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Research Article

Using the Epiphyseal Cartilage to Index Bobcat Age Classes

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Received: December 15, 2020; **Published:** January 30, 2021

Abstract

The ability to determine wildlife age classes is important for wildlife management and understanding the life history of a species. We used radiograph images of the epiphyseal cartilage at the distal end of the radius to separate bobcats (*Lynx rufus*) into mature and immature age classes using a known age bobcat. Although requiring a modicum of experience, we consider this technique superior to current bobcat ageing methods as it is less time consuming and can be used on both live and dead animals. Using this method, biologists can index young and mature bobcats thus helping to estimate recruitment rates and predict population changes.

Keywords: *Ageing; Bobcat; Epiphyseal Cartilage; Lynx rufus; Recruitment Rate*

Introduction

Fur trappers in Arizona are required to submit the lower jaw of each bobcat taken to the Arizona Game and Fish Department along with an annual report of their catch. This provision is to conform to Convention on International Trade in Endangered Species (CITES) regulations and provides a data base for tracking the age classes of bobcats taken. This requirement, while of management value [1], is inconvenient, as it requires the trapper to process, clean and provide each bobcat jaw and for the Department to archive, section, and process the teeth for ageing [2].

We propose using the epiphyseal cartilage as an alternate means of differentiating immature from mature bobcats as this technique has proved satisfactory for ageing cottontail rabbits (*Sylvilagus floridanus*), tree squirrels (*Sciurus* spp.) and jackrabbits (*Lepus* spp.) [3-7]. This technique also indicates the approximate age of an animal when it can expend more energy than that required for osteological growth.

Methods

A wild born bobcat kitten estimated to be only a few days old was surrendered to the Southwest Wildlife Conservation Center (SWCC) in August 2018. The forepaws of this male, named "Rocket," were radiographed on 8/27/2019 when Rocket was *ca.* 12 months of age and when the gap of the epiphyseal cartilage at the distal end of the radius was readily apparent (Figure 1). We continued to radiograph Rocket's forepaws at monthly intervals until the epiphyseal cartilage was closed on August 30, 2020 - a period of close to 2 years (Figure 2-4).

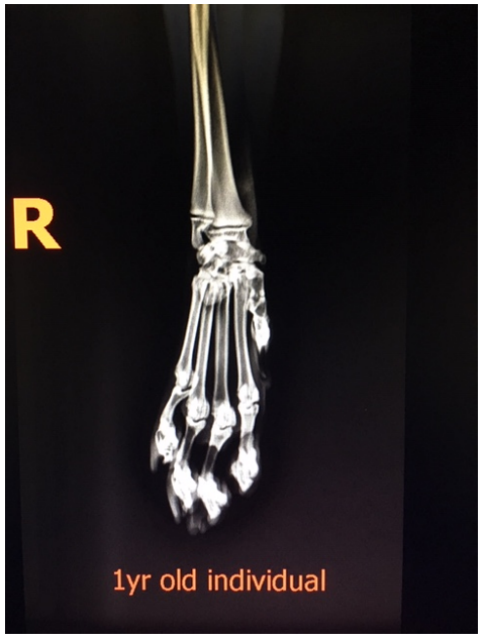

Figure 1: *Radiograph of front leg taken 8/27/2019 at 1 year of age. The epiphyseal cartilage gap is clearly discernable.*

Figure 2: *X-ray of front leg taken March 2, 2020 at age of 19 months.*

Figure 3: *X-ray taken 4/27/2020 at age of 21 months. The epiphyseal gap remains clearly visible.*

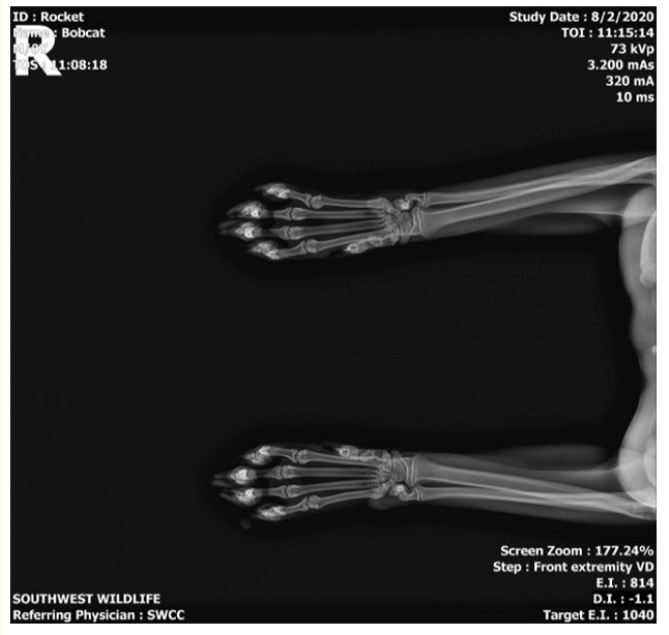

Figure 4: *X-ray taken at 23 months of age showing the epiphyseal cartilage still present.*

