The raccoon in Limburg, period 2019-2022

Maurice La Haye, Dick Bekker, Robert Delbroek, René Janssen

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Author:	M. La Haye, D.L. Bekker, R. Delbroek & R. Janssen
Illustrations:	M. La Haye (front photo)
Quality check:	P. Bergers
Production:	**Mammal Foundation, in report mentioned as Dutch Mammal Society** Adres: Toernooiveld 1 6525 ED Nijmegen, The Netherlands Postadres: Postbox 6531 6503 GA Nijmegen. The Netherlands Tel.: 0031 24 7410500 secretariaat@zoogdiervereniging.nl www.zoogdiervereniging.nl
Client details:	Province of Limburg Cluster Nature and Water Postbox 5700 6202 MA Maastricht, The Netherlands
Contactperson client:	Walter Oudshoorn

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Summary

The raccoon (*Procyon lotor*) arrived in Europe from North America more than 50 years ago and is listed as an 'invasive exotic species'. For several years, there have been signs of population formation in Limburg with frequent reports of raccoons from the area near Sittard and Maastricht. Under the 'European Union Invasive Exotic Species List' (Regulation No 1143/2014), the Province of Limburg is obliged to remove raccoons from the wild if there are signs of population formation.
The Province of Limburg asked the Mammal Society to coordinate the 'Raccoons in Limburg' project and to work closely with Bionet Natuuronderzoek, Water Board Limburg, AAP Foundation, FBE Limburg and RIVM for implementation of the project.

The project aimed to gain knowledge about raccoon trapping, set up an online notification portal and evaluate the effectiveness of trapping. Trapped raccoons were taken in by AAP Foundation in Almere. Shooting raccoons was possible under strict conditions, but no raccoons were shot during the project.

It appeared that raccoons (now) live throughout the province of Limburg. A genetic analysis using DNA samples from raccoons trapped or found dead in Limburg was carried out by RIVM in collaboration with the Natural History Museum of Luxembourg. A previous study with a limited set of samples showed that the population in the core area near Sittard is genetically different from other (European) populations and (thus) of regional origin. The population around Sittard forms one entity with the population of raccoons near Gangelt, Germany, located in the state of North Rhine-Westphalia. It is not yet known whether the raccoons caught in the Geul and Meuse valleys are genetically related to the population in the Ardennes (Wallonia) or genetically related to the population around Sittard/Gangelt.
In Limburg, there is (yet) no immigration from the established raccoon population in central Germany, as its front lies halfway of North Rhine-Westphalia.

Trapping raccoons was successful in the core areas (Valley of the Roode Beek, Geleenbeek valley, Geul valley and around Maastricht). A total of 95 raccoons were trapped, but this did not result into the complete disappearance of the population in Limburg.

RIVM, in collaboration with AAP Foundation, investigated how many of the trapped raccoons were infected with raccoon roundworm (*Baylisascaris procyonis*). Of these raccoons, 52% of the animals were found to be infected with this roundworm.

Italian research shows that it is possible to completely eliminate a local population of raccoons, provided control is maintained for a longer period of time: at least several years. In Limburg, there are several cross-border populations. This makes it difficult to sustainably reduce the numbers of raccoons present in Limburg if intervention is only done in Limburg. Due to the continuous exchange with and/or immigration of raccoons from adjacent areas, coordinated cross-border control is needed to keep the population and densities at low levels. This requires intensive cooperation and consultation with neighboring countries. The

Province of Limburg has been in contact with the relevant foreign authorities and asked for appropriate control to prevent migration to the Netherlands. This has not yet led to noticeably fewer catches in Limburg.

If raccoon trapping in Limburg is not continued, it is inevitable that raccoon numbers will increase sharply in the coming years. This is expected to result in much more perceived nuisance by citizens and many more complaints about the presence of raccoons. There is little or no way to prevent this nuisance, which requires much more than reinforcing hen houses or properly storing of rubbish. Raccoons are smart and strong animals that are difficult to keep out. The increase in raccoons will also lead to increasing damage and predation of vulnerable wildlife (including rare breeding birds, amphibians, small mammals and hibernating bats).

1 Introduction

1.1 General

The raccoon (*Procyon lotor*) arrived in Europe from North America more than 50 years ago and is listed as an 'invasive exotic species'. Under the Union Invasive Exotic Species List (EU Regulation 1143/2014), the Province of Limburg is obliged to remove raccoons from the wild if there is population formation. Since at least 2017 (Bekker 2017), there has been signs of population formation of raccoons in two core areas: the Sittard-Schinveld-Nuth triangle and the Maastricht-Eijsden-Gronsveld area. In recent years, the number of raccoon reports in the Geul Valley has been increasing markedly (Delbroek & Janssen 2018).

In Limburg a research project has been running during the past 3 years to determine whether and how the trapping of raccoons can be done effectively. The province of Limburg asked the Dutch Mammal Society to supervise this research project.

Part of the project was a) to set up a low-threshold notification portal (website) to collect more sightings of raccoons, b) to study the origin of raccoons if possible, and c) to determine whether and how many raccoons from the wild are infected with the raccoon roundworm. Humans infected with eggs of this roundworm can, in exceptional cases, become seriously ill and develop neurological symptoms (Maas *et al.* 2021).

This report describes the results of the project over the period 2019-2022.

1.2 Project objective

The aim of the 'Raccoons in Limburg' project was to gain experience in trapping raccoons, evaluate the methodologies used and, if possible, find out the origin of the raccoons.

1.3 Acknowledgments

This project was carried out in close cooperation with Water Board Limburg, AAP Foundation, Faunabeheereenheid (FBE) Limburg and RIVM. When dealing with sightings on the notification portal, Anna Carpendale (volunteer) helped considerably, so we were able to verify most reports quickly and smoothly. We also thank all staff, landowners, local hunters, groundkeepers and students who were involved, for their pleasant cooperation and efforts, as well as the many individuals who made a report by the way of www.wasberenmeldpunt.nl.

2 Method

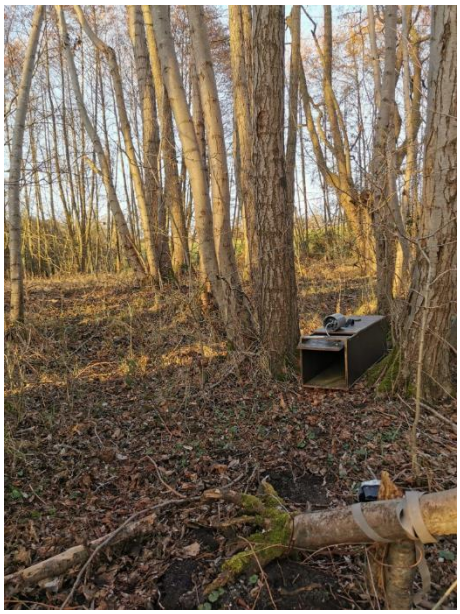
The project included the following activities:
1. Set up an online raccoon sighting portal (www.wasberenmeldpunt.nl);
2. Trapping raccoons using life-traps (both wooden and mesh traps);
3. Setting camera traps;
4. Establish cooperation with FBE Limburg and Water Board Limburg;
5. Transfer trapped raccoons to AAP Foundation;
6. Conduct research on the occurrence of raccoon roundworm among trapped raccoons by RIVM and AAP Foundation;
7. Determine the origin of captured raccoons based on DNA analysis by RIVM;
8. Produce a leaflet on the distinction between raccoon, raccoon dog and badger (Appendix 1).

1. Online raccoon sighting portal

A special online portal for reporting raccoons has been established: www.wasberenmeldpunt.nl. Appeals in local and regional media informed the general public about the project and urged them to be alert for raccoons and report sightings of (possible) raccoons. The portal was launched in September 2019 and is 'online' to date. Reports were assessed within 48 hours whenever possible: all reporters received a response following their report.

2. Trapping raccoons using life-traps

Trapping raccoons was done by putting life-traps at locations where raccoon presence was confirmed. The focus was on the aforementioned core areas. The 2018 report by Bionet Nature Research (Delbroek & Janssen 2018) was used as a basis for this. In addition, life-traps were placed at locations where 'single' raccoons had been reported through the raccoon portal, at locations with sightings from other sources (including the NDFF), as well as new sightings made during the course of this project using camera trap surveys (see point 3).



Wooden life-trap in a small marshy wood, Valley of the Roode beek. Photo: *Billy Scaf*

During the period of October 15th 2019 – March 15th 2020 and September 1st 2020 - March 15th 2021, Cat 3 type wooden life-traps were used with a gangway and a 'trigger' to which the bait was attached. In the first period, mainly life-traps were used with a partition with a hole in it (to reduce bycatch) and with the bait attached to a steel cable as a 'trigger'. During the second trapping period the same wooden traps were used, but differently fitted, with a gangway that acted as a 'trigger'. In these traps, the trigger

mechanism was located on the outside consisting of fixed rods instead of a steel cable. Also, most traps in the second period no longer had partitions.

During the period October 14th 2021 - December 15th 2021 and February 6th 2022-April 2nd 2022, mesh-wire life-traps were used for three reasons:
1) wildlife camera footage showed that raccoons could escape in and out of the wooden traps by lifting the slanted trap flap slightly;
2) mesh-wire life-traps are more manageable in the field;
3) mesh-wire life-traps function better (due to fewer moisture problems).

