Monitoring Plan

A Plan for assessing the impacts of a free living beaver population on the River Otter

Science and Evidence Forum
River Otter Beaver Trial
April 2016

River Otter Beaver Trial

Monitoring Plan – April 2016

Devon Wildlife Trust

Version : **2**

Date: 1st April 2016

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Input from : National Mammal Symposium, Exeter, Oct 2016
ROBT Fisheries Forum

Signed Off by Science and Evidence Forum : 1st April 2016

In October 2015 Hugh Graham began a PhD at the University of Exeter investigating the impacts of the beavers on the physical geographical and associated ecological impacts of the beavers on the catchment. Detailed mapping of beaver field signs will be an important part of this.

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The River Otter Beaver Trial is led by Devon Wildlife Trust working in partnership with The University of Exeter, the Derek Gow Consultancy, and Clinton Devon Estates.

Expert independent advice is also provided by the Royal Zoological Society of Scotland, Professor John Gurnell, and Gerhard Schwab, an international beaver expert based in Bavaria.

In addition to the generous support of DWT members and others who have donated to our appeal, the trial is also funded by The Royal Society of Wildlife Trusts (RSWT). The ongoing complementary research work at the enclosed beaver trial near Okehampton is funded by Westland Countryside Stewards.

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1. Background and purpose of Monitoring Plan

On 2nd February 2015, Devon Wildlife Trust (DWT) on behalf of the River Otter Beaver Trial (ROBT) partners, was granted a licence by Natural England under the Wildlife and Countryside Act 1981, to release Eurasian beavers, (*Castor fiber)*, into the River Otter catchment in east Devon.

The beavers had been living wild for a number of years, but were shown to be breeding in 2014, resulting in the Department for Environment, Food and Rural Affairs (Defra) proposing their removal. The subsequent licence application followed a campaign by local people and DWT for the beavers to remain if they were shown to be healthy. It was argued that although this was not how re-introductions should take place, the presence of the beavers was an ideal opportunity to study their impacts in a productive lowland English landscape.

The Natural England licence to release the beavers was granted in the context of a 5 year trial running between March 2015 and March 2020. In February and March 2015, Defra trapped and tested some of the beavers, and DWT then released them back into the river at the end of March under this licence.

Beaver being released back into the river as part of the River Otter Beaver Trial (Photo Nick Upton / Naturepl.com)

A Monitoring Framework was submitted to Natural England as part of the licence application process. The River Otter Beaver Trial Management Group have established a Science and Evidence Forum who are now responsible for refining this Monitoring Framework and developing it into this detailed programme of work.

This document now sets out an ambitious set of Research Objectives that the partners have identified as being pertinent to the understanding of the impacts of the beavers on the river Otter and their colonisation of the catchment. It is important to note that this is a trial, and the ability to monitor different aspects of their behaviour and impacts is part of the trial. For that reason we would not expect all of these research objectives to be investigated in great detail. These objectives will be reported on individually either via direct research or by indirect research with recourse to existing literature and expert knowledge.

The different areas of work have been prioritised and some may only become possible as resources or technology become available.

The Objectives have been developed in consultation with national experts in various fields including a session at the National Mammal Society Symposium in October 2015, and taking into account comments made by the ROBT Fisheries Forum

The Science and Evidence Forum will regularly review these objectives and progress against them as different things become more relevant than others. It will become clear as the project progresses that there will be some objectives that will become more important to answer in detail, while others may be less important or impossible to answer within this 5 year trial.

2. River Otter Beaver Trial Objectives

The objectives of the ROBT were outlined in the licence application and were to:

1. **Identify and assess impacts of beavers on habitats, wildlife, built infrastructure and local communities.** In particular this will concentrate on recording any impacts on farmers, wildlife, fish populations, water management infrastructure, roads, paths and the people that live and work in the valley.

2. **Identify wider public benefits associated with beaver activity in the landscape.** This includes the potential benefits of beaver dams storing floodwater, reducing pollution, which will be the subject of a PhD with Exeter University. This objective also includes other benefits such as economic benefits for local tourism businesses.

3. **Develop an effective management process for a free living beaver population.** Protecting important trees and structures, and trialling "beaver deceivers" in any dams will form the basis of mitigation measures. These techniques and the decision making steps are all outlined in the "Beaver Management Strategy" published in January 2016.

