



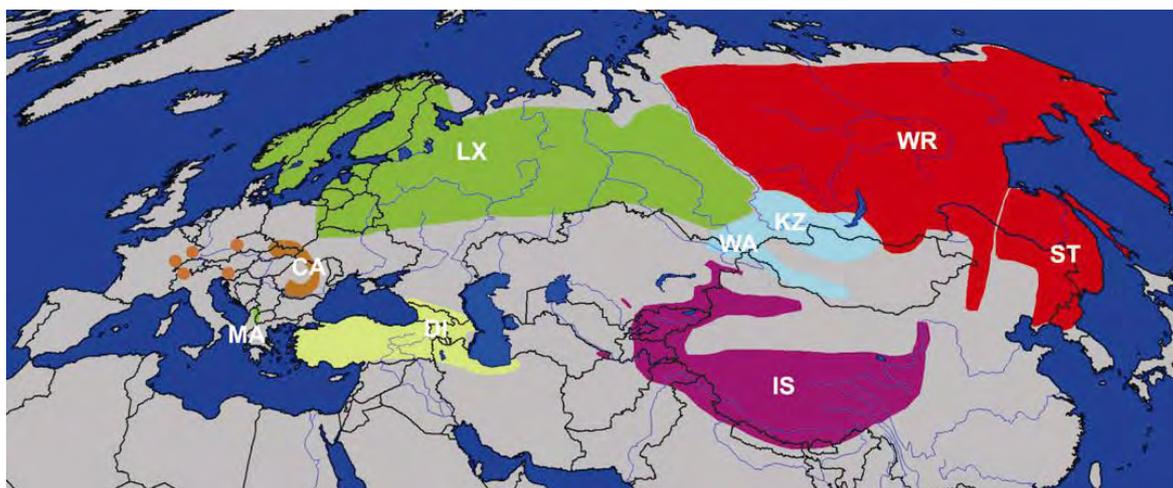
**Fig. 2.4.** Skull of an adult male lynx from the Swiss Alps. (© Ch. Breitenmoser-Würsten, KORA)

The snout is short, giving the skull a round and high shape (Fig. 2.4), granting a high biting force of the canines. The intermediate part of the skull between the facial part and the brain-case is very small, and the skull crests most often poorly developed. The mandible is short and massive with a wide ramus and strong processes. Lynx have 24 deciduous and 28 permanent teeth. The dental formula is:

$$I \frac{3}{3} C \frac{1}{1} P \frac{2}{2} M \frac{1}{1} = 28$$

## 2.2. Phylogenetic history and subspecies

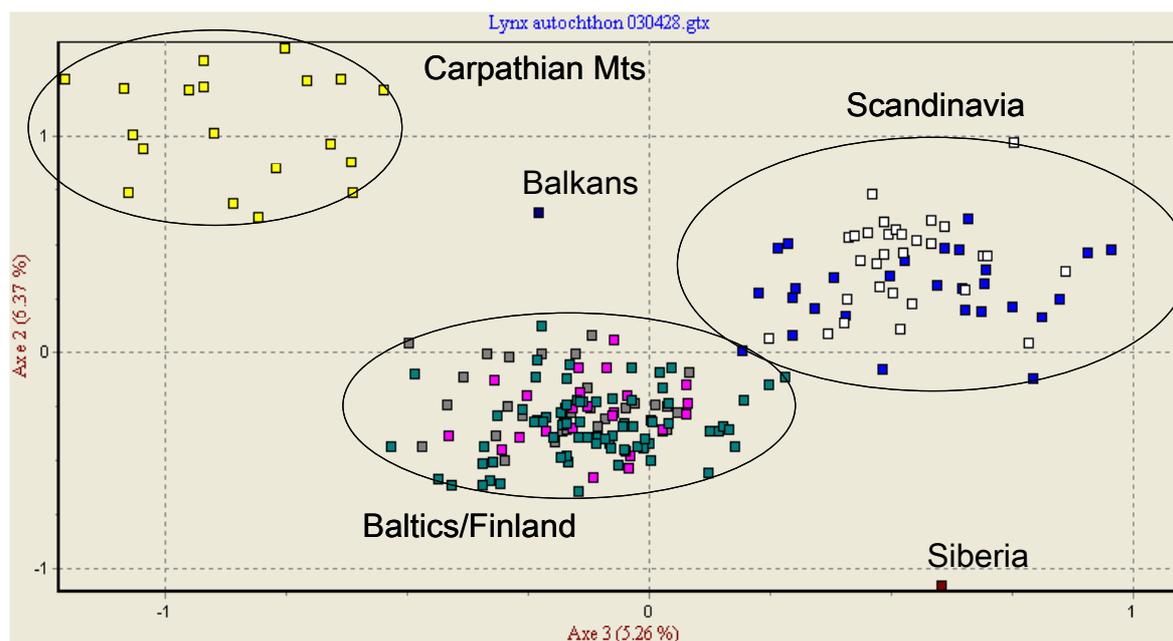
The lynx-like cats are united in one genus (*Lynx*) with four species (*lynx*, *pardinus*, *rufus*, and *canadensis*). They occur nowadays in the northern hemisphere only: *L. lynx* and *L. pardinus* in the Palearctic, *L. rufus* and *L. canadensis* in the Nearctic. *Lynx pardinus*, the Iberian lynx, was always restricted to the Iberian Peninsula south of the Pyrenees, whereas the entire remaining area in the Old World from the Atlantic coast in Europe to the Pacific Ocean in the Far East is generally regarded as the area of the Eurasian lynx (*Lynx lynx*). Over such an extended range, stretching not only from west to east, but also from south to north across several climatic zones and different habitats, a differentiation on the level of subspecies is to be expected, not only due to the geographic (and ecological) distance, but also as a consequence of the repeated isolation and merging of sub-areas during the Pleistocene glaciations. The lynx distribution during the last ice age and the subsequent recolonisation of Europe has to be considered for the reconstruction of the (pre)historic range as well as for the possible differentiation of subspecies. Morphologic differences and palaeontologic and zoo-geographic considerations (MIRIC 1974, MIRIC 1978, MATJUSCHKIN 1978, WERDELIN 1981, HEMMER 1993, HEMMER 2001, MATYUSHKIN & VAISFELD 2003) are today complemented with genetic findings (HELLBORG *et al.* 2002, BREITENMOSE-WÜRSTEN & OBEXER-RUFF 2003, RUE-NESS *et al.* 2003), but there is no final agreement on the classification of subspecies yet. From all these works, we compile what we believe to be at present the best possible interpretation of the distribution of recent subspecies in Europe (Fig. 2.5).