At the back of the mesh-wire life-traps, where the bait was placed in the trap, a cover made of EPDM was placed, so that the bait would stay dry in case of rain. This canopy is also necessary from an animal welfare point of view, giving trapped animals the opportunity to take some shelter.
A can of sardines was present in the life-traps as bait, supplemented with dog treats. A new can of sardines was placed after every catch or, with no catch, after every month. At these moments the dog food was also replenished.
The life-traps were removed from the field in mid/late March to avoid catching lactating female raccoons. The life-traps were returned to the field in September/October. The shortened trapping period ('summer break') was an explicit wish of the Province of Limburg out of animal welfare concerns. The aim was to avoid catching lactating raccoons, with the expectation that any young that might nevertheless be born could still be caught relatively easily in the autumn.

We have chosen to trap intensively in the core areas rather than placing traps on a large scale throughout South Limburg, because of the expected low numbers of raccoons outside these core areas (Delbroek & Janssen 2018). The life-traps were equipped with a trap alarm so the trapping team was immediately notified if a trap was closed. This also allowed unintentional bycatch to be released quickly from these remotely 'monitored' traps.

Traps were mainly placed in bushes, along watercourses or in wetlands (ponds, alder brook forest, etc.). Wherever possible, traps were placed along wildlife corridors, but it was not always possible to place a trap in the 'best' location, as traps would then be too conspicuous, so the risk of theft/vandalism was assessed as being too high. In addition to the life-traps in nature reserves, along watercourses and in swamp forests, several traps were placed in private gardens or at (hay)attics. This was mostly after a report through the online portal, and in cases in which a raccoon was present 'on site' for a longer period of time.

3. Camera traps
On a number of locations where traps were placed, also camera traps were set to establish the presence of raccoons and check the functioning of the trap. Camera traps were also placed at some locations to check the accuracy of a raccoon report before proceeding with trap placement.

4. Cooperation with FBE Limburg and Water Board Limburg

The cooperation with the FBE Limburg (Faunabeheereenheid) has been established in connection with the possible use of hunters for shooting, trapping, spotting raccoons and registering/collecting traffic victims.
Cooperation was also established with the nutria/muskrat trappers of the Water Board Limburg, as they occasionally catch raccoons (as bycatch) in their traps. Raccoons caught by these trappers were (also) transferred to AAP Foundation.

5. Handing over trapped raccoons to AAP Foundation

Trapped raccoons inside a life-trap were checked as soon as possible by the trapping team and placed in a travel carrier with straw, water and food. The life-traps and cages were disinfected with a gas-powered weed burner after each raccoon capture, to prevent viable eggs of the raccoon roundworm from remaining in the traps or cages and infecting the trappers or animals in other parts of the project area.
Once captured, raccoons were picked up by AAP Foundation, which then arranged for deworming, spaying/neutering the animals and finding an animal park for their final capture.

6. Research of raccoon roundworm presence

All trapped raccoons were checked by AAP Foundation for the presence of raccoon roundworm. Raccoons found dead were, whenever possible, delivered to DWHC and/or RIVM for investigation of the cause of death and checking for the presence of raccoon roundworm or another zoonosis. The results are reported by DWHC/RIVM outside this project. A DNA sample of almost all raccoons examined was kept, as well as a DNA sample of raccoon roundworms.

7. Determine the origin of trapped raccoons based on DNA analysis

An analysis of DNA samples from 2019-2020 has been published in the scientific journal 'Transboundary and Emerging Diseases' (Maas *et al*. 2021.). A comprehensive analysis based on DNA samples from the entire 2019-2022 period is in preparation. The DNA study was (and will be) performed by Dr. Alain Frantz, from the University of Luxembourg.

8. Making a leaflet on the distinction between raccoon, raccoon dog and badger

The leaflet is included in Appendix 1 and the pdf is sent on request or for information. The leaflet can also be downloaded from the raccoon portal.

3 Results

3.1 Raccoon portal

Into the raccoon portal a total of 493 sightings was entered during the project period with a sighting date in the period October 1st 2019 to August 31st 2022 (for the whole of the Netherlands and surrounding foreign countries). Each report was assessed and additional information was requested if necessary. The reports can be divided into: certain (photo or video as evidence), probable (clear description of a raccoon), possible (description fits raccoon, but another species cannot be ruled out), not assessable (species cannot be determined/observer did not respond) or incorrect (definitely does not concern a raccoon). See table 1 for an overview of all reports in the Netherlands and figure 1 and figure 2 for the numbers of certain and probable reports per month in the Netherlands and Limburg, respectively. All certain and probable reports of raccoons are recorded in the National Database Flora and Fauna (NDFF). No action was taken on the foreign reports (observers were of course thanked for reporting).

Table 1. Sightings entered into the raccoon portal between October 1st 2019 and August 31st 2022 (excluding reports from other online portals).

Validation	Limburg	Other NL	Abroad	Total
Certain	85	46	13	144
Probable	83	56	8	147
Possible	30	32	2	64
Not assessable	31	44	3	78
Incorrect	32	28	0	60
Total	**261**	**192**	**21**	*493*

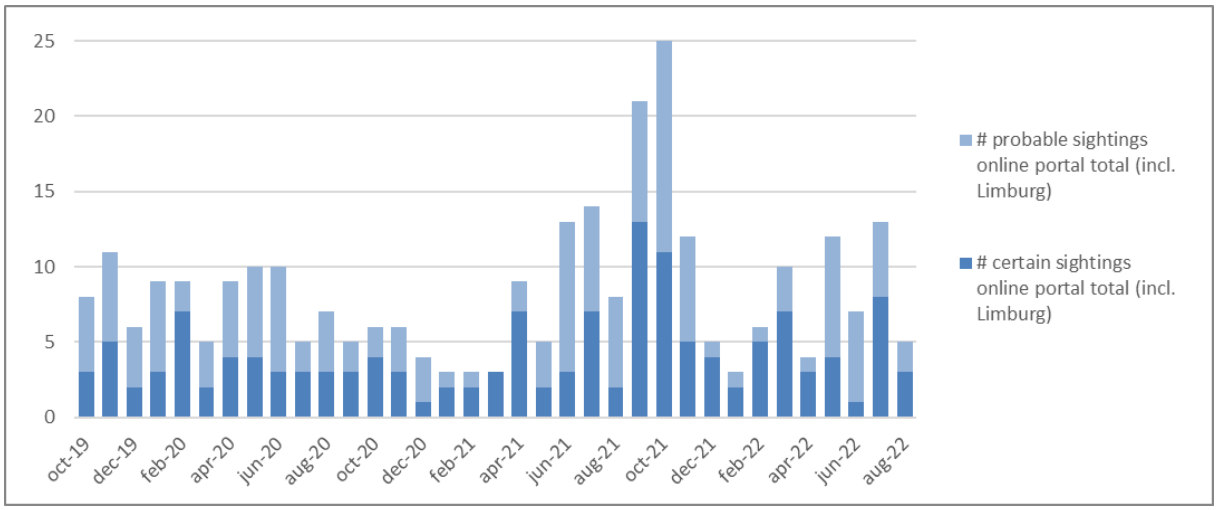


Figure 1. Number of certain and probable sightings of raccoons per month based on the online raccoon portal during the period October 1st 2019 to August 31st 2022 (note the Y axis).

