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Back On Our Map

The Hazel Dormouse

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1.0 Introduction to BOOM

Back on Our Map (BOOM) aimed to re-engage communities in South Cumbria with their natural environment, by restoring the landscape and reintroducing and reinforcing locally threatened or extinct native species. National Lottery players supported the £2m project, alongside several other public, private and charitable sector organisations. Led by the University of Cumbria, BOOM worked closely in partnership with Morecambe Bay Partnership, and lead partners, Cumbria Wildlife Trust, Natural England and Forestry England.

The project focussed on a network of protected areas including Sites of Special Scientific Interest (SSSIs), National Nature Reserves (NNRs) and Arnside and Silverdale Area of Outstanding Natural Beauty (AONB). It covered an area of 600km², extending along the lowlands of Morecambe Bay from Barrow-in-Furness in the west to Arnside and Silverdale in the east and Ambleside in the north (Fig. 1.1).

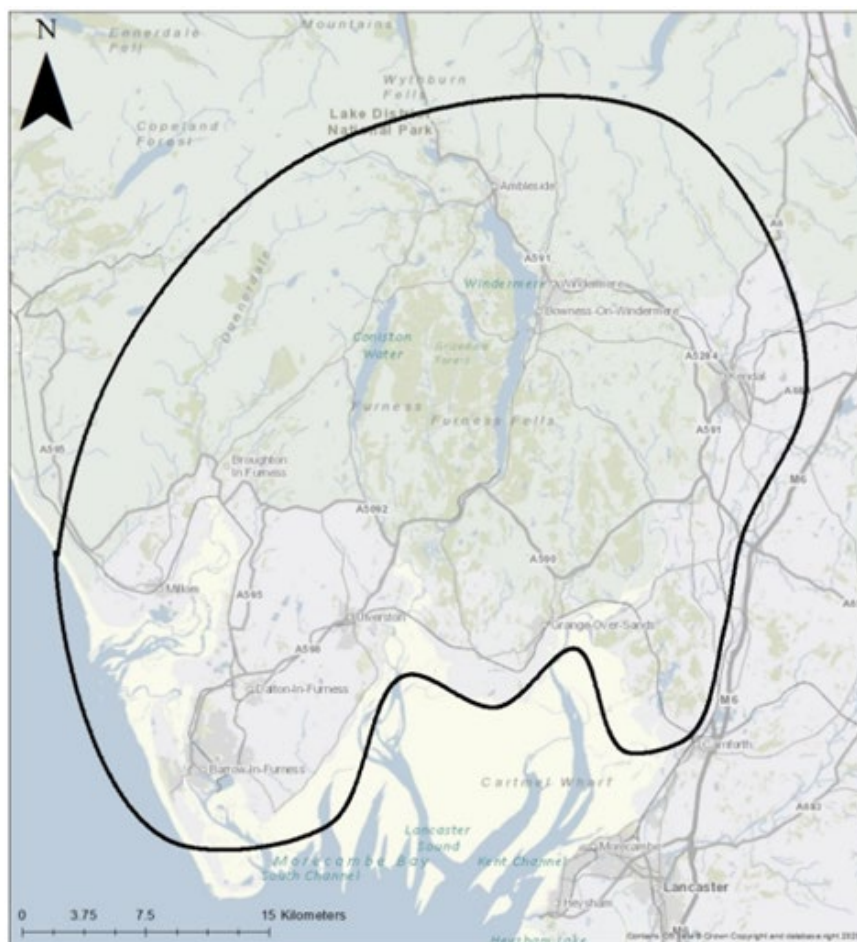


Figure 1.1: Map of the BOOM working area.

BOOM reintroduced and expanded the range of the hazel dormouse, small blue butterfly, goldilocks aster, great and oblong-leaved sundew, green-winged orchid, maidenhair fern, spiked speedwell, aspen and reinforced the Duke of Burgundy at a key site (table 1.1). The pine marten community-based feasibility study identified suitable locations for future reinforcement. For the Corncrake, public engagement sound walks raised awareness of the species.

Table 1.1: Species included in the BOOM project.

Common Names	Scientific Name	BOOM Objectives
Aspen	<i>Populus tremula</i>	Reintroduction
Corncrake	<i>Crex crex</i>	Public Engagement and Interpretation
Duke of Burgundy	<i>Hamearis lucina</i>	Reinforcement
Goldilocks Aster	<i>Galatella linosyris</i>	Reintroduction
Great Maidenhair fern	<i>Drosera anglica</i>	Reintroduction
Green-winged Orchid	<i>Anacamptis morio</i>	Reintroduction
Hazel Dormice	<i>Muscardinus avellanarius</i>	Reintroduction
Maidenhair Fern	<i>Adiantum capillus-veneris</i>	Reintroduction
Oblong-leaved Maidenhair fern	<i>Drosera intermedia</i>	Reintroduction
Pine Marten	<i>Martes martes</i>	Feasibility Study
Small Blue	<i>Cupido minimus</i>	Reintroduction
Spiked Speedwell	<i>Veronica spicata</i>	Reintroduction

Across south Cumbria, the project engaged a wide range of community groups, volunteers and members of the public. Social activities and training events helped communities get involved with the BOOM species reintroductions.

This document covers the work BOOM did on the Hazel Dormouse, including the survey techniques, reintroduction methods and community engagement events.

2.0 Species background

The Hazel Dormouse (*Muscardinus avellanarius*), is a small, nocturnal mammal native to continental Europe and Britain (Bright et al., 2006). Their big, dark eyes and large ears allow them to be alert and see sharply at night. Adults have golden fur and a fluffy tail, which they often wrap over their heads and grip with their paws when sleeping during the day. Hazel dormice are rare to see, this combined with their, attractive, endearing features make them popular with the public and conservation volunteers across the country.

As their name suggests, hazel dormice are commonly associated with hazel (*Corylus avellana*) woodland. Coppiced hazel provides a sprawling highway of connected stems allowing movement through the woodland from herb layer to canopy (Bright et al., 1994). Despite their name, however, dormice are not exclusive inhabitants of hazel and can be found exploring an extensive range of other woody habitats: ancient or semi-natural woodland, species-rich scrub, hedgerows and even some rural gardens. As well as hazel; oak, bramble and honeysuckle (*Quercus robur*, *Rubus fruticosus* and *Lonicera periclymenum*) are thought to be highly valuable sources of food (Bright et al., 2006). As dormice are arboreal, only really coming to ground in winter to hibernate, they rely on a three-dimensional structure of connected vegetation (herb-scrub-canopy) in a woodland to allow them to move freely for food and nesting material and to avoid predation.

Dormice rely on a dynamic, successional woodland and have adapted to eat a wide variety of food to account for the changing phenology through the seasons. Flowers and developing leaves in spring, insects, caterpillars and aphids as supplement, and nuts and berries in autumn to fatten up before hibernation. Therefore, a species rich mosaic of trees and shrubs is necessary to maintain a sequence of appropriate food source from April and throughout the season to November (Chanin et al., 2015; Goodwin et al., 2020; Juškaitis, 2007)

The last few centuries has seen a big change in woodland management (Williams et al., 2020). The use of traditional forestry techniques, such as coppicing, which provided firewood for industrial and domestic use, have rapidly declined since the early 1900s, as coal became a dominant source of fuel. This reduced the abundance of ideal habitat for dormice and many other woodland species (Goodwin et al., 2018). The industrial movement combined with increased woodland destruction to make way for new infrastructure, pressure on woodland from over abundant grazers and intensification of agriculture seeing a reduction in connecting highways of hedgerows across arable fields has caused dormouse habitat in Britain to fracture (Trout et al., 2012).

In 2017, the dormouse population was estimated to have declined 72% in 22 years (Goodwin et al., 2017). Despite their historical status as widespread mammals in England and Wales, extending north to the Scottish border, dormice are now found almost entirely south of the line between Shropshire and Suffolk. Since 2000, the population has fallen by a half (51%), decreasing on average by 3.8% per year (Wembridge et al., 2019). They are now categorised as 'Vulnerable' to extinction under the Red List criteria (Mathews and Harrower, 2020).

3.0 Project rationale

Through continued conservation science, increased media coverage and activism there is a renewed awareness of wildlife decline in the UK and across the globe. This has incentivised landowners to manage their woodland for, and in ways that are sympathetic to, wildlife and nature. This is certainly the case in areas of South Cumbria, where this project is based. Coppicing is now a popular conservation woodland management technique, resulting in abundant suitable habitat that is able to support sustainable populations of dormice. However, lack of habitat connectivity from remaining dormouse strongholds in the south combined with their low dispersal potential in fragmented landscapes (Bright et al., 1994) and reluctance to cross habitat gaps (Bright, 1998) deems the likelihood of a natural recolonisation to these enticing new woodlands extremely low. In this instance, using reintroduction and translocation as a conservation technique is likely to be the only way dormice can recover to the northern edge of their range.

