

Historical presence of the Eurasian beaver (*Castor fiber*) in the IJssel River (the Netherlands) in 1450-1500

Sander Govaerts

Flemish Research Council, Department of History, Ghent University, Sint-Pietersnieuwstraat 35, 9000 Gent, Belgium, e-mail: sander.govaerts@ugent.be

Abstract: This article studies the presence of the Eurasian beaver (*Castor fiber*) in the IJssel River (the Netherlands) in the second half of the fifteenth century on the basis of preserved financial records. It argues that the beaver may have become functionally extinct in the Netherlands as early as 1500, several centuries before the last individual was reportedly killed (in 1826). The study also demonstrates the value of using medieval administrative sources to reconstruct the historical range of mammals in Western Europe. At least 153 beavers were presented to the city councils of Deventer and Zutphen in 1454-1489 in order to receive a financial reward. The species was hunted for multiple reasons, among which the prevention of economic damage was the most important. The introduction of a bounty system to capture beavers was probably a deliberate attempt to exterminate the animal. The presence of large numbers of beavers in the fifteenth-century Netherlands is remarkable, because the species may have become very rare or extinct in most of the Low Countries by 1400. Its possible reappearance and temporary recolonisation of large stretches of the IJssel River could be interpreted in the context of environmental changes. The digging of a new canal, which connected the city of Deventer with its German hinterland, may have created a new corridor that facilitated beaver migration from refugia in north-western Germany. The volume of water transported by the IJssel towards the Zuiderzee also declined significantly during the fifteenth century, which may have limited the species' dispersal options and exacerbated conflicts with humans.

Keywords: bounties, Middle Ages, Deventer, Zutphen, ecology, dispersion, migration, hunting, nuisance animal, biogeography.

Introduction

As a result of new European protection laws and effective reintroduction efforts the Eurasian beaver (*Castor fiber*) has rapidly recolonized most of Western Europe during the last three decades (Halley et al. 2021). In the Netherlands, for example, in 1988-1991 42 animals from the Elbe were released in the Biesbosch National Park, followed by reintroductions in the Gelderse Poort (1994) and the Leudal

(2002). By 2003 there were 200-250 animals in the country, and in 2019 the population had grown to 2000-3500 animals (Sluiter 2003, Dijkstra 2019).

Knowledge about beavers' historical presence in Europe on the other hand is rather limited. It is well established that the European population had become fragmented into several distinct populations by the early twentieth century (Veron 1992, Halley et al. 2012, Horn 2014). The exact date when the species became extinct in a specific country is more controversial. For example, British scholars traditionally assumed that the beaver became extinct

relatively early, around 1200 or 1300 AD in Wales and Southern England, and around 1600 in Scotland (Kitchener & Conroy 1997, Raye 2014). The archaeologist Bryony Coles challenged this view in 2006, by arguing that the beaver survived in Britain until at least the eighteenth century (Coles 2006, 2010). This 'late' extinction date has not been universally accepted. Coles' use of historical sources in particular has drawn criticism (Raye 2014).

Another issue is that many scientific studies simply accept extinction dates given in older literature, without critically analysing the historical sources on which these claims are based. For Belgium two distinct extinction dates are put forward: the fifteenth century (Libois 1982, Veron 1992), or the year 1848 (Halley et al. 2012, Rosell & Campbell-Palmer 2022). No beaver was seen in Belgium in 1848, it is simply the year Julien Deby's book on the natural history of Belgium was published. He mentions the beaver, but also notes that it became extinct a long time ago (Deby 1848). The idea that beavers were still present in late medieval Belgium is also based on Deby's book, and more specifically on his claim that the village of Beverlo got its name from a beaver population that lived in that area until the mid-fifteenth century (Deby 1848). However, this is a misinterpretation of toponymic evidence. The oldest reference to Beverlo dates back to the twelfth century, not the fifteenth (Gysseling 1960). If this name refers to actual beavers, which is far from certain, it can only be used as evidence for their presence during the eleventh or twelfth century.

Even if the date of extinction actually corresponds to the last recorded killing of a beaver, focussing on a single year can be misleading. The species may after all have been functionally extinct for a long time, perhaps even for centuries. Functional extinction occurs when *'a reduction in its population size, caused by an increase in its mortality rate or decrease in its fecundity, leads to the extinction of another species in the ecosystem'* (Säterberg et al. 2013). In other words, the animal has become so rare

that it can no longer fulfil its ecological role (Säterberg et al. 2013, Sellman et al. 2016).

In the Netherlands the year 1826 is commonly accepted as the date the last beaver in the Netherlands was killed, more specifically in Zalk between Kampen and Zwolle. Yet beavers had been very rare in the country for almost a century, with killings being recorded in Gorinchem in 1742, Middagten (Rheden) in 1757, Moerdijk and Nieuwland in 1759, Hedel in 1770, the River Merwede in 1791, Epse in 1799, Doesburg in 1801, Gorinchem in 1819 and Zalk in 1826 (Martinet 1778, Pasteur 1796, Bonn 1806, van Wijngaarden 1966, Canters & Hoekstra 2019). The last record of a beaver family with offspring - two adults and six kits - comes from 1742 (Martinet 1778). It is also noteworthy that all beaver sightings occurred in two geographical areas: the Rhine-Meuse estuary (including the Biesbosch) and the IJssel River (Canters & Hoekstra 2019).

Current knowledge about the presence of beavers in Europe before 1900 is mostly based on early zoological studies, hunting manuals, travel accounts, and legislation. Such sources are relatively reliable for one specific geographical area or country, namely the one the author resided in or visited, but are of limited value when it comes to a European level.

Archaeozoological research can also provide proof for the presence of beaver populations in the past (Duval et al. 2011, Liarsou 2013, Çakırlar et al. 2019). Some caution is advised, as people may have transported body parts of beavers over large distances because of their economic or cultural value. A piece of wood with gnawing marks of a beaver offers more solid evidence (Manning et al. 2014).

It is clear that current knowledge of the beaver's gradual extinction in most of Europe during historical times is rather limited. In order to gain a better understanding of the geographical distribution and population dynamics of the Eurasian beaver in the past we need to consider the full range of available historical sources. Administrative documents, such as financial accounts, refer to the killing of

individual animals and often mention specific locations. In this way they can complement the data provided by other historical sources and archaeozoological research.

The advantage of using such administrative sources is that the information obtained allows us to extent our historical inquiries to the Middle Ages. Medieval encyclopaedias, including Albertus Magnus' famous books on animals, are of limited use for biogeographical studies because they mainly rely on earlier Greek or Roman works rather than directly on observation (Hossfeld 1983).

However, only a very small part of medieval financial accounts provides substantial data on wild animals. These documents provide a systematic overview of an institution's or official's income and expenses during a specific year. They only mention animals if these were treated as commodities or gifts. So far, references to beavers in late medieval administration from the Netherlands have only been found in the accounts of the cities of Deventer and Zutphen, dating to the second half of the fifteenth century. Nineteenth-century naturalists already knew that these two cities paid bounties for beavers in the Late Middle Ages, but did not analyse their accounts in a systematic way (Molhuysen 1840, Groneman 1882).

The objective of this article is therefore to study the presence of beavers in the IJssel River (the Netherlands) in 1450-1500 by using preserved financial accounts from the cities of Deventer and of Zutphen. It will use the data gathered from these sources to reconstruct the species' historical dispersal patterns and ecology.