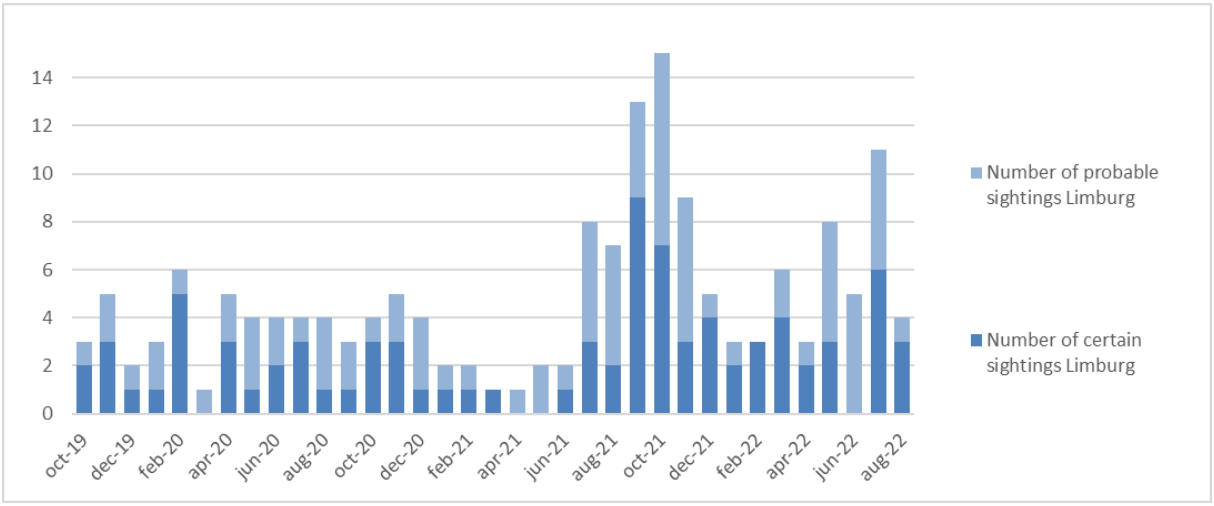
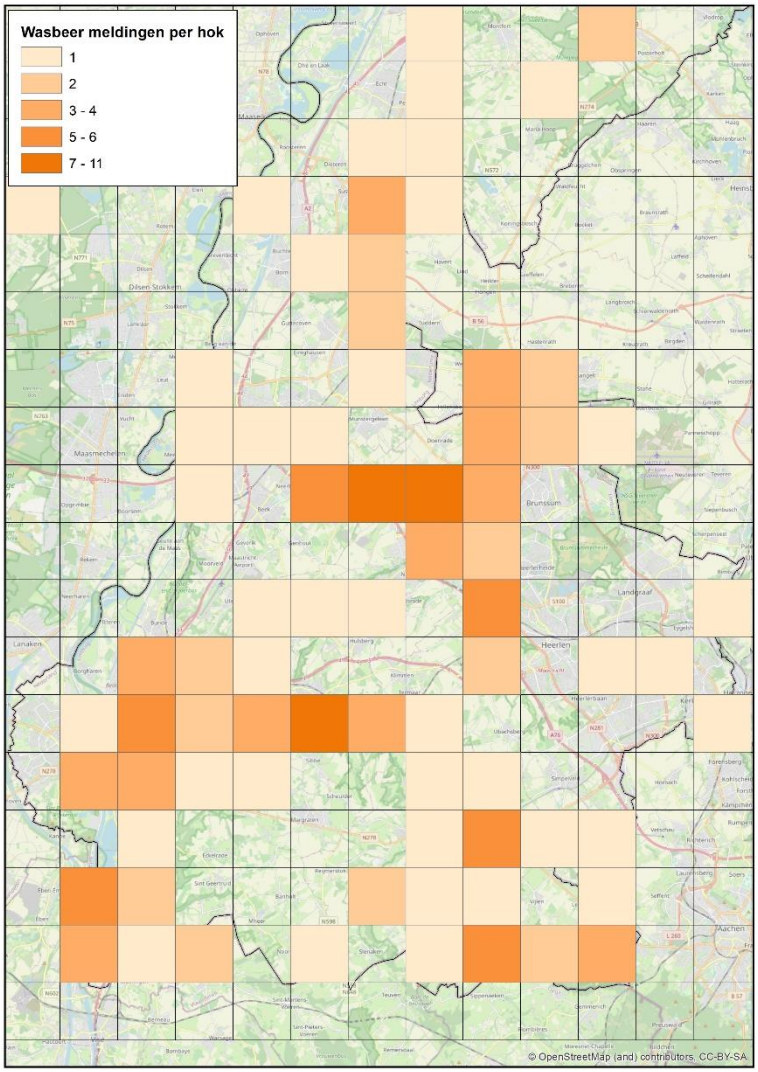


Figure 2. Number of certain and probable sightings of raccoons in the province of Limburg per month based on the online raccoon portal in the period October 1st 2019 to August 31st 2022 (note the Y axis).

All sightings from the raccoon portal are shown in Map 1. The colors indicate the number of sightings per 2,5 x 2,5 km square.



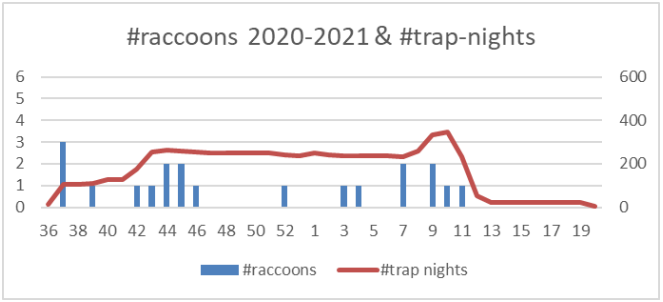
Map 1. Overview of validated raccoon sightings in Limburg based on the raccoon portal (October 1st 2019 to August 31st 2022).

3.2 Trapping effort of life-traps and number of trapped raccoons

Within each trapping period 50 to 60 life-traps were used.

In total 95 raccoons have been trapped in recent years: eight by the Water Board Limburg, one by a private individual and 86 by the project team. In the three seasons (2019-2020, 2020-2021 and 2021-2022), 0.36, 0.25 and 0.70 raccoons were captured per 100 trap nights respectively. This does not include catches by the Water Board Limburg, catches by individuals or catches by the project team in individuals' gardens or attics.

Trapping efforts per trapping period are difficult to compare, because in the (last) trapping period 2021-2022 no trapping was done in the winter months (Dec-Jan). Based on previous years, it was concluded that it is not efficient to continue trapping in winter, because the number of raccoons trapped decreases rapidly during November (blue bars in Figure 3a and 3b), meanwhile, with the traps left in the field, it is necessary to respond on each bycatch. Moreover, leaving traps on a more visible location increases the risk of theft and destruction of the traps.



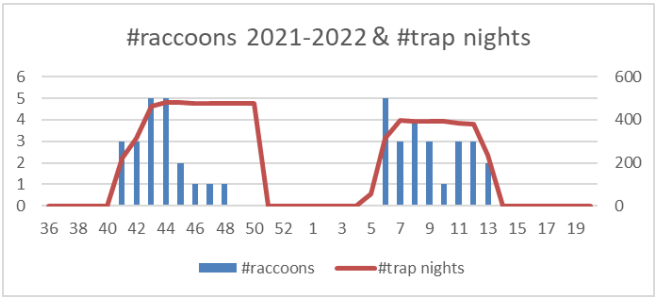
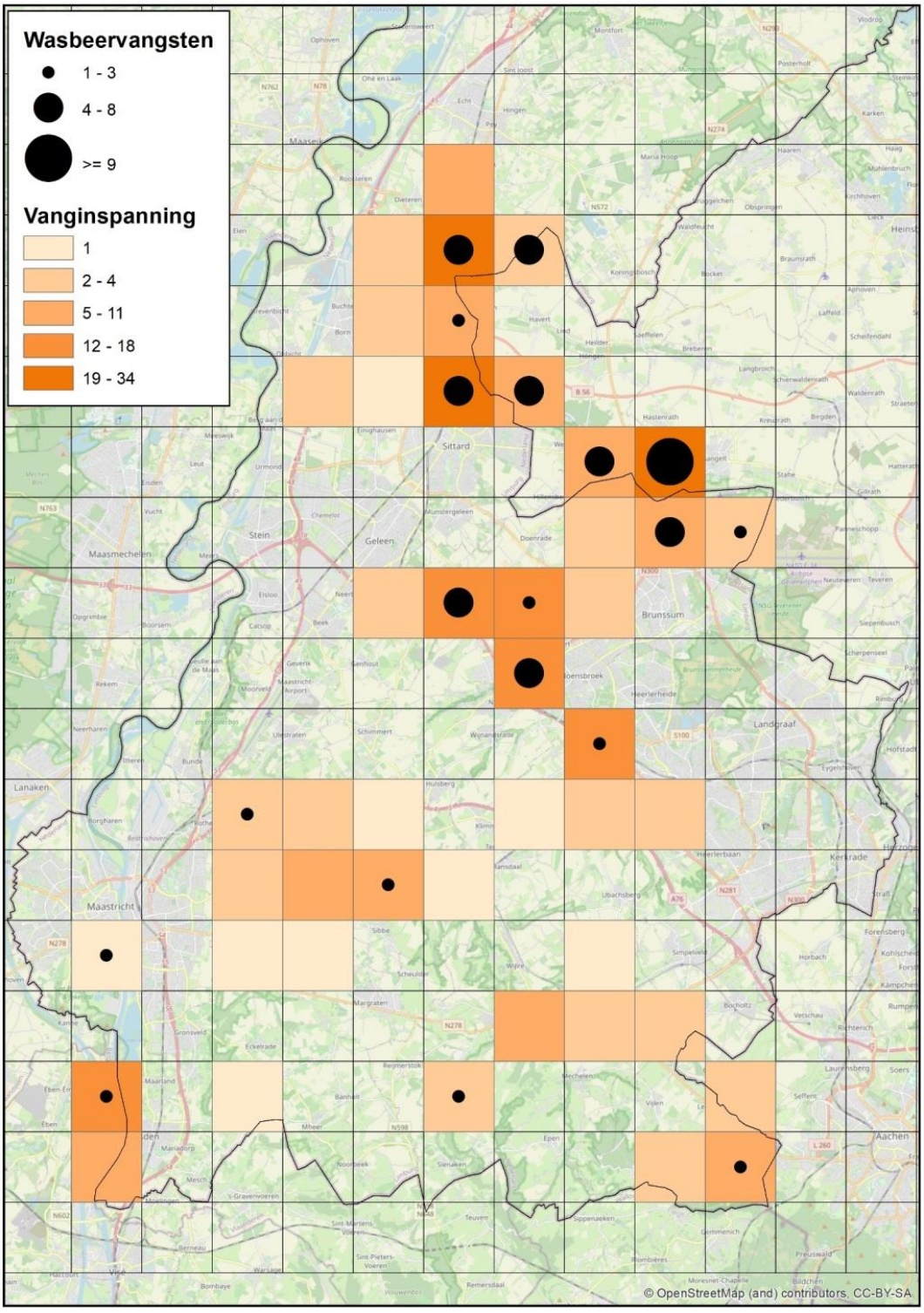


Figure 3a en 3b. Overview of the number of raccoons trapped (left y-axis, blue bar) per week (week number on the x-axis) and the trapping effort provided by the trapping team (red line, right y-axis) in 2020-2021 (wooden traps) and 2021-2022 (mesh-wire traps). The 'peak' in #trap nights in early 2021 is due to the deployment of additional traps.

