MICA

Management of Invasive Coypu and muskrAt in Europe

NATURA 2000

Monitoring and management of coypu and muskrat

Innovative methods developed by the LIFE-MICA project and their application for monitoring and management of invasive alien species beyond the project

MICA
Management of Invasive Coypu and muskrAt in Europe

LIFE-MICA project

Innovative methods for monitoring and management of coypu and muskrat

MICA (*Management of Invasive Coypu and MuskrAt in Europe*) is an EU-LIFE project with the aim to develop management strategies for invasive coypus (*Myocastor coypus*) and muskrats (*Ondatra zibethicus*) in Europe. From 2019 to 2023, innovative methods for population control of these species are tested in cooperation between German, Dutch and Flemish institutions.

Invasive alien species

In the course of globalization, species increasingly establish outside their native dispersal areas. These species are called invasive if they threaten biodiversity, human and animal health or cause economic damage in their new habitats.

EU Regulation on invasive alien species

The EU Regulation No. 1143/2014 aims to mitigate negative impacts of invasive alien species on biodiversity. The regulation defines measures to prevent the introduction of invasive alien species and to manage established populations. A Union list names invasive alien species of Union concern: among others are coypus and muskrats.

Coypus and muskrats in Europe

Originally, coypus come from South America and muskrats from North America, respectively. They established in Europe after releases from fur farms in the 20th century. Both species are semi-aquatic rodents, which mainly feed on riparian vegetation and burrow tunnels in riverbanks.

Figure 1: swimming coypu.

Impact of coypus and muskrats

- alteration in the habitats of rare animal and plant species
- undermining of waterway infrastructure (dikes and dams)
- damage to agricultural land

Figure 2: Coypu den at a riverbank.

Methods developed by the LIFE-MICA project

In the LIFE-MICA project, innovative methods for monitoring and management of coypus and muskrats are developed and tested in 11 project areas in Flanders, the Netherlands and Germany. The aim of LIFE-MICA is to provide tools for coypu and muskrat management that can be employed in further regions with coypu and muskrat occurrence. Generally, those methods could be applied for the management of other invasive alien species as well. The following pages contain an overview of the developed management tools with some technical information and an outlook on possible application of the methods in invasive species management in general.

Smart camera tracking

Large-scale screening of occurrence of coypus and muskrats

In the management of invasive alien species, an efficient early recognition of the first occurrence of the respective species and a thorough monitoring of existing populations are essential. As a consequence, prompt measurements for rapid eradication or prevention of further spreading of those species can be taken. For this purpose, the LIFE-MICA project develops an innovative camera trap monitoring that reduces the workload of image analysis with the help of artificial intelligence and thus enables a large-scale monitoring of the occurrence of coypus and muskrats on waterways.

Method

In the course of LIFE-MICA, numerous camera traps have been installed at key locations on waterways in project areas in Flanders, the Netherlands and Germany.

Figure 3: Installation of camera traps at a waterway. The cameras are directed towards the surface of the water.

The camera traps take pictures of all animals passing on the waterways.

Figure 4: Camera trap image of a coypu (left) and a muskrat (right) on a waterway.

The camera trap images are uploaded and organized on the platform Agouti (www.agouti.eu). In the beginning of the project, all uploaded images were classified manually according to observed species and number of animals.

Figure 5: Screenshot of the Agouti interface for classification of the camera trap images.

With the help of the classified images, an algorithm was trained for automated image recognition. The algorithm is operating and able to differentiate coypus and muskrats from other species. However, some camera trap images are still classified manually in order to further refine the algorithm.

Figure 6: Classification of camera trap images by the algorithm for image recognition in Agouti. A muskrat is correctly classified as muskrat (Ondatra zibethicus).

Agouti has a user-friendly interface and works with the Camera Trap Data Package Standard, the exchange format for camera trap images.

Application of the method

The organization of camera trap data on Agouti and the screening of the images for the occurrence of coypus and muskrats with the help of the Agouti algorithm, significantly reduces the workload of camera trap monitoring. The Agouti algorithm can also be used for recognition of other animal species. Thus, the Agouti platform might be employed for monitoring of other invasive alien or even protected species.

Figure 7: Camera trap image of an otter at a desiccated waterway.