Materials and Methods

Study area

The River IJssel is a branch of the Rhine (figure 1), which flowed into the Zuiderzee until the twentieth century, and is now connected to the IJsselmeer. The cities of Deventer and

Zutphen are located halfway the IJssel River, about fifteen kilometres from each other. Their financial accounts are a unique source for an historical analysis of beaver presence in the IJssel basin because both city councils paid financial rewards (bounties) for the catching of these animals.

Used sources

The study was conducted by systematically processing the financial administration (yearly accounts) of the cities of Deventer and Zutphen in 1448-1500. The accounts of Deventer for the year 1459-1460, and those of Zutphen for the years 1471-1472, 1473-1475, 1476-1477, and 1483-1489 have not been preserved. The accounts of both cities have been published for the years 1337-1447 and 1364-1446 respectively, but these do not mention beavers (van Doorninck et al. 1885-1914, Alberts 1959, de Meyer 1968-1985, Wartena 1977).

Medieval financial accounts are typically divided into different subheadings. In the great majority of cases payments for beavers were included in a rest category, called '*alrehande saken*' in Deventer and '*gemeyn onraed*' in Zutphen. These listed divers small payments not included in the main subheadings (construction works, wages for officials, etc.). In Deventer payments for caught beavers were sometimes also included under the subheading dedicated to payments for messengers. This may have been the case because messengers from nearby cities or noblemen regularly presented wild animals, such as roe deer (*Capreolus capreolus*) and red deer (*Cervus elaphus*), to the city council as gifts.

Deventer and Zutphen both used the Julian calender in the fifteenth century, and identified individual days by referring to the liturgical year. The account of Zutphen for the year 1482-1483 specifies, for example, that a beaver was presented to the city council on the 'Monday before Pentecost' (*des mandags voir pinxten*). In order to correctly identify the months



Figure 1. The IJssel River in the second half of the fifteenth century (© Hans Blomme, Ghent University). The map is based on the following datasets:

<https://hdl.handle.net/10622/HPIC74>

<https://data.overheid.nl/dataset/11592-paleogeografische-kaarten---atlas-van-nederland-in-het-holoceen>

beavers were captured, the dates mentioned in accounts were first calculated by using the Julian calendar, before converting them to their corresponding dates in the Gregorian calendar.

References to beavers in the accounts of Deventer and Zutphen were combined with a study of beaver bones found during archaeological research in the Netherlands (Database Boneinfo). An overview of this data is pre-

sented here. A literature study was conducted for use in the discussion.

Results

Beavers in the financial accounts of Deventer and of Zutphen

According to the financial accounts studied

at least 153 beavers were presented to the city councils of Deventer and Zutphen from 1454 to 1489 (figure 2a). No beavers are recorded in the accounts covering the years 1490-1500. The actual number of bounties paid before 1490 was probably higher, given that several accounts have not been preserved.

There are also two references to non-lethal actions, both in Deventer: in 1449 Henrick '*den wruchter*' (an official tasked with managing the city's trees and wood supply) put thorns around willow shoots to protect them against beavers, and in 1471 the city paid two labourers to demolish four beaver dams. They needed two days to complete this task.

Of the 153 aforementioned animals, 79 were caught in Deventer and 74 in Zutphen, 36 were described as 'small' or 'young' beaver (figure 2b), 101 as 'beaver' and 16 as 'large beaver' (figure 2c). Deventer paid bounties for beavers from 1454 to 1480 and Zutphen from 1464 to 1489. The highest numbers of beavers were caught in Deventer in the year 1472 (13) and in Zutphen in 1477 (14).

Exact dates are indicated only occasionally. Of the 56 instances where the approximate date of capture of one or more beavers is known 33 (or 58 %) concern the months March-June (figure 3).

In Deventer the location where one or more beavers were caught is mentioned seven times. Most (four) refer to common lands to the southeast of the city, between two river arms of the IJssel (the 'old' and 'new' IJssel). These were known collectively as the 'Mars' or 'Marsch' (figure 4). Note that the 'old' IJssel no longer existed in the late sixteenth century, when Joannes van Doetecum made this map. He did draw its former riverbed, however.

The Marsch was largely uninhabited in the fifteenth century, but it formed an essential part of the city's rural hinterland, used for the pasture of livestock, stone production (brick kilns), and wood supply (Kronenberg 1902). On one occasion, dating to 1469, the accounts simply note that a beaver was caught on the 'Marsch', in the other three instances (dat-

ing to 1468 and 1469) the accounts refer to the 'wrucht' or 'wrocht' specifically. These were parts of the Marsch, located near the 'old' and 'new' IJssel, which were closed off by a ditch or fence to protect the trees growing there against livestock (Kronenberg 1902). The four beaver dams demolished in 1471 were also located here.

Beavers were also captured in three other locations. In 1467 one beaver was caught in the 'Worp', the name given to a strip of land in the IJssel floodplain, located on the left riverbank opposite the city centre. This area was originally connected to the right riverbank by a ferry, a wooden bridge was only built in 1482 (Poelhekke 1870). In 1469 another beaver was caught on the 'stad weerde', an island in the IJssel, to the southeast of Deventer (figure 4). One year later three young beavers were taken on the border of the city's territory: in an earthen embankment with hedges planted on top (a *landweer*) that served as its outer defence (Brokamp 2015).

In Zutphen the location of the capture is mentioned twelve times. Most beavers (seven) were caught in the floodplain of the River IJssel, to the northwest of the city (the '*stadsweerd*'). Three others were taken in the IJssel floodplain (*weerd*) without specifying the exact location. The final two were captured near a dike, and near brushwood located on higher ground (*bij dat veerste horst*). The landscape around Zutphen was similar to that around Deventer, and provided the city with access to pasture, hay, clay and wood. At least one basket weaver, one carpenter, and a pair of hunters were rewarded for presenting beavers to the city council. Given that fishermen also received bounties in 1466, 1468 and 1469 it is likely that some animals were caught in the River IJssel itself.

Archaeological finds of beavers in the Netherlands

Remains of beavers are rarely found in archaeological contexts dating to the High or Late