4. **Understand the ecology, behaviour and population dynamics of a beaver population in a lowland productive agricultural landscape.** Research will seek to understand how the beavers colonise the catchment and utilise the resources within it, and will enable the carrying capacity for the catchment to be calculated. Monitoring the population of the beavers and how they form territories will be a key aspect of this.

5. **Increase knowledge and awareness with local communities and other key stakeholders of beavers and their interactions in the landscape.** Public engagement and local education work will seek to explain the ecology and behaviour of beavers to local people, and ensure decisions about their future are based on factual information, rather than myths.

6. **Provide data and evidence to augment national knowledge base re beaver re-introduction.** The knowledge gained as part of the ROBT will be disseminated to various national and international audiences. There are numerous projects around Britain seeking to restore beavers to wetlands, and advice and experience will be provided to these where appropriate.

3. Objective Outcomes from Research work

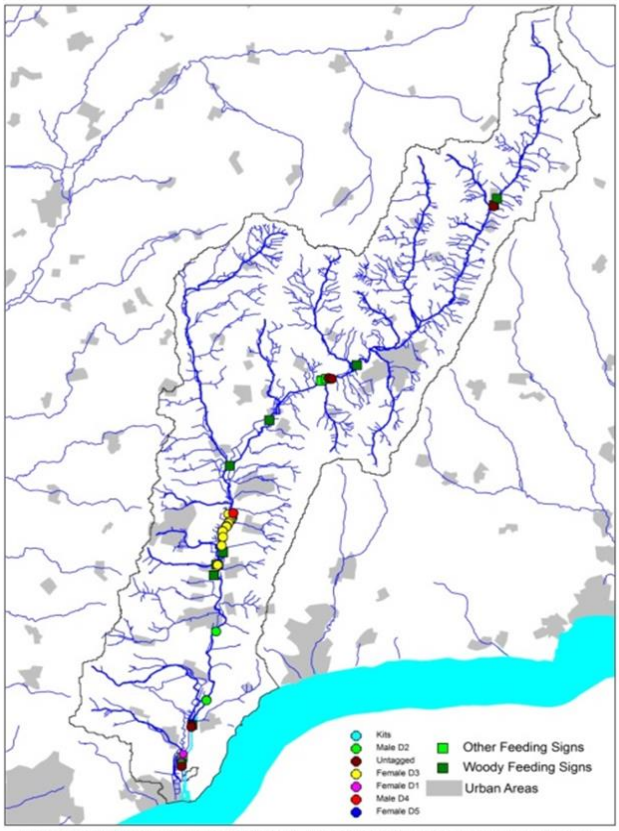
This Monitoring Plan sets out the actions that will be carried out to deliver 8 core Research Objective that were detailed in the Monitoring Framework included within the licence application submitted by DWT on behalf of the ROBT partners to Natural England in 2014.

The Science and Evidence Forum will now oversee the delivery of this Monitoring Plan. Fundamental to the delivery of this research work will be the scientific objectivity of the findings. It is one of the key roles of the Science and Evidence Forum to guarantee that rigorous scientific methods are employed throughout. The Forum is chaired by Professor Richard Brazier from University of Exeter and includes a majority from academic institutions including other representatives from the Universities of Exeter and Southampton. Other organisations including the Environment Agency are also represented.

Throughout the trial period, key research findings will be published in the peer reviewed scientific literature. Much of the work will also be included within a number of PhD theses that will have been published during the lifetime of the Trial.

In 2019/20 the Forum will publish a final report that will collate the series of End of Project Reports as detailed in this Plan. This report will comprise an executive summary of the key findings and recommendations, with links to any research reports and papers published in the academic literature and elsewhere.

Mapping of beaver activity and field signs will allow colonisation of the catchment to be monitored together with any seasonal movements, exploitation of resources and establishments of territories.



4. Research Objectives

1. Economic and land-use impacts - Assess and quantify the associated costs and benefits of beavers in a productive English landscape including impacts on agriculture and forestry and infrastructure.

1a. To characterise the land use, agricultural and forestry activities within the catchment and monitor any changes that can be attributed to beaver activity.

1b. To qualify and quantify any impacts on farmers, foresters, and other landowners taking into account costs and benefits of mitigation measures

1c. To identify and map infrastructure at risk of beaver activity, and quantify any impacts and associated costs.

