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COMPARISON OF BOBCAT AGE ESTIMATES FROM
ANNULI IN THE CEMENTUM OF INCISOR AND CANINE TEETH

by

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Introduction

Crowe (1972, 1975) estimated the ages of bobcats (Lynx rufus) by counting cementum annuli in canine teeth. However, a canine tooth is impractical to remove from a live-trapped bobcat, and its absence may significantly reduce the fitness of the animal after release. The purpose of this study was to determine the feasibility of using cementum annuli counts from alternate teeth for bobcat age estimates.

Materials and Methods

Teeth were obtained from carcasses collected in conjunction with the 1980-81 survey of hunter and trapper harvested bobcats (Cooley et al. 1981). Mandibles were removed from the skulls, boiled for 0.5 h, and the teeth extracted. Entire tooth rows (Fig. 1) consisting of three incisors (I_1 , I_2 , I_3), one canine (C_1), two premolars (P_3 , P_4), and one molar (M_1) were initially removed from 10 animals to determine which teeth could be quickly extracted, easily observed for annuli, and were unlikely to affect a bobcat's fitness. The third incisor best met these criteria; thus annuli counts of all subsequent specimens were made from only the I_3 and C_1 teeth.

Teeth showing open root apical foramina (ORF) were assumed to be from bobcats less than 1 year of age (Crowe 1975) and were not sectioned. All other teeth were soaked in Decalcifying Solution¹ for 16-22 h until completely decalcified, rinsed in cold running water for 2 h, and sectioned at a 45 degree angle on a SLEE Cryostat² at -20° C. Sections of 15 microns were taken from several locations along the root of each tooth, transferred to a glass slide, floated on a drop of water, and blotted dry. Slides were fixed with methanol, drained, stained 4 minutes with Giemsa Stain³ (1 part Giemsa to 4 parts Sorenson's Buffer³, pH 6.86), rinsed in distilled water, blotted, air dried, and cover slips affixed with CoverBond¹. Cementum annuli in each section were counted at 30x and 125x using a binocular microscope, and age estimated following the method of Crowe (1975).

¹American Scientific Products

²SLEE International, Inc.

³Fisher Scientific Company

Results and Discussion

The annular pattern in lower molar and premolar teeth of bobcats was similar to the lower canine (Table 1). The first distinctive annulus seen in each tooth was assumed to have been deposited during the animal's second winter (Crowe 1975). An additional, lightly stained band in canine teeth occasionally could be discerned adjacent to the dentino-cemental interface (D-C junction), but this extra band was not counted when it was present. In contrast, the incisors consistently showed an additional dark-stained layer close to the D-C junction near the root tip, that became contiguous with the D-C junction near the crown. This additional layer of cementum was probably deposited during a bobcat's first winter.

Attempts to extract both upper and lower tooth rows from bobcat carcasses revealed that lower incisors would be the only teeth readily extracted from anesthetized bobcats. The I_3 was the preferred tooth because of its slightly larger size, and its location adjacent to the canine provided protection from excessive wear and breakage. The other two incisors were frequently worn away or missing in older animals, but a sufficient portion of an I_3 was usually present to permit sectioning.

Cementum annuli counts of I_3 and C_1 teeth from 66 bobcats from Michigan's Upper Peninsula (Region I) and from 15 bobcats from Michigan's northern Lower Peninsula (Region II) are shown in Tables 2 and 3, respectively. Age estimates were assigned to most specimens without difficulty, but annuli counts from 11 incisors (14%) and 6 canines (7%) were ambiguous. Greatest interpretive difficulty was encountered while separating "split" or "false" annuli from the more continuous and distinct "true" annuli in areas of a section where little deposition between dark stained bands was apparent.

Management Application

Bobcat ages can be most efficiently estimated by removing and sectioning canine teeth. The lower third incisors can be used effectively in situations where canine teeth are impractical to remove. Ages of live-trapped bobcats can be estimated by extracting and sectioning an I_3 , but the effect of removing this tooth on the animals' fitness should be tested under field conditions.

Acknowledgments

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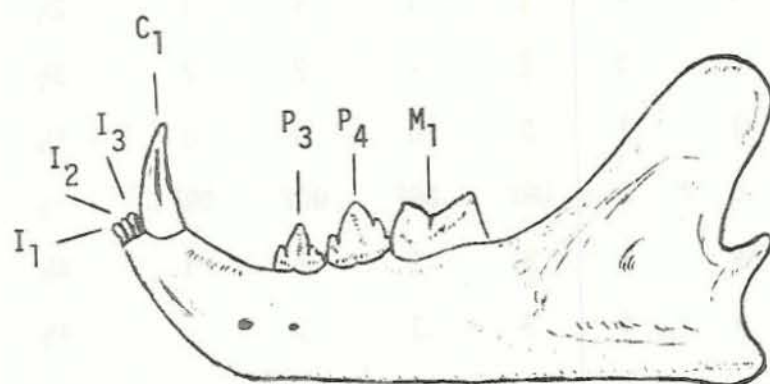


Fig. 1. Bobcat mandibular dentition

Table 1. Cementum annuli in teeth from bobcat mandibles.

