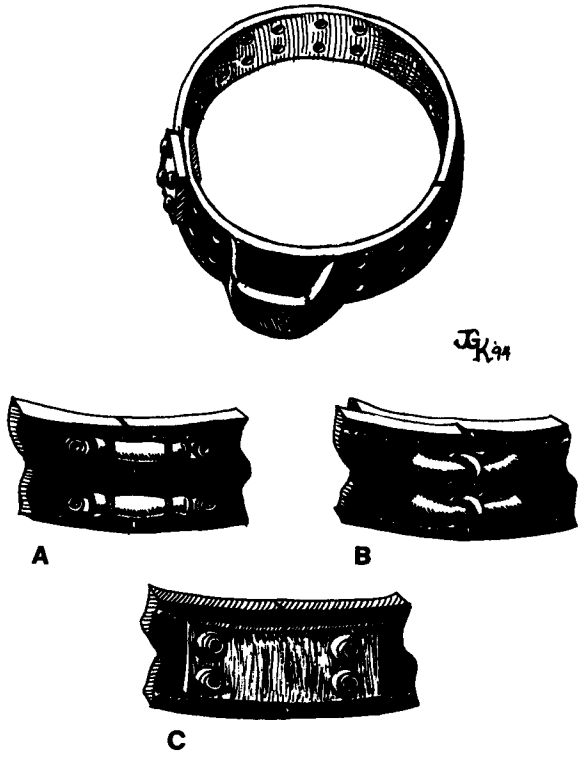

Figure 1. The three types of breakaway mechanisms used on black-bear radio collars in Florida, Ocala National Forest 1985–1988 and Apalachicola National Forest 1990–1993: A) Telonics breakaway system; B) hand-tied surgical tubing; and C) leather spacer.

used to enhance rusting and shorten the life of the leather spacer. As the rivets rust, the leather around the rivets becomes weak and brittle, eventually breaking, thus allowing the severed collar to fall off the bear. This type of collar was used on 27 bears (6 F, 21 M) that ranged in weight from 35 to 168 kg.

Only "dropped" collars, defined as a collar that broke free of the bear from weathering, were used in the analysis. Differences in longevity among collar types were examined by the Kruskal-Wallis procedure (Siegal 1956). Because 2 of the 3 collar types relied on surgical tubing as the breakaway mechanism, the Mann-Whitney U-Test was used to test for differences between these 2 types of collars.

Results and Discussion

Forty-eight collars were deployed on 43 bears. A total of 21 collars (7 Telonics, 4 surgical tubing and 10 leather) were dropped (Table 1). There was no

Table 1. Longevity (days) of 3 types of breakaway mechanisms used on black bear radio collars in Florida, Ocala National Forest 1985–88 and Apalachicola National Forest 1990–93.

Breakaway type	N	$\bar{x}$	SE	Range
Telonics	7	185	21	130–283
Surgical Tubing	4	163	22	125–207
Leather	10	399	48	192–637

difference in longevity during the time period of the surgical tubing-type collars ($U = 10$, $P = 0.26$). Therefore, they were combined for the non-parametric analysis of variance. Collars using leather spacers as the breakaway mechanism lasted longer ($H = 11.43$, 1 df, $P = 0.0007$) than the surgical tubing-type collars (Table 1). No neck injuries were observed on collared bears that were killed by hunters, vehicles, or recaptured during this study.

The surgical tubing-type breakaway mechanisms did not last as long as breakaway cotton spacers used on bears of either sex in Shenadoah National Park (SNP) or Great Dismal Swamp National Wildlife Refuge (GDS) (Hellgren et al. 1988). However, collars using leather breakaway mechanisms lasted longer in our study than the breakaway cotton spacers used on bears of either sex in GDS and male bears in SNP, but not as long as breakaway cotton spacers used on collars of females in SNP.

The 27 collars that did not drop provided data on minimum time deployed. Seven bears collared with leather breakaway mechanisms were monitored for 350–793 days. Six collared bears with leather spacers were killed by hunters 29–353 days after being collared. The collar which was on for 353 days was rotted, and it broke when the hunters pulled on it. Two worn leather collars were replaced with new leather collars after recapture at 174 and 253 days, respectively, and 2 bears removed their collars by pulling them over their heads after 109 and 178 days of monitoring, respectively. Four collars that were tied together with surgical tubing were monitored from 231 to 444 days until contact was lost. One bear with a collar of this type was monitored for 222 days when the study ended. Also, 1 bear removed its collar after 277 days of monitoring, and 1 bear died of unknown causes after 215 days. Of the 3 commercially manufactured Telonics breakaway collars that were recovered intact, 2 were worn and replaced during recaptures after 66 and 116 days of monitoring, and 1 bear was hit by a vehicle and killed after 134 days of monitoring.

Leather breakaway mechanisms were the longest lasting type of breakaway used. Even in the hot, humid conditions of Florida, most leather spacers lasted for >1 year. Longevity of the leather spacers was highly variable, ranging from 192 to >793 days. Much of the variability may depend on the sex of the collared bear. Hellgren et al. (1988) reported that spacers lasted longer on females bears

than on male bears, because of males fighting, and marking trees. Of the six female bears collared with leather breakaways, no collars dropped. One was replaced at recapture and 5 were being monitored when the study ended.

Each of the collars tested have merit for studying bears. Surgical tubing breakaway collars have little risk of injuring bears, but break quickly. Leather breakaway mechanisms lasted considerably longer, but potentially increase the chances for injury. The selection depends on research objectives and size and age of bears. Collar choice is a trade-off between longevity and potential risks of injuring the bear. In the Southeast, where it is unlikely that collars can be changed annually in dens, we recommend that young bears be collared with a surgical tubing breakaway or a similar material that breaks quickly. Older, slower growing bears, can be fitted with leather breakaways as an alternative to static collars.

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