END OF PROJECT REPORT: Comprehensive net cost assessment to farming, forestry and infrastructure management sectors.

Contrib. to:	Proposed work	Priority / timing / conditions	Organisations / **Lead**	Funding
1a.	Groundtruth land-use mapping carried out by DBRC, and analyse data. Repeat at end of trial if appropriate	High / 2016 & 2019	DBRC contracted by DWT	ROBT core work
1a & 1b.	Monitoring areas of beaver activity for signs of impact, and follow up all reports of impact. Produce Site Impact Reports to record important details.	Ongoing throughout trial	DWT / EA / DCC / BT / WP	ROBT core work / partner staff time
1c.	EA / DWT to identify and monitor key water management infrastructure, including fish passes, and quantify in detail any detected impacts, and costs of management solutions.	Ongoing throughout trial and agreed in MOU	EA / DWT Potential volunteer task.	ROBT core work / EA staff time
	Monitor for and quantify any impacts on infrastructure including roads, rights of way, electricity and telecommunications	Ongoing throughout trial	DWT / DCC / WP / others	ROBT core work
1b & 1c	Record staff time spent following up impacts	Ongoing throughout trial	DWT / EA / DCC / others	ROBT core work / partners
1a & 1b	Investigate areas of at-risk commercial forestry and monitor and record any impacts	Ongoing throughout trial	DWT / DBRC / UoE	ROBT core work
all	Employ Agricultural economist / land agent to quantify impacts	High priority. 2018/19	ROBT to identify suitable contractor / partner	Funding required

all	Publish End of Project Report, including identifying high risk areas and issues	High priority 2019/20	Will be produced by Science and Evidence Forum	ROBT core / Funding required

2. Economic and land-use impacts - Further economic benefits of beaver re-introduction will be determined, such as through eco-tourism, fisheries and education.

2a. To characterise the local eco-tourism industry and quantify any benefits of 'beaver tourism' for local businesses.

2b. To monitor and understand the changes in access to the river Otter, including to the rights of way, and other areas.

2c. To characterise the socio-economic value of the river Otter fishery, and any impacts of beavers on this.

END OF PROJECT REPORT: Quantitative and qualitative assessment of the socio-economic value of beavers in the river

Contrib. to:	Proposed work	Priority / timing / conditions	Organisations / **Lead**	Funding
2a.	Research project with local businesses / chamber of commerce to quantify beaver tourism impacts	Medium priority. Will be difficult to quantify.	Partners to be identified.	Funding required
2b.	Install path counters to understand changes in useage of Rights of Way.	Counters being installed 2016/7	**ED AONB** / DWT	ED AONB
2b.	Analyse data on changes in Rights of Way usage. Investigate potential impacts on fishermen and landowners, and tourism operators.	Medium priority 2018/19	ED AONB / DWT / CDE / contractor / specialist volunteer?	tbc
2c.	Gather data on fishery usage and economics.	2016/17 to 2018/19	Fisheries Forum / specialist volunteer / conbractor	Funding required
all	End of Project Report	High Priority 2019/20	Will be produced by Science and Evidence Forum	ROBT core / Funding required

3. Biodiversity - Habitats and Species - Determine the impact of beaver activity on vegetation communities, in particular semi-natural habitats. Studies should determine changes in both the nature of and extent of the habitats.

3a. To characterise the ecological value of the river Otter and monitor any changes that can be attributed to beaver activity.

3b. To understand whether beaver activity has a significant impact on vegetation structure, including changes in canopy and key (and non-native) plant communities.

3c. To characterise and quantify changes to channel plan form and quantify whether beaver activity has any impacts on long term rates of change, and sediment transport.

3d. In the event that beavers are recorded in designated sites, to determine their impacts, if any, on the designated interest features of the site.

3e. To map any new wetland habitats created by beaver activity, including standing open water

3f. To understand the rate of dead wood entering watercourses, and quantify proportion related to beaver activity. Monitor for any impacts associated with this and investigate it as a method for beaver surveys.

NB. The End of Project Report for this section would be integrated into the single Biodiversity report outlines in Section 4 below.

