

The history of urban foxes in Aarhus and Copenhagen, Denmark

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Abstract: Literature testifies to the presence of red foxes (*Vulpes vulpes*) in Copenhagen as early as the time of the Slesvig War in 1848-1850, and they became numerous from the middle of the 1960s onwards. In Aarhus red foxes have only become numerous within the last 15 years. In both cities foxes seem to have colonized the cities at times when the main cause of death around the city border was not hunting, but when there were protected green areas established close to the city border and/or during periods when persecution by man was low.

Keywords: urban ecology, red fox, colonization, city.

Introduction

Urban red foxes (*Vulpes vulpes*) are well-known in British cities (e.g. Macdonald & Newdick 1982, Harris & Rayner 1986) and have been present in London since the 1930s (Teagle 1967). Initially this was thought to be a uniquely British phenomenon (Harris 1977, Macdonald & Newdick 1982). However, during the past 25-30 years foxes have been reported in several European cities and suburbs e.g. Paris, France (Brosset 1975), Stockholm, Sweden (Page 1981), Oslo, Norway (Christensen 1985) and Stuttgart, Germany (Gloor et al. 2001). Since 1985 foxes have become widespread in the cities of Switzerland e.g. Zurich and Geneva (Gloor et al. 2001). In Denmark foxes have been observed in several cities, and they have been studied in Aarhus and Copenhagen (Nielsen 1989, Nielsen 1990, Simonsen et al. 2003).

The invasion times of foxes in different European cities are not synchronous. As a result, there are several theories and hypotheses about how, why and when foxes colonize urban areas. Gloor et al. (2001) propose two main

hypothetical explanations for the presence of urban foxes: the population pressure hypothesis (PPH), and the urban island hypothesis (UIH). The PPH assumes these foxes to be intruders from adjacent rural areas, which invade human settlements because of high population density in rural areas. Hence the PPH assumes that the size of the urban fox population size is closely correlated to that of the fox population in adjacent rural areas, and as such does not expect any genetic isolation between the urban foxes and the population in the rural surroundings. Urban areas provide suboptimal habitats for foxes. The UIH postulates that urban foxes have adapted to specific urban conditions, such as a high density of human population, scavenging food items and finding special hiding places. It argues that foxes live in urban areas, not out of necessity due to lack of breeding space or food shortages in the surrounding areas, but because they find sufficient resources and conditions to breed and spread within human settlements. The UIH expects no correlation between fox populations in the urban and surrounding rural areas, and implies genetic isolation over time (Gloor. et al. 2001).

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This paper describes the history of foxes invading the cities of Copenhagen (1.8 million citizens) and Aarhus (293,000 citizens), and discuss this and its timing in relation to the two theories put forward by Gloor et al. (2001).

The history of urban foxes in Copenhagen

Literature testifies to the presence of foxes in Copenhagen already as early as the time of the Slesvig War in 1848-1850, where foxes denned in the embankments glacis of the ramparts of Copenhagen (Tauber 1878). According to Tauber (1878) the glacis were fertilized by refuses from the city and police and soldiers kept the ramparts under surveillance, both acts resulting in a rich mammal fauna. Foxes were also seen at the Marble Place in the centre of Copenhagen at that time (Tauber 1878). Tauber (1878) assumed that the men were then occupied with combat, and therefore had less time for hunting, so the fox population, together with other wildlife populations, increased noticeably both around and inside the city borders. After the war, when hunting was taken up again, the number of foxes outside the city decreased, but was maintained inside the ramparts (Tauber 1878). In 1860 foxes were so numerous in Frederiksberg Garden that they had almost undermined the Chinese Pavilion (Hvass 1940).

By the end of the 19th century foxes became rare within the city of Copenhagen, although they were still present (Tauber 1878). At the beginning of the 20th century foxes were present in the outskirts of Copenhagen, especially near waste deposits (Degerbøl 1930, Holten 1935, Hvass 1940). In two numbers of hunting magazines from 1953 foxes, seen in different residential areas of Copenhagen, are mentioned in short communications e.g. fox cubs playing at broad daylight by the road and foxes entering gardens to steel fowl in chicken runs (Anonymous 1953a, Anonymous 1953b). In the 1950s foxes are also known to have denned under a workmen's hut during the construction of the new Zoological

Museum of Copenhagen and under the steps of the School of Dentistry (B. Jensen, personal communication, zoology student in Copenhagen in 1950).