The 'fastest' catch was in a trap that had been open for only one night. On the other hand, the 'slowest' catch was in a trap that had been in the field for 189 nights at the same location. In addition, many traps did not catch a single raccoon. On average, it took wooden traps 43 nights to catch a raccoon, with a median of 18 nights. For mesh-wire traps, it took an average of 15 nights (2 weeks) for a raccoon to be caught after placement, with a median of 11-12 nights.

The map below shows the number of raccoons trapped per 2,5 x 2.5 km-square as well as the trapping effort. In this case the trapping effort is the number of traps (not the number of trap nights) set in the field per square (cumulative for all periods).



Map 2. Summary of trapping effort per 2,5 x 2,5 km-square and number of raccoons trapped during 2019-2022.

Table 2 summarizes all trapped raccoons. The sex ratio was almost equal: 47 females and 48 males. The estimated age (estimated by the vet of AAP Foundation based on dental characteristics) ranged from about a few months old to about 7 years. The average age is just over 2 years (for both sexes). Of the females trapped during spring (N=17), seven animals were pregnant. None of the trapped females was lactating. A detailed overview of all trapped individuals can be found in Appendix 2.

Table 2. Overview of all trapped raccoons.

Trapping period	Region	#Female	#Male
2019-2020	Valley of the Roode Beek	6	7
	Geleenbeek Valley	4	2
	Susteren	1	1
	Valley of the river Roer	1	
	Tegelen	1	
2020-2021	Valley of the Roode Beek	6	6
	Valley of the Geleenbeek	2	2
	Susteren	2	2
	Maas estuary	2	1
2021-2022	Valley of the Roode Beek	9	12
	Valley of the Geleenbeek	7	10
	Susteren	5	
	Meusevalley		1
	Valley of the Geul	1	4
Total		47	48

3.3 False ‘triggers’/ bycatch

All life-traps were equipped with a 'trap alarm', so trappers were notified if the life-trap was closed. In this way, a trapped animal could be released as soon as possible or, in the case of a raccoon, the animal could be transferred to AAP Foundation.
Most bycatch involved brown rats, but also several domestic cats, foxes, polecats, weasels, hedgehogs and birds were caught. The most unusual bycatch was a European mink (*Mustela lutreola*), that appeared to have escaped from the German 'Tierpark Gangelt' (just across the border).
Wooden life-traps were used for the first two years (2019-2021). However, we discovered that life-traps regularly 'closed' while no raccoon was trapped (or any other animal). These ‘false alarms’ had different causes, in order of occurrence:
* leaves or twigs between the trap-door and the ground, allowing the trapped animal to open the trap;
* a skewed trap causing the trap-door to stick halfway;
* unknown cause (possibly partly wood mice and bank voles that set off the trap mechanism but then managed to escape through the mesh);

* frozen parts of the trap mechanism;
* cable curling up (causing the trapdoor to stick);
* jumping on/manipulating the trap from the outside by a raccoon, causing a trap to shut;
* escaped raccoon;
* theft of the trap (see also 3.9).

Therefore, the deployment of wooden traps in a humid environment (marsh forest in valleys) is not ideal. The above reasons contributed to the decision to use mesh-wire traps in the 2021-2022 trapping period.

During trapping in 2021-2022, disadvantages of mesh-wire traps were also noted. In practice, it was frequently found that a mesh-wire trap 'closed' but no raccoon was caught (or any other animal). Hereby a list of possible causes (in order of occurrence):

* small mammals (wood mouse, bank voles and brown rats) that set off the trap mechanism may escape between the mesh;
* unknown cause;
* slightly shifting sensor/magnet causing a notification of a tight trap;
* fallen branches on the trap causing the trap to go off;
* jumping on/manipulating the trap from outside by a raccoon, causing the trap to fall shut;
* escaped raccoon (four times at three different traps; probably by two different individuals);
* flooding, causing the trap to move and close;
* curious humans and theft of the trap (see also 3.9).

3.4 Raccoons with a transponder

Two trapped raccoons already had a transponder when caught. The first animal was catch number 5, an estimated five-year-old female. The producer of the transponder stated that the transponder of this animal had been sold to a veterinary practice in South Limburg, but the animal could not be found in the records of this practice (personal com. veterinarian). The conclusion is that the animal must have been released or escaped from a private owner in South Limburg.
The second animal, number 84, had a transponder with the German country code and had already been castrated. This indicates that the animal escaped from an 'animal park' or private collection in adjacent Germany.
The raccoons with a transponder were also identifiable as 'escaped pets' in terms of behaviour by AAP Foundation staff, as these animals had a distinctly different day-night rhythm than other captures. The animals were more diurnal and not afraid of the keepers.

3.5 Shooting

No raccoons have been shot in the province of Limburg in recent years, according to the FRS registration system. Shooting was possible at locations where a life-trap had been in place for three weeks when the presence of a raccoon was proven, but without trapping the animal. In practice, no use was made of this possibility.
As far as known, in adjacent Germany just across the border near Lemiers, two animals were caught and trapped by German hunters. A third shot raccoon was found dead just on the German side of the border near Nieuwstadt. This animal was possibly shot just across the

border in Germany (where shooting is allowed).

3.6 Distribution and number of raccoons

Over the past three years 95 raccoons have been trapped in several sessions. Also road kills and other dead raccoons have been reported with some regularity. At the start of the project there were still clear 'core areas', based on the results of Delbroek & Janssen (2018), such as the Valley of the Roode Beek, Valley of the Geleenbeek and the region around Maastricht. Due to the online raccoon portal, the increased number of sightings showed that raccoons were living in a much larger area in the province of Limburg than previously was known. Most sightings seem (still) to be concentrated to the aforementioned stream valleys, including the entire Geul valley and locally along the Meuse.
In cities and villages, the number of reports is low, although raccoons are reported with some regularity in Maastricht and in several villages on the Central Plateau. The number of reports in the forest on the slopes of the Geul valley (incl. Vijlenerbosch) seems to be increasing.
Looking at the estimated age of the captured raccoons (based on Table 2), about a third of the animals appear to be one year or younger. This indicates that the majority of the population present consists of adults.
Several locations show raccoons literally living on the border, with their activity area located both in Limburg and abroad: in adjacent North Rhine-Westphalia (Germany) or in the Voerstreek (Belgium). In the Voerstreek, raccoons are trapped with some regularity (personal comment R. Delbroek). In North Rhine-Westphalia, the German government has requested hunters to control raccoons more actively, but it has become clear that not all hunters are willing to do so.

3.7 Origin & raccoon roundworm

A genetic survey by RIVM, with the first 23 samples from Limburg, has shown that the raccoons in the Sittard area (Geleenbeek and Roode Beek) can be considered a local population, that is not part of the population in Hesse (Germany) or the population in Wallonia (Maas *et al*. 2021). A second genetic survey is planned in summer 2022. In this second survey, samples from the Geul Valley and Meuse Valley will also be studied, together with some additional samples from the Geleenbeek valley and Roode Beek valley.
Of the 95 trapped raccoons, 49 individuals were found to be infected with raccoon roundworm, while 46 animals were free of this parasite. This means that 52% of the number of raccoons captured were infected with roundworm.

3.8 Precense of raccoons in North Rhine-Westphalia

Information on raccoon distribution in North Rhine-Westphalia, the German state bordering Limburg, was provided by the Landesamt für Natur, Umwelt und Verbraucherschutz NRW (Lanuv) (Gehle, personal communication). Based on that report, which provides insight into the number of raccoons shot per 100 ha of huntable area, it can be concluded that the center of raccoon distribution is in the easternmost municipalities (assuming that raccoons

are hunted as often in the western part of North Rhine-Westphalia as in the eastern part). Based on these data, the 'front' of the raccoon's distribution in North Rhine-Westphalia is not located at the Dutch border but halfway of this federal state.

3.9 Trap theft

During the first trapping period 10 traps with trap alarms were stolen, while only one trap alarm was stolen in the second trapping period. Three camera traps set up near the traps were also stolen. No new life-traps were set up at these locations to prevent repetition of theft. Thefts were reported to the police after each event. These thefts of material significantly hampered the investigation, as no traps could be set up at these locations and fewer trapping devices could be used. The reason for the theft has not become clear.

During the third and fourth trapping rounds (2021-2022), mesh-wire traps were also found to be stolen. Twice the trap including the trap alarm was stolen; once only the trap alarm (although nobody can use the alarm without a code). Once the trap was delivered to the Water Board Limburg because it was thought it had drifted with the flooding (which was not the case), twice a trap was disabled.