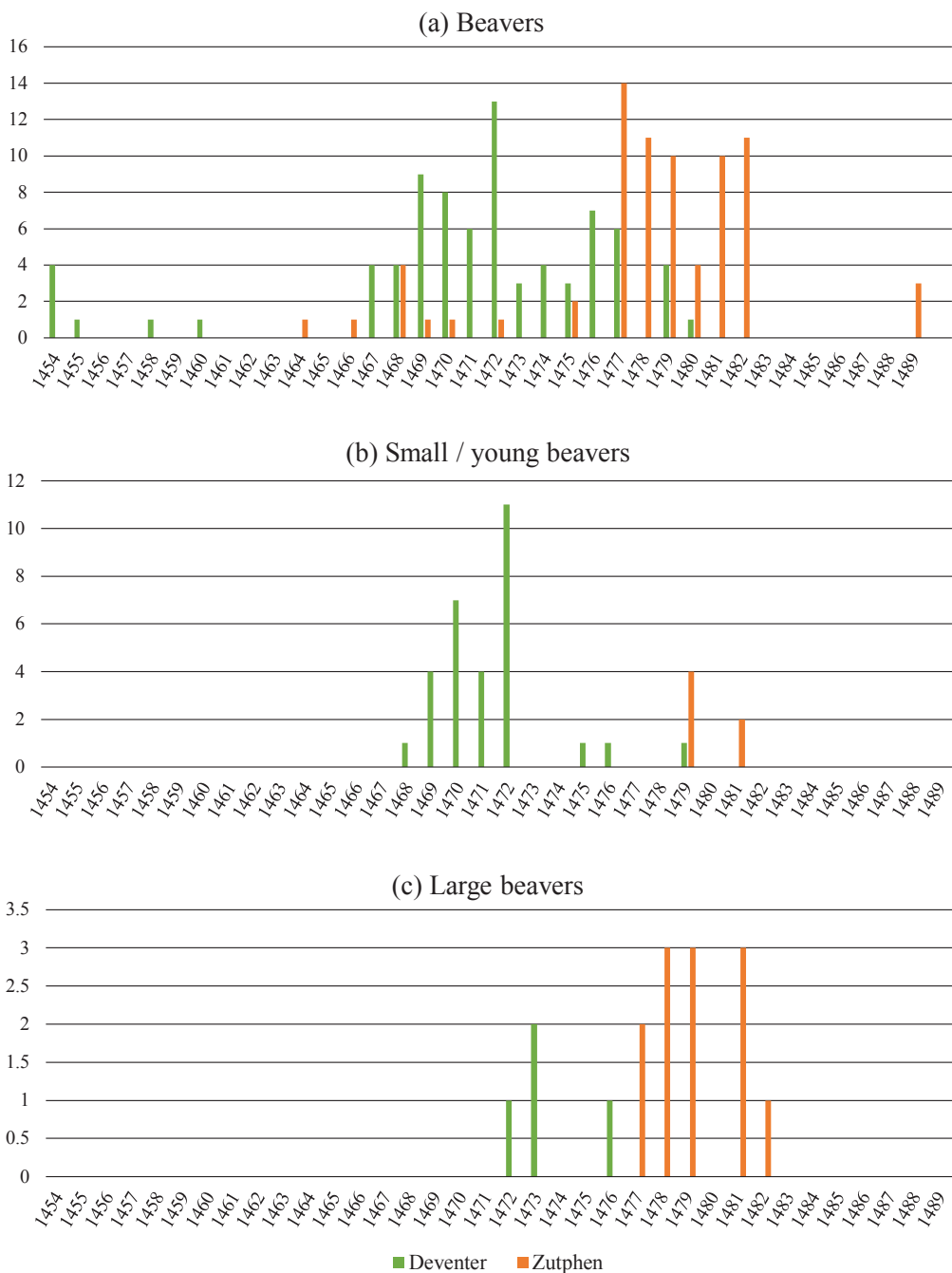


Figure 2. Bounties paid for captured beavers (a), 'small' and 'young' beavers (b) or 'large' beavers (c) in Deventer and Zutphen from 1454 to 1490.

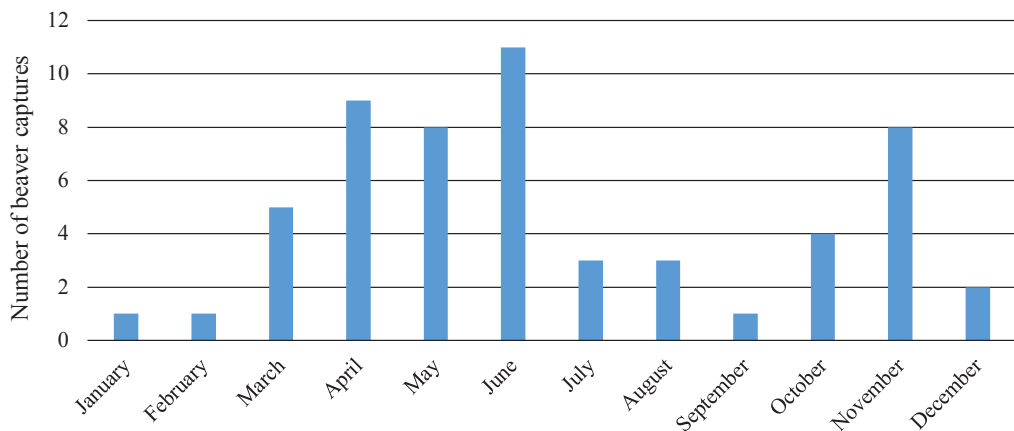


Figure 3. Distribution of beaver captures across the year in Deventer and Zutphen from 1454 to 1490.

Middle Ages (1000-1500). In the Netherlands beaver bones deposited after the year one thousand have been found only four times: one bone fragment in Borsele (Zeeland) dating to 1050-1499, three bones in Houten-Loerik (Utrecht) dating to 900-1200, five bone fragments in Houten (Utrecht) deposited before 1250 and two deposited in 1350-1450 (Hazenberg 2000, Hielkema 2003, Dijkstra & van Benthem 2004). In Belgium, four beaver bones were recovered from the fortress of Franchimont in the Ardennes. These all come from the oldest archaeological layers, dating to the eleventh and twelfth centuries. None were found among the numerous animal bones deposited in the late fifteenth and early sixteenth century (Gautier et al. 2005).

Discussion

Several scholars have analysed motivations for hunting beavers during historical times (Delort 1978, Dieberger 2003, Duval et al. 2011). The economic value of their fur, meat (specifically the tail and hind legs), and castoreum, the widespread belief that they eat fish, and the damage they cause to woody plants and human infrastructure (dam building, burrowing) constituted the most important reasons for killing them. Damage to

woody plants (willow shoots), and dam building are explicitly mentioned in the financial accounts of Deventer. Damage done to river dikes may have been an important consideration as well, but is not stated explicitly.

It is uncertain whether the species was hunted because of other reasons. In 1470 a furrier presented three young beavers to the city council of Deventer. He had captured them in the *landweer*. It is possible that this man also caught the parent animals, but did not bring them in because their fur was worth more as a trade object than the bounty. The financial accounts provide no explicit evidence that beavers were eaten by members of the city council or presented to noblemen living nearby as gifts. On only one occasion, in 1455, a financial account specifies that a man presented a beaver tail to the city council (Deventer).

As mentioned before, fishermen caught beavers on several occasions in Zutphen, but it is unclear whether they believed that the animal ate fish. Both Deventer and Zutphen paid only one bounty for the killing of an otter (*Lutra lutra*), in 1488 and 1473 respectively. This makes it unlikely that preservation of fish stocks was an important consideration. In fact, existing economic incentives to hunt beavers were probably considered to be not strong enough; otherwise the city councils