The existential threat of ongoing climate change is also posing a risk to hibernating species like the dormouse (Bright and Morris, 1996). The unpredictable nature of our changing seasons can affect available food sources, with warmer winters and cooler springs affecting individual fitness and population dynamics (Findlay-Robinson, 2021). To adapt to these changes, it is thought that some UK species groups will begin to shift their distribution north. A Natural England commissioned report shows a focus of climate refugia in the north (Suggitt et al., 2014). Therefore, it was considered a benefit to focus a dormouse reintroduction in the northern limit of their current range.

As well as ecological factors associated with habitat, there were also social and practical factors that were considered important when determining the feasibility of a reintroduction in this area. These included; an extensive web of partner organisations, accessibility to sites for reintroduction activities, support from the local community and a dedicated group of volunteers to not only help with reintroduction activities but to continue monitoring efforts with the

landowners post termination of BOOM. The dormouse project scored highly in all these criteria enhancing probability the of reintroduction success in the long term.

4.0 Project location

Prior to this project, the last extant population of dormice in Cumbria was Roudsea Woods National Nature Reserve (NNR), managed by Natural England. This population is small, stable and well established but there is limited dispersal availability for dormice from this site. It was decided not to use this site as a donor population, nor to reinforce the current population there due to limited dispersal potential nearby. Instead, it was agreed that reintroduction into other areas of south Cumbria was considered the best approach to reinforce dormice in the county and improve their status at a national level (White, 2019).

The sites for reintroduction (Fig. 2.1) were chosen via an amalgamation of information from local landowners and then assessed fully for suitability by People's Trust for Endangered Species (PTES). The Arnside and Silverdale Area of Outstanding Natural Beauty (AONB) has a higher woodland cover than the UK national average (approximately 30% compared with 10% for England). This higher area of woodland together with increased woodland management and improved connectivity makes the wider AONB area favourable for dormouse reintroduction. Gait Barrows NNR (SD 483777) and Eaves Wood (SD471759) both achieved high selection score when compared with particular habitat criteria, such as woodland species'

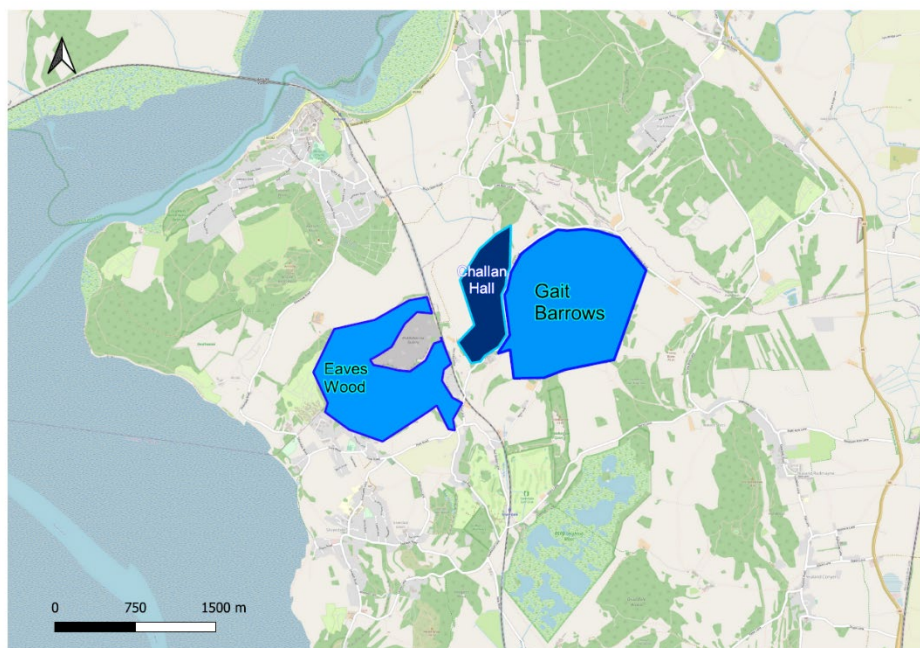


Figure 2.1 Woodland locations for dormouse release within Arnside and Silverdale AONB. The two release sites, Eaves wood, (National Trust), Gaitbarrows, (Natural England), with linking woodland site RSPB Challan Hall

diversity and further connectivity, and were considered highly favourable sites for reintroduction. Gait Barrows and Eaves Wood were selected out of an initial 10 sites in south Cumbria.

5.0 Project objectives

As part of the Back on our Map project, the aim for the hazel dormouse project was to reintroduce 90 hazel dormice into adjacent sites of appropriate woodland in the Arnside and Silverdale AONB. Therefore, re-establishing dormice to their natural northern range and climatic envelope, supporting current populations and reducing risk of extinction at a national scale.

Success will be determined by the existence of a healthy, abundant, reproducing and dispersing population of hazel dormice after 10 years.

The initial objectives for the dormouse project were as follows:

- Release 90 captive bred dormice into adjacent sites in the Arnside and Silverdale AONB over 2 years.
- Set up and maintain 200 nest boxes at each site
- Evidence short-term success or failure through a detailed monitoring programme of nest box checks and footprint tunnel surveys post release.
- Contribute annually to the National Dormouse Monitoring Programme (NDMP) managed by the People's Trust for Endangered Species (PTES)
- Formulate and manage a dormouse volunteer group who will assist in reintroduction activities throughout the BOOM process and facilitate the group's progress to become a self-sustaining monitoring group post BOOM. Ensuring project legacy and evidence of long-term success or failure for at least 10 years.
- Provide training opportunities for members of the volunteer group to gain dormouse-handling licence.
- Be a central managing body for a landscape scale, multi-partner project; ensuring smooth collaboration across the network of stakeholders.

- Host a selection of engagement events targeted to people in the local area and wider community.

6.0 Project Partners

The successful completion of this project would not have been possible without the collaboration from a wide range of regionally and national partners and stakeholders both, listed below:

Table 6.1. Table of all partners involved and their role in the project

Partner	People	Role
The University of Cumbria	Ian Convery, Professor of Environment and Society.	<ul style="list-style-type: none"> • Lead organisation for BOOM and employer of BOOM officers and staff. • Key member of stakeholder group. • Assisted with media support on release day.
Morecambe Bay Partnership	Michelle Cooper, Engagement Officer BOOM (2019 - 2022) Anya Kuliszewski, Engagement Officer BOOM (2022 + 2023)	<ul style="list-style-type: none"> • A lead partner for all BOOM species/activities. • Volunteer management and communication. • Community engagement; dormouse related events and consultations. • Administrative support.
PTES	Ian White, Dormouse Officer Adela Cragg, PR Consultant	<ul style="list-style-type: none"> • Direct consultation with Ian White during development and delivery phases of the project. • Facilitated connections with other national partners such as Zoological Society of London (ZSL), Paignton Zoo and the Common Dormouse Captive Breeders Groups (CDCBG) • Lead training events and workshops for volunteers and staff • Managed media coverage for release day. • Continued support post release.

		<p><i>Ian manages the Dormouse Reintroduction Programme at a national scale and has facilitated dormouse reintroductions across the country since his initial posting in 2006. From 1993, PTES have reintroduced 1069 dormice across 26 sites, and have set up and managed the NDMP, which acts as a central hub for all dormouse data, allowing us to understand dormouse population trends over time and giving us a tool to make evidence based decisions in regards to dormouse reintroductions. The NDMP is an important tool in the conservation of dormice nationally and as part of this project, we intend to contribute to it for the foreseeable future.</i></p>
Natural England	<p>Jim Turner, Senior Reserves Manager. Tracy Cumberbatch, Reserves Manager</p>	<ul style="list-style-type: none"> • Land managers of the reintroduction site, Gait Barrows NNR, in 2021. • Practical, onsite support in reintroduction process. • Lead nest box checks and footprint tunnel surveys with volunteers. • Committed to ongoing monitoring, volunteer engagement and dormouse focused habitat management.
The National Trust	<p>Jamie Armstrong, Ranger for Arnside and Silverdale</p>	<ul style="list-style-type: none"> • Land managers of the reintroduction site, Eaves Wood, in 2022. • Practical, onsite support in reintroduction process. • Jamie is training for a dormouse handling licence and upon completion will begin to lead nest box checks at Eaves Wood with volunteers.
Yorkshire Dales National Park	<p>Ian Court, Wildlife Conservation Officer</p>	<ul style="list-style-type: none"> • Assisted in sharing valuable knowledge from recent reintroduction projects in Yorkshire • Prepared and presented training workshops for volunteers.

		<ul style="list-style-type: none"> • Facilitated and lead on-site handling training for volunteers.
ZSL	Tammy Shadbolt, Wildlife Veterinarian & Postdoctoral Research Assistant	<ul style="list-style-type: none"> • Quarantined dormice for release in 2021 and 2022. • Dormouse veterinary care. • Disease prevention control. • Dormouse health checks at crucial stages during release.
The Wildwood Trust	Hazel Ryan, Senior Conservation Officer	<ul style="list-style-type: none"> • Captive bred dormice for release. • Provided training for volunteers both online and in the field.
Paignton Zoo	Ghislaine Sayers, Head of Veterinary Services	<ul style="list-style-type: none"> • Quarantined dormice for release in 2021 and 2022. • Dormouse veterinary care. • Disease prevention control. • Dormouse health checks at crucial stages during release.
CDCBG	Neil Bemment, Group Chair	<ul style="list-style-type: none"> • Captive bred dormice for release.
RSPB	Nick Godden, Assistant Warden Laura Nunnerley, Assistant Warden	<ul style="list-style-type: none"> • Supported monitoring efforts with the implementation of dormouse footprint tunnels.