In 1963 Hvass wrote that foxes had become numerous and he presented several records of fox sightings in built-up areas where the foxes showed little or no reaction to human activity (Hvass 1963). The presence of foxes in the suburbs of Copenhagen is also mentioned in literature from the 1970s (Jensen 1972). From 1980 onwards the foxes of Copenhagen received increasing media attention, with articles about fearless foxes entering gardens and houses.

In 2005 local authorities received more than 300 complaints about foxes being a nuisance to people in the built-up area of Copenhagen, according to the Danish Forest and Nature Agency, Ministry of Environment. A study, carried out between 1997 and 1999, found genetic and morphometrical differentiation between the foxes from Copenhagen and those from the rest of Zealand (Simonsen et al. 2003).

The rise of urban foxes in the city of Aarhus

There are no records about the presence of foxes in the city of Aarhus before 1986. The first survey of foxes in the city of Aarhus was carried out between 1986 and 1988 (Nielsen 1989). The investigation was advertized through announcements in three local newspapers and the radio. In addition, the Office of City Gardeners, around 250 taxi drivers, and the Animal Rescue Corps were asked to report foxes on seen or killed by car accidents in the built-up area of Aarhus. During the two years of investigation, 20 records of fox sightings within the built-up area were obtained; with one further observation recorded in the summer of 1989. Most sightings were glimpses of foxes close to green areas at the edge of the city. Apart from dens found in green areas and along railway lines, only two dens were found in built-up areas, in undisturbed gardens. The woods south of the city, partly surrounded by human

dwelling and partly by rural areas, was searched for dens. The frequency of occupied dens was about twice as high in the wood surrounded by human dwellings than it was in the wood outside the city, suggesting either a higher fox population in the former woods, or a higher intensity of human disturbance, causing foxes to move more frequently between dens (Nielsen 1989).

An investigation of eating habits of the foxes in the public woods of Aarhus showed that there was a significant higher frequency of feather remains of passerine birds in the fox scats from the woodland next to the suburban environment, than in the woods surrounded by rural areas (Nielsen 1990). As many passerine bird species are known to occur in higher densities in gardens and city parks than in intensively managed rural habitats, foxes from the woods near the city borders were assumed to forage in residential areas at night (Nielsen 1990). This was in agreement with the sightings of foxes in the residential areas edging the public woods.

From the middle of the 1990s and onwards more cases of fearless foxes in Aarhus appeared in the media. In July 2005 the Natural History Museum of Aarhus asked, via one of the free local newspapers, people who had seen foxes in the built-up area of Aarhus, to contact them. This enquiry resulted in 28 reports of fox sightings within 14 days of the request and one in December 2005. Most sightings were in residential neighbourhoods and allotments, 25 were from 2005, two fox sightings from 2004 and one from 2003, and one approximately 10 years old. There were numerous reports of foxes that had entered gardens or had passed by people at close hand, without showing signs of fear. This time the sightings were from all parts of the city and not only restricted to residential areas close to the public woods, as they were during the 1986-1989 survey.

Discussion

Considering the efforts made to obtain records of fox sightings during the investigation in 1986-

1989, and the relatively few sightings obtained at that time, the higher levels of sightings reported during the short public survey in 2005, suggest that foxes became more numerous in Aarhus between the two surveys. As previously observed in British cities by e.g. Harris and Rayner (1986) many fox sightings in this investigation were from owner-occupied housing. However, the arrival of foxes in Aarhus and Copenhagen cannot be related to the development of the suburbs. Foxes invaded Copenhagen long before, and Aarhus a long time after the main development of the suburbs, which in both cities was between the 1950s and the 1970s.

The PPH may explain the invasion of foxes in Copenhagen during the middle of the 19th century, when the number of foxes increased during the Slesvig War. On the other hand the genetic and morphometric differences found between the foxes in Copenhagen and the foxes from the rest of Zealand, suggests that the foxes in Copenhagen may be considered as an isolated population and that there is a limited gene flow between foxes in rural and urban areas (Simonsen et al. 2003), this supporting the UIH. Also the situation in Aarhus, where foxes have become numerous in the built-up areas during a 10 year period when the fox population has otherwise decreased by 50-60% as a result of an epidemic of sarcoptic mange (according to game bag records made by the National Environmental Research Institute of Denmark) supports the UIH.