Contact

Instituut voor Natuur en Bosonderzoek (INBO)
Havenlaan 88
1000 Brussel
Email: emma.cartuyvels@inbo.be

RESEARCH INSTITUTE NATURE AND FOREST

Environmental-DNA screening

Detection of muskrats in low density areas

In regions where coypus and muskrats occur just in low population densities, tracking based on visual cues, such as damage to waterways and vegetation becomes extremely time consuming and thus expensive. In these cases, analysis of water samples for the presence of environmental DNA (eDNA) can be a useful tool. As part of the LIFE-MICA project, a method was developed by the University of Amsterdam (UvA) to detect muskrat eDNA in water samples.

Method

Semi-aquatic species, such as muskrats constantly shed DNA into the water by losing skin cells, urine or feces. With the help of qPCR, even those small amounts of eDNA can be detected in water samples.

Figure 8: Swimming muskrat.

To reduce the number of samples that must be taken, water from a waterway is pooled over a distance of 5 km to a final volume of 500 ml. To facilitate the sampling, an automated water sampling device was developed; the eDNA autosampler.

Figure 9: eDNA autosampler for automated water sampling.

The current version of the eDNA autosampler can be used from a boat, a remote-controlled boat or for sampling on foot. The eDNA autosampler accurately logs the coordinates of the route taken and can also be adjusted for taking 500 ml of water over tracks of 1 km.

Figure 10: Water sampling via eDNA autosampler from a boat. The water samples run through a plastic tube and are collected in a plastic bottle.

The collected water samples are brought to a laboratory the same day, where they are filtered and further processed for analysis.

Figure 11: Processing of the water samples. The water from the plastic bottle is filtered and the filter paper containing the eDNA is further processed.

During the LIFE-MICA project, the strategy for water sampling was improved constantly and adapted to field conditions by frequent exchange with the trappers testing the method in the field.

If a 5 km track is positive for muskrat eDNA, the track can be divided in 1 km tracks to further narrow down the home range of the muskrats. If no visual signs of burrows are present along positive 1 km tracks, point water samples every 100 m along this track can be taken to precisely localise burrows. Point water samples are taken using a manual device.

Application of the method

Results from the LIFE-MICA project indicate that full coverage sampling of waterways in an area is not required for obtaining a good estimation of the muskrat population in an area. Therefore, management areas are subdivided into sampling areas. Semi-random sampling of a subset of the waterways with 40 5 km samples can give a good approximation of the population in a sampling area. To statistically confirm that an area is empty of muskrats, an additional 40 samples from different waterways are taken.

In principle, the protocols developed by LIFE-MICA for sampling and sample processing for muskrat detection can be transferred and adapted for monitoring of eDNA of other invasive species, such as crayfish, or protected species such as beavers.

Contact

Universiteit van Amsterdam
Science Park 904, room C2.272
1098 XH Amsterdam
Email: m.boonstra@uva.nl

UNIVERSITY OF AMSTERDAM

DNA-Mapping

Identification of migration routes of muskrats

Once an invasive alien species is detected in a certain region, it is crucial for an effective management to identify migration routes of the animals. That way, management actions can be directed to avoid a continuous influx of those animals. The LIFE-MICA project develops a method that allows identification of relationships between different muskrat populations by genetic analyses (DNA-Mapping) and helps to identify their migration routes.

Method

The protocols for DNA-Mapping were developed and tested exemplary for the province of Friesland in the Netherlands.

For this purpose, tails of trapped muskrats were collected in the course of the Dutch muskrat management in the province of Friesland and neighboring provinces. Samples of the tails were used to elaborate DNA profiles of the animals and compare them with each other.

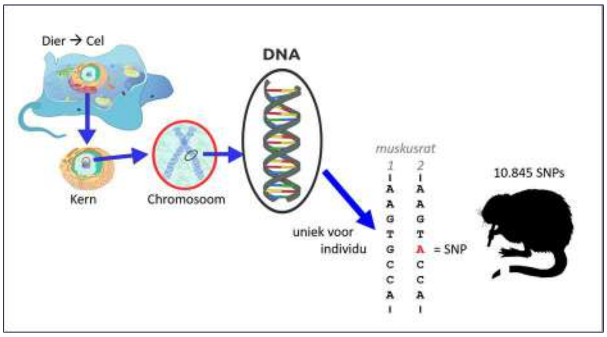

Figure 12: Illustration of DNA-Mapping of muskrats for differentiation of individuals.

