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Dental anomalies in North American lynx

By Richard H. Manville

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The nature of variations or departures from the normal is an important feature of studies in systematics or evolution. Among mammals, the teeth are of special significance to the taxonomist, since they are so patently adaptive in structure and, because of their hardness, are often preserved in fossil specimens. Variations in series of teeth are a regular occurrence. The extent of such variations differs in the several groups of mammals; Colyer (1936) recorded them in at least 40 families of 9 orders. A knowledge of dental abnormalities, aside from its interest to systematists, is of practical value to dental pathologists and oral surgeons. The present paper is a by-product of a more extensive revisionary study of these North America cats, as was the previous note (Manville, 1959) on the anomalous bregmatic bones in these species.

Most students of vertebrate anatomy have encountered many anomalous structures in the domestic cat. So far as the teeth are concerned, such atypical features are equally common in the native North American cats of the genus *Lynx*. Data summarized here result from an examination of the skulls of 2,448 adult specimens in the U.S. National Museum (Biological Surveys) collection, representing 465 Canada lynx, *Lynx canadensis,* and 1,983 bobcats, *L. rufus.*

Dental variations in *Lynx* have been reported previously. For example, in a revision of the genus in California, Grinnell and Dixon (1924: 344) stated that "with respect to purely individual variation . . . there is undoubtedly some range, involving, among other features, . . . size and shape of teeth." From an examination of 64 specimens of *Lynx,* Colyer (1936: 68, 307) noted variations in the position of the incisors in 4, or 6.3 percent; among 44 specimens of the Old World cat, *Lynx lynx,* he found one with "an extra tooth in each premaxilla . . . the extra teeth are close to the canines and are separated from the third incisors by spaces". Reporting on 50 bobcats in Minnesota, Rollings (1945: 133) wrote that "one unusual skull, with double inciors, was obtained". Doubtless many other cases have gone unreported.

The normal dentition in the genus *Lynx* is customarily expressed by the formula $I\ ^3/_3\ C\ ^1/_1\ P\ ^2/_2\ M\ ^1/_1 = 28$. This represents a reduction from the 44 teeth of the primitive placental, by loss of the first two premolars and last two molars, above and below, on each side. The six incisors of each jaw, of which the outermost are somewhat enlar-

ged, are typically aligned in a straight transverse row. The four single canines, the enlarged tearing and stabbing teeth of carnivores, are separated by a space from the upper incisors in front and from the upper and lower cheek teeth behind. The premolars and molars comprise a continuous series of cheek teeth, used for chewing. The upper molars are reduced to small nubbins. The fourth upper premolar and the first lower molar, specialized as carnassial teeth in most carnivores, are shearing teeth used for severing tough tendons. The typical arrangement of these teeth is indicated in Fig. 1, A and B.

Departures from the normal fall as a rule into two categories: those related to (1) number of teeth, and to (2) position, size or shape of individual teeth. The former may occur in almost any part of the toothrow, but most commonly at the ends of the cheek teeth. Extra teeth, even though lost, are usually evidenced by the empty sockets. Missing teeth may result from an earlier injury or disease, followed by ossification of the socket. The second group of variations may involve rotation, displacement or asymmetry of the teeth. These may result from changes in the normal order of eruption of the teeth; they may be associated with a disease, as rickets; they may sometimes be caused or aggravated by injuries. Specimens discussed here were all adults having conspicuous irregularities. None appeared to represent cases of retention of the normally deciduous milk teeth.

In the case of *L. canadensis*, variations in number of teeth were noted in 5 (1.07 percent) of the specimens examined, and variations in position or shape of teeth in 3 (0.65 percent). With respect to *L. rufus*, the corresponding figures were 31 (1.6 percent) and 5 (0.25 percent). There appeared to be no causal relationship between presence of such anomalies and sex or geographic origin of the individual.

Canada lynx *(L. canadensis)* possessed extra teeth in four cases — a right p^2 in one, a right and a left p^2 in one, and a fourth lower incisor in two (No. 135631, Fig. 1).