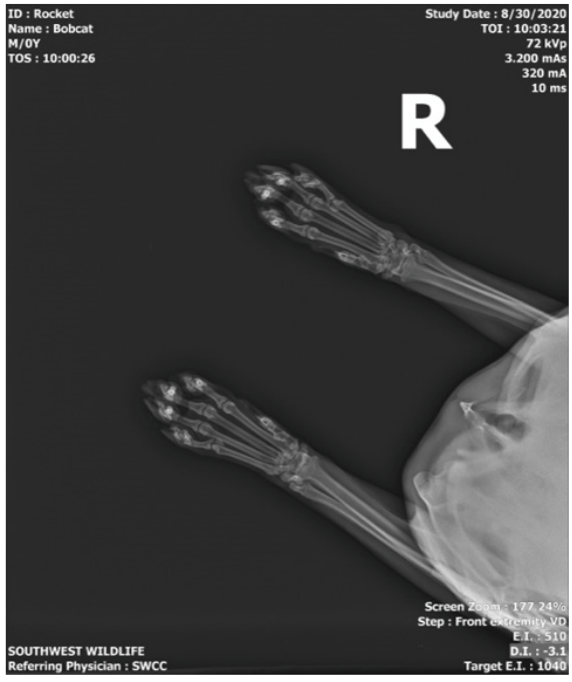

Figure 5: *X-ray taken 8/30/2020. The epiphyseal gap is closed, and the animal is considered an adult at 24 months of age.*

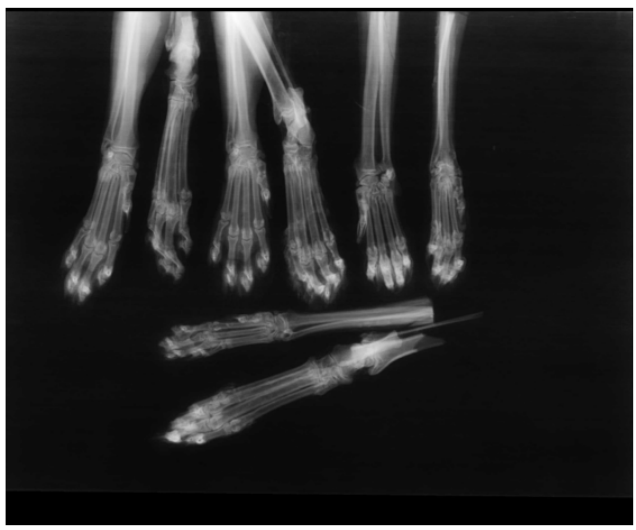

Figure 6: *Array of bobcat feet recovered from a carcass pile. Reading clockwise from upper left we classified these feet as 1. Immature, Immature, 3. Adult, 4. adult, 5. Immature/Adult, 6. Adult, 7. Adult, 8 Immature. The trappers release all kittens < 1 year of age, and this composition of ca. 50% immatures appears reasonable.*

The SWCC is an Arizona Game and Fish Department approved wildlife holding facility and Rocket's care procedures complied with American Society of Mammalogists and Institutional Animal Care and Use Committee standards. The frequency of x-rays was within the time frame considered safe for the animal, the shortest interval being 23 days. Although ossification can be delayed because of malnutrition or stress [8,9], this study can be considered as providing optimum conditions as the animal was retained in captivity, fed daily and subjected to a minimum of stress.

To check on the practicality of the technique in the field we visited a site where two trappers had deposited their carcasses. Eight bobcat legs were extracted from the site and x-rayed for examination.

Results

We examined the epiphyseal cartilage after each x-ray and noted the amount of closure. We considered the bobcat an adult when the epiphyseal cartilage was replaced by bone at the age of 101 weeks (Figure 5). We described the animal when < 2 years of age as immature, and > 2 year of age as an adult. We consider first year animals to be kittens.

An x-ray of the 8 bobcat legs collected in the field is shown in figure 6. We considered these leg bones as belonging to 4 immatures and 4 adults, the trappers releasing kittens < 1 year of age.

Discussion

We believe this technique has management applications in that collecting bobcat legs provides an easier and less time-consuming method of indexing bobcat age ratios than tooth sectioning when the objective is only to separate immature and adult bobcats. That the technique can be applied to live animals is also an advantage. X-raying the epiphyseal cartilage is potentially more timely and less expensive - valuable characteristics for wildlife managers.

That the bobcat was nearly 2-years old before the epiphysis was closed was a surprise and should be a biological consideration when managing this species.

Although several accounts report yearling females reproducing based on placental scars, and many states consider 1-year old animals as mature, we suspect successful reproduction is uncommon prior to dispersal and that bobcats < 2years of age are not a reproductive cohort of most populations [1,10].

Crowe [2] reported that male bobcats in Wyoming because yearling males were not producing spermatozoa. Parker and Smith [11] noted that male bobcats in Nova Scotia continued to gain weight and girth after 2.5 years of age when the growth of female bobcats generally ceased.

Conclusion

Although requiring a modicum of experience, this technique is superior to current bobcat ageing methods, is less time consuming, and can be used to index both live and dead animals. Using this method, biologists can separate young bobcats < 2-years of ages from mature animals, thus helping to estimate recruitment rates and predict population changes.

Acknowledgements

We are greatly indebted to the staff at Southwest Wildlife Conservation Center for the care and husbandry of "Rocket" and for the use of their x-ray machine. Thanks too to Mrs. Pat King of the Anvil Ranch and to Ron and Marge Makovsky for sharing bobcat trapping information and access to their "bone-pile" where Karen Hajek and Dawn (Bones) Langston helped gather bobcat leg bones. We would also like to thank the reviewers for their edits and contributions to the manuscript.

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Volume 6 Issue 2 Febuary 2021