Contrib. to:	Proposed work	Priority / timing / conditions	Organisations / **Lead**	Funding
3a	Based on the land-use assessment, designated sites, WFD status and species records summarise ecological character of River Otter catchment.	High 2016/17	DBRC contracted by DWT	ROBT core funded
3a & 3d	Monitor for any beaver impacts on designated sites, and their interest features.	High / Only where beavers are in designated sites.	DWT / DBRC / EA / specialist volunteers / contractors	ROBT core funded / other partners
3b	Monitor canopy structure in some areas of beaver activity using UAV technology, and quantify biomass changes.	High / integral to PhD	**UoE will lead as part of PhD**	PhD funded by UoE / DWT
3b	Carry out research projects into any impacts of beavers on japanese knotweed and himalayan balsam.	Low / As opportunities arise	Potential student / volunteer research project	Vol / student time

3b	Monitor in-channel aquatic macrophytes and other riparian plant communities for any detectable beaver related impacts	Low priority / if opportunity arises	Student / volunteers / EA?	Funding required
3c	Characterise channel plan form and assess whether beavers impact on long term rates of change and sediment transport, and WFD status	High / integral to PhD	**UoE will lead as part of PhD / EA**	PhD funded by UoE / DWT
3b & 3c & 3f	Monitor for any changes in natural rates of erosion and loss of bankside trees, including rates of woody debris entering watercourse.	High / integral to PhD	**UoE will lead as part of PhD**	PhD funded by UoE / DWT
3e	Map in detail the extent and development of new wetland habitats created by beavers	High priority wherever opportunity arises	**UoE will lead as part of PhD**	PhD funded by UoE / DWT

4. Biodiversity - Habitats and Species - Determine the impact of beaver activity on key fauna populations. The monitoring will focus on impacts on fish populations, but will also include amphibians, and invertebrates (aquatic and terrestrial) and birds

4a. To characterise fish populations in the river Otter, and in the event of any beaver damming or other significant changes, to investigate their impacts on fish populations, including passage and recruitment.

4b. In the event of significant beaver impacts on the river Otter, to understand in detail the changes to macro-invertebrate assemblages at a reach-scale.

4c. In the event of significant beaver activity, investigate the impacts on riparian and floodplain bird populations at a reach-scale.

4d. To understand any impacts of the beavers on otters, water voles and bats within the valley where interactions and impacts are likely.

4e. In the event of the creation of suitable new wetland areas, to monitor the impacts on amphibian communities.

END OF PROJECT REPORT: A single Biodiversity report summarising all effects on habitats, fish and other species.

Contrib. to:	Proposed work	Priority / timing / conditions	Organisations / **Lead**	Funding
4a.	Gather baseline fisheries data and characterise fish populations in the River Otter, (incl eels, lamprey, bullheads, other course fish and salmonids)	2015/6 and 2016/17	UoS / DWT / EA / Fisheries Forum	DWT / UoS / staff time
4a	In the event that beaver dams are built in the river or streams, carry out detailed monitoring of impacts on fish populations and migration	High priority if beaver dams are built in key areas	UoS / DWT / EA	Funding required
4b	Characterise invertebrate assemblages based on existing EA datasets, and additional sampling.	High / integral to PhD	**UoE will lead as part of PhD** / EA	PhD funded by UoE / DWT
4b	Intensively monitor changes in macro-invertebrate communities in areas of intensive beaver activity	High / integral to PhD	**UoE will lead as part of PhD** / EA	PhD funded by UoE / DWT
4c	In the event of significant beaver activity, carry out detailed bird monitoring of key species	Low / As opportunities arises	Potential volunteer opportunity / student project	Vol / student time
4d	Carry out surveys of otter population at catchment scale, and more detailed monitoring of beaver / otter interactions	Work underway	**DMG** / DWT / volunteer opportunities	Vol time

4d	In the event of beaver activity in Tale catchment, carry out water vole monitoring work	Medium priority as opportunity arises	DMG / DWT / Volunteer opportunities	Vol / student time
4d	Consider deploying anabat tecnhology in areas where significant beaver activity occurs or is predicted	Low / as Opportunity arises	Potential volunteer opportunity / student project	Vol / student time / EcoSulis
4e	Carry out eDNA surveys for amphibians at key pond sites	Medium	EcoSulis	EcoSulis
4b	Other species surveys as suitable opportunities arise – eg Odonata etc	Low / As opportunity arises	Potential volunteer opportunity / student project	Vol / student time / EcoSulis
all	End of Project Report	High Priority 2019/20	Will be produced by Science and Evidence Forum	ROBT core / Funding required

Sampling macro-invertebrate indicator species will be an important way of assessing the impacts of beavers on wetland habitats

5. Ecosystem Services - Water Resources - Quantify the impact of beaver activity on water resources regulation at a range of scales in the Otter catchment.