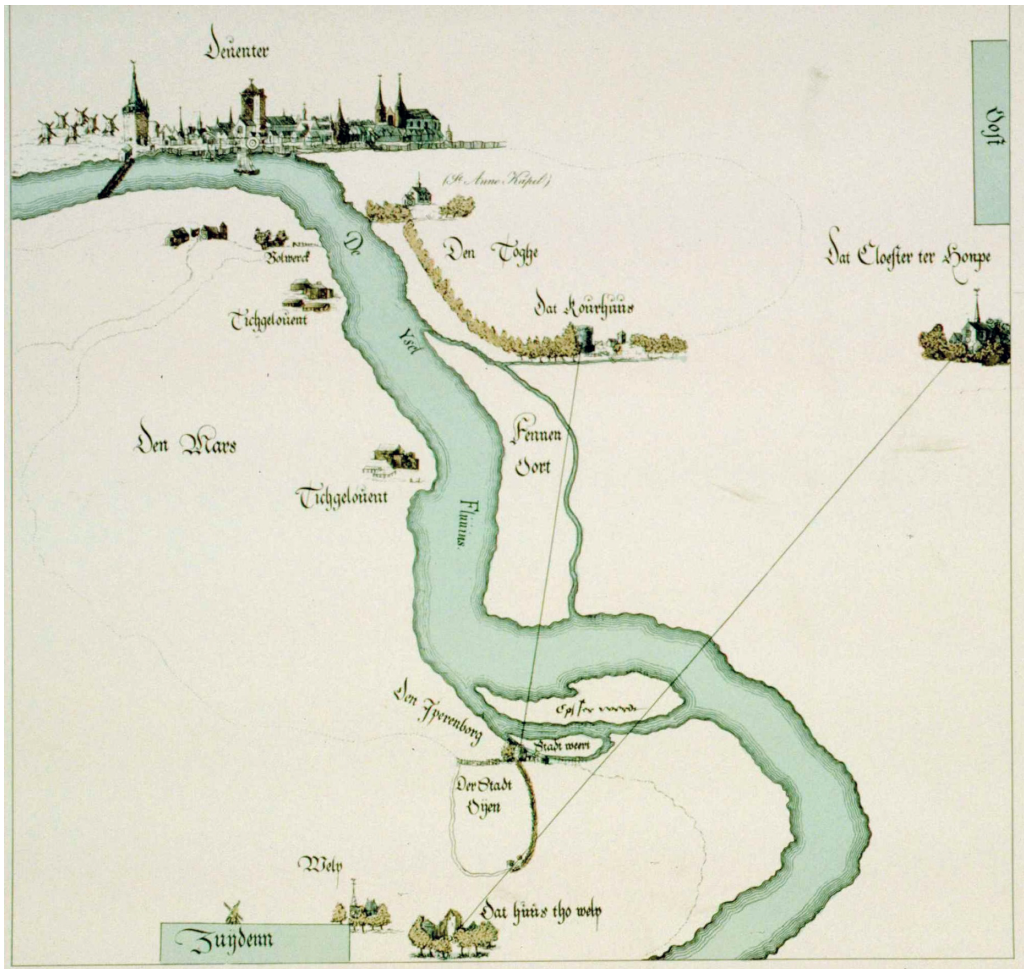


Figure 4. Map of the IJssel River and the city of Deventer in 1567 by Joannes van Doetecum in 1567. The original is preserved in Historisch Museum Deventer.

would not have deemed it necessary to pay a financial reward for each captured individual. Deventer paid one guilder as bounty for a beaver and Zutphen one pound. Both bounties are the equivalent of seven to fourteen working days' wages for a skilled labourer.

During the second half of the fifteenth century Deventer and Zutphen probably perceived the presence of beavers as a problem. The absence of any record of the species in the published financial accounts of both cities from the fourteenth and early fifteenth century could thus be taken as an indication that

the beaver was either absent or very rare in the upper and middle part of the IJssel basin in the decades before 1449 (the first mention of beavers in Deventer). It is of course possible that the cities simply did not pay bounties for its capture. However, this leaves open the question why they suddenly started to do so in the second half of the fifteenth century. It also does not explain why so few beavers were captured in the first years after the bounty system was first introduced.

The fact that beavers are mentioned in the accounts in Deventer for more than a decade

(from 1449 onwards) before one was caught in Zutphen (in 1464) rather suggests a gradual southward dispersal along the River IJssel. From 1454 to 1466 only seven beavers were reportedly killed in Deventer and two in Zutphen. Recent studies on reintroduced beaver populations also attest to a slow initial expansion, followed by a more rapid increase once the population has established itself (Bluzma 2003, Rosell & Campbell-Palmer 2022). Migrating beavers tend to occupy the most suitable habitats first which can result in irregular dispersal patterns with considerable distances between individual territories (Fustec et al. 2001). In this specific case, high hunting pressures may have been at least partially responsible for the slow population expansion.

The terminology employed in the financial accounts provides further evidence for a gradual expansion upstream along the IJssel, from north to south. Small and young beavers, possibly referring to kits, are mentioned for the first time in Deventer in 1468, and in Zutphen in 1479. The time lag between the first mention of a beaver, and the first mention of a kit, indicates that it took around 19 and 15 years before beavers actually reproduced near the respective cities. It is also revealing that 'large beavers' are only mentioned near Deventer and Zutphen from 1472 and 1477 onwards. These were probably fully grown adult beavers. If citizens typically encountered yearlings or subadult beavers searching for a territory of their own, they may very well have perceived a fully-grown beaver as 'large'.

Still, we should not rely too much on the distinction between 'beavers' and 'large beavers', for the clerks of Deventer seem to have been less consistent in making such distinctions. In Zutphen twelve 'large beavers' are recorded as opposed to only four in Deventer. Both Deventer and Zutphen paid the same bounty for a 'beaver' and a 'large beaver' (one *guilder* and one pound respectively), which means that the distinction between the two kinds may not have been considered essential from an administrative point of view. 'Young'

and 'small' beavers were valued as one half or one third of a 'beaver' or a 'large beaver'.

The date of the capture, when known, further supports the hypothesis that most beavers captured near Deventer and Zutphen were yearlings or subadult animals trying to establish a territory of their own. When the exact date of the capture is mentioned, it is mostly (in 33 of 56 instances – ca 58 %) during the months March-June (figure 3). Several studies have noted that beavers leave their parental territory shortly before the arrival of a new litter (Hartman 1997, Sun et al. 2000, McNew & Woolf 2005, Mayer et al. 2017). Beavers typically give birth in the period mid-April to mid-August. The dispersal rate is mainly determined by population density. Beavers disperse at a younger age when the population density is low (Hartman 1997, Sun et al. 2000, McNew & Woolf 2005, Mayer et al. 2017).

High mortality due to human persecution probably explains the long time span between the first mention of a beaver in the accounts and the first mention of a kit (more than a decade in both Deventer and Zutphen). It may have taken several years before a beaver family was not only able to establish a territory near the city, but also reproduce successfully. Fully-grown adult beavers that survived their first encounters with humans could have had significant advantage over their competitors, and occupied the most optimal territories (Nimje et al. 2021).

The landscape around the cities of Deventer and Zutphen after all provided a very suitable habitat for beavers. The water level in the river IJssel would certainly have been higher than the minimal water level (0.6-1.0 m) required for the establishment of a territory (Rosell & Campbell-Palmer 2022) and there was plenty of food (herbaceous plants, willows and ash trees) (Hartman 1996). Both cities used lands near the river for the pasture of livestock, mainly cattle, and planted large numbers of willows and ash trees to secure their wood supply. The brick kilns located next to the

river IJssel in particular needed access to large quantities of firewood. The fact that human presence in these areas was relatively limited may initially have been to beavers' advantage. Adult beavers with young show risk-avoiding behaviour when selecting habitats (Steyaert et al. 2015).

It is also noteworthy that most sites where beavers were caught were located to the southeast of Deventer's city centre and to the northwest of Zutphen's. In other words: many beaver territories, if not all, were probably situated in between the two cities. This part of the River IJssel may have been the most suitable for beavers because of several reasons. The first is political. Deventer was part of the Bishopric of Utrecht until it became a free imperial city in 1495, while Zutphen owned allegiance to the duke of Guelders. This made the lands in between the two cities a frontier zone, which was generally more sparsely populated by humans than a political 'core' area.

