

## Oral fertility control for grey squirrels



### Summary

The National Wildlife Management Centre (NWMC), under the terms of a contract with the UK Squirrel Accord, is researching the development and delivery of an effective immuno-contraceptive vaccine for grey squirrels.

This document responds to frequently asked questions (FAQs) that have been posed about the background and business case for this research.

## FAQs

### 1 Why control grey squirrels?

#### i) The adverse impact of grey squirrels on the UK's landscape and trees

Grey squirrels damage our forests and woodlands by stripping bark from the trunks and branches of trees. If they strip a complete ring of bark, the tree will die. This damages our broadleaved woodland landscape and damage to property costs in the tens of millions of pounds each year.

#### ii) The impact of grey squirrels on red squirrels

Grey squirrels are contributing to the extinction of reds in many areas of the UK. Greys spread the squirrelpox virus disease, which cannot be transmitted to humans, and directly compete for habitat and food. For example, grey squirrels can eat nuts/fruits at an earlier stage reducing the amount of available food for reds.

#### iii) The impact on songbirds and other wildlife

Studies suggest that grey squirrels are a main predator of songbirds\* in some environments and may be a large factor in the decline in some of our species.

#### iv) Grey squirrels are a non-native species

The grey squirrel (*Sciurus carolinensis*) is a non-native species which was introduced to the UK from North America in 1876 and its population has since grown rapidly. It is estimated that 2.5 million grey squirrels now live in the UK, with just 150,000 native red squirrels (*Sciurus vulgaris*) remaining.

### 2 How are grey squirrels currently controlled?

The authorised methods of grey squirrel management are confined to trapping and shooting. The use of warfarin for grey squirrel control has not been allowed since July 2016. Neither is drowning. Despite extensive culling in some parts of the UK, the number of grey squirrels continues to grow.

### 3 Why do we need fertility control?

Other methods of controlling grey squirrels, such as trapping can be expensive and time consuming. Widespread control of grey squirrel populations in some areas has shown that the reds can survive and thrive. But other management methods alone have so far failed to bring the problem completely under control because the reproductive rate of grey squirrels far exceeds the numbers controlled. Oral contraceptives for grey squirrels offer a humane option of population control that might be used in addition to other methods.

#### **4 How does the fertility control vaccine work?**

The fertility control vaccine stimulates the production of antibodies that bind to the Gonadotrophin Releasing Hormone (GnRH), a hormone in an animal's body that signals the production of sex hormones (e.g. estrogen, progesterone, and testosterone). By binding to GnRH, the antibodies reduce GnRH's ability to stimulate the release of these sex hormones. All sexual activity is decreased, and animals remain in a non-reproductive state as long as a sufficient level of antibodies is present.

#### **5 Does it work on both male and female grey squirrels?**

Yes. The vaccine can render both males and females infertile because it targets the parent hormone that makes both female and male sexual hormones.

#### **6 Are there any health or welfare effects?**

No side effects were observed in the first studies on the oral contraceptive vaccine.

#### **7 How would the vaccine be delivered to the grey squirrels?**

The vaccine would be encapsulated, rather like many of today's common tablets, but using a natural capsule of a pollen or spore grain (known as a SPeC). These SPeCs will then be added to a bait. When the animals eat the bait, the 'sticky' SPeCs attach to the intestine and release the fertility control vaccine into the blood stream. This encapsulation technique is already being used to deliver many different types of chemicals, including the common painkiller ibuprofen.

#### **8 Is the product species-specific and will non-target species be affected?**

A grey squirrel-specific food hopper will be implemented which will be weighted to prevent entry of other mammals such as red squirrels. To mitigate the risk of spillage of bait containing contraceptives, the project will formulate the bait as a paste, such as hazelnut paste, that animals must consume inside the hopper. Bait uptake by target and non-target species will be monitored in captivity and in the field. The vaccine is mammal-specific so birds are not at risk.

#### **9 What are the risks to the environment or to other animals?**

The risks to the environment and to non-target species will be evaluated as part of the research programme. The fertility of squirrels' predators is unlikely to be affected as the contraceptive is a protein vaccine and not a reproductive hormone. This means the vaccine will be broken down in the tissues and the stomach of the host animal. It is likely, therefore, that the amount of active

product (if any) passed onto predators would be very small and unlikely to have any biological effect.

The breaking down of the protein vaccine by the stomach and tissues will mean that it is very unlikely that any active product will be passed into the environment via excretory products such as faeces or urine. Full detailed data on secondary hazards will be collected when registration is considered for this vaccine.