The results of the genetic analyses are depicted in Figures 13 and 14 below. Each color represents a trapping organization from different Dutch provinces. In Figure 13, the single red dots on the right side represent the original population of the province of Friesland. On the other hand, the red dots among the cluster of yellow dots, for example, symbolize animals that were trapped in Friesland, but were genetically similar to the population of the province of Zuiderzeeland.

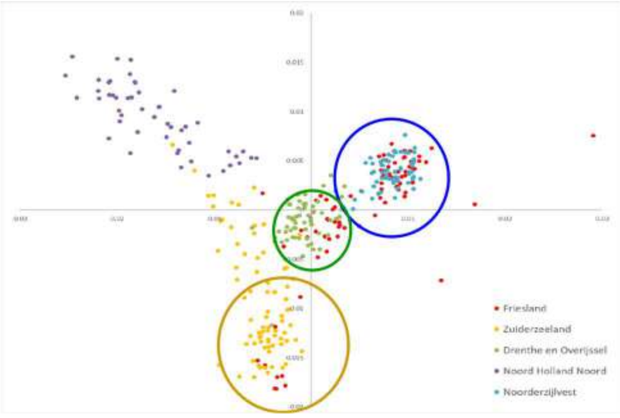

Figure 13: Results of DNA-Mapping of muskrats from Friesland and neighboring provinces. The colors symbolize the different trapping organizations.

On the basis of the identified relationships of muskrat populations from Friesland to populations from neighboring provinces, regions could be identified along which muskrats supposedly migrate to Friesland.

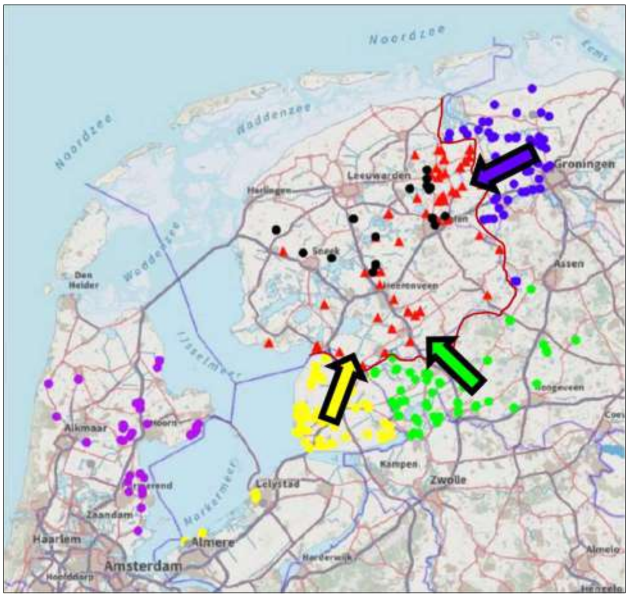

Figure 14: Illustration of the muskrats trapped by different trapping organizations in Friesland and neighboring provinces. The colors symbolize the different trapping organizations. The arrows identify the regions where high migration to Friesland was detected based on the genetic analyses.

The detection of those migration routes of muskrats allows more efficient management measurements, for example, by increasing trapping efforts along water ways where migration occurs.

Application of the method

DNA-Mapping for the analysis of relationships between different populations and identification of migration routes is generally replicable for other invasive alien species.

Contact

Unie van Waterschappen
Koningskade 40
2596AA Den Haag
Email: info@uvw.nl

UNIE VAN WATERSCHAPPEN

Smart life traps

Avoiding unwanted by-catch during trapping

Trapping is an essential tool for population control of coypus and muskrats. However, both species share their habitat with protected mammals like otters and beavers. In order to avoid unwanted by-catch of those protected species, the LIFE-MICA project develops selective life traps that work with an image recognition software and only close for the target species coypu and muskrat.

Method

The smart life traps are equipped with an image recognition system in the rear part of the traps and a reverse electromagnet which secures the door of the traps and keeps it open.

Figure 15: Composition of the prototype of the selective life traps with electromagnet at the door and image recognition system in the rear part of the trap. Inserted picture: image recognition system in the trap.

