Aging mountain lions using gum-line recession

John W. Laundré, Lucina Hernández, Donald Streubel, Kelly Altendorf, and Carlos López González

Abstract The ability to accurately age mountain lions (*Puma concolor*) would be a valuable tool for management. However, no reliable or standardized technique is currently available. We tested the accuracy of using gum recession as an aging technique. We measured gum recession of the upper canine teeth in 13 known-age individuals (12 females, 1 male). Gum recession was significantly related to age in months ($R^2 = 81.0$, $t_{28} = 10.16$, $P < 0.001$). The 95% confidence intervals for age estimations of lions based on gum recession ranged from ±0.5 to 1.3 years. Gum recession appears to provide reasonably accurate ages for free-roaming mountain lions.

Key words aging, gum recession, Idaho, mountain lion

The ability to accurately age wildlife is an important wildlife management tool. In the case of adult mountain lions (*Puma concolor*), 2 aging techniques are available. The first relies on measurements of carcasses or skulls (Gay and Best 1996); the second involves measuring various tooth characteristics such as cementum annuli (Trainer and Matson 1988), tooth-wear patterns (Ashman et al. 1983), tooth color (Shaw 1986), or gum-line recession (Currier 1979). Aging based on carcass and skull measurements can be laborious and influenced by geographical variation (Gay and Best 1996). Use of cementum layers in lions has not been successful (Lindzey 1987). Tooth-wear patterns and tooth color are subjective and only permit assigning individuals to broad (2- to 3-year) categories (Ashman et al. 1983, Shaw 1986). The gum-line-recession technique holds promise (Anderson 1983), but its accuracy has not been established. If gum-line recession was accurate (±1 year), it could provide a quick and easy technique to age mountain lions (alive or dead) in the field. It also could enable researchers to estimate more accurately the age structure of their study populations.

In our long-term study (14 years) of mountain lions in south-central Idaho and northwest Utah, we had the opportunity to measure gum-line recession of the upper canine teeth in known-age (±3 months) animals up to 8 years old at different times of their lives. We tested the hypothesis that gum line recession can be used to accurately estimate age in live mountain lions.

Methods

The study area, approximately 2,500 km^2 in south-central Idaho and northwestern Utah, consisted of 5 small mountain ranges (approximately 1,000 km^2) separated by agricultural valleys. Lions were captured with the aid of hounds, sedated with a mixture of ketamine hydrochloride (10mg/kg) and xylazine hydrochloride (0.2 mg/kg), marked with permanent tattoos, radiocollared, and released. Gum recession (Currier 1979) also was measured at the time of capture and was defined as the distance (mm) from the gum tissue to the visible gum line on the upper canine tooth (Figure 1). It must be stressed that this measurement is not to the underlying

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Figure 1. Photo shows gum recession in an adult female. Amount of gum recession was measured in millimeters as the distance between the juvenile (17 months) gum line, indicated by the lower arrow, and the current gum line, upper arrow.

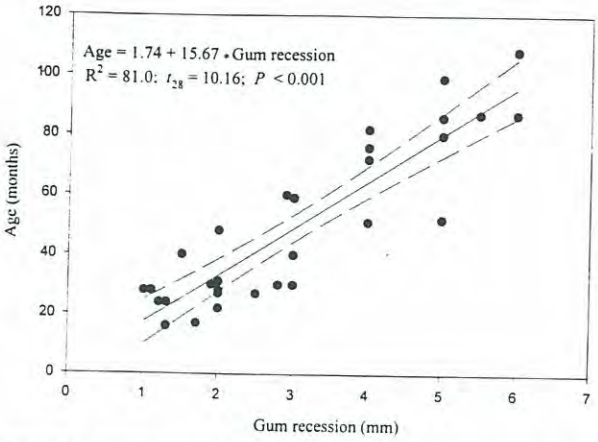

Figure 2. Regression of known-age mountain lions (months) to measurements of gum recession (mm) of the upper canine tooth. There were 13 individual animals (1 male and 12 females) in the sample.

bone tissue as outlined in Ashman et al. (1983). For this study, only animals that were initially captured when they were less than 1 year old (i.e., kittens) were considered. This provided a population of known (within ±3 months)-age animals. Individuals recaptured later (2–8 years) comprised our sample. As gum recession did not become evident until at least 17 months of age (unpublished data), the initial captures of these animals (gum recession = 0) were not included in the combined analysis.

Adult female lion in an aspen tree just before being tranquilized.

As we were testing whether age could be predicted by gum recession, we regressed age (months) against gum recession (mm) with a simple linear model (Zar 1999). For some animals, we had multiple measurements (≥4) over several years (maximum age = 6 years). We calculated additional individual regressions for these animals. In these analyses we included the data from their first capture (gum recession = 0). We assumed that increasing age was associated with increasing gum recession, thus we used a 1-tailed test for all regression slopes. The null hypothesis was the slope (b) of the regression line equaled 0. Our level of rejection was $P \leq 0.05$. We conducted all statistical tests with Sigmastat© software.