4 Discussion and conclusion

4.1 Online raccoon portal

Obtaining sightings of raccoons from the 'general public', in addition to observations using wildlife cameras, is very effective in detecting the presence of raccoons. The raccoon portal has worked very well and has proven to be a low-threshold way to get (more) reports of raccoons. A large proportion of the sightings were complementary to wildlife camera sightings and to sightings entering the NDFF (National Database on Flora and Fauna) through other sources (La Haye *et al*. 2021). It therefore appears that relative to other data sources, clearly more raccoons are reported through the specific online portal than through other routes and databases.
More than half of the sightings on the portal were actually raccoons. A good result which shows that the portal played an important role in signaling raccoons in Limburg, but also elsewhere in the Netherlands.

4.2 Distribution and origin of raccoons in Limburg

In the entire province of Limburg, raccoons are present (Delbroek & Janssen 2018; La Haye *et al*. 2020; La Haye *et al*. 2021). From a Dutch perspective, higher densities are found in the south of the province of Limburg. Moreover, the population near Sittard (Valleys of Roode Beek and Geleenbeek) appears to be of local origin (Maas *et al*. 2021). Trapping raccoons with a transponder indicates that raccoons, still, escape from private individuals or from zoos with non-native animals in their collection.

Based on information from North Rhine-Westphalia (Gehle 2019), the 'front' of the expanding Central German population of raccoons is, for the time being, located in the eastern part of this German state. It is estimated that the influx of raccoons into Limburg from central Germany will therefore be small for the time being, with the current influx of raccoons coming only from the present local population. However, it has been observed that raccoons do enter the Netherlands from the Selfkant region (Gangelt area) with some regularity. The largest numbers of raccoons were caught in the valley of the Roode Beek, while only on Dutch territory. It is inevitable that 'German' raccoons were also caught. Even after three trapping seasons, the Roode Beek valley was the region with the highest number of catches. As this stream is a border stream and partly runs through Germany, this means that 'German' raccoons will continue to be caught in the Netherlands.

The Province of Limburg is in contact with the competent German authorities and has asked for appropriate control to prevent migration to the Netherlands. To date, this has not (yet) led to noticeable results: no decrease in catches has been observed in Limburg.

To bring the issue of cross-border populations to the attention of neighboring countries, Province of Limburg organized an online meeting on raccoon control in Limburg in early 2021. Experts and officials from the following countries/regions participated in this meeting: Flanders, Wallonia, North Rhine-Westphalia, Luxembourg and the Netherlands. The

information discussed was also shared with colleagues from northern French regions, who unfortunately could not participate in the meeting.

It is noteworthy that in the second and third trapping sessions (2020-2021 and 2021-2022 respectively) significantly more raccoons were reported in the extreme south of South Limburg by nature managers (Staatsbosbeheer, Natuurmonumenten), while in the same period hunters also repeatedly reported raccoons in the Geul valley. It is possible that these raccoons originate from the expanding Belgian (Walloon) population. Raccoons are widespread in Wallonia and locally densities are high (with up to 10 visible raccoons in one camera photo). These high densities came to light during the control of the African swine fever outbreak in the Ardennes. It is conceivable that the raccoons near Maastricht and in the Geul Valley originate from Belgium. Additional genetic research will shed more light on the origin of these animals.

4.3 Present population

At the start of the project, it was assumed that there were about 100 raccoons present in Limburg and that the project could help to reduce the numbers and/or contribute in removing the population. Based on catching 95 individuals, it is possible to conclude that almost all the raccoons present should have been trapped. However, this assumption is unjustified for several reasons:
First it should be noted that during the project raccoons turned out to be present at more locations in Limburg than previously thought (Delbroek & Janssen 2018; La Haye *et al*. 2021). This could be the result of an actual growing population due to local reproduction or animal migration from nearby German/Belgian regions and/or escapes. But it could also be an apparent increase due to increased awareness around the raccoon and the low-threshold possibility of reporting through the online raccoon portal.
Secondly, it appears that in areas where many raccoons were caught, such as the Roode Beek valley, some of the raccoons had a 'transboundary' habitat. Thus, the local population around Sittard is actually a Limburg-German population, whereas previous estimates specifically referred to the 'Limburg part' of the population. However, there is no insight into how many animals make up the 'German part' of the population. It is also unknown whether and, if so, how intensively raccoons are managed in North Rhine-Westphalia, although it is clear that the enthusiasm among German hunters to shoot raccoons varies. In adjacent Belgium, particularly the ‘Voer region’, intervention does take place (on a small scale) and raccoons are removed following reports of nuisance.
Besides possible, short-distance migration from neighboring countries, there is also the possibility of natural recruitment. Every year, some of the raccoon females present give birth to young, some of which will survive and support the population numerically. However, it is unknown what proportion of females give birth, what is the average litter size or what is the survival of young raccoons. Hence, it is known that at least 41% of captured females were pregnant in spring. With the current data, it is not possible to calculate how large the annual natural population growth (without immigration) could be or is.
Taking all uncertainties into account, it is estimated that there are still a few dozen raccoons living in Limburg. While the population may have declined due to trapping (and incidental

road casualties), this is difficult to substantiate. With a declining population, it is expected that trapping raccoons will become more difficult, with increased time for a raccoon to walk into a trap. However, there is no evidence of this: raccoon activity remains unchanged in many locations and trapping rates remain seemingly constant. At the same time, it should be noted that it is also unknown how large the population would have been without raccoon trapping in recent years. Moreover, the trapping of raccoons in several locations has solved the perceived nuisance, although it remains to be seen whether the effect is sustainable or only temporary.
It is now clear that the 'Limburg' population, especially in the Sittard area, is larger than expected, so that -even after three seasons- decent numbers of raccoons are still being caught.
Another explanation could be that 'German-Limburg' or 'Belgian-Limburg' raccoons are shifting their activity area after raccoons have been caught away from Limburg. The 'Limburg' population is therefore 'replenished' by the capture of raccoons with raccoons that were previously (more) active in neighboring countries/border regions. The cross-border population as a whole did shrink or grow less rapidly (possibly also because reproduction was prevented), but efforts were insufficient to demonstrably reduce numbers in Limburg. Reducing raccoon numbers in Limburg will probably require more intensive removal of raccoons, both in Limburg and in adjacent regions abroad.

4.4 The use of life-traps in practice

In practice, raccoons appear to be trappable with some patience, using wooden life-traps and mesh-wire traps. A 'direct' comparison between wooden traps and mesh-wire traps is difficult, due to differences in the number of traps used and the number of trap nights made. However, in the third trapping season, when mesh-wire traps were used, twice as many raccoons were caught than in the previous two trapping seasons combined. The mesh-wire traps therefore have a significantly better and higher trapping success than wooden traps. In addition, mesh-wire traps are much more practical to use, making it easier to place larger numbers in the field. A (minor) disadvantage is that raccoons can demolish the trap alarms more easily, which can be overcome with a better attachment.

4.5 (Im)possibilities for accommodating captured or injured raccoons

AAP Foundation indicated in April 2022 that long-term accommodation of raccoons has become very difficult in the Netherlands. There are potentially still some accommodations available in Dutch zoos, but complicated licensing procedures currently prevent animals from being legally rehomed. It has therefore become impossible to house raccoons caught in Limburg in Dutch or foreign zoos.
This also creates problems in other areas: raccoons that end up in animal ambulances or an animal shelter are not allowed to be returned to the wild or rehomed after being taken in or collected. However, sustainable sheltering these animals is also no longer possible. This will create bottlenecks in practice, for which a solution will have to be found

4.6 Raccoon roundworm

Raccoons are potential reservoirs for multiple zoonotic diseases (Stope 2019), while little information is available on the actual presence of zoonotic disease in raccoons and the risks it poses to humans. Research by RIVM and AAP Foundation shows that just over half of the raccoons caught in Limburg carried the raccoon roundworm. RIVM advocates to continue the monitoring of the presence of raccoon roundworms in raccoons. Not only in captured raccoons, but also in traffic victims or other death finds. It is therefore recommended to sample the latrines (defecation sites) of raccoons by RIVM for the presence of raccoon roundworm, with adequate hygienic measures to be taken when removing such a latrine (https://www.rivm.nl/baylisascaris-procyonis/wasberenlatrines).

It is notable that raccoon roundworm seems to be absent in the Walloon population of raccoons (Maas *et al*. 2021). If the Limburg population of raccoons, where about half of the animals are infected, comes into contact with the Walloon population, there is a good chance that raccoon roundworm will establish itself in the Walloon population, which would significantly increase the spread of this zoonosis in Belgium. The chances of people in Belgium contracting roundworm would then increase.