The second reason is connected to the River IJssel itself. The IJssel is a relatively young river that only developed from the ninth century onwards because of the establishment of a connection between its precursor and the Rhine (Makaske et al. 2008). In the fifteenth century the IJssel split into two river arms after passing Zutphen, which reconnected again near Deventer. The fact that these river arms were known as the 'old' and 'new' IJssel suggests that the river had started carving out a new riverbed. In 1395 larger seagoing ships already found it difficult to navigate the 'old' IJssel. During the fifteenth century the volume of water transported by both river arms declined further as a result of the so-called Elisabeth floods (1421 and 1424). In their aftermath, a new estuary emerged, the Biesbosch, which increased the volume of water flowing into the North Sea through the main river arms of the Rhine. By 1485 navigation difficulties had become so critical that cities located on the river IJssel organised a conference to discuss these problems. At some point between 1456 and 1485 the 'old' IJssel had

become little more than a brook, and seagoing ships, such as cogs, could no longer pass through the 'new' IJssel either (van Doorninck 1839, Jordens 1852, Weststrate 2008).

This gradual lowering of the water level may have limited beavers' dispersal options, and simultaneously lowered human tolerance for their engineering abilities. It could also have contributed significantly to Deventer's and Zutphen's decision to pay bounties for the capture of beavers. The drying up of the riverbed of the 'old' IJssel may also explain the presence of four beaver dams in the 'wrucht' in 1471. The financial account of Deventer refers to the destruction of four dams 'that were still left', which suggests that there used to be more. Perhaps these four were the largest and most difficult to demolish.

Environmental changes are probably the main reason why beavers appear in the financial records of Deventer and Zutphen around the mid-fifteenth century. It is unlikely that beavers were common in the IJssel in the decades immediately preceding the introduction of bounties to catch them. As mentioned before, remains of beavers are rarely found in the Netherlands among animal bones deposited after the year one thousand. So far, they have been found once in Zeeland and three times in Utrecht. This could be taken as evidence that the animal was uncommon in the Low Countries during the late Middle Ages.

Historical sources confirm this impression. In the early thirteenth century the encyclopaedist Thomas of Cantimpré questioned the common belief that beavers castrate themselves to escape human hunters seeking castoreum by stating that people in Poland knew that beavers had their testicles inside their body (Boese 1973). The reference to Polish beavers may indicate that he did not know anyone in his own region (Brabant and northern France) who had seen beavers. Jacob van Maerlant, who made a Dutch translation of Cantimpré's book on animals while living on the island of Voorne in Holland, did not add any new information on the beaver (Verwijs 1878).

Surviving financial accounts demonstrate that Countess Mahaut of Artois kept a beaver in her menagerie in 1303-1306 (Delmaire 1977, Dowling 2012), and that Margaret of Flanders, Duchess of Burgundy, received one as gift from Champagne in 1376 (Delort 1978). The fact that a beaver was considered a worthy addition to a menagerie, which typically includes exotic animals, implies that very few people in northern France had seen it.

Even if beavers were rare or extinct in the Scheldt basin by 1300, substantial populations could have survived in the nearby Meuse and Rhine basins. Financial records of William II, Duke of Jülich and Guelders, show that he bought 553 beaver pelts in the cities of Utrecht and Arnhem in 1388 as preparation for his crusade to Prussia (van Hasselt 1807). The great majority, if not all, probably came from the Baltic (Delort 1978), but it is possible that some were locally procured. In 1482 a merchant from Bastogne (Luxemburg, Wallonia) agreed to supply furs to a colleague in Mons (Hainaut, Wallonia) at fixed prices (Slootmans 1952). The inclusion of beaver fur on this list suggests that beavers were still present in the Ardennes and Eifel in the late fifteenth century. However, given that beaver fur was the most expensive item on the list, being valued at the same rate as Eurasian lynx (*Lynx lynx*) fur, the species was probably not very common.

Archaeological and historical sources both suggest that beaver populations in northern France, Belgium, and the Netherlands declined significantly during the early Middle Ages, more specifically during the reign of the Carolingian dynasty (eighth-ninth centuries). Beaver bones are far more numerous in Dutch and French archaeological contexts from the early Middle Ages than after the year one thousand (Duval et al. 2011, Çakırlar et al. 2019). A palace ordinance written in 882, and supposedly based on the organisation of the Carolingian court under Charlemagne, also mentions beaver catchers (*beverarii*) who probably had to supply the court with beaver fur (Prou 1884).

It is possible that the IJssel basin, or the lands to the east of the Zuiderzee more generally, still provided a refugium for beavers. Emperor Otto I allowed the bishop of Utrecht to hunt large game, such as Eurasian brown bears (*Ursos arctos arctos*) and elk (*Alces alces*), in his hunting reserve near Vollenhoven according to a charter from 944, a privilege confirmed twice by his successors in the early eleventh century (Sickel 1879). If bears and elk survived in this area until at least the tenth century, it is likely that beavers did as well. However, this does not prove their continued presence into the 1400s. Very few administrative sources of this area have been preserved, which makes it very difficult to prove either beavers' presence or absence during the fifteenth century.

What these sources do suggest is that the arrival and subsequent spread of beavers in the IJssel River from 1449 onwards may have constituted a major recolonisation attempt, a population expansion that is particularly remarkable considering that beavers were probably more or less exterminated in most of the Low Countries around that time.

The question now remains why the southward dispersal into areas with a relatively strong human presence (near two city centres) occurred at all. The most likely explanation for this migration and population growth are changed environmental circumstances (Bowler & Benton 2005). A first possibility is the creation of a corridor that enabled migrating beavers to spread to an area that had previously been cut off by a barrier. In 1399-1404 the city of Deventer dug a canal called the Schipbeek, which connected the city to Diepenheim and its German hinterland. Although the canal was more or less complete around 1404, construction work continued until 1422. The creation of this canal may have allowed beavers from German populations to spread to the Netherlands. It could explain why beavers were recorded first in Deventer and later in Zutphen. Another, not necessarily mutually exclusive, explanation is that the

southward migration of beavers was related to the aforementioned changes in the water level of the river IJssel after the so-called Elisabeth floods (1421 and 1424).

Beavers probably experienced and responded to changes in the water level decades before political elites in the region finally took action (in 1485). This would have been particularly so given that sedimentation builds up faster near beaver dams because they slow down water-courses (Rosell & Campbell-Palmer 2022). These changes may have had only a limited effect on beaver families established in the most optimal territories. Subadult beavers on the other hand could have been confronted by a decreasing number of dispersal options as the carrying capacity of the IJssel basin declined. It is also well established that beavers disperse more frequently when the population density is low (Hartman 1997, Sun et al. 2000, Mayer et al. 2017).

Finally, it is possible that beavers coming from northern Germany or a refugium near the Zuiderzee were joined by conspecifics dispersing from other, more southern, populations. Beavers remained after all present near Zutphen until at least the year 1487, while they are no longer mentioned in Deventer after 1480. This discrepancy can also be explained, however, by beavers establishing territories on tributaries of the IJssel, such as the Issel/Oude IJssel (not to be confused with the like-named river on which Deventer and Zutphen are located) during preceding years. Testing either hypothesis is difficult because the financial accounts of Zutphen for the years 1483-1489 have not been preserved. The financial accounts of the city of Doesburg for the years 1476-1484 do not mention beavers (Streekarchivariaat de Liemers en Doesburg). We do know that the last beavers in Nordrhein-Westfalen were reportedly killed in the nineteenth-century Möhne and Ruhr (Nitsche 2020). According to Conrad Gessner they could still be found in the Rhine in the mid-sixteenth century (Gessner 1551-1587). Theoretically, German beavers could have reached Zutphen from the south by

swimming downstream along the Rhine.