There is also divergence in the results of other studies in relation to the two hypothetical explanations for the presence of foxes in urban areas. The fact that the smallest home range sizes and the highest fox population densities are found in urban areas (Harris 1981, Macdonald & Newdick 1982), suggests that foxes live in urban areas because they find sufficient resources and conditions to breed and spread within human settlements, which supports the UIH. By contrast, Gloor et al. (2001) found a significant correlation between the number of foxes in the canton of Zürich and the city of Zürich, and suggest that foxes invaded the city during high population density in the rural areas. Wandeler et al. (2003)

found genetic differentiation between rural and urban fox populations in Zürich, but assumed that these urban populations were founded by a small number of individuals from adjacent rural areas, resulting in genetic drift. They expect that the currently observed levels of migration between urban and rural populations of Zürich will erode genetic differentiation over time.

The PPH and the UIH may not be completely contradictory. As earlier described by Harris (1986) foxes seem to colonize cities in two steps. According to Harris (1986), foxes colonizing British cities first established themselves in the suburban fringes and from there spread into the city centres. Harris (1986) explains how fox populations during the inter-war years were enclosed in rural enclaves by the ribbon-like development of the suburbs. As a result foxes were isolated and forced to live in close contact with man. As these patches were later developed, the foxes had to move into the surrounding suburban areas (Harris 1986).

Foxes are known to spread over large distances (Jensen 1973), but dispersing rural foxes may avoid settling in areas with high human activity, due to centuries of persecution. Although at least some urban areas turn out to be rich habitats with plenty of anthropogenic food, sufficient to feed a much higher number of foxes than currently present (Contesse et al. 2004), rural foxes may not enter the city unless they have a period to become habituated to human activity. This may occur in the suburban fringes as suggested by Harris (1986), in protected green areas with little or no hunting activity or in periods when persecution is low. During the period when fox sightings became numerous in the build-up area of Aarhus, the public woods close to the city border were significantly extended (from 1,019 ha in 1989 to 1,897 ha in 2005). These public woods act as recreational areas for the citizens of Aarhus and during the last 20 years very few foxes have been shot in these woods (Svend Warming, forest ranger, personal communication). A change in the behaviour of foxes in the surrounding areas of the city, toward less fearfulness to humans, may lead more foxes to discover and explore the

urban habitat. Once adapted to human activity foxes can settle and successfully spread in urban areas, independently of the fox population outside the city boundaries. Further investigations on this subject are needed.

Acknowledgements: I would like to thank Søren Toft, Birger Jensen, Karsten Hassellund and Vibeke Simonsen, and two anonymous reviewers for valuable comments on the manuscript and Joan Alexandersen Coke for correcting the English. Also many thanks to Tommy Asferg, National Environmental Research Institute of Denmark, for permission to use Danish game bag records of foxes and to Sven Norup Jakobsen, of the Danish Forest and Nature Agency, Ministry of Environment for information's on foxes in Copenhagen.

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Samenvatting

De historie van stadsvossen in Aarhus en Kopenhagen, Denemarken

Het opduiken en voorkomen van de 'stadsvos' in de Deense steden Aarhus en Kopenhagen vertoont parallellen maar ook verschillen met andere Europese steden. Op basis van literatuur blijken vossen (*Vulpes vulpes*) reeds aanwezig in Kopenhagen ten tijde van de Slesvig oorlog in 1848-1850, en namen hun aantallen er toe vanaf het midden van de jaren 1960 tot op heden. In Aarhus werd de vos pas talrijk sinds de laatste 15 jaar. In beide gevallen lijken vossen de stad te zijn binnengedrongen in periodes dat de belangrijkste doodsoorzaak in de onmiddellijke omgeving van de stad niet de jacht was. Meer bepaald werden in die periodes rustige groene zones aangelegd aansluitend bij de stadsgrenzen, terwijl actieve vervolging door de mens gering was.

Received: 7 July 2007

Accepted: 19 December 2007