5a. To quantify impacts on channel flow / discharge using existing data collected.

5b. In the event that beaver dams are constructed, to quantify impacts of dams on water storage and flood attenuation, and drought amelioration benefits. These impacts would also be expressed in the context of WFD status.

END OF PROJECT REPORT: Final report on ecosystem services; part 1 – hydrology including potential impacts on flood risks and low flows.

Contrib. to:	Proposed work	Priority / timing / conditions	Organisations / **Lead**	Funding
5a	Compile and analyse existing datasets provided by EA to charcterise baseline discharge conditions	High / integral to PhD	**UoE will lead as part of PhD** / EA	PhD funded by UoE / DWT
5b	Wherever practical, install additional hydrometric monitoring equipment where beaver damming is predicted or occuring.	High / in the event that beavers dam in an area condusive to monitoring impacts.	**UoE will lead as part of PhD** / EA	PhD funded by UoE / DWT
5b	Continue work at enclosed beaver site in West Devon to monitor impacts of dams on peak and base flows	Ongoing	DWT / UoE	Funding required. Exisiting funding ends 2016
	Modelling localised impacts in enclosure on flows at catchment scale	Next step for enclosed beaver trial work. Consider as part of PhD	DWT / UoE / EA	Funding required
all	End of Project Report	High Priority 2019/20	Will be produced by Science and Evidence Forum	ROBT core / Funding required

6. Ecosystem Services - Water Quality - Quantify the impact of beaver activity on water quality including sediment, and macronutrients (Nitrogen, Phosphorus, Carbon) retention at a range of scales in the Otter catchment

6a. To investigate whether water chemistry more or less variable than natural annual variability in the presence of beaver activity, using existing datasets.

6b. In the event that beaver dams are constructed, to investigate any reach-scale impacts on water quality, including sediment transport, and impacts on gravel beds.

6c. To investigate impacts on ecological status, as defined by macro-invertebrates using existing data collected, and through additional sampling.

END OF PROJECT REPORT: Final report on ecosystem services; part 2 – impacts on water quality, including potential of beavers to contribute to improving WFD status of watercourses.

Contrib. to:	Proposed work	Priority / timing / conditions	Organisations / **Lead**	Funding
6a	Compile and analyse existing datasets provided by EA to characterise baseline water chemistry across the catchment	High / integral to PhD	**UoE will lead as part of PhD / EA**	PhD funded by UoE / DWT
6b	Wherever practical, install additional hydrometric monitoring equipment where beaver damming is predicted or occuring.	High, in the event that beavers dam in an area condusive to monitoring impacts	**UoE will lead as part of PhD / EA**	PhD funded by UoE / DWT
6c	Compile and analyse existing datasets provided by EA, and collect additional samples to charcterise macro-invertbrate communities and assess them against specialist indices.	High / integral to PhD	**UoE will lead as part of PhD / EA**	PhD funded by UoE / DWT
6b & 6c	Monitor invertebrate populations wherever significant beaver impacts are predicted, including where damming occurs if possible.	High / integral to PhD. Even if dams are not created, other impacts will be assessed.	**UoE will lead as part of PhD / EA**	PhD funded by UoE / DWT
all	Continue work at enclosed beaver site in West Devon to monitor impacts of dams on peak and base flows	Ongoing	DWT / UoE	Funding required. Exisiting funding ends 2016
all	End of Project Report	High Priority 2019/20	Will be produced by Science and Evidence Forum	ROBT core / Funding required

7. Social Impact - Provide a qualitative analysis regarding community interaction with this controversial issue. The study would consider the involvement and perception of the project by the general public and other stakeholders.

7a. To understand how stakeholders develop perceptions of introduced wildlife populations, including their potential risks and benefits.

7b. To understand how social attitudes towards beavers change over the course of the trial.