Beavers are no longer mentioned in the financial administration of either Deventer or Zutphen from 1490 to 1500. This could mean that the species became locally extinct, or that its population had declined to such an extent that the city councils no longer felt the need to pay bounties. In the early sixteenth century beavers were again recorded in the area. According to financial accounts the Duke of Guelders received the tails and hind legs of three beavers in 1519 and one in 1522 (van Hasselt 1805, 1807). These animals were caught in or near Borucht ('s Heerenberg between the Rhine and Oude IJssel) and Wisch (Terborg on the Oude IJssel), and in marked contrast to their fifteenth-century predecessors, were treated as prestigious gifts and as a delicacy rather than a nuisance. This could be taken as evidence for the beaver's rarity. A shift towards beaver tails as high-status food is also visible in Germany and Latvia in the late fifteenth and early sixteenth century (Ehlert 2010, Mänd 2016).

As far as the seventeenth century is concerned, we have access to two important naturalist studies: the hunting treatise *Jacht Bedryff*, probably written by the deputy forester of Holland Cornelis van Heenvliet around 1635, and Ernst Brinck's notes on animals (dating to the 1630s and 1640s and stored at the Streekarchivariaat Noordwest-Veluwe). The *Jacht Bedryff* does not mention beavers at all, which is remarkable considering that it includes species such as the red fox (*Vulpes vulpes*), which was only seen in Holland as an occasional immigrant from neighbouring provinces (Swaen 1948). Ernst Brinck, scholar and mayor of Harderwijk, claims to have seen a living beaver in his native city in 1636. However, he does not give any information about the location where the animal was captured. Given that the rest of his notes only gives a brief description of the animal before specifying the number of pelts imported from North America in a certain year, the animal in question may have been imported from outside the Netherlands.

So far, one of the few explicit pieces of evi-

dence that beavers might still have been present in the seventeenth-century Netherlands comes from Peter von Streithagen's poem on the Rur/Roer, published in 1638. It lists the beaver among several animals that could be found in this river, a tributary of the Meuse (Teschmacher 1638). It is unclear if there were any beaver territories in the Rur at that time, perhaps the animal was only seen as a rare visitor.

As mentioned in the introduction, the last recorded killing of a beaver in the Netherlands dates back to Zalk, approximately 40 km north of Deventer, in 1826. At this moment there is very few evidence to support the permanent presence of beaver populations in the Netherlands between 1522 and 1826. Jan Floris Martinet, our main source regarding beavers in the eighteenth-century Dutch Republic, claimed in his 'Catechism of nature' that the beaver was not 'native' to the Netherlands (*'geen inboorling van ons Vaderland'*) and only caught occasionally (Martinet 1778). In a later abbreviated version of this book, he noted that the beavers seen in the Republic were immigrants from Germany (Martinet 1779).

We should consider the possibility that all sightings of beavers in the Netherlands after 1500 or 1600 refer to immigrants from Germany and their immediate descendants. The species' gradual disappearance from western Europe may after all not have been a linear process, but included dispersal and recolonisation attempts. The evidence that is currently available indicates that the beaver may have become functionally extinct in the Netherlands before 1500, several centuries before the death of the last known individual.

Conclusions

The financial records of the cities of Deventer and Zutphen provide detailed evidence on the presence of Eurasian beavers in the IJssel River during the second half of the fifteenth century. Beavers may have been absent or very

rare near these cities in the early fifteenth century, before migrating southwards along the IJssel around the middle of the century. This gradual expansion could be related to environmental changes: the creation of a new corridor, a canal linking the city of Deventer with Germany, and/or a significant decline in the water volume transported by the IJssel. Beavers reached Deventer by 1449 and Zutphen by 1464. The initial population expansion may have been slowed down by severe hunting pressure, namely the issuing of financial rewards for beavers' capture. The introduction of a bounty system was likely intended to exterminate the species. By 1490 it had achieved its purpose.

The beaver may have become functionally extinct in the Netherlands before 1500. The possibility that all references to beavers after 1500 or 1600 refer to immigrants and their immediate descendants merits further study.

This article demonstrates the value of using historical archives, more specifically financial accounts, for the study of the Eurasian beaver in the Netherlands, but can also serve as an example to conduct similar research on other species and geographical regions. Medieval administrative documents can be a valuable source for such research because they provide detailed information on a historical period for which few other records based on direct observation exist.

Acknowledgements: This study was made possible by a Junior Postdoctoral Research Fellowship of the Flemish Research Council (FWO), grant number 12W5622N. I would like to thank the anonymous reviewer and the corresponding editor for their helpful comments on an earlier version of this article.

Bibliography

Archival sources

- The financial accounts of Deventer are preserved in Deventer, Collectie Overijs-

sel, 0698 Cameraars, inventory numbers 1.20-1.28. They can also be accessed online: <https://collectieoverijssel.nl/>

- The financial accounts of Zutphen are preserved in Zutphen, Regionaal Archief Zutphen, 0001 Inventaris van het oud-archief van de stad Zutphen, inventory numbers 1037-1076. They can also be accessed online: <https://erfgoedcentrumzutphen.nl/>
- The financial accounts of Doesburg are preserved in Doesburg, Streekarchivariaat de Liemers en Doesburg, Oud Archief Doesburg. Inventory numbers 859-865 contain those of the years 1476-1484.
- Ernst Brinck's notes on the beaver can be found in Harderwijk, Streekarchivariaat Noordwest-Veluwe, Adversaria van Dr. Ernst Brinck, inventory number 2058 'Nieuwe Aenmerckongen over sommige Viervoetige Gedierten', f. 128r.- f. 129r. The document can also be accessed online: www.archieven.nl

Archaeozoological research

Database Boneinfo: <https://www.cultureelerfgoed.nl/onderwerpen/bronnen-en-kaarten/overzicht/boneinfo>