The image recognition system consists of a motion detector, a camera and a mini computer. If an animal enters the trap, the motion sensor detects a movement and induces the camera to take pictures. The pictures of the animal in the trap are classified by the mini computer with the help of an algorithm.

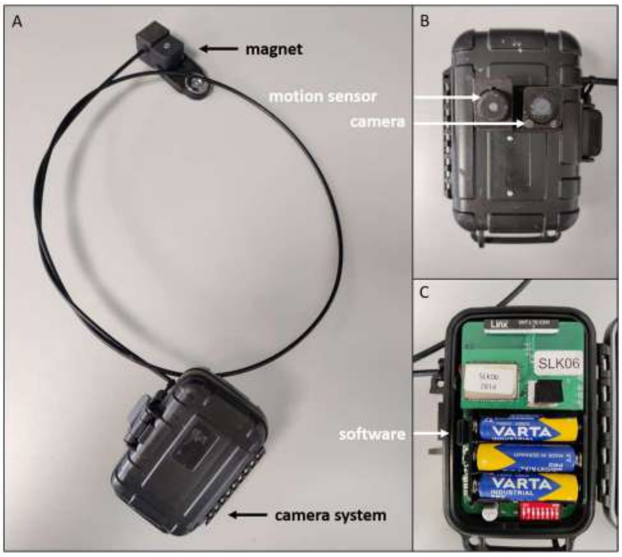

Figure 16: Components of the image recognition system. (A) The camera is connected with the electromagnet, which can be connected to the door of the trap. (B) Frontal view of the camera. (C) Camera system and mini computer from inside.

When the image recognition system detects a target species, coypu or muskrat, a short power pulse (12 V) is applied on the reverse electromagnet and results in a demagnetization which releases the door of the trap.

Figure 17: A coypu enters the smart life trap. The inserted picture shows an image taken of the animal by the camera inside of the trap. The image is directly analyzed and classified by the algorithm.

Furthermore, the image recognition system issues a message with an image from inside of the trap via messaging application (e.g. Telegram) to the smartphone of the trapper.

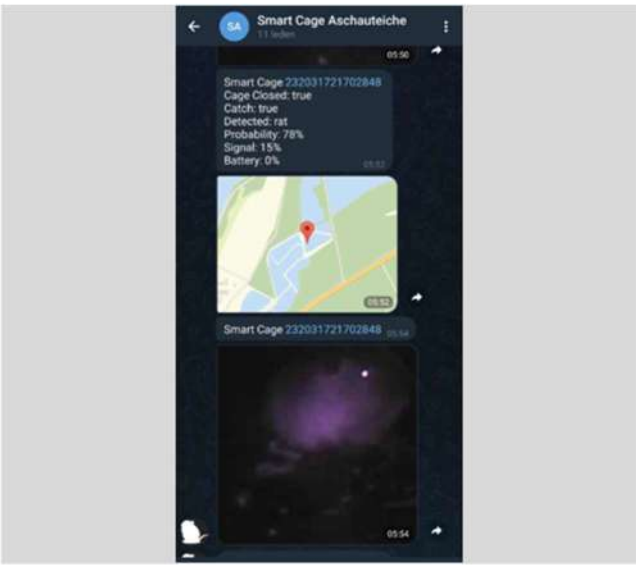

Figure 18: Screenshot of a notification of a coypu catch via messenger service to the smartphone of the trapper.

Application of the method

Prospectively, the developed image recognition and closing mechanism will be adjusted for trapping of other target species (e.g. other invasive alien species or predators) and adapted for complying with different types of life traps.

Figure 19: Raccoon and otter at a smart life trap. The inserted images show photos taken from the animals inside the trap.

Contact

Waterschap Rivierenland
De Blomboogerd 1
4003 BX Tiel
Email: lifemica@wsrl.nl

Waterschap Rivierenland

Dashboard

Collection of data on monitoring and trapping of coypu and muskrat

Management concepts for invasive alien species should be based on available data from species monitoring and an evaluation of applied management actions. Since invasive alien species usually occur transnationally, data on monitoring and management should ideally be exchanged between neighboring countries. The LIFE-MICA project developed a dashboard which visualizes data on monitoring and trapping of coypus and muskrats in Flanders, the Netherlands and Germany.