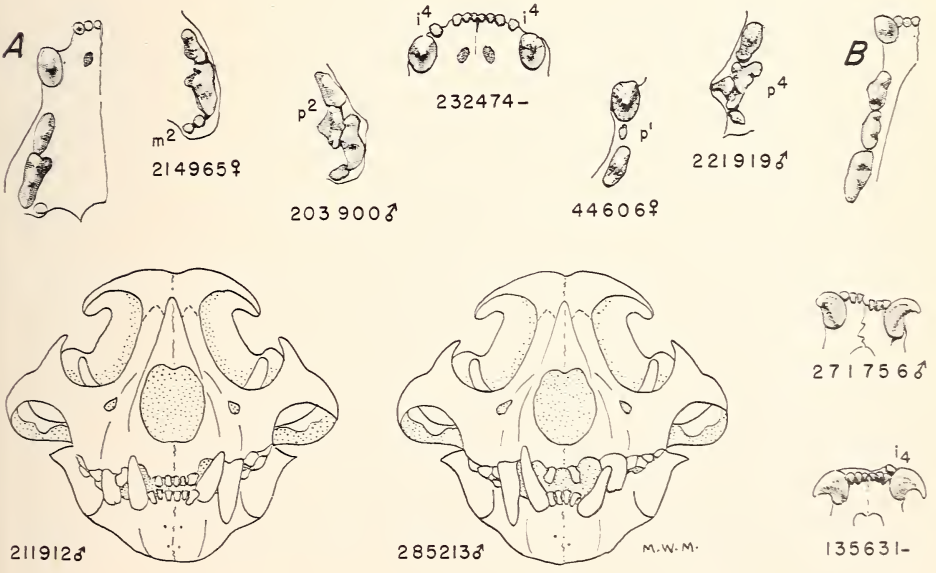

Fig. 1. Types of dental structures observed in North American *Lynx* (No. 135631, *L. canadensis;* all others, *L. rufus).* A and B represent the normal adult dentition of the right upper jaw and left lower jaw, respectively. All are similarly oriented and drawn to the same scale (about X 1/2).

In one case the left m ^{1} failed to develop. Three specimens had teeth in abnormal positions; these all consisted of lower incisors out of line, the one furthest to the right being in front of its neighbor. In the case illustrated, this was doubtless caused by the presence of an accessory incisor in the series.

Supernumerary incisors were present in each of two bobcats *(L. rufus);* both specimens had 8 upper incisors, in a continuous series in one, and in the other (No. 232474) with the left accessory incisor separated from both the canine and i ^{3}. Ten bobcats had extra premolars; in two, there was an extra p ^{1} on both right and left sides (No. 44606); in two, there was an extra left p ^{1}; in one, an extra right p ^{1} was situated in the palate; and in one, there was an extra right p $_{1}$. In two specimens, there was an extra p ^{2} on both right and left sides (No. 203900); one specimen had an accessory p ^{2} on the right side, and one the same on the left side, in both cases the extra teeth situated in the palate. In one specimen (No. 221919) there was an accessory lateral cusp on the right p ^{4}. A small extra m ^{2} was present in three specimens — on the left side in two (No. 214965), and on the right in one. In 14 cases individual teeth had failed to develop; four bobcats had only 5 upper incisors; one lacked the right p $_{3}$; three lacked the p ^{4} and the adjacent m ^{1} — two on the right and one on the left side; six bobcats lacked the m ^{1} — two on the left, three on the right, and one on both sides. In one specimen, the left i $_{3}$ was situated immediately in front of the i $_{2}$; both were adjacent to the canine. In another (No. 271756), the entire left side of the lower jaw was displaced aboute 3 mm ahead of the right side; this suggests a fracture at the suture early in life.

Three additional bobcat specimens were of unusual interest, all having abnormalities probably traumatically produced. A female from the Skokomish River in the Olympic Mountains, Washington, had lost the right and left i ^{1} and the left i $_{1}$; the sockets were well ossified and the remaining teeth were all normal. This skull contained a healed, round hole 11 mm in diameter high on the right frontal bone. Apparently a bullet had penetrated at this point and emerged at the external nares, or vice versa, clearing a track through the nasoturbinals.

A male bobcat from Colebrook, Coos County, New Hampshire (No. 285213), had only two incisors above and four below, the left c ^{1} was badly worn, and the left c $_{1}$ displaced so far forward as to be non-functional. This case is nearly identical with that of a tigress, *Panthera tigris,* shown in Fig. 391 of Colyer (1936), and suspected as coming from a captive specimen.