References

- Alberts, W.J. 1959. De cameraarsrekeningen van Deventer betreffende het jaar 1447. J.B. Wolters, Groningen, the Netherlands.
- Bluzma, P. 2003. Beaver abundance and beaver site use in a hilly landscape (Eastern Lithuania). *Acta Zoologica Lituanica* 13 (1): 8-14.
- Bowler, D.E. & T.G. Benton 2005. Causes and consequences of animal dispersal strategies: Relating individual behaviour to spatial dynamics. *Biological Reviews* 80: 205-225.
- Bonn, A.C. 1806. *Anatome Castoris, atque chemica castorei analysis, ejusque in medicina usus*. Haak & co, Leiden, the Netherlands.
- Brokamp, B. 2015. Der Stat lantweer' en de 'lantweren vort lant van Zallant', De laatmiddeleeuwse verdedigingsgordels rond Deventer. *Deventer Jaarboek*: 19-34.
- Çakırlar, C., J. van den Hurk, I. van der Jagt, Y. van Amerongen, J. Bakker, R. Breider, J. van Dijk, K. Esser, M. Groot, T. de Jong, L. Kootker, F. Steenhuisen, J. Zeiler, T. van Kolfschoten, W. Prummel & R. Lauwerier 2019. Animals and people in the Netherlands' past: >50 years of archaeozoology in the Netherlands. *Open Quaternary* 5 (13): 1-30.
- Canters, K.J. & B. Hoekstra 2019. De bever van Zalk, 'de laatste bever van Nederland' nader onder de loep genomen. *Overijsselse Historische Bijdragen* 134: 11-55.
- Boese, H. (ed.) 1973. *Liber de natura rerum*. Walter de Gruyter, Berlin, Germany.
- Coles, B. 2006. *Beavers in Britain's past*. Oxbow Books, Oxford, UK.
- Coles, B. 2010. The Eurasian Beaver. In: T. O' Connor & N. Sykes (eds). *Extinctions and Invasions. A Social History of British Fauna*: 104-115. Oxbow Books, Oxford, UK.
- Deby, J. 1848. *Histoire naturelle de la Belgique*. 2 volumes. Brussels, Belgium.
- Delmaire, B. (ed.) 1977. *Le compte général du receveur d' Artois pour 1303-1304*. Commission Royale d' Histoire, Brussels, Belgium.
- Delort, R. 1978. *Le commerce des fourrures en Occident à la fin du Moyen Age (vers 1300-vers 1450)*. Tomes 1 et 2. École française de Rome, Rome, Italy.
- de Meyer, G.M 1968-1985. *De stadsrekeningen van Deventer 1394-1440*. 6 volumes. Wolters-Noordhoff, Groningen, the Netherlands.
- Dieberger, J. 2003. Die Bejagung des Bibers (*Castor fiber* L.) von der Steinzeit bis zur Gegenwart. *Denisia* 9: 21-46.
- Dijkstra, J. & A. van Benthem 2004. Definitief archeologisch onderzoek op terrein 9 in Houten. ADC-ArcheoProjecten, Amersfoort, the Netherlands.
- Dijkstra, V. 2019. Beverpopulatie blijft groeien. URL: <https://www.Zoogdiervereeniging.nl/nieuws/2019/beverpopulatie-blijft-groeien>; viewed 7 November 2022.
- Dowling, A. 2012. Landscape of luxuries: Mahaut d'Artois's (1302-1329) management and use of the park at Hesdin. In: C.R. Clason & A. Classen (eds): *Rural space in the Middle Ages and Early Modern*

- Age: the spatial turn in premodern studies: 367-88. Walter de Gruyter, Berlin, Germany.
- Duval, J., C. Callou & M.-P. Horard-Herbin 2011. Le castor *Castor fiber* Linnaeus, 1758 en France. Étude archéozoologique. *Anthropozoologica* 46 (2): 7-39.
- Ehlert, T. (ed.) 2010. Küchenmeisterei: Edition, Übersetzung und Kommentar zweier Kochbuch-Handschriften des 15. Jahrhunderts, Solothurn S 490 und Köln, Historisches Archiv GB 4° 27; mit einen repographischen Nachdruck der Kölner Handschrift. Peter Lang, Frankfurt am Main, Germany.
- Fustec, J., T. Lode, D. Le Jacques & J.P. Cormier 2001. Colonization, riparian habitat selection, and home range size in a reintroduced population of Eurasian beavers in the Loire. *Freshwater Biology* 46: 1361-1371.
- Gautier, A., P. Hoffsummer & M. Vanguetstaina 2005. Faune médiévale et post-médiévale du château de Franchimont (Theux). *Vie Archéologique* 64: 73-90.
- Gessner, C. 1551-1587. *Historia animalium*. 5 volumes. Zürich, Switzerland.
- Groneman, H.J.H. 1882. Bevers in Nederland. *Album der Natuur* 31 (1): 28-31.
- Gysseling, M. 1960. Toponymisch woordenboek van België, Nederland, Luxemburg, Noord-Frankrijk en West-Duitsland (vóór 1226). 2 volumes. Belgisch Interuniversitair Centrum voor Neerlandistiek, Brussels, Belgium.
- Halley, D., F. Rosell & A. Saveljev 2012. Population and distribution of Eurasian beaver (*Castor fiber*). *Baltic Forestry* 18 (1): 168-175.
- Halley, D., A.P. Saveljev & F. Rosell. 2021. Population and distribution of beavers *Castor fiber* and *Castor canadensis* in Eurasia. *Mammal Review* 51 (1): 1-24.
- Hartman, G. 1996. Habitat selection by European beaver (*Castor fiber*) colonizing a boreal landscape. *Journal of Zoology* 240 (2): 317-325.
- Hartman, G. 1997. Notes on age at dispersal of beaver (*Castor fiber*) in an expanding population. *Canadian Journal of Zoology* 75 (6): 959-962.
- Hazenbergh, T. 2000. Aanvullend archeologisch onderzoek op het tracé van de Noordoeververbinding van de Westerscheldetunnel, 1999 Borsele-Ellewoutsdijk. Archeologisch Diensten Centrum, Bunschoten, the Netherlands.
- Hielkema J.B. 2003. Aanvullend archeologisch onderzoek op terrein 9 in Houten-Loerik, gemeente Houten (U.). ARC-Publicaties, Groningen, the Netherlands.
- Horn, S. 2014. Ancient mitochondrial DNA and the genetic history of Eurasian beaver (*Castor fiber*) in Europe. *Molecular Ecology* 23: 1717-1729.
- Hossfeld, P. 1983. Die eigene Beobachtungen des Albertus Magnus. *Archivum fratrum praedicatorum* 53: 147-174.
- Jordens, E.A. 1852. De IJssel, als handelsweg en als waterweg van vroegere tijden tot heden: geschiedkundige proeve. Overijsselsche Almanak voor Oudheid en Letteren 17: 73-168.
- Kitchener, A.C. & J.W.H. Conroy 1997. The history of the Eurasian beaver *Castor fiber* in Scotland. *Mammal Review* 27 (2): 95-108.
- Kronenberg, H. 1902. Deventer weidrechten. PhD Thesis. Leiden University, Leiden, the Netherlands.
- Liarsou, A. 2013. Interactions between the beaver (*Castor fiber* L.) and human societies: a long-term archaeological and historical approach. *Archaeological Review from Cambridge* 28 (2): 171-185.
- Libois, R.M. 1982. Le castor. Les mammifères menacés de disparation en Wallonie. Service public de Wallonie. Direction générale opérationnelle de l'agriculture, des ressources naturelles et de l'environnement, Namur, Belgium.
- Makaske, B., G.J. Maas & D.G. van Smeerdijk 2008. The age and origin of the Gelderse IJssel. *Netherlands Journal of Geosciences* 87 (4): 323-337.
- Mänd, A. 2016. Horses, stags and beavers: animals as presents in late-medieval Livonia. *Acta Historica Tallinnensia* 22: 3-17.
- Manning, A.D., B.J. Coles, A.G. Lunn, D.J. Halley, P. Ashmole & S.J. Fallon 2014. New evidence of late survival of beaver in Britain. *The Holocene* 24 (12): 1849-1855.
- Martinet, J.F. 1778. *Katechismus der natuur*. Tweede deel. Johannes Allart, Amsterdam, the Netherlands.
- Martinet, J.F. 1779. *Kleine Katechismus der natuur voor kinderen*. Johannes Allart, Amsterdam, the Netherlands.
- Mayer M., A. Zedrosser & F. Rosell 2017. When to