Specimen Number	Tooth							Age Estimate
	I ₁	I ₂	I ₃	C ₁	P ₃	P ₄	M ₁	
30	-	-	0	ORF*	ORF	ORF	ORF	$\frac{1}{2}$
31	1	1	1	0	0	0	0	$1\frac{1}{2}$
32	-	-	-	1	1	1	1	$2\frac{1}{2}$
33	3	3	3	2	-	2	2	$3\frac{1}{2}$
34	1	1	1	0	0	0	0	$1\frac{1}{2}$
35	0	0	0	ORF	ORF	ORF	ORF	$\frac{1}{2}$
36	4	4	4	3	3	3	3	$4\frac{1}{2}$
37	4	4	4	3	3	3	-	$4\frac{1}{2}$
38	-	-	0	ORF	ORF	ORF	ORF	$\frac{1}{2}$
40	4	4	4	3	3	3	-	$4\frac{1}{2}$

*Open root apical foramen.

Table 2. 1980-81 Bobcat Season-Region I
I₃ and C₁ Tooth Cementum Annuli

Specimen Number	Sex	Date Killed	Cementum I ₃	Annuli C ₁	Age Estimate
129	F	12/3/80	0	ORF*	1½
38	F	1/5/81	0	ORF	1½
220	F	2/6/81	0	ORF	1½
212	F	2/26/81	0	ORF	1½
35	M	11/16/80	0	ORF	1½
233	M	12/6/80	0	ORF	1½
234	M	12/10/80	0	ORF	1½
30	M	1/8/81	0	ORF	1½
223	M	3/5/81	0	ORF	1½
236	M	3/6/81	0	ORF	1½
222	M	3/21/81	0	ORF	1½
123	F	10/26/80	1	0	1½
152	F	11/3/80	1	0	1½
150	F	11/5/80	1	0	1½
219	F	11/16/80	1	0	1½
34	F	11/16/80	1	0	1½
209	F	12/9/80	1-2	0-1	1-2½
216	F	1/2/81	1	0	1½
110	F	1/7/81	1	0	1½
133	F	1/8/81	1-2	0	1½
218	F	1/17/81	1	0	1½
237	F	1/25/81	1	0	1½
215	F	3/5/81	1	0	1½
321	F	3/25/81	1	0	1½
111	F	-	1	0	1½
157	M	10/28/80	1	0	1½
31	M	11/16/80	1	0	1½
154	M	1/26/81	1-2	0	1½
231	M	1/31/81	1-2	0	1½
138	M	-	1	0	1½
151	F	11/2/80	2	1	2½
159	F	12/3/80	2	1	2½
213	F	3/23/81	2-3	1-2	2-3½
107	F	-	2	1	2½
108	F	-	2	1	2½

Specimen Number	Sex	Date Killed	Cementum I ₃	Annuli C ₁	Age Estimate
112	F	-	2	1	2½
130	F	-	2	1	2½
147	F	-	2	1	2½
146	M	11/2/80	2	1	2½
144	M	11/6/80	2	1	2½
134	M	12/1/80	2	1	2½
230	M	2/18/81	2	1	2½
245	M	3/13/81	2	1	2½
238	M	3/14/81	2	1	2½
106	M	-	2	1	2½
116	M	-	2	1	2½
136	M	-	2	1	2½
74	F	11/8/80	3	2	3½
33	F	11/29/80	3	2	3½
104	F	-	3	2	3½
125	F	-	3	2	3½
126	F	-	3	2	3½
156	M	11/1/80	3	2	3½
37	F	11/21/80	4	3	4½
36	F	12/1/80	4	3	4½
127	F	-	4-5	3	4½
40	M	-	4	3	4½
557	F	11/30/80	6	5	6½
105	F	-	5±1	5	6½
142	M	2/7/81	6	5	6½
227	M	3/16/81	6	5	6½
240	M	11/18/80	7	6	7½
158	M	10/30/80	8	7	8½
322	M	-	8	7	8½
225	M	-	7±1	7	8½
228	M	-	7±2	9	10½

*Open root apical foramen

Table 3. 1980-81 Bobcat Season-Region II
I₃ and C₁ Tooth Cementum Annuli

Specimen Number	Sex	Date Killed	Cementum	Annuli	Age Estimate
			I ₃	C ₁	
52	F	1/1/81	0	ORF*	$\frac{1}{2}$
214	F	2/1/81	0	ORF	$\frac{1}{2}$
302	M	1/2/81	1	0	$1\frac{1}{2}$
56	M	1/9/81	1	0	$1\frac{1}{2}$
189	M	1/22/81	2	1	$2\frac{1}{2}$
166	M	2/81	2	1	$2\frac{1}{2}$
393	F	1/23/81	3	2	$3\frac{1}{2}$
193	F	2/16/81	3	3 ± 1	$3\frac{1}{2}$
91	M	2/8/81	3	2	$3\frac{1}{2}$
165	M	2/81	3	2	$3\frac{1}{2}$
239	M	-	3 ± 1	2	$3\frac{1}{2}$
191	F	2/6/81	4 ± 1	3 ± 1	$4\frac{1}{2}\pm 1$
192	F	2/14/81	5	5 ± 1	$5\frac{1}{2}$
392	M	1/24/81	5	4	$5\frac{1}{2}$
303	F	10/80	6	5 ± 1	$6\frac{1}{2}$

*Open root apical foramen.