6.1 Consents and agreements

As part of any translocation process, there may need to be licenses, consents or agreements in place to ensure legal compliance before any work takes place. It is advised that a thorough investigation be initiated with landowners and local statutory bodies concerning what processes need to be started before any translocation preparation. Below is a list of licences, consents or agreements that were obtained by this project prior to translocation:

- SSSI – A consent from Natural England to perform a translocation within a ‘Site of Special Scientific Interest’

- Habitat Regulation Assessment – The impact a translocation on European protected sites within a range of the translocation area.
- Dormouse Level 1 Survey Class Licence CL10a - permits surveying by taking by hand, including handling of dormice in nest tubes and nest boxes
- Landowner agreements – Written contracts with the landowners in question about the works to take place onsite presently and into the future.
- National Trust Environment Advisory Board – Consent.

6.2 IUCN requirements

Prior to any reintroduction or translocation, it is important that particular biological and social aspects be met in order to optimise chances of success and mitigate any risks. As part of the BOOM project, we complied fully with reintroduction guidelines outlined by the International Union of the Conservation of Nature (IUCN, 2013).

Below is a list of considerations set out by the IUCN guidelines that were assessed in detail during the development phase of the project

- Habitat suitability
- Climate suitability
- Founder population suitability
- Genetic considerations
- Disease and parasite considerations
- Animal Welfare considerations
- Social considerations

7.0 Release methodology

In June 2021, 30 dormice were released into Gait Barrows NNR. In June 2022, a further 39 dormice were released into Eaves Wood which lies within dispersal range of Gait Barrows with adequate habitat connectivity.

7.1 Nest box set up

Dormouse nest box surveys are considered an appropriate way to obtain estimates of population size within a woodland (Juškaitis, 1997). These boxes are similar to bird boxes

although the entrance hole lies at the back of the box facing the trunk of the tree and is usually made out of red cedar, Douglas Fir or Larch.

In spring of 2021, BOOM staff and volunteers set up 197 dormouse nest boxes at Gait Barrows. A further 184 boxes were set up at Eaves Wood the following year.

Details of plank dimensions and how to create a dormouse box can be found here: https://ptes.org/wp-content/uploads/2014/12/Box_specification_front_fixing.pdf

Boxes were placed about 1.5m off the ground (or at breast height), to assist accessibility in future surveying, as dormice are known to nest at any height, including the canopy (Bright and Morris, 1991). They were placed within areas of suitable habitat, at least 20m apart, spanning out from the site indicated as the priority release area in a grid like format. The grid was pre-set onto a map using QGIS (Fig. 7.1) and the co-ordinates of each box were uploaded onto each volunteer group's GPS as waypoints. This was used as a guide for box location but volunteers were encouraged to put boxes in areas that dormice were more likely to use i.e. on a coppiced hazel rather than isolated holly. The boxes were attached to the tree-using bungee cord and numbered on the lid, and side, using a Sharpie pen. Once set up, a 10-figure grid

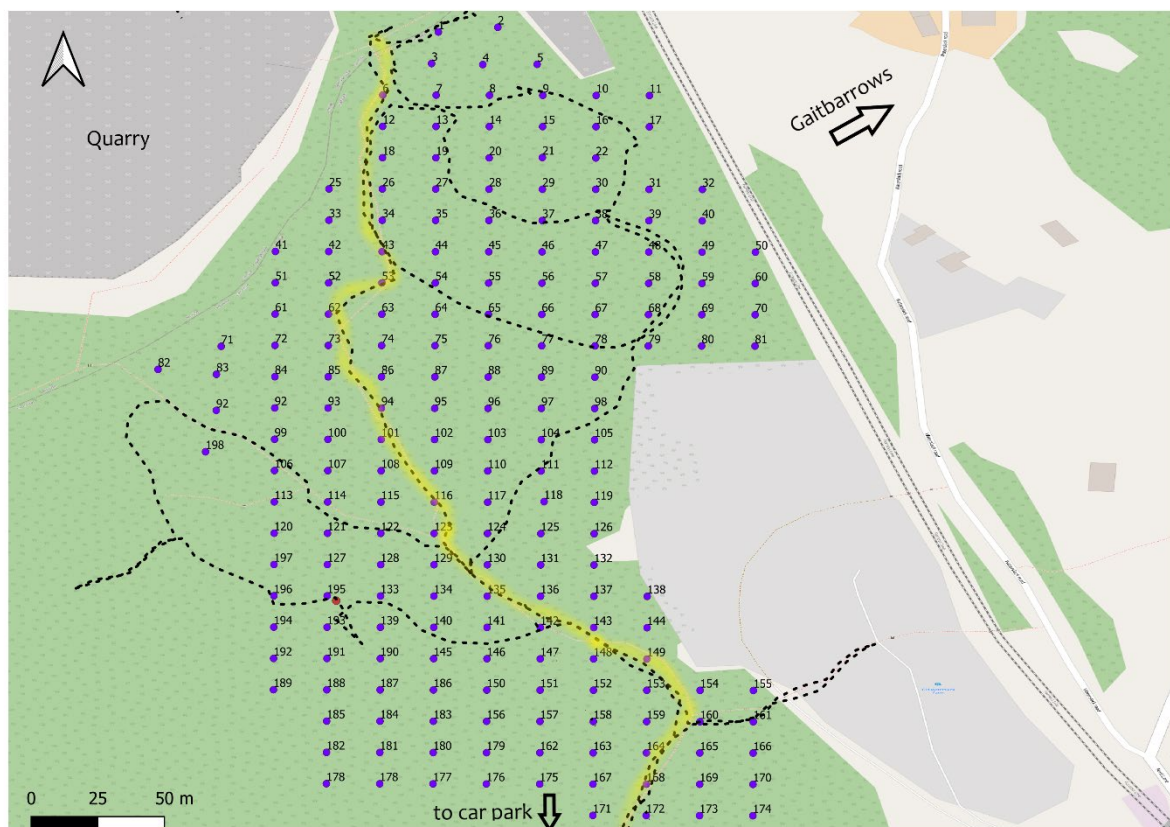


Figure 7.1., example of initial grid set – up of nest boxes at Eaves Wood, created on GIS and made accessible on a map for volunteers to use in the field using compass and GPS.

reference was recorded for each box using a GPS along with the corresponding identification number, in case the initial location indicated on QGIS was inappropriate.