4.7 Bottlenecks in implementation

4.7.1 Trapping period versus animal welfare

Trapping of raccoons in recent years always ended on March 15th (in 2022, spring trapping was done until April 1st, see below). The main purpose to stop trapping in early spring was to avoid trapping lactating raccoons. The province of Limburg indicated that from an animal welfare point of view, catching lactating raccoons was not desirable. By limiting the trapping period in spring, no lactating raccoons were trapped. However, of the captured females (n = 17) in spring, 41% were found to be pregnant (n = 7) (Table 2, Appendix 2).
To check whether trapped raccoons were possibly already lactating, raccoons were checked using a clamp cage in February-March 2022. This allows (with some practice) to see whether individuals are lactating or not, allowing trapping in 2022 until April 1st.
Lactating females would be released again, as it was necessary to prevent any litter left behind from starvation, with the expectation that any litter could easily be captured in autumn.
Limiting the trapping period from early September to March 15th and/or April 1st has the disadvantage that raccoons can only be trapped during a limited part of the year. Moreover, raccoons are also hardly active in the middle of winter (Figure 3a and 3b: hardly any raccoons were caught in December and in January).
By checking trapped females in spring and summer for signs of lactation, it would (in practice) be possible to capture them over a much longer period, with the scientific literature showing that the spring months of April and May are months with relatively good capture rates (Troyer *et al.* 2014). This means that by stopping on March 15th/April 1st, a period of 2-2.5 months, with a relatively high catch probability, was left unused to trap raccoons.
From a control point of view and based on our results, it is clear that trapping can be started

at least in September. In mid-winter trapping can be paused and it can start again in spring and continue into the summer, without adverse animal welfare impacts. All under the condition that lactating females are returned on the site.

4.7.2 Wooden or mesh-wire life-traps

Working with mesh-wire life-traps, including a trap alarm, is much better and more efficient than with wooden traps. Mesh-wire life-traps are lighter and therefore more manageable, not sensitive to rising moisture and less visible in the field. A drawback is that some of the caught raccoons, managed to grab the trap alarm and destroy it. Also some raccoons escaped from the mesh-wire traps by brutal force.

4.7.3 Relocation of traps

Relocating traps more often takes some extra time, as finding a suitable trapping location can be difficult and therefore time-consuming. Especially during the winter period, with less cover as bushes and trees have dropped their leaves. Nevertheless, moving traps more often (say, after 5-6 weeks) seems a good strategy, because raccoons are caught on average after two weeks (mesh traps) or three weeks (wooden walk-in traps). Relocating probably increases the probability that a raccoon will encounter a trap and walk into it. Meulemans (2021) and Fiderer *et al.* (2019) show that raccoons use several smaller 'foraging cores', with which the probability of discovering a trap is related. It seems that the best trapping sites may not always be found during trap placement, as it sometimes takes a long time to find and trap an individual.

4.7.4 Use of EGG-traps

Some raccoons show reluctance to walk into the traps. To catch these individuals, the use of the 'EGG trap' could be considered. It is an authorized trapping device (leg trap), also within the EU, that catches raccoons very selectively. In terms of use, however, there are serious animal welfare concerns, making the use of this trapping device more difficult to justify.

4.7.5 Shooting possibilities for hunters

On several locations outside the core areas, attempts were made to trap a raccoon for three weeks following a sighting (from a hunter). In practice, this only rarely resulted in the project team actually catching a raccoon with a life-trap. After the 'mandatory' three-week trapping period, several WBEs (local hunter associations) were subsequently granted dispensation to shoot the animal, but this did not result in the actual shooting of raccoons. The reason(s) for this is/are not known.
Therefore, the agreed procedure of shooting raccoons only after a three-week trapping period has not proved to be very efficient to remove a raccoon from the wild. At least four different hunters in South Limburg have reported (supported by film footage) that they have had one or more raccoons 'for the run', but were unable to shoot these animals due to the lack of an appropriate permit for that situation. Therefore, allowing shooting immediately when a hunter has the opportunity to shoot a raccoon, seems to be a better strategy that is

already applied in other provinces. However, hunters have a varying degree of willingness to shoot raccoons. On the one hand, people are apprehensive about public opinion, on the other hand about the possible disruptive effect on other hunting species.

Within this project, the possibility of immobilizing and trapping raccoons using a stun gun was also explored, but that exploration was quickly stopped because of the complex regulations, logistics and the expected high costs of employing a vet with a 'shooting license'.

4.8 Article 17 or Article 19 status

According to the 'Exotic Species Regulation' (EU Regulation 1143/2014), the Netherlands is obliged to take measures against the presence of exotic species in the wild, including the raccoon. All Union list species have a specific 'status'. Depending on the 'status' of a species, there is a duty to 'eradicate a population' (for Article 17 species) or to 'establish management measures for species that are widespread' (for Article 19 species). The difference between Article 17 and Article 19 is subtle, with Article 17 focusing on the eradication of a 'population', where a population in the ecological sense refers to a group of animals or plants that sustain themselves by reproduction. Article 19 concerns the obligation to take management measures for Union list species that are widespread in the territory of an EU member state. The European Commission has indicated that the term 'widespread' should be interpreted broadly, including small populations that were already present before the Union list came into force. Within Article 19, as under Article 17, complete eradication can be targeted for the entire territory if cost-effectively possible (NVWA 2016). The raccoon is considered an Article 17 species by the Dutch Ministry of Agriculture, Nature and Food Quality, which means that provinces are obliged to remove raccoons from the wild. However, the status is under debate, as experts say the raccoon is 'not eradicable'. This would mean that the species might be better placed under Article 19.

The raccoon cannot be eradicated in the Netherlands as a species in the current situation, because 'new' raccoons can enter the Netherlands in various ways and will continue to do so in the future: through escapes from private individuals or zoos, but also through unintended transport (in trucks or by other means of transport) and through (incidental) migration of animals from (nearby) foreign countries. This suggests, on a very strict interpretation, that an Article 17 status is not feasible for this species. However, Article 17 is about intervening to prevent population formation. It is not necessary to remove the very last individual and, moreover, reproduction has so far only been demonstrated in Limburg (as of 2017). Article 19 has a bit broader scoop, because it is about taking management measures that 'allow' (although undesirable) population formation and 'eradication' is not necessarily the goal (but a possibility).

When the Exotic Species Regulation came into force in 2016, the raccoon was not widespread in the Netherlands and reproduction has only recently been confirmed, resulting in the Article 17 status for the species in the Netherlands. Since then, the species has been found in many more locations and there is actually population formation (in Limburg), so Article 19 status would eventually be more appropriate. A change of status (from 17 to 19)

suggests that management measures can be down-scaled: intervening only in places of nuisance, because '100% eradication' is not possible. However, for the time being, there is still only a regional population with a limited distribution range and a species whose individuals do not travel widely. In such a case, the Exotic Species Regulation requires active intervention to prevent (further) population formation, provided this is cost-effectively possible. It is up to the Province and the Ministry of LNV to determine what constitutes cost-effective control. Note that managing or not controlling raccoons will also result in (substantial) costs.

At this moment there is no need to change the status of the raccoon. Reproduction by raccoons in the Netherlands seems mainly confined to Limburg, and the species does not seem to migrate over long distances (apart from an occasional unintended transport). The raccoon is not a species that suddenly appears at all kinds of locations through natural migration. The actual spread of the species is relatively slow. Locally, however, densities (numbers) can increase if no management takes place. Control of the raccoon can therefore (probably) be effective, provided that control is intensive and maintained for a long time. This is even more effective when management is also implemented in (neighboring) Belgium and Germany. Should the intensive control not have the desired result in the medium term (large numbers of raccoons remain present, including population formation), then the option of changing the status to Article 19 and down scaling control measures is still possible.

4.9 Conclusion

Trapping raccoons in Limburg seems to have been more effective in the last trapping session (autumn 2021/early spring 2022) than in the previous ones, probably due to the switch from wooden life-traps to mesh-wire traps. All trapping efforts have not resulted in the 'complete' disappearance of the population in recent years.
It appears that raccoons occur throughout the province of Limburg and that transboundary populations are present. In Limburg, however, migration of raccoons from the population in central Germany does not seem to occur yet. It is very likely that there is a local cross-border population, which means that raccoons from the directly adjacent areas in North Rhine-Westphalia and Belgium also live in Limburg (and vice versa).
The population in the region around Sittard-Gangelt seems to be of local (German) origin, which can be deduced, among other things, from the German transponder found.
In the southern part of Limburg in the Geul and Meuse valleys, raccoons may have originated from the Belgian (Walloon) population. A new genetic analysis, now started, will hopefully give a definitive answer on this topic.
Of the raccoons trapped, about half were found to be infected with the raccoon roundworm and 41% of females caught in spring were pregnant.

5 Future perspective

Based on the results of this study, it must be concluded that the presence of raccoons in Limburg is a structural issue. Currently, at least one population is present in Limburg in the valleys of the Roode Beek and the Geleenbeek. This population has established itself in the region due to local escapes and/or released raccoons, as evidenced by genetic analysis (Maas *et al.* 2021) as well as catches of two animals with a transponder. This population is present across borders; the population is located both in Limburg and in adjacent North Rhine-Westphalia. To reduce this population, active intervention on both sides of the border is needed.

The situation in the Geul and Meuse valleys is more ambiguous, although there also seems to be population formation in these areas. The origin of the raccoons in this area is not yet known, although migration from the Belgian population is the most logical explanation. The population in the Geul and Meuse valleys has shown a notable increase in recent years, as evidenced by the increased number of sightings. However, trapping raccoons in both river valleys is difficult, as there are few locations where life-traps can be placed safely (without disturbance or risk of theft).