**Fig. 2.5.** Distribution of subspecies of the Eurasian lynx (*Lynx lynx*): LX: *lynx* (nominate form, northern Europe and western Siberia), CA: *carpathicus* (Carpathians), MA: *martinoi* (Balkan), DI: *dinniki* (Caucasus), IS: *isabellinus* (Central Asia), WA: *wardi* (Altai), KY: *kozlovi* (Sajan), WR: *wrangeli* (eastern Siberia), ST: *stroganovi* (Russian Far East). Brown dots: re-introduced populations in Europe (*carpathicus*). The area of *dinniki* shows the historic range; the present distribution is not known, but strongly reduced and scattered. The distribution of *isabellinus* is proximate. Recent genetic works suggest that there is a marked differentiation within the range of *lynx*. In Europe, the evolutionary history of the species is distorted by human-made fragmentation and bottlenecks.

Assuming that the lynx' ecology during the late Pleistocene was not completely different from the recent species (chapter 2.4), we can speculate that the recolonisation followed the expansion of forests and prey. Some regions

that we today intuitively regard as “good” lynx habitat were also so during the late Pleistocene, other areas however were not. The Alps, for instance, were entirely glaciated and no living space for lynx. This mountain range was likely recolonised from both opposite ends, and the now “homogenous” habitat complex is actually the suture of two isolated Late Pleistocene habitat patches, so called glacial refuges. In contrast, the Carpathians were a forest refuge during the last ice age (BURGA & PERRET 1998), and provided probably a better lynx habitat than the surrounding cold steppe plains. Parallel to the “natural” recolonisation, large scale human activities such as deforestation have had an impact on the distribution of large mammals in Europe for at least 5000 years. Human-caused extinction or near-extinction, genetic bottlenecks and recolonisation – whether natural or artificial – have altered not only the distribution, but also the genetic set-up of what may have been the original arrangement of subspecies. As an example, HEMMER (1993) proposes that lynx recolonised Scandinavia in the Holocene from the south (Denmark) and from the north (Finland). The genetic pattern of the recent lynx populations (Fig. 2.6) does not support Hemmer’s hypothesis. This is however no proof that Hemmer was wrong; the reduction of the lynx area and the subsequent recovery (JONSSON 1983) may have camouflaged phylogenetic differences within Scandinavia.



**Fig. 2.6.** Genetic differentiation of lynx in Europe (BREITENMOSER-WÜRSTEN & OBEXER-RUFF 2003). Preliminary genetic analyses confirm the subspecies status of the lynx from the Carpathians, depict a marked difference between the Scandinavian and the Finnish-Baltic populations, and indicate – with one specimen only – the special status of the Balkan population.

Considering all these aspects, we suggest to adopt the following subspecies of *Lynx lynx* in Europe for conservation purposes (Fig. 2.5): 1. Northern lynx (*L. l. lynx*), including the Fennoscandic, the Baltic and the Russian populations; 2. Carpathian lynx (*L. l. carpathicus*) in the Carpathian Mountains; and 3. Balkan lynx (*L. l. martinoi*), restricted to the south-western Balkan, mainly Albania and FYR Macedonia. Obviously, the extinct lynxes of the western Alps and the Pyrenees (referred to as *L. l. spelaeus*) were distinct. This form may have stretched from the Apennines (the place of origin) as far north-east as Scotland. HEMMER (2001) argued that the cave lynx was rather a species (*L. spelaeus*) than a subspecies, spreading from the Italian refuge after the last ice age and forming a distribution range between the Eurasian lynx (*L. lynx*) and the Iberian lynx (*L. pardinus*); but this hypothesis needs verification.

Lynx for the re-introductions in the Alps, the Vosges, the Dinaric, and the Bohemian-Bavarian Mountains were taken from the Carpathian population; other occurrences are of unknown origin or – as in the German Harz Mountains and the Kampinoski national park in Poland – a mixture of zoo animals of very diffuse origin (see chapter 2.3). From the preliminary genetic analysis (Fig. 2.6), the differentiation of the European lynx populations is obvious. As this differentiation is not only the result of human-made fragmentation of the area, but reflects the phylogenetic history and local adaptations, we recommend careful selection of animals or source populations for further re-introductions. Furthermore, crossbreeding of subspecies in European zoos should be avoided. Certain subspecies of lynx (e.g. the highly threatened Balkan lynx, *L. l. martinoi*, or the Caucasus lynx, *L. l. dinniki*) would be in need of a conservation-breeding programme. The present situation in European zoos, however, is marked by crossbreeding and inbreeding (chapter 2.3).