END OF PROJECT REPORT: Final report on social impacts of beavers on the river Otter and any changes to societal attitudes in the valley

Contrib. to:	Proposed work	Priority / timing / conditions	Organisations / **Lead**	Funding
7a	Undertaken research to understand how stakeholders develop perceptions of introduced wildlife populations, including their potential risks and benefits.	2014/15 – research undertaken during campiagn and consultation process	**UoE will lead as part of a PhD** being undertaken by Sarah Crowley	PhD funded by ??
7b	Carry out questionnaires and focus groups to understand social attitudes towards beavers by a cross section of the local population	2016 and 2018/9	UoE will undertaken 2016 survey through MSc by Roger Auster. Repeat survey in 2018/9 TBC.	UoE and DWT will fund this work
all	End of Project Report	High Priority 2019/20	Will be produced by Science and Evidence Forum	ROBT core / Funding required

8. Beaver Health, behaviour and population change - Monitor the health of the beavers before and after release and their behaviour and population demography through time.

8a. To understand the baseline health of the beaver population living wild on the river Otter and to assess their health through the trial period, including understanding any mortality.

8b. To understand the population size and distribution throughout the trial period, and to map and understand their use of the river Otter resources.

8c. To develop a detailed understanding of beaver damming stimuli, and scenarios for the location of dam building in the catchment over time.

END OF PROJECT REPORT: A summary of the health status of the River Otter beaver population

END OF PROJECT REPORT: The population dynamics, dispersal and future carrying capacity of the River Otter

Contrib. to:	Proposed work	Priority / timing / conditions	Organisations / **Lead**	Funding
8a	Carry out health screening of wild-living beavers to assess health status of adult animals living wild on the river at the start of the trial.	Completed 2015	APHA / DWT / RZSS	Defra / DWT
8a	Health screen additional animals released into the river during the trial, or other wild-living beavers captured during the course of the trial.	High priority and ongoing. Need balanced with welfare considerations.	**DWT** / RCP / Volunteers / local vets	DWT / Funding required
8a	Capture and health screen a sample of animals at the end of the trial to compare health status with baseline data.	High priority / 2018/19	**DWT** / RCP / local vets	DWT / Funding required
8a	Recover any dead beavers wherever possible, and carry out detailed post-mortem to identify cause of dealth and condition.	High priority / if situation arises	**DWT** / RCP / local vets	ROBT Core funded
8b	Map historical records of beavers and pre-2015 beaver field signs to develop understaning of early colonisation of the river.	High priority / Ongoing 2015/16	**DWT** / UoE	ROBT Core funded
8a & 8b	Using observations and camera traps, monitor active beaver burrows and other areas of focused activity to identify individuals where	High priority / ongoing throughout	DWT / Volunteers	ROBT core funded / additional funding

	possible, monitor health and understand family structure.			sought
8a & 8b	Monitor additional released animals using camera traps, and detailed surveys. If practical consider radio transmitters.	High priority / 2016 – 2018. Feasibility and funding determine radio tracking methodology	DWT / volunteers / others?	ROBT core funded / additional funding required
8a & 8b	Collect DNA samples at any opportunity to understand inter-relatedness and family structure	High Priority / whenever beavers are handled throughout trial	DWT / RCP / volunteers	ROBT core funded / funding required
8b	Map all field signs systematically, at least annually, to understand colonisation of the river, seasonal behaviour and use of territories.	High priority / ongoing / timing will depend on resources and seasonal behaviour of beavers	DWT / UoE / Volunteers	ROBT core / funding required
8b	Map beaver food resources and compare with beavers' use of the river and territory size. Assess available resources to understand carrying capacity of different habitat types and entire catchment.	High / integral to PhD	DWT / UoE / volunteers	PhD funded by UoE / DWT
8c.	Compare known ecological requirements of beavers with hydrologcial characteristics of River Otter catchment to understand where beavers may dam, and whether flooding may determine their distribution in the catchment	High / integral to PhD	DWT / UoE	PhD funded by UoE / DWT
all	End of Project Reports	High Priority 2019/20	Will be produced by Science and Evidence Forum	ROBT core / Funding required

RCP - Roisin Campbell-Palmer
APHA - Animal and Plant Health Agency
RZSS - Royal Zoological Society for Scotland.