It is important to consider the raccoon situation in Limburg in a national and international perspective. The raccoon is on the rise throughout the Netherlands and Europe (Salgado 2018), but the species is only incidentally managed through targeted control programs (Mazzamuto *et al.* 2020). In contrast, the 'European Union Invasive Exotic Species List' (Regulation No 1143/2014) requires active control or population management. It is to be expected that, in coming years, more attention will be paid in the Netherlands and Europe, and specifically within the EU, to the control of this species. How this control can or should be carried out efficiently and effectively is not (yet) clear, but this study has provided the first insights. In Italy, raccoons have actually been successfully controlled locally (Mazzamuto *et al.* 2020). Control in Italy was implemented during several years and control was done year-round by professionals.

Several studies show that limiting the raccoon population in number and distribution has important benefits for preventing problems in the future (Salgado 2018; Suzuki & Ikeda 2020). When densities are still low, the often limited budget for control can be used effectively and removal is also less of an issue among residents in an area.
With increasing densities, many more costs have to be made, population control is much more difficult, it takes longer for an effect to be visible and it is expected that there is less support among residents for raccoon removal because of the ‘cuteness-factor’.
In addition, with the increase of raccoon populations in Europe, more and more problems with raccoons and conflicts with native species have been reported, for example by Cichocki *et al*. (2021). They reported high predation of bats in Nietoperek (a bunker complex in Poland used as a winter roost by thousands of bats).
Due to the climbing capabilities of this species, it is very imaginable that raccoons will also become a serious threat for bats present in Limburg marl quarries. Sparks *et al.* (2003)

describe significant predation pressure on two bat species in the native range of the raccoon in the United States at higher raccoon densities.
Gottschalk *et al.* (2019) describe a study on the breeding success of red kites. They found among nests where they could hang camera traps (n = 58) six nests preyed upon by raccoons and three failed nests by pine martens.
Limiting the population of raccoons in Limburg could possibly also prevent the raccoon population in Wallonia from becoming infected with raccoon roundworm. The Walloon population currently appears to be free of raccoon roundworm, but this may change rapidly if it comes into contact with the Limburg population.
Finally, perceived nuisance from raccoons in Limburg has been found to be rapidly increasing. In recent years, several complaints were received about hen houses being broken open, including hen houses which were solidly built. There was also nuisance from raccoons in (hay) attics, in an office, garden ponds being turned upside down and nuisance in and around holiday and recreational homes. With a further increase in the raccoon population, it is inevitable that nuisance will also increase.

It is important that the province of Limburg, and the other Dutch provinces, develop a long-term strategy on how to deal with the presence of raccoons and, in particular, how to deal with the cross-border populations with Germany and Belgium in order to limit population formation in Limburg (and elsewhere) as much as possible. This requires (inter)national cooperation and the exchange of knowledge and experience, as the problems and solutions are transnational.

For a long-term strategy, the province of Limburg has the following options:
1) No control
2) Control only in case of perceived nuisance
3) Continuous control (similar to muskrat control).
The 'no control' option is not allowed for a species with Article 17 status. If the choice is nevertheless to stop management of raccoons, the population is expected to remain limited in size in the short term, but to increase substantially in the medium term. Once the population has reached a substantial size, the perceived nuisance is expected to increase rapidly (exponentially). Control (removal of the population) at that moment is practically and financially no longer possible, after which only option 2 remains: act when nuisance is experienced.
The disadvantage of option 2, intervening only when nuisance is experienced (by people), is that it requires an ad hoc, case-by-case response. Preventive measures will (have to) be taken in first instance, but raccoons are extremely difficult to exclude in practice, while being very agile and strong. In practice, for instance, even very solid hen houses can literally be broken open by raccoons.
Trapping (and killing) a resident raccoon (or raccoons) is usually only a temporary solution, as a location is apparently attractive for a raccoon. It therefore is highly probable that a new individual will appear again. It is estimated that intervening when a nuisance is experienced, will only provide temporary relief and problems and nuisance will continue to occur. The province, as the responsible authority, will be continually asked to act.

In addition to problems and nuisance caused by raccoons in the human environment, higher raccoon densities will also lead to damage to nature and fauna in particular. There are examples from abroad where (rare) birds of prey (eagle owl and red kite) have a reduced breeding success because raccoons take the eggs or young from the nest. Locally, raccoons can also have a strong negative effect on rare amphibians and wintering bat species (including Natura 2000 species).
Our recommendation, in line with option 3, is to establish a coordinated control program for the raccoon, with the goal of keeping the raccoon population in Limburg at low levels. A truly complete eradication of the raccoon in Limburg (and the Netherlands) is not feasible, because probably not all individuals will be caught and because there will be continuous immigration of individuals. Targeted and active control by a professional control organization provides the best opportunity to minimize the population and reduce its size. This will also reduce the negative effects of the resident raccoons.

Hence, while the live (trapping) of raccoons is socially and from an animal welfare perspective desirable, legally trapping raccoons is no longer possible, if at all. In addition, it is also debated as to whether lifelong capturing of animals is ethically defensible.

6 Recommendations

We have listed a number of practical recommendations for the short term.

Recommendation 1: start with active management
Over the past three years, substantial efforts have been made to gain experience in trapping raccoons in Limburg and to get grip on the population size and origin. As a result, we know that capturing raccoons, as expected, is not easy and a long-term effort, especially when the population is low. The Italian project (Mazzamuto *et al.* 2020) shows that persistent control can result in a complete eradication of a local, isolated population.
In Limburg, there is no isolated population, but transboundary populations are present. Nevertheless, the advice is to actively pursue control in Limburg. This will, in our estimation, reduce the population around Sittard. It is also important to intervene on the German side of the border. Whether this also applies to the cross-border population in the Geul and Maas valley needs additional research.
Collaboration with muskrat trappers remains desirable, for detecting raccoons or traces of raccoons and for the easy transfer or humane killing of raccoons that are caught as bycatch in nutria or muskrat traps.

Recommendation 2: extending the period of trapping
Trapping of raccoons in spring has been limited in recent years until March 15th, but April and May are months with a relatively high trapping probability. To remove an existing population of raccoons more quickly, it is recommended to allow raccoon trapping in late spring and summer as well. Longer trapping may be at odds with animal welfare, but this is easily overcome by immediately checking trapped raccoons for sex and whether animals are lactating. Lactating individuals can then be released immediately. In autumn, trapping should also be started quite early, preferably as early as late summer.

Recommendation 3: central coordination and focal point is crucial
A permanent point of contact (with a professional coordinator) is crucial for smooth cooperation with all relevant individuals and organizations involved in the management of raccoons.

Recommendation 4: use mesh-wire traps for trapping
In practice, mesh-wire traps prove to be much better trapping devices than wooden life-traps, with mesh-wire traps having the advantage of being easier to (re)place. The advice is to use only mesh-wire traps for trapping raccoons. However, the loose parts of mesh-wire traps should be really firmly attached to each other to prevent raccoons from breaking out.

Recommendation 5: make shooting easier
It is recommended to make it easier for hunters to shoot raccoons, which should be seen as complementary to professional control. It is likely that the raccoon population will decline more quickly if hunters can shoot raccoons. There have been several occasions where

shooting would have been possible, but was not allowed. Shooting by hunters is not a replacement for professional control, but should be seen as an additional activity to reduce the population. Without professional control, the advice is not to allow shooting by hunters, as it is not an alternative for active management.

Recommendation 6: maintain the online raccoon portal
The online raccoon portal has shown to be an easy way of getting more raccoon sightings and thus keep track of raccoon presence. It is recommended to give the raccoon portal a more structural character and make arrangements for handling and forwarding reports to the NDFF.

Recommendation 7: start a national and international cooperation in raccoon management
The province of Limburg is largely bordered by Belgium and Germany and therefor has every interest that the population of raccoons in neighboring countries are kept as small as possible. In this sense, it is important to permanently ask Belgium and Germany to actively remove the population of raccoons in the adjacent regions as much as possible. The exchange of knowledge/experience can also be interesting in order to remove raccoons from the wild as efficiently as possible (exchange of best practices).
Within the Netherlands, the province of Limburg has the most experience in terms of knowledge in dealing with the raccoon. The other Dutch provinces can benefit from Limburg's experience. For successful control, national and international cooperation is crucial.

Recommendation 8: monitor immigration/origin of raccoons through DNA analysis
The origin of raccoons can be monitored by carrying out a DNA analysis on samples of raccoons caught or found dead at regular intervals. This provides insight into whether raccoons come from abroad or are of local origin. This makes it easier to determine where policy should focus: local/regional control or encouraging control in neighboring countries and near the borders.

Recommendation 9: GPS- transmitters for more ecological information
It appears that some traps consistently trap raccoons, while no raccoons are trapped in other traps in the same area. For an effective management, it is desirable to understand how and in what way raccoons use an area or a specific valley landscape. Studies from Germany (Fiderer *et al.* 2019) and Wallonia (Meulemans 2021) do give an impression of habitat use by raccoons, but the situation of the valleys in Limburg seems different. Telemetry studies using GPS collars can help to get a better grip on habitat use, allowing further optimization of trapping efforts.