- leave: the timing of natal dispersal in a large, monogamous rodent, the Eurasian beaver. *Animal Behaviour* 123: 375-382.
- McNew Jr, L.B. & A. Woolf 2005. Dispersal and survival of juvenile beavers (*Castor canadensis*) in Southern Illinois. *American Midland Naturalist* 154 (1): 217-228.
- Molhuysen, P.C. 1840. Bevers in den IJssel. Overijsselsche Almanak voor Oudheid en Letteren 5: 95-98.
- Nimje, P.S., M. Mayer, A. Zedrosser, M. Sæbø & F. Rosell 2021. Territory acquisition and mate choice in a monogamous mammal, the Eurasian beaver. *Animal Behaviour* 178: 165-173.
- Nitsche, K.A. 2020. Historisch Nachrichten über Biber in Deutschland. *Castor Research Society*, Dessau, Germany.
- Pasteur, I.D. 1796. Beknopte natuurlijke historie der zoogende dieren. Tweede deel. Honkoop & Dumortier, Leiden, the Netherlands.
- Poelhekke, J. 1870. De Deventer Worp en zijne omgeving. Deventer, the Netherlands.
- Prou, M. (ed.) 1884. *De ordine palatii*. Paris, France.
- Raye, L. 2014. The early extinction date of the beaver (*Castor fiber*) in Britain. *Historical Biology* 27 (8): 1-13.
- Rosell, F. & R. Campbell-Palmer 2022. *Beavers: ecology, behaviour, conservation, and management*. Oxford University Press, Oxford, UK.
- Säterberg, T., S. Sellman & B. Ebenman 2013. High frequency of functional extinctions in ecological networks. *Nature* 499: 468-470.
- Sellman, S., T. Säterberg & B. Ebenman 2016. Pattern of functional extinctions in ecological networks with a variety of interaction types. *Theoretical Ecology* 9: 83-94.
- Sickel, T. (ed.) 1879. *Die Urkunden der Deutschen Könige und Kaiser 1 Hannover*, Germany.
- Slootmans, K. 1952. Huiden en pelzen op de jaarmarkten van Bergen op Zoom. In: L.G. Verberne & A. Weijnen (eds). *Land van mijn hart*. Brabantse feestbundel voor Mgr. Prof. Dr. Th.J.A.J. Goossens op zijn zeventigste verjaardag (8 Februari 1952): 100-108. Henri Bergmans, Tilburg, the Netherlands.
- Sluiter, H. 2003. The reintroduction and the present status of the beaver (*Castor fiber*) in the Netherlands: an overview. *Lutra* 46 (2): 129-133.
- Steyaert, S.M.J.G., A. Zedrosser & F. Rosell 2015. Socio-ecological features other than sex affect habitat selection in the socially obligate monogamous Eurasian beaver. *Oecologia* 179: 1023-1032.
- Sun, L., D. Müller-Schwarze & B.A. Schulte 2000. Dispersal pattern and effective population size of the beaver. *Canadian Journal of Zoology* 78 (3): 393-398.
- Swaen, A.E.H. (ed.) 1948. *Jacht-Bedryff*. Brill, Leiden, the Netherlands.
- Teschenmacher, W. 1638. *Annales Cliviae-Iuliae-Montiae, Marchiae, Ravensburgiae Antiquae et Moderna*. Jacob van Biesen, Arnhem, the Netherlands.
- van Doorninck, J. 1839. Welke zou de hoofdoorzaak van het verval der bevaarbaarheid van den IJssel zijn. *Overijsselsche Almanak voor Oudheid en Letteren* 3: 62-126.
- van Doorninck, J.I., J. de Hullu & J.G.R. Acquoy (eds) 1885-1914. *De cameraars-rekeningen van Deventer, 1337-1393*. 9 volumes. J. de Lange, Deventer, the Netherlands.
- van Hasselt, G. 1805. *Bydragen voor d'oude Geldersche maaltyden*. Arnhem, the Netherlands.
- van Hasselt, G. 1807. *Geldersch Maandwerk*. 2 volumes. Arnhem, the Netherlands.
- Veron, G. 1992. *Histoire biogéographique du castor d'Europe Castor fiber* (Rodentia, Mammalia). *Mammalia* 56 (1): 87-108.
- Verwijs, E. 1878. *Jacob van Maerlant's Naturen Bloeme*. J.B. Wolters, Groningen, the Netherlands.
- Wartena, R. 1977. *De stadsrekeningen van Zutphen 1364-1445/46*. 3 volumes. Gemeentearchief Zutphen, Zutphen, the Netherlands.
- Weststrate, J. 2008. In het kielzog van moderne markten: handel en scheepvaart op de Rijn, Waal en IJssel, ca. 1360-1560. *Verloren, Hilversum*, the Netherlands.
- Wijngaarden, A. van 1966. De bever, *Castor fiber* L., in Nederland. *Lutra* 8: 33-52.

Samenvatting

De historische aanwezigheid van de bever (*Castor fiber*) in de IJssel in 1450-1500

Dit artikel beschrijft de aanwezigheid van de

Euraziatische bever (*Castor fiber*) in de IJssel gedurende de tweede helft van de vijftiende eeuw op basis van middeleeuwse stadsrekeningen. Het beargumenteert dat de bever mogelijk al voor 1500 functioneel uitgestorven was in Nederland, verschillende eeuwen voordat het laatst bekende exemplaar werd gedood (1826). De studie toont ook het belang aan van middeleeuwse administratieve bronnen (rekeningen) voor de reconstructie van de historische aanwezigheid van zoogdieren in het verleden. Bevers worden in de stadsrekeningen van Deventer (de 'cameraarsrekeningen') vermeld van 1449 tot en met 1480 en in de stadsrekeningen van Zutphen (de 'overrentmeestersrekeningen') van 1464 tot en met 1489. Minstens 153 bevers werden in de jaren 1454-1489 aan de schepenen van beide steden getoond om een premie te krijgen. Bevers werden om meerdere redenen bejaagd, maar in dit geval was preventie van economische schade de belangrijkste motivatie. De invoering van een premiesysteem om bevers te vangen was waarschijnlijk een doelbewuste poging de soort uit te roeien. De rekeningen specificeren soms dat de getoonde bevers jong/klein of groot waren. Deze details geven een indicatie van de aanwezigheid van beverjongen en volwassen bevers in specifieke jaren. De meeste gedode dieren waren waarschijnlijk subadulte exemplaren. In twee gevallen, beide in Deventer, worden niet-dodelijke acties ver-

meld: het beschermen van wilgenpoten met doorns en de vernieling van vier beverdammen. Het voorkomen van relatief grote aantallen bevers in de IJssel is opmerkelijk, want historische en archeologische bronnen suggereren dat de soort rond 1400 grotendeels uit de Lage Landen verdwenen was. Zijn mogelijk opnieuw opduiken en tijdelijke rekolonisatie van grote delen van de IJssel kan verklaard worden door ecologische veranderingen. In de vroege vijftiende eeuw liet het stadsbestuur van Deventer een nieuw kanaal graven, de Schipbeek, dat de stad met Diepenheim en het Duitse achterland verbond. Dit kanaal kan als corridor gefungeerd hebben voor bevers uit populaties in Noordwest-Duitsland. Gedurende de vijftiende eeuw daalde het watervolume in de IJssel ook zeer sterk als gevolg van de Sint-Elizabetsvloeden van 1421 en 1424. Hierdoor werden dispersiemogelijkheden voor subadulte bevers mogelijk beperkt, terwijl het risico op mens-bever conflicten steeg. Een overzicht van zestiende- en zeventiende-eeuwse bronnen voor de aanwezigheid van bevers in Nederland suggereert dat individuele bevers, mogelijk immigranten uit Duitsland en hun nakomelingen, steeds zeldzamer werden, om in de achttiende en negentiende eeuw uiteindelijk helemaal te verdwijnen.

Received: 9 August 2022

Accepted: 22 October 2022