Method

The LIFE-MICA project collects data on monitoring and trapping of coypus and muskrats in 11 project areas in Flanders, the Netherlands and Germany. Furthermore, management authorities and trapping organizations in Flanders and the Netherlands register data on trapping of both species nationwide. Data transfer scripts were written for the different data sets and enable publishing the data on GBIF, the global databank for biodiversity data.

Figure 20: Illustration of the data flow from data collection via smartphone application and publication on GBIF to visualization on the dashboard.

After the publication of the data on GBIF, they are visualized on the dashboard of the LIFE-MICA project (http://mica.inbo.be/). The datasets can be selected separetedly for visualization and the data can be filtered for species and time period. In future, next to visualization on the map, data can be also displayed in graphs illustrating the development of monitoring or trapping data.

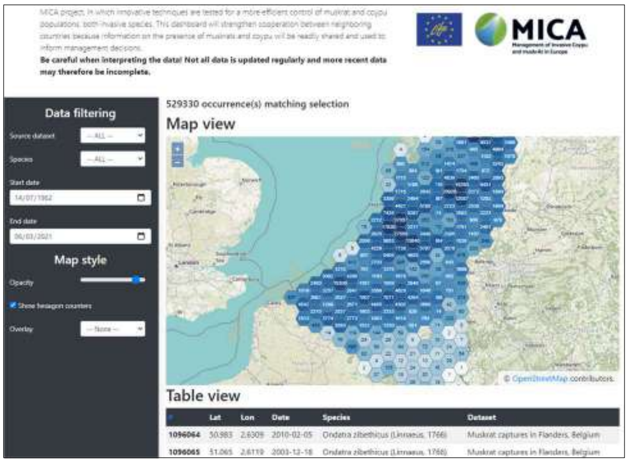

Figure 21: Screenshot of the dashboard of the LIFE-MICA project for monitoring and trapping data of coypus and muskrats.

Application of the method

An exchange of data on management and monitoring of invasive coypus and muskrats between neighboring countries is essential for an efficient and coordinated transnational management. The dashboard developed by the LIFE-MICA project should therefore ideally integrate data sets from further countries and might also serve as a model for data management regarding other invasive alien species.

Contact

Instituut voor Natuur en Bosonderzoek (INBO)
Havenlaan 88
1000 Brussel
Email: emma.cartuyvels@inbo.be

RESEARCH INSTITUTE
NATURE AND FOREST

Replication and Transfer

Employing LIFE-MICA methods for the management of invasive alien species beyond the project

The LIFE-MICA project aims to ensure the replication and transfer of results and experiences beyond the project, including in other sectors, entities, regions or countries.

Replication

So far, methods for coypu and muskrat management developed by LIFE-MICA are implemented in project areas in Flanders, the Netherlands and Germany. Prospectively, those methods can be replicated in other regions in Europe for improving transnational management of coypus and muskrats.

Transfer

Furthermore, the developed methods can be transferred and employed for the management of other invasive alien species and provide interesting tools for an innovative management.

Figure 22 : Raccoon in one of the smart life traps.

Outlook

If you are interested in any of the presented methods and would like to learn more about the developed management tools, please, don´t hesitate to contact us!

You can find an informative video about the LIFE-MICA project by scanning the QR code below:

MICA
Management of Invasive Coypu and muskrAt in Europe

Contact

Tierärztliche Hochschule Hannover
Bischofsholer Damm 15
30173 Hannover
friederike.gethoeffer@tiho-hannover.de

Instituut voor Natuur en Bosonderzoek
Havenlaan 88
1000 Brussel
emma.cartuyvels@inbo.be

Universiteit van Amsterdam
Science Park 904, room C2.272
1098 XH Amsterdam
t.m.breit@uva.nl

Landwirtschaftskammer Niedersachsen
Mars-la-Tour-Str. 6
26121 Oldenburg
heiko.fritz@lwk-niedersachsen.de

Unie van Waterschappen
Koningskade 40
2596 AA Den Haag
dmoerkens@uvw.nl

Waterschap Rivierenland
De Blomboogerd 1
4003 BX Tiel
lifemica@wsrl.nl

Vlaamse Milieumaatschappij
Koning Albert II-laan 20
1000 Brussel
d.slootmaekers@vmm.be

https://lifemica.eu/

This project has received funding from the European Union´s LIFE environment sub-programme under the Grant Agreement LIFE18NAT/NL/001047