#### **10 Are there any risks to humans?**

No, the bait delivery will be in species-specific hoppers elevated in trees so the risk to humans would be negligible. The quantities of the appropriate active ingredient for squirrels are very unlikely to have an effect on humans either from direct ingestion or from eating squirrel meat.

#### **11 Can we target enough animals to reduce the population?**

The project will assess the proportion of the population of squirrels that take the bait containing the contraceptive and the duration of the action of the contraceptive. These data will be used to assess whether we can target enough animals for fertility control to reduce the number of animals in an area.

#### **12 When do you hope to start using the contraceptive in the wild?**

If all trials and formal registration of the vaccine are successful it is possible that vaccine could be brought to market within 6-8 years.

#### **13 Will oral contraception be publicly supported?**

A recently published Forest Research survey on social acceptability of methods used to manage grey squirrels in the UK found that contraception is considered the most acceptable control method available. 61.5 per cent of responders indicated that it is either acceptable or highly acceptable.

#### **14 By how much are you hoping to reduce the population, and in which geographical areas?**

The current research has not set a target for reducing squirrel populations or targeted specific areas. This will be considered as part of the business case for further development.

### **15 Hasn't this been tried before in squirrels unsuccessfully?**

Forest Research undertook a study (with collaboration from NWMC) in 2013\*\* looking at a different oral contraceptive DiazaCon™ (which affects serum cholesterol levels). The study was partially successful with a proportion of the squirrels being affected by the drug. However fertility could not be measured as although the treated animals did not breed the control (untreated) animals did not breed either.

In the present study the fertility control vaccine works through a completely different biological system (targeting Gonadotrophin Releasing Hormone). To minimise the error and variability in the study all the animals (treated and control) will be bred to establish fertility in captivity prior to the study. In addition, because the current trials will involve a vaccine, the appropriate antibodies (a measure of effectiveness) can be determined so that we have a secondary indicator of infertility.

### **16 Has this been shown to be effective in other animals?**

A similar product (GonaCon™) made by the National Wildlife Research Center (NWRC) in the USA, (see below) is currently registered as an injectable single-dose contraceptive for white-tailed deer, horses and donkeys. In addition to these species, GonaCon™ has proved effective for use with other wildlife, including California ground squirrels, prairie dogs, Norway rats, feral cats, goats and cattle, badgers, kangaroos, wild boar and elk.

Studies carried out by NWMC on this injectable product have included the use on feral goats with 85-92 per cent infertility achieved for 4 years after a single dose, and captive wild boar in which one injection caused 92 per cent of females to remain infertile for at least 8 years.

The oral GnRH vaccine to date has only been trialled in a pilot study on laboratory rats. This study demonstrated that 60 per cent of rats were rendered infertile when the agent was delivered in a 'naked' form without encapsulation. It is hoped that encapsulating the fertility control vaccine may increase this efficacy between 2- and 10-fold. To determine whether this is the case, trials are currently being conducted on laboratory rats using the encapsulated form of the fertility control vaccine.

### **17 Who is doing this research?**

The National Wildlife Management Centre, which is part of the Animal and Plant Health Agency. The NWMC provides evidence, impartial advice and services, to resolve human-wildlife conflicts and to support policy and decision making, drawing on expertise in wildlife management, invasive non-native species, wildlife disease, animal ecology, population modelling, and animal welfare. The NWMC has been studying fertility control in different species as a wildlife management tool for around 20 years. In addition the NWMC is the UK testing centre for humaneness of traps. The

NWMC also boasts the most extensive captive wildlife research centre in the UK and probably Europe.

The contraceptive has been developed by the National Wildlife Research Center (NWRC), which is part of the U.S. Department of Agriculture's (USDA) Animal and Plant Health Inspection Service (APHIS), in collaboration with European partners, including the NWMC. The NWRC provides Federal leadership and expertise to resolve wildlife conflicts that threaten the Nation's agricultural and natural resources, human health and safety, and property.

### *References*

\* Professor Roy Brown. *A Review of the Impact of Mammalian Predators on Farm Songbird Population Dynamics*. Prepared for SongBird Survival July 2006 School of Biological and Chemical Sciences, Birkbeck, University of London.

\*\*Mayle, B., Ferryman, M., Peace, A., Yoder, C., Miller, L., Cowan, D., (2013) The use of DiazaCon™ to limit fertility by reducing serum cholesterol in female grey squirrels, *Sciurus carolinensis*. *Pest Management Science* **69**, 414-424.