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Appendix 1. Information leaflet on raccoon recognition & raccoon portal

Waarnemingen doorgeven

Heeft u een wasbeer gezien of heeft u een wasbeer in de tuin, schuur, in huis (op zolder) of in het natuurgebied in de buurt, geef uw waarneming door via www.wasberenmeldpunt.nl of scan de QR-code.

Foto voorzijde Maaike Plomp

Besmetting en preventie

Heeft u een wasbeer in huis en ligt er ontlasting, raadpleeg dan de website van het RIVM (www.RIVM.nl) om de ontlasting op een hygiënische manier op te ruimen i.v.m. de mogelijke kans om besmet te raken met wasberen-spoelworm (gebruik altijd minimaal handschoenen en een mondkapje bij het opruimen).

Wasbeer gezien?

Zoogdier vereniging

In samenwerking met provincie limburg

DE ZOOGDIERVERENIGING verzamelt waarnemingen van wasberen in het kader van onderzoek en monitoring. Deze gegevens worden door de provincies gebruikt om passende maatregelen te nemen. In sommige provincies is dit het vangen van wasberen, waarna de dieren worden opgevangen door o.a. Stichting AAP. Andere provincies staan het toe om wasberen te schieten. Wilt u meer weten of wilt u een wasbeer melden? Kijk dan op de website www.wasberenmeldpunt.nl.

2018.096

Hoe herken je een wasbeer?

- Middelgroot dier met een plomp lichaam
- Brede kop die spits toeloopt
- Relatief lange poten
- Langharige vacht; peper-en-zoutkleurig, soms grijs, rossig of geel-grijs op de rug, witgrijs op de buik en licht in de flanken
- Dikke stompe staart met om en om zwarte en grijswitte ringen (4 tot 7 zwarte ringen)
- Typisch gezichtsmasker (zwarte band bij de ogen) met een witte snuit, witte wenkbrauwstrepen en grote oren

Foto Maaike Plomp

wasbeer

Hoe herken je een das?

- Grote, brede kop en een zwaargebouwd gedrongen lichaam
- Witte kop met twee brede zwarte strepen. Deze lopen vanaf het achterhoofd over de oren en ogen en eindigen in een punt bij de mondhoeken.
- Korte poten en een korte, brede, bossige witte staart
- Kleine wit-zwarte oren
- De rug en de flanken hebben een zwart-witte vacht en de onderzijde is geelwit

Foto Aaldrik Pot

das

Hoe herken je een wasbeerhond?

- Hondachtige met korte poten en een gedrongen lijf, ongeveer zo groot als een vos
- Zwart-witte tekening op de brede kop en de bakkebaarden
- Beige-bruinachtige langharige vacht met zwarte vlekken op de rug en flanken
- Donkerbruine poten en buik
- Volle, donkere staart, zónder ringen

Foto Richard Witte

wasbeerhond

Appendix 2. Detailed overview of all trapped raccoons

Serial nr.	Date	Region	Gender	Age in years (estimate)	Comments
1	2019-09-11	Roode Beek valley	Male	2	Nutria/Muskrat trappers
2	2019-09-20	Roode Beek valley	Female	1	Nutria/Muskrat trappers
3	2019-10-11	Roode Beek valley	Male	3	Nutria/Muskrat trappers
4	2019-10-18	Roode Beek valley	Male	<1	
5	2019-10-21	Geleenbeekvalley	Female	5	With transponder
6	2019-10-22	Roode Beek valley	Male	0,5	
7	2019-10-22	Roode Beek valley	Female	3	
8	2019-10-22	Geleenbeekdal	Female	2	
9	2019-10-22	Roode Beek valley	Female	1	
10	2019-10-27	valley of the Roer	Female	0,5	Nutria/Muskrat trappers
11	2019-11-02	Tegelen	Female	3	Nutria/Muskrat trappers
12	2019-11-18	Geleenbeekvalley	Female	5	
13	2019-11-29	Roode Beek valley	Male	1,5	
14	2020-01-05	Geleenbeekvalley	Male	3	
15	2020-01-14	Roode Beek valley	Female	3,5	Pregnant upon capture
16	2020-01-27	Roode Beek valley	Male	1	
17	2020-01-28	Roode Beek valley	Female	9 months	
18	2020-02-11	Geleenbeekvalley	Female	4-5	
19	2020-02-12	Geleenbeekvalley	Male	4-5	
20	2020-03-01	Roode Beek valley	Female	3,5	Pregnant upon capture
21	2020-03-15	Susteren	Female	2	
22	2020-03-16	Susteren	Male	3	
23	2020-04-02	Roode Beek valley	Male	2	Nutria/Muskrat trappers
24	2020-09-10	Roode Beek valley	Female	8 months	
25	2020-09-10	Roode Beek valley	Female	1,5	
26	2020-09-13	Roode Beek valley	Male	8 months	
27	2020-09-24	Roode Beek valley	Female	1,5	
28	2020-10-14	Maastricht	Female	2,5	
29	2020-10-22	Roode Beek valley	Female	3	Nutria/Muskrat trappers
30	2020-10-24	Maastricht	Female	4	
31	2020-10-26	Geleenbeekvalley	Female	8 months	
32	2020-10-27	Roode Beek valley	Male	8 months	Nutria/Muskrat trappers
33	2020-10-30	Geleenbeekvalley	Female	3	
34	2020-11-02	Geleenbeekvalley	Male	3	
35	2020-11-04	Susteren	Female	1,5	
36	2020-11-13	Roode Beek valley	Female	2	
37	2020-12-24	Roode Beek valley	Male	1,5	
38	2021-01-21	Geleenbeekvalley	Male	5	
39	2021-01-25	Meuse	Male	4	Private
40	2021-01-27	Susteren	Male	6	

Serial nr.	Date	Region	Gender	Age in years (estimate)	Comments
41	2021-02-20	Roode Beek valley	Female	2	Pregnant upon capture
42	2021-02-20	Susteren	Female	2	
43	2021-03-02	Susteren	Male	5	
44	2021-03-03	Roode Beek valley	Male	1	
45	2021-03-14	Roode Beek valley	Male	1	
46	2021-03-15	Roode Beek valley	Male	4	
47	2021-10-16	Roode Beek valley	Female	7	
48	2021-10-16	Geleenbeekvalley	Male	8 months	
49	2021-10-17	Roode Beek valley	Female	3	
50	2021-10-17	Geleenbeekvalley	Male	1,5	
51	2021-10-18	Roode Beek valley	Female	2	
52	2021-10-25	Roode Beek valley	Female	5	
53	2021-10-25	Roode Beek valley	Female	1,5	
54	2021-10-25	Roode Beek valley	Female	2	
55	2021-10-26	Geulvalley	Male	3 months	
56	2021-10-26	Geleenbeekvalley	Female	2	
57	2021-10-27	Roode Beek valley	Male	3	
58	2021-10-27	Roode Beek valley	Male	9 months	
59	2021-11-01	Geleenbeekvalley	Male	6 months	
60	2021-11-02	Geleenbeekvalley	Male	3	
61	2021-11-02	Susteren	Female	4 months	
62	2021-11-05	Meuse valley	Male	2	
63	2021-11-05	Roode Beek valley	Male	1	
64	2021-11-07	Geleenbeekvalley	Male	3 months	
65	2021-11-08	Geleenbeekvalley	Female	6 months	
66	2021-11-10	Susteren	Female	3	
67	2021-11-12	Roode Beek valley Beek	Female	6	
68	2021-11-12	Geleenbeekvalley	Female	4	
69	2021-11-16	Geleenbeekvalley	Male	11 months	
70	2021-12-05	Roode Beek valley	Male	8 months	
71	2022-02-07	Roode Beek valley	Female	8 months	
72	2022-02-11	Roode Beek valley	Female	2	
73	2022-02-11	Geleenbeekvalley	Female	4	Pregnant upon capture
74	2022-02-11	Geleenbeekvalley	Male	4	
75	2022-02-11	Geleenbeekvalley	Male	6 months	
76	2022-02-12	Roode Beek valley	Male	4	
77	2022-02-14	Roode Beek valley	Male	3	
78	2022-02-17	Roode Beek valley	Male	1	
79	2022-02-17	Roode Beek valley	Male	4	
80	2022-02-21	Geleenbeekvalley	Male	2	
81	2022-02-22	Geleenbeekvalley	Female	9 months	
82	2022-02-24	Dal van de Roode Beek	Male	4,5	

Serial nr.	Date	Region	Gender	Age in years (estimate)	Comments
83	2022-02-27	Roode Beek valley	Male	2	
84	2022-03-01	Roode Beek valley	Male	3,5	With transponder (German code)
85	2022-03-03	Susteren	Female	2,5	Pregnant upon capture
86	2022-03-05	Geulvalley	Female	1	Pregnant upon capture
87	2022-03-08	Geulvalley	Male	4	
88	2022-03-15	Geleenbeekvalley	Female	9 months	Pregnant upon capture
89	2022-03-16	Geleenbeekvalley	Female	2	
90	2022-03-19	Geulvalley	Male	9 months	
91	2022-03-25	Roode Beek valley	Male	4,5	
92	2022-03-26	Geulvalley	Male	2	
93	2022-03-28	Geleenbeekvalley	Male	3,5	
94	2022-03-30	Susteren	Female	2,5	
95	2022-04-01	Susteren	Female	1	