Results

We analyzed 30 non-zero measurements of 13 adult lions (12 females and 1 male), for each of which we knew the age (±3 months). Number of measurements/individual ranged from 1 to 5. The regression for the 30 measurements (Figure 2) had a significant slope ($P < 0.001$) and explained 81% of the variation in ages. We had sufficient data to

Juvenile (17 month) male lion in a Douglas-fir tree just before being tranquilized.

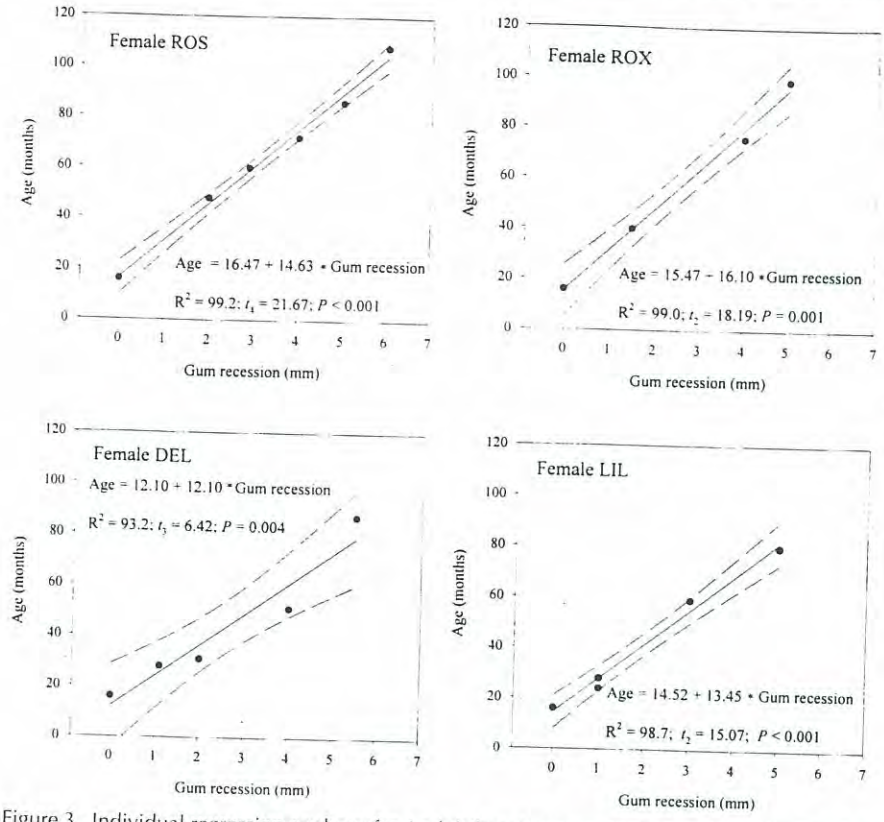

Figure 3. Individual regression analyses for 4 adult female mountain lion individuals. The data pairs for the last age at which gum recession was 0 are included in this analysis. The individuals are identified with randomly selected 3-letter codes.

calculate individual regressions for 4 females (Figure 3). The equations all had significant slopes and coefficients of determination (R^2) that ranged from 93.0 to 99.0. Slopes and elevations did not differ significantly among the 4 animals.

Based on the combined regression analysis, we obtained the following predictive equation for animals greater than 17 months of age:

$$\text{Age (months)} = 1.7 + 15.67 \times \text{Gum recession (mm)}$$

We used the above equation to estimate ages ± 95% confidence limits for 1-mm intervals of gum recession. Based on the equation, gum-recession measurements to the nearest mm would allow managers to classify mountain lions into 1-year intervals within 0.5 to 1.3 years.

Discussion and management implications

Most studies which report ages of free-ranging mountain lions use the multiple criteria described by Ashman et al. (1983). This method considers qualitative characteristics (tooth wear and color), which can be difficult to standardize. Other studies have used counts of tooth cementum annuli to estimate ages, but until recently there were problems with the technique (Thomas 1977, Carrel 1980). However, Trainer and Matson (1988) found that using premolars appeared to accurately estimate ages of mountain lions, but further testing with known-age specimens was necessary.

Use of gum recession as an aging technique as proposed by Currier (1979) also could be a useful tool to age mountain lions, but the technique has not been adequately evaluated. Our results suggest that gum recession of upper canine teeth and age are related within live individuals >17 months old. Even though there is variation among individuals, gum recession appears to be an accurate aging technique, at least for female mountain lions. Males were underrepresented in our sample because they normally dispersed from the study area at around 18 months of

Recently collared adult female lion recovering from the tranquilizing drugs.

age. For females, our predictive equation will enable managers to classify mountain lions to 1-year intervals with a great degree of confidence, particularly in the younger age groups (3–7 years). Gum recession is easy to measure in the field and should be easy to standardize.

We must caution about the use of our equation for harvested animals. Gums of dead animals may further recede as carcasses dry and affect the estimation of age (H. Shaw and F. Lindsey, personal comments). Data on whether such shrinkage occurs and, if so, at what rate may allow development of a correction factor.

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