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# COMPARATIVE RECOVERY RATES OF MARKED COYOTES

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Recovery of free-ranging animals marked with ear tags or collars has long been used to collect data regarding movements and mortality (Leopold 1933). Methods for reporting and interpreting recovery rates (Seber 1970, 1972; Youngs and Robson 1975; Brownie et al. 1978) have improved in recent years. Comparative recovery rates of terrestrial carnivores marked in different ways have not been reported, but may benefit researchers using marked animals. We document and compare recovery rates by age class and sex of free-ranging coyotes (*Canis latrans*) equipped with ear tags, vinyl collars, and radio-telemetry collars.

## METHODS

Free-ranging coyotes were captured with leghold traps during September 1981 and 1982, in conjunction with a series of ecological studies of coyotes at the Idaho National Engineering Laboratory (INEL) in the Great Basin desert of southeastern Idaho. Before release we recorded sex and age class (juv = <1 yr, ad = >1 yr) and marked each coyote in 1 of 3 ways: (1) a numbered aluminum ear tag affixed to each ear; (2) ear tags and a vinyl collar (70 g); or (3) ear tags and a vinyl collar with attached radio transmitter (270–320 g). Ear tags and both types of collars were inscribed with "Reward For Return" and a notification address. All collars were off-white belting material. A reward of $5.00 was paid for the return of 1 or both ear tags, and an additional $5.00 was paid for a collar.

We report recoveries as rates that ear tags or collars were returned to us by the general public. Most (>90%) returned tags and collars were from coyotes shot or trapped by ranchers or sportsmen on private land adjacent to the INEL; a few were from coyotes found dead along roads by motorists.

We used contingency-table analysis to compare recovery rates among the 3 marking techniques, between 2 age classes, and between sexes. A *G*-test of independence and Williams' correction (Sokal and Rohlf 1981: 735) were used to test the hypotheses that recovery rates were independent of marker type, age class, and sex.

## RESULTS

Of 138 coyotes captured, marked, and released at the INEL in 1981 and 1982, ear tags or collars (or both) were recovered from 44 (32%) before 1 November 1986. Times from release to dates that coyote were taken in the field ranged from 1 to 51 months ($\bar{x}$ = 15.4 months).

Recovery rates of coyotes marked by the 3 methods differed significantly ($P$ = 0.007). While 50% (24 of 48) of coyotes equipped with ear tags and radio collars were recovered, only 21% (11 of 53) of the "ear tags only" coyotes and 25% (9 of 36) of the "ear tags plus vinyl collar" coyotes were recovered (Table 1). Although the addition of a radio collar to an ear-tagged coyote was associated with a significant increase in the recovery of that coyote ($P$ = 0.003), the addition of a vinyl collar was not ($P$ = 0.64).

Recovery rates of juveniles and adults did not differ, either within each marker type ($P$ = 0.60, 0.45, 0.57, respectively), or when pooled ($P$ = 0.68). There was no difference in recovery rates between sexes ($P$ = 0.75).

## DISCUSSION

Collars or neck bands often are used to aid in field identification of free-ranging animals (Day et al. 1980). We thought that use of conspicuous collars might increase the recovery rate of ear-tagged coyotes. However, vinyl collars alone were ineffective in increasing the

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Table 1. Recovery rates (%) of coyotes marked and released at the Idaho National Engineering Laboratory in September 1981 and 1982.

| Age class and year | Marking technique | | |
|---|---|---|---|
| | Ear tags only | Ear tags + vinyl collar | Ear tags + telemetry collar |
| Adults | | | |
| 1981 | 22 (9)[a] | 30 (10) | 45 (11) |
| 1982 | 14 (14) | 30 (10) | 64 (11) |
| Juveniles | | | |
| 1981 | 14 (7) | 0 (6) | 53 (19) |
| 1982 | 26 (23) | 30 (10) | 29 (7) |
| Totals[b] | 21 (53) | 25 (36) | 50 (48) |

[a] Sample sizes in parentheses.
[b] The age class of 1 coyote was not recorded at time of capture; that animal was not included in certain analyses.

rate of recovery. Only when a radio transmitter was present did the recovery rate increase significantly.

The comparatively high recovery rate of radio-collared coyotes may reflect a higher mortality rate of such coyotes, or greater human motivation to return radio-telemetry collars, or both. Although we assumed that the 3 marking techniques had no effect on mortality rate, the greater weight and bulk of radio collars may have reduced coyote foraging efficiency or increased coyote vulnerability to human-caused mortality. However, because juvenile coyotes are probably more susceptible to mortality associated with radio collars, the lack of a significant difference in recovery rates between radio-collared juveniles and adults (Table 1) provided support for the assumption of no effect of marking techniques.

Motivation to return radio collars may have exceeded motivation to return ear tags or plain vinyl collars. Some persons finding radio collars may have felt compelled to return an apparently expensive electronic unit. They also may have expected a large reward. Others may have wanted to participate in and learn more about the "high technology" wildlife research occurring in their area. Some people may have returned radio collars out of fear that wildlife officials would soon "home in" on them if they did not. Plain vinyl collars would have been less likely to elicit such responses.

Regardless of the causes of the observed differences in recovery rates, use of plain vinyl collars did not appear to effectively increase recovery rates of terrestrial carnivores. To accomplish this, researchers should seek other simple and inexpensive methods.

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