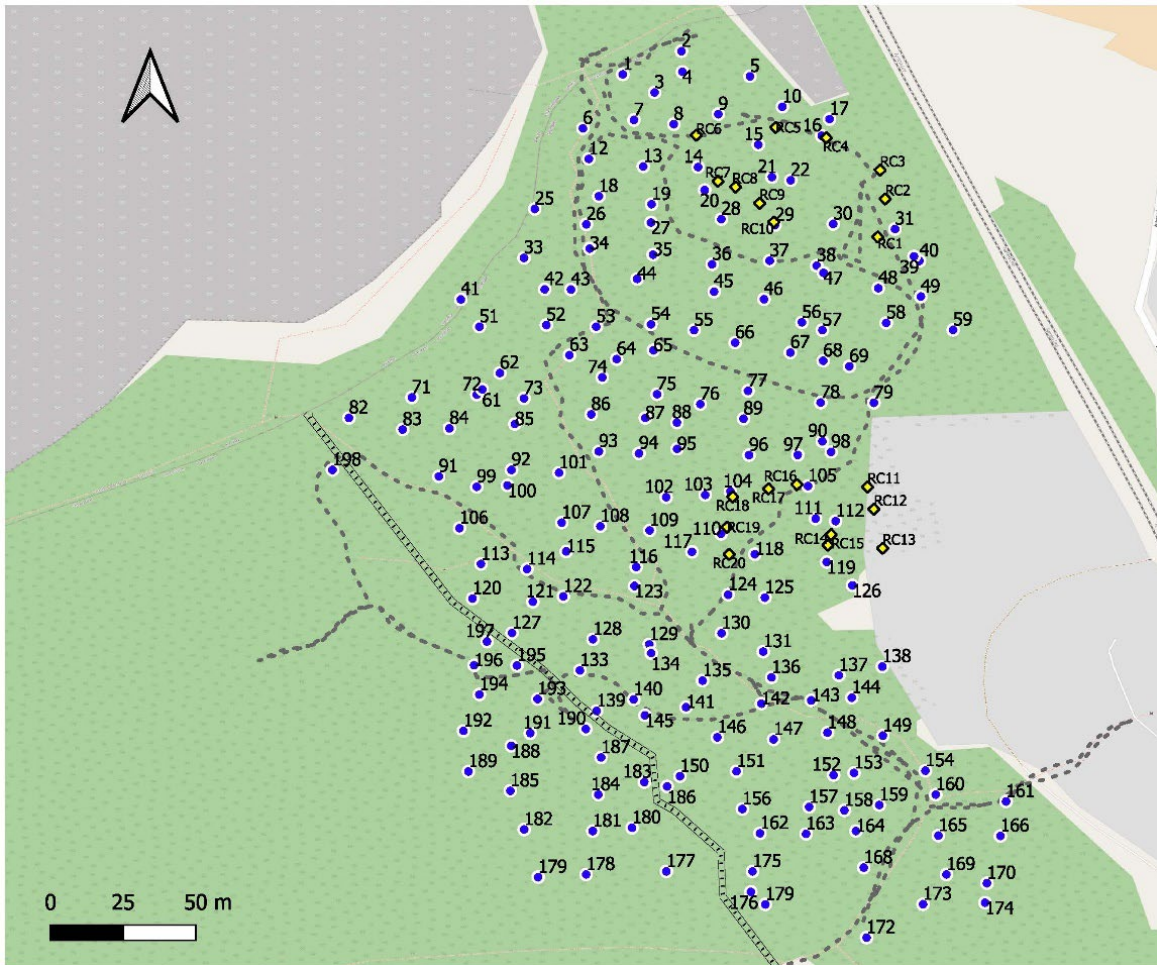


Figure 7.2, Final set up of nest boxes and release cages at Eaves Wood. Boxes are blue and release cages are yellow

7.2 Release Cage set-up.

To limit stress to the dormice and to allow them time to become accustomed to their new environment, this reintroduction was planned as a ‘soft-release’ (Bright and Morris, 1994). This involved confining the animal in a cage or structure, within the suitable woodland habitat for 10 days pre-release with food, water and protection from predators.

Twenty cages, provided by PTES, were set up at each site (Fig. 7.2) and attached to poles of mature hazel or yew using large cable ties. Cages were assembled on site by volunteers; the walls of the cages were secured together with cable ties being sure to minimise gaps. Excess plastic from the ties was removed to discourage the dormice from chewing.

Prior to the arrival of the dormice, these cages were filled with fresh branches of vegetation, giving areas for the dormice to climb and explore, mimicking the woodland. Each cage also contained a feeding tube in which the feeding bottle that contained the dormice food was placed through a small doorway in the top corner of the cage. Each cage also contained a small container to catch fresh rainwater as well as a water dispenser typical of those seen on the cages of household pets.

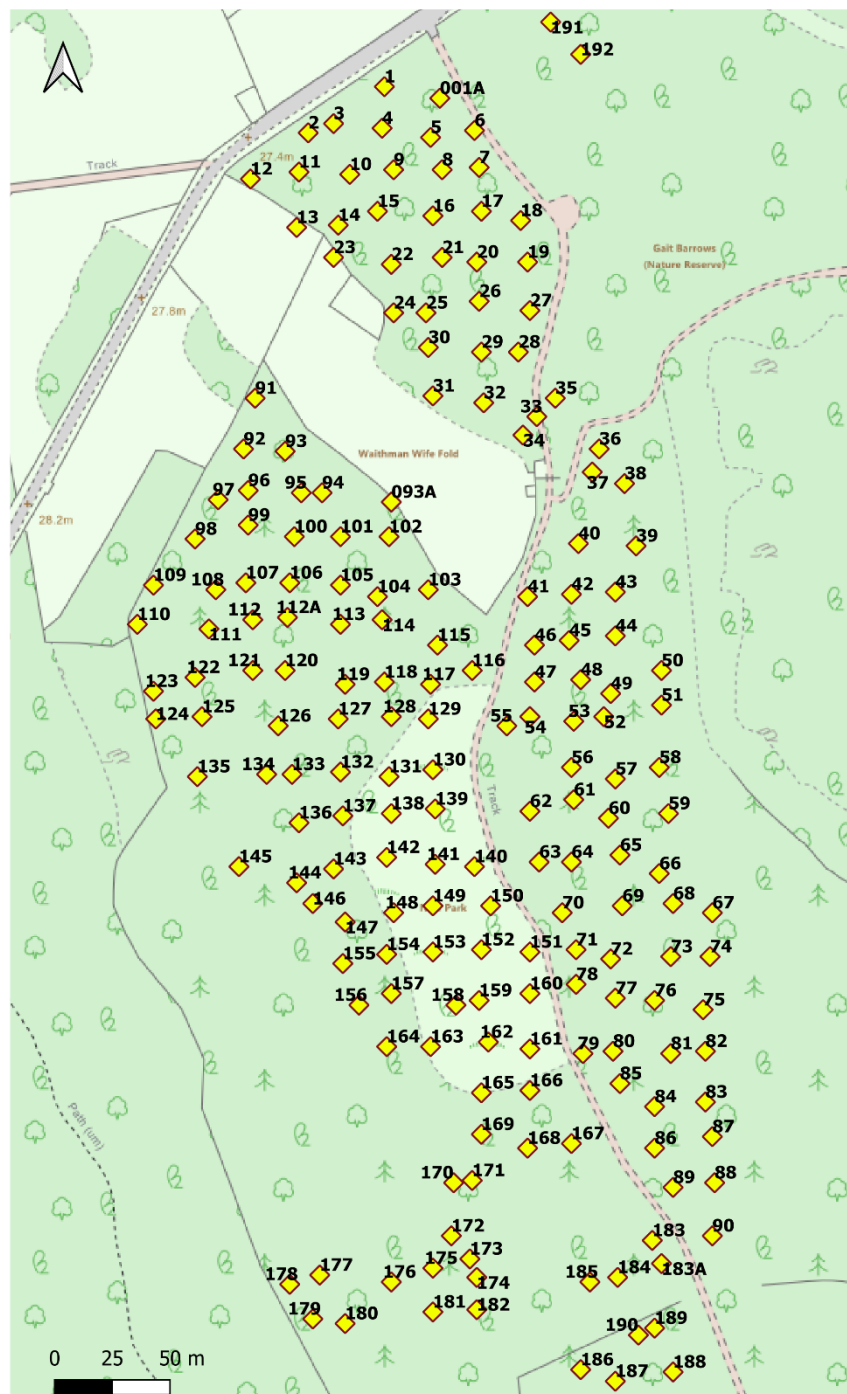


Figure 7.3, Final set up of nest boxes at Gait Barrows



Figure 7.4, Release cage set up in Eaves Wood with reintroduced dormice, in their boxes, inside (left) and example of dormouse nest box (right). Photo credit, Peter Howarth

7.3 Release day

On both release days, the dormice were brought to site by ZSL and Paignton Zoo where they had spent time in quarantine and had been given health checks. The dormice arrived in their nest boxes with the entrance holes sealed shut. Two boxes were dedicated to a cage, ensuring that male and females were placed together. The volunteer group were standing by to assist, placing the dormice boxes into the release cages and keeping a record of which dormice were assigned to which cage. This is important, as each dormouse was weighed and health checked that morning by veterinary staff, and we wanted to keep track of their health throughout the 10 days in the soft release pen.

As landowners and important stakeholders, members of Natural England and the National Trust were present to oversee operations and give important information concerning habitat management and site access. Members of PTES were also present to co-ordinate any media attention relating to the release.



Figure 7.5 Arrival of dormice. Photo credit: Peter Howarth



Figure 7.4 Members of PTES, ZSL and BOOM, discussing release day plans. Photo credit: Peter Howarth

7.4 Post release feeding

Dormice in soft release cages were fed daily by volunteers for 10 days and every other day after the cage doors were open as a precaution. Quantities and ingredients per mouse were as follows:

Table 7.1 Table of food amounts to be given to dormice on a daily basis for 10 days whilst in their soft release cage

Ingredient	Brand and availability	Proportion
Mixed corn	Dodson and Horrell Poultry (available online at Amazon https://www.amazon.co.uk/)	2.86 grams (2 parts)
Superior egg food	EMP (available online at Amazon https://www.amazon.co.uk/)	0.71 grams (1/2 part)
Uni Patee insectivore mix	Orlux Versele-Laga (available online at Amazon https://www.amazon.co.uk/)	0.71 grams (1/2 part)
Sultanas	Supermarket own brand (available at all major supermarkets)	0.71 grams (1/2 part)
Sunflower seeds	Wildlife Kingdom (available online at Ebay https://www.ebay.co.uk/str/wildlifekingdom)	Two seeds
Hazelnut	Supermarket own brand (available at all major supermarkets)	One hazelnut
Fruit/ Vegetable: Grapes for the nutrition study weeks; Viable alternatives: apple, carrot, celery, blueberries, blackberries.	Supermarket own brand (available at all major supermarkets)	Piece of fruit or vegetable 1.5cm ³

The corn, egg, insectivore mix and sultanas were premixed in a large container and volunteers weighed out 12grams at a time for each cage (i.e. on average twice the amount listed above). Each cage contained a small door with a feeding bottle attached. This was a large plastic bottle, cut in half, and placed within a tube at the top of the cage and attached to the cage with wire. The 12 grams of mixed food plus four seeds, two hazelnuts and two pieces of fruit were placed into the feeding bottle. This was then returned to the tube and the door securely shut. When approaching the cage it was important to check the feeding bottle for dormice before opening the cage door as dormice were often found in there feeding, even during the day. During the first year of reintroductions at Gait Barrows NNR, all waste food (food that was not eaten during 24 hours between volunteer checks) was weighed before being discarded and replaced with fresh food. This gave us an idea of how much food each cage was consuming and whether the measurements were appropriate



Figure 7.7 Volunteers, Fiona Newy (left) and Julia Sier (right), prepping food for dormouse feeding. . Photo credit: Peter Howarth



Figure 7.8 Volunteers prepping to fill the release cages with fresh vegetation whilst awaiting the arrival of the dormice. . Photo credit: Peter Howarth

7.5 Cage opening and health check

After ten days, ZSL returned to site to give the dormice a final health check before being left to venture into their new surroundings. Each dormouse was weighed and given a brief examination of health; this also allowed those volunteers planning to apply for a dormouse licence to gain some handling experience in the presence of fully trained licenced staff. Weights and health assessments were recorded for research use by ZSL and as a record for BOOM. After checks were completed, a small hole on the top of the cage was opened, allowing the dormice to leave as and when they wished.

The cages were dismantled and removed in December once all dormice had left and were safely in hibernation.



Figure 7.9 ZSL, Tammy Shadbolt and BOOM officer, Ellie Kent, assessing dormouse health before opening the cage and allowing the dormice to venture into the woodland. Photo credit: Peter Howarth

7.6 Recommendations

- It is important to remember, when setting up boxes in the spring that the vegetation is likely to change dramatically and finding boxes during survey can become difficult in the middle of summer. Some of the vegetation was cut away, creating small pathways, making it a lot easier for volunteers to locate boxes in the future, but attention was made not to disrupt the surrounding habitat too much. This was valuable when working in dense hazel coppice.
- Take time to train volunteers to navigate using GPS and compass, although difficult in a closed canopy habitat it works well enough to re-find boxes in dense and confusing woodland and scrub. A good way to do this is to hide chocolate treats in the wood and challenge volunteers to find them using the GPS.
- Assembling the release cages in the woodland uses a large amount of single use plastic. Identify places in the local area that will make use of this plastic once the cages have been

constructed. For example, the waste cable tie ends were collected and given to a charity who recycled the plastic into plant pots.

- To minimise the stress during the release day it is recommended to plan a day agenda and share with all stakeholders in advance. If possible, it should be considered to do a separate 'actual' release and a 'staged' release for the media on different days to limit stress to the animals as much as possible. However, this may not always be possible when taking other partners and stakeholders into account, some of which may have travelled a large distance to be involved.

8.0 Monitoring methodology

“Monitoring the course of a translocation is an essential activity. It should be considered as an integral part of translocation design, not to be merely added on at a later stage.” [IUCN Translocation Guidelines 2013](#).

The BOOM project strictly followed the IUCN guidelines when developing translocation strategies. Therefore, robust monitoring was planned and implemented throughout project delivery and encouraged to continue as part of the project legacy.

8.1 Nest box checks

Nest box checks were conducted at each site in the latter half of each month from April to November. All nest box checks were conducted with a licenced handler present and followed guidelines and training from PTES's NDMP. Two or three groups would survey at each site and each group of surveyors consisted of one licenced staff or volunteer and two assistants. It was planned to survey early in the morning, as this meant the dormice were more likely to be in torpor and less likely to be active.

For detailed protocols on nest box monitoring methods please explore the following resources provided by PTES:

[NDMP 2023 guidelines and survey sheets](#)

[Kit list suggestions](#)

[Dormouse handling training videos](#)

[Aging and sexing dormice presentation slides](#)

[Checking nest boxes presentation slides](#)

Results from every survey were stored on a dropbox folder, accessible to landowners and stakeholders in the project, also to volunteers who had skills in data analysis. All results are also shared with PTES as part of the NDMP.

Data was collected on the number of individuals found, their sex, age class and weight. Information on the presence, number and weight of young was also collected during the breeding season (Goodwin et al., 2017). This data allowed us to understand the short term progress of the project. It will allow us to see trends in population number and size, the spread or dormice through the landscape, their health and ability to reproduce. However, it is important to remember that this data is not necessarily representative as not all dormice use boxes, and depending on the habitat, they may be more likely to make natural nests in the canopy. Although nest box surveys are a useful tool, that is standardised and popular across the country, complimentary methods such as footprint tunnels and hazelnut surveys should also be encouraged to ensure you are gaining as much information as possible.

8.2 Footprint Tunnel surveys

Footprint tunnel surveys are an alternative way to obtain presence data of dormice within a woodland (Melcore et al., 2020). This can be especially useful if the dormice are creating natural nests in branches of hazel or hollows of mature oaks and not using nest boxes. As part of the BOOM project, footprint tunnels were used to look for presence of dormice in areas where we expected them to spread but there were no boxes. Or in areas in which dormice were not regularly found in the nest boxes (Fig. 8.2).

It is not necessary to have a licence holder present during a footprint tunnel survey, therefore it is a great engagement tool for those who do not wish to handle dormice in the nest. Tunnel surveys are also popular because they are less intrusive than box checks; there is no nest disturbance or handling of individuals. However, a project may not want to take on footprint tunnel checks if it is lacking resources. They can time and labour intensive and results are quite dependent on the weather, a heavy downpour can really limit chances of finding recognisable footprints. However, they are enjoyable, sociable and useful, albeit slightly messy!

Kit list:

- 1 paint brush
- 1 pot of gloop (1 teaspoon charcoal, 15 teaspoons olive oil)

- 50 sheets of card (depending how many tunnels you have)
- 1 compass
- 1 pen
- 1 GPS
- 2 spare batteries
- 1 role of masking tape
- 1 map of your area
- 1 survey data sheet
- 2 x folders. One for new card one for old footprints
- 1 x rubbish bag

Method:

1. Use GPS to find the tunnel
2. Always check inside tunnel first, in case there is a dormouse nest or a dormouse
3. Remove the wood
4. If there are clear footprints of any kind (mouse or bird) then make a record
5. Write clearly on the back; no. of tunnel, site and date
6. Replace the card and stick with masking tape
7. Put generous amount of oily-charcoal gloop on each end, where masking tape sits
8. Place back into the tunnel and continue

Dormice will walk through the tunnel, getting their paws coated in charcoal at the entrance and leave black paw prints on the white card within the tunnel. Dormice footprints are unique and recognisable; they have triangular shaped palm pads that our volunteer team like to call 'cheese wedges' (Fig. 8.3). Many other creatures like to explore the tunnels, so to an untrained eye it can be difficult to identify a positive dormouse print.



Figure 8.1 Footprint tunnel set up. Photo credit: Sammy Haddock

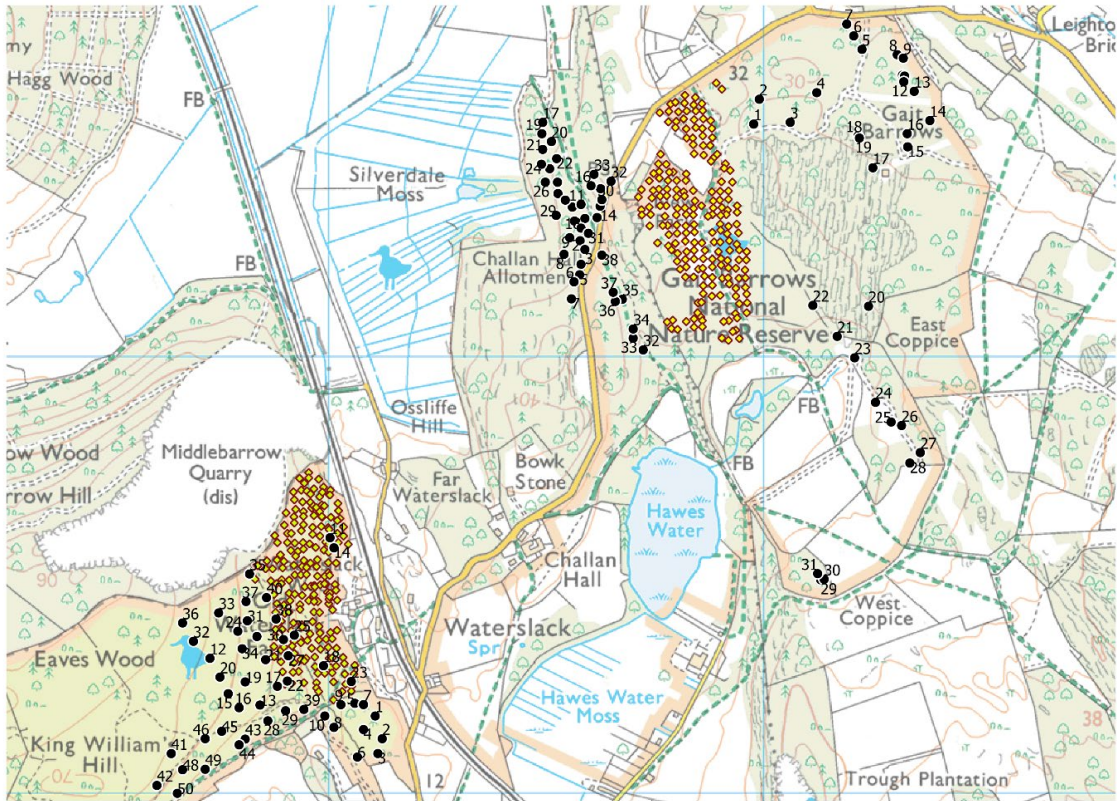


Figure 8.2 Map of dormouse footprint tunnels set up across release area in the ANOB and into potential dispersal corridors. Numbered black dots represent tunnels and yellow squares represent nest box location



Figure 8.3, Image of dormouse footprints.

8.3 Hazelnut surveys

Dormice have a specific technique of eating a hazelnut. Meaning it is possible to determine which species has eaten the nut depending on the patterns they leave behind on the empty hazelnut shell. Hazelnut surveys are a great way to get members of the public involved in a project and they can provide great data on the presence of dormice in an area.

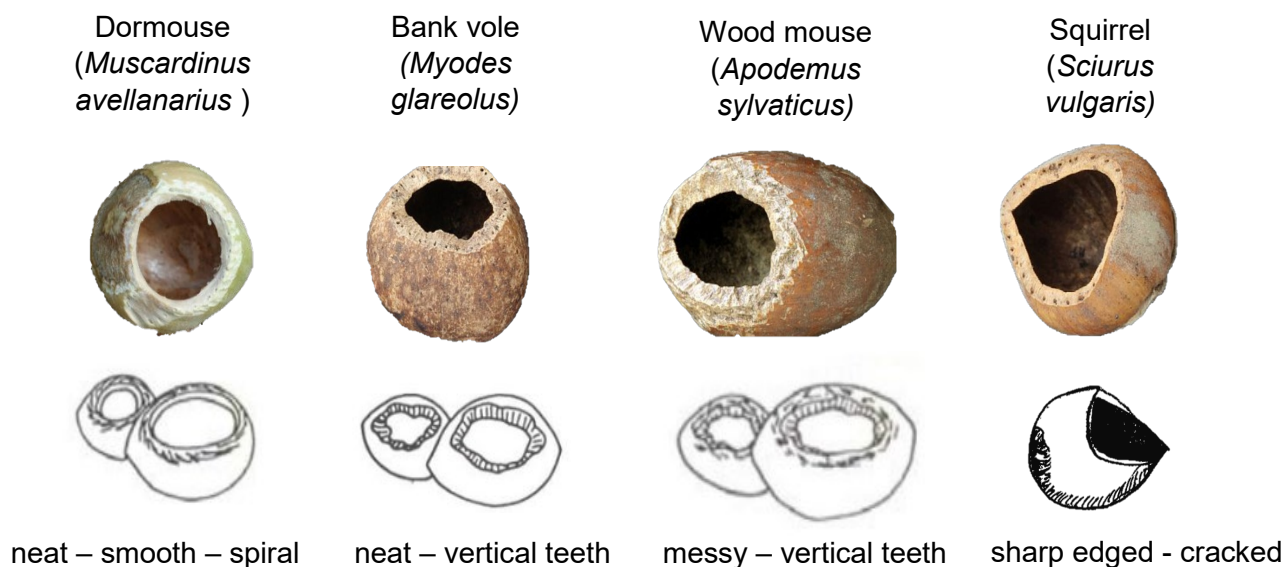


Figure 8.4, Comparison of varying hazelnut

To see full details of hazelnut survey methods please use the following resource:

[Hazelnut survey PTES](#)

8.4 Recommendations

- Dormice do not always use nest boxes, therefore it is important to support your data with alternative survey methods. In addition, it is easy to become too focussed on nest box surveys, take the time to look at your surroundings as you may spot a natural dormouse nest. Not only is this very special thing to see but it is good evidence of dormouse presence.
- It is important to be open about the scientific importance of monitoring dormice in this way. It is not uncommon for opinions to arise about the invasiveness of nest box checks. Every opinion is valid and it is vital that open and friendly discussion is encouraged.

- During tunnel surveys it is recommended that one individual is dedicated to being the 'pot and brush holder' as the oily charcoal can become messy very quickly and will coat all equipment if spilt into the equipment bag.

9.0 Results

9.1 Nest box survey results

Since the initial translocation into Gait Barrows in June 2021, there have been 18 nest box checks at Gait Barrows, there have been 11 nest box checks at Eaves Wood since the release there in June 2022. During these checks, we have documented 449 occurrences of dormice at Gait Barrows, and 109 at Eaves Wood (see table 9.1). This includes all age brackets (adult, juvenile, grey eyes open, grey eyes closed and pinks when appropriate). In total across both sites, 193 females were found and 261 male dormice were found and 107 in which the sex was not identified. These checks took place between April and November 2021, 2022, 2023. Data for October and November of 2023 is yet to be collected.

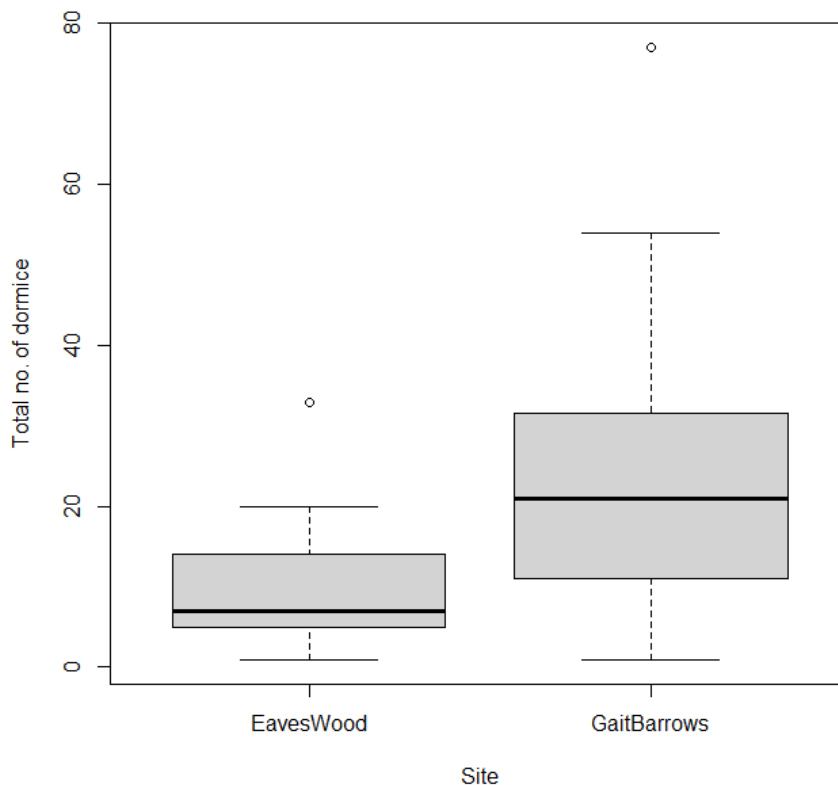


Figure 9.1 Box and Whisker plot showing total dormouse count per survey each site. I.e. the highest count at Gait Barrows during survey was 77 dormice. Data collected from Gait Barrows between July 2021 and June 2023. Data collected from Eaves Wood between July 2022 and July 2023.

9.2 Total dormice and nests

The highest number of dormice recorded during a survey, was 77 in October 2022, at Gait Barrows NNR, this was 16 months after initial release (this equates to 19.5 dormice per 50 boxes). The highest recorded total for Eaves Wood is 33 dormice; recorded in September 2022 three months post release (8.9 dormice per 50 boxes). On average the month recording the lowest number of dormice each year is April, recording just one or two dormice at each



Figure 9.2. Maps showing presence of dormice. Top left – Dormouse presence in boxes at Eaves Wood between 2022 and 2023. Bottom left – The same data of dormouse presence but in relation to the position of the release cages. The same is shown for Gait Barrows on the right although with an extra year of monitoring in 2021.

site (Fig. 9.2). The highest number of adult dormice found at Gait Barrows was 54 in May 2023 (13.7 per 50 boxes) and the highest number of adults at Eaves Wood was ten in July 2022, (2.7 per 50 boxes).

On average, the most nests were found at Gait Barrows in October (63.5 nests) and at Eaves Wood in September (24 nests). Again, April saw the lowest number of nests found at both sites (one at Eaves wood and one at Gait Barrows) (Fig. 9.3).

Only nine dormice were found dead in a nest box during a survey, four of these were ‘tagged’ dormice, i.e. initial dormice from the release.

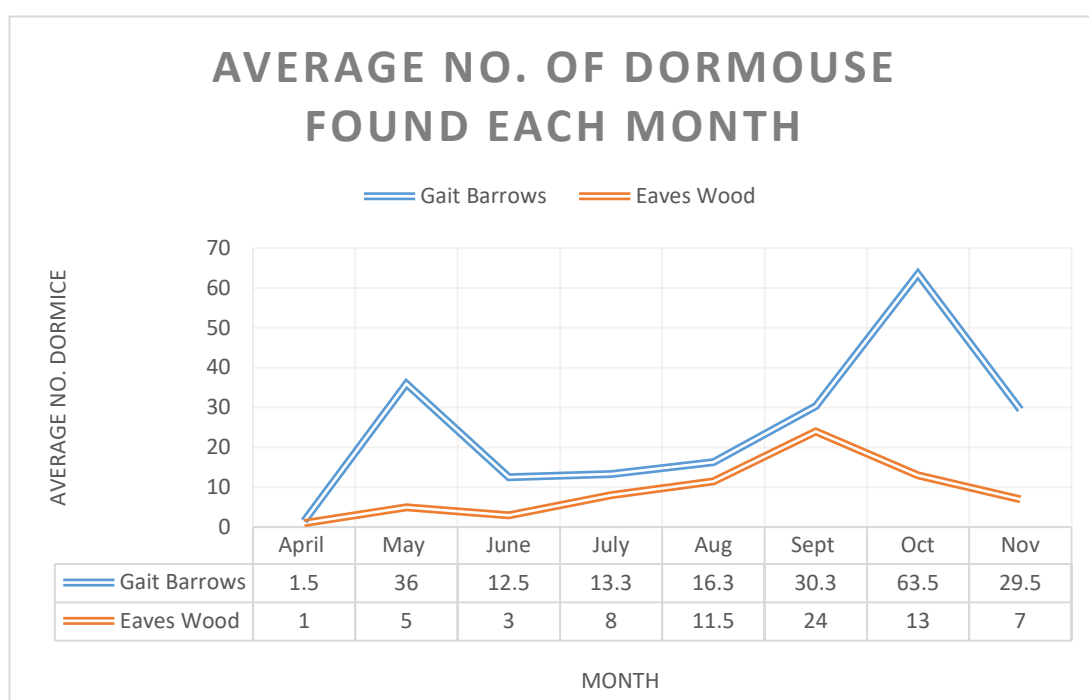


Figure 9.3. A line graph showing the average number of dormice found each month at Eaves Wood and Gait Barrows. Data taken from box checks running from 2021 – 2023.

Table 9.1 – Total number of dormice found by age class at each site

Total no. dormice by age class at Eaves Wood		Average no. dormice by age class per check	Total no. dormice by age class at Gait Barrows		Average no. dormice by age class per check
Adult	53	4.8	Adult	215	11.3
Juveniles	18	1.6	Juveniles	136	7.2
Eyes Open (EO)	14	1.3	Eyes Open (EO)	38	2.0
Grey Eyes Closed (GEC)	7	0.6	Grey Eyes Closed (GEC)	30	1.6
Boxes with pinks	6	0.5	Boxes with pinks	15	0.8
Unknown/dead	11	1.0	Unknown/dead	15	0.8
TOTAL	109		TOTAL	449	

9.3 Dormouse weight

Dormouse at Eaves Wood we found to be 15% heavier, on average, at Eaves Wood than at Gait Barrows NNR (17.4g at Eaves Wood and 15.1g at Gait Barrows)(Fig 9.4). This is likely due to dormice at Gait Barrows NNR being weighed more often outside of a release cage. On average, November records the heaviest dormice at each site (Fig. 9.5).

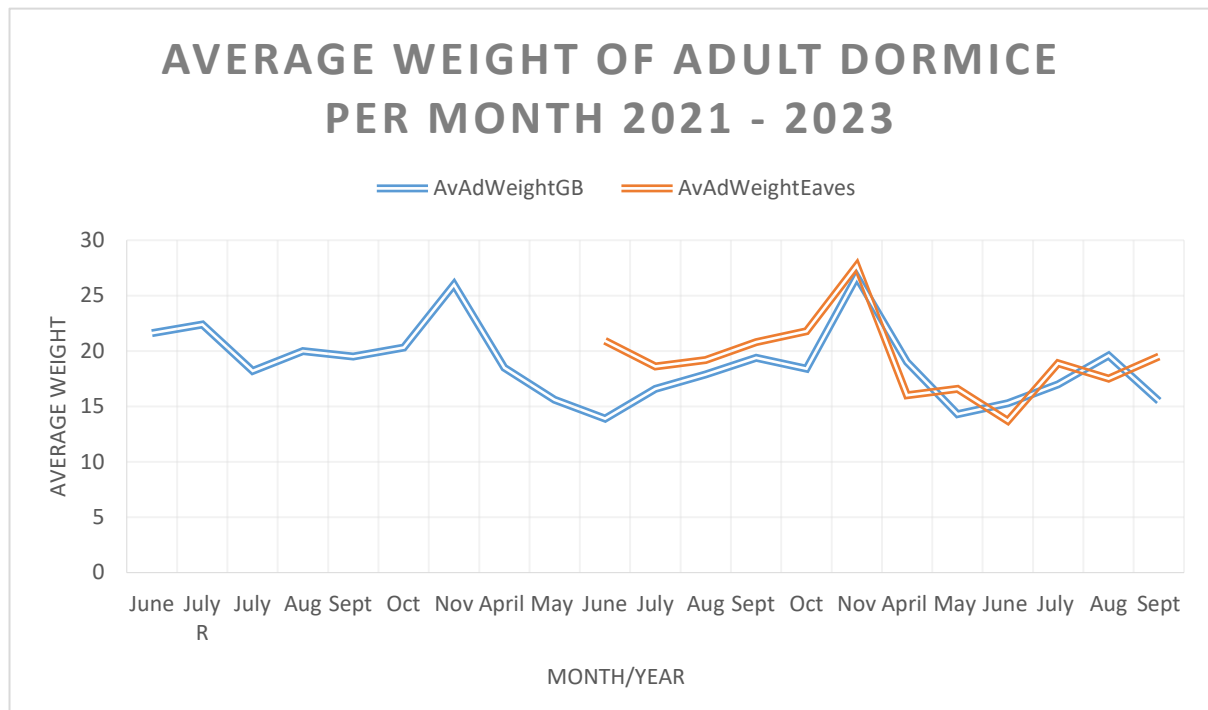


Figure 9.6 Line graph showing the average weight of adult dormice found in each monthly check starting in June 2021 – September 2023. “July R” Stands for the weight of the dormouse during health check on cage opening day.

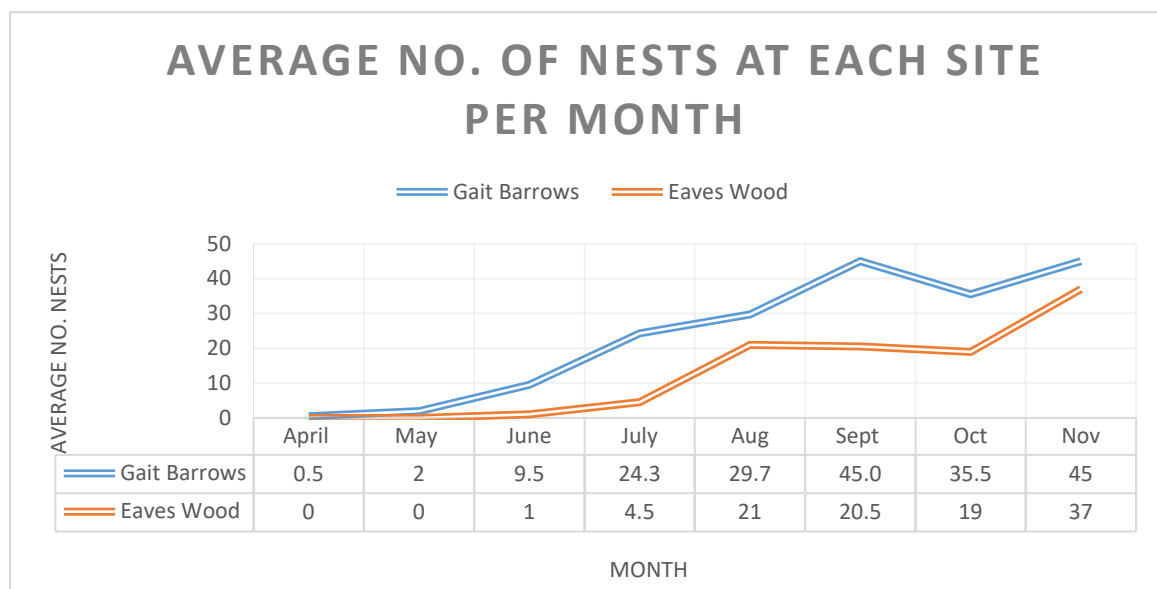


Figure 9.4. A line graph representing the average number of dormouse nests found each month at Eaves Wood and Gait Barrows. Data taken from box checks running from 2021 – 2023.

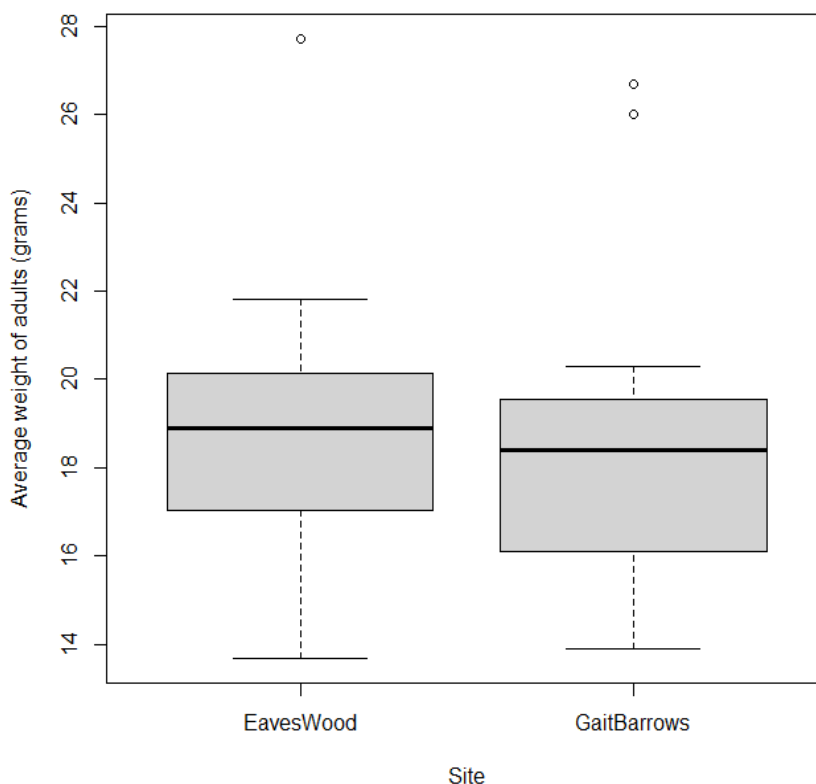


Figure 9.5. Box and Whisker plot showing the average weight of adult dormice per check at each site.

9.4 Post release comparison

Data was collated to compare dormouse weight, count and breeding in the relevant months after the initial releases at each site. In the first checks at Gait Barrows and Eaves Wood post release (i.e. July 2021 at Gait Barrows, and July 2022 at Eaves Wood) both sites recorded 10 adult dormice and 0 young. In August 2021, Gait Barrows recorded 11 adults and 18 young (Fig. 9.7). In August 2022, Eaves Wood recorded just 7 adults and no young. There was no record of young dormice at Eaves Wood until September 2022, in which 18 were recorded. In October and November, Gait Barrows continued to record high counts of young dormice (23 in October and 21 in November) whereas Eaves Wood had a low record count of young (9 in October and 4 in November). Comparing the number of adults recorded between sites remains fairly constant throughout the season although when adjusting these figures to account for how many were initially released (i.e. % of total released), Eaves Wood records lower percentage counts of dormice each month (Fig. 9.8).

The average weight of adults found in boxes post release were consistent across both sites, with a rise in average weight in November, prior to hibernation, which is to be expected. A

comparison of the average weight of adult dormice at each site was completed using a Kruskal-Wallis Rank test which showed was no significant difference between adults weights at each site in months post release ($\chi^2=0.2$, $df=1$, $p=0.6$).

Likewise, male and female dormice were recorded a similar amount of times on each survey at each site, i.e. there was no discrepancy in finding either sex more than the other at either site ($\chi^2=6.3$, $df=1$, $p=0.011$). These records were also not separated in space, male and female dormice were found within dispersal range of each other in the first two months of survey at Eaves Wood and Gait Barrows post release (Fig.9.10).

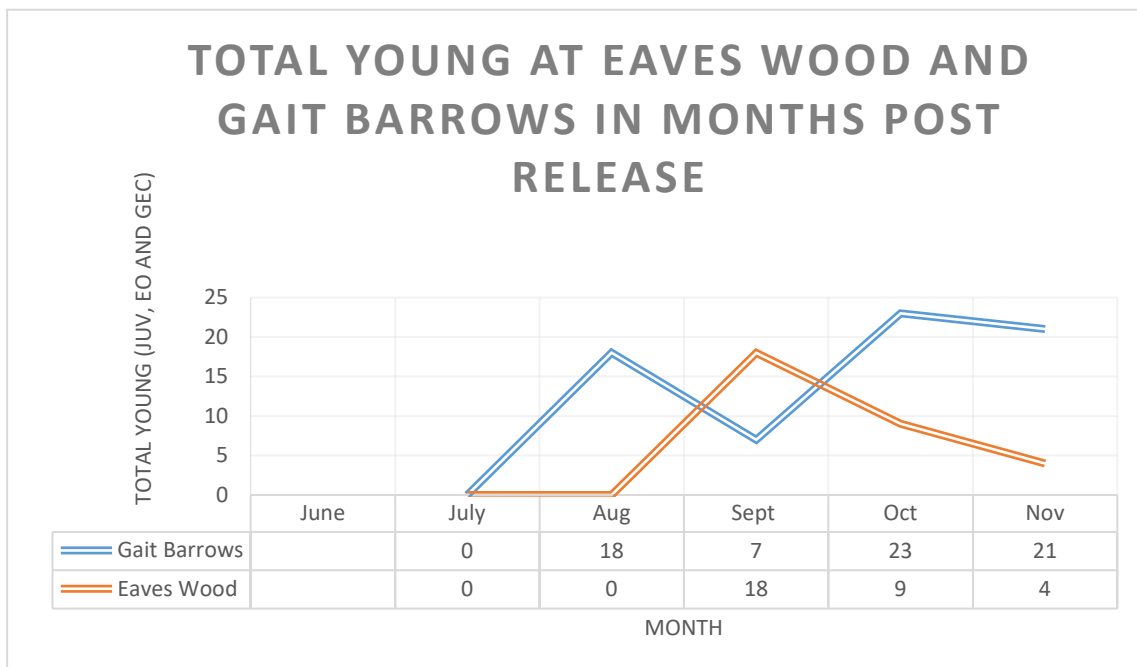


Figure 9.7. Line graph showing the number of young dormice found during box checks in the months immediately after the release.

TOTAL ADULTS FOUND POST RELEASE AND AS A PERCENTAGE OF TOTAL RELEASED

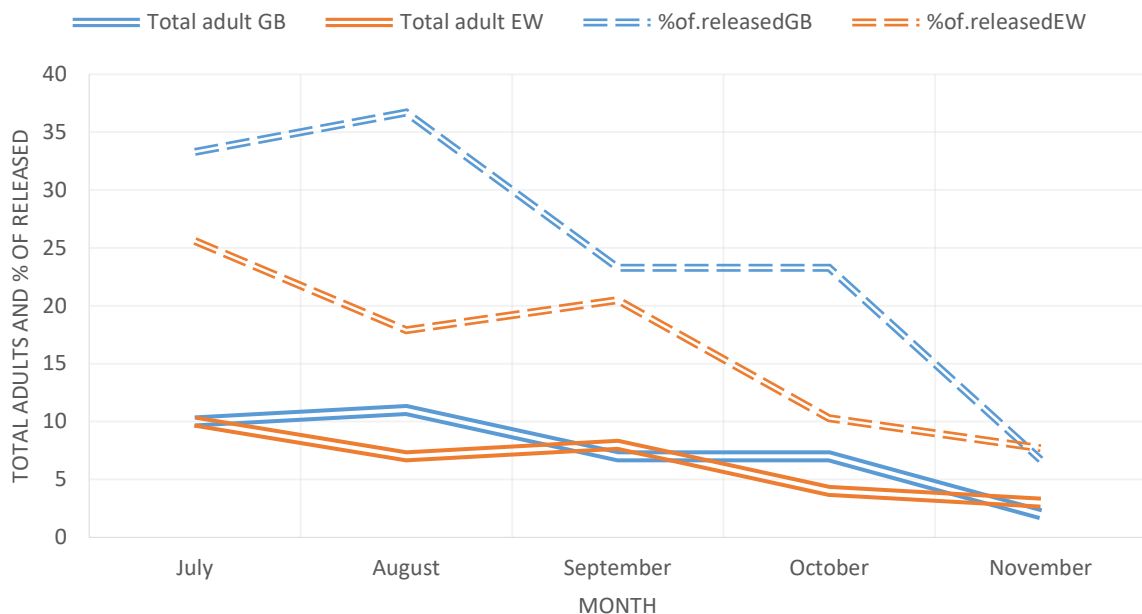


Figure 9.8. A line graph showing the total number of adult dormice found at each site in the months post release (solid lines) and that total as a percentage of the amount of animals initially released (dashed lines).

AVERAGE WEIGHT OF ADULTS POST RELEASE