A second male bobcat from Pearsall, Frio County, Texas (No. 211912), had the right i ^{3} displaced next to the canine, leaving a diastema between i ^{2} and i ^{3}. The right c $_{1}$ and the i $_{3}$ next to it were displaced slightly forward, and the canine occluded into the diastema above. Search for some causative factor disclosed a 1-cm fragment of quill from a porcupine, *Erethizon dorsatum,* lying in the medial portion of the right orbit, partially overgrown by bone. A mouthful of such quills might well cause a young bobcat to chew on one side only or to otherwise alter his feeding habits so as to affect the tooth structure. As a sequel, a check of our files shows that the nearest records of porcupines are from Tascosa, Oldham County, 500 miles NNW, and from Alpine, Brewster County, 300 miles WNW of Pearsall, respectively. This may be indicative of the distance that a frightened young bobcat can travel.

Dental anomalies are known in many groups of mammals. They occur with fair frequency in members of the genus *Lynx.* Their causes are largely unknown, but it seems likely that at least some cases of supernumerary teeth are atavistic in nature, representing reversion to an ancestral condition. Thus, they may provide a clue to phylogenetic relationships. Genetic evidence would be helpful in further evaluating this possibility. Apparently these anomalies, interesting per se, are of no taxonomic significance among Recent mammals.

Summary

Anomalies relating to number and to position, size or shape of teeth are reported in 8 of 465 *Lynx canadensis* and in 37 of 1,983 *L. rufus* skulls examined. Such variations from the normal condition are probably mostly congenital in origin, but in some cases are due to trauma. They appear to be of no taxonomic significance.

Zusammenfassung

Es wird über Abnormitäten in bezug auf Zahl und Stellung, Größe und Form bei 8 unter 465 *Lynx canadensis*- und bei 37 unter 1983 *L. rufus*-Schädeln berichtet. Solches Abweichen vom Normalzustand ist wahrscheinlich meistens angeboren, in einigen Fällen aber auch traumatischen Ursprungs und scheint keine taxonomische Bedeutung zu haben.

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Die Steine im Robbenmagen

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In den Mägen von Angehörigen aller drei Robben-Familien (Odobaenidae, Otariidae, Phocidae), wahrscheinlich in denen aller Robbenarten, können sowohl in Freiheit als auch in Gefangenschaft Steine und andere Fremdkörper gefunden werden, deren Mengen und Abmessungen in beträchtlichem Maße wechseln. Immer wieder stößt man auf die Behauptung, die Steine würden absichtlich aufgenommen zu dem Zweck, daß sie die von den nichtkauenden Robben zumeist im Ganzen verschlungene Beute auf mechanischem Wege zerkleinern helfen müßten, ebenso wie die körnerfressenden Vögel zum Zerschroten ihrer Nahrung absichtlich Steine aufnehmen und für sich arbeiten lassen.

Nun hat der körnerfressende Vogel einen wenig dehnbaren, aber recht kräftigen Muskelmagen, in dem — unter Mithilfe aufgenommener Steinchen — die im Kropf vorgeweichte Nahrung zerschrotet wird. Der Robbenmagen dagegen ist sehr einfach, ist kaum mehr als eine Erweiterung des Oesophagus, die sich am Pförtnerende in den Darm umbiegt. Rein äußerlich erinnert er an einen Fischmagen; seine Längsachse verläuft in Richtung der Körperachse. Der leere Robbenmagen ist wie ein schlapper nasser Lappen bzw. Beutel. Er ist sehr dehnbar. Scheffer (1960) ließ den ausgetrennten Magen eines 8 Jahre alten Seebären, *Callorhinus ursinus* L., künstlich mit Wasser füllen (Abb. 1) und konnte dabei 39½ pounds (17,7 l) Wasser einlassen. Das Bruttogewicht des dadurch erheblich gedehnten Magens betrug 44 pounds (20 kg).

Havinga (1933) stellte fest, daß ein durch reichliche Nahrungsaufnahme ausgedehnter Seehunds-Magen, *Phoca vitulina* L., bei 5 cm Wasserdruck 7 l Wasser enthalten kann.

Es ist klar, daß ein derart weicher dehnbarer Magen nicht genug Widerstand leisten könnte, um mit Hilfe von Steinen Nahrung mechanisch zu zerkleinern. Die Wände weichen aus und werden sogar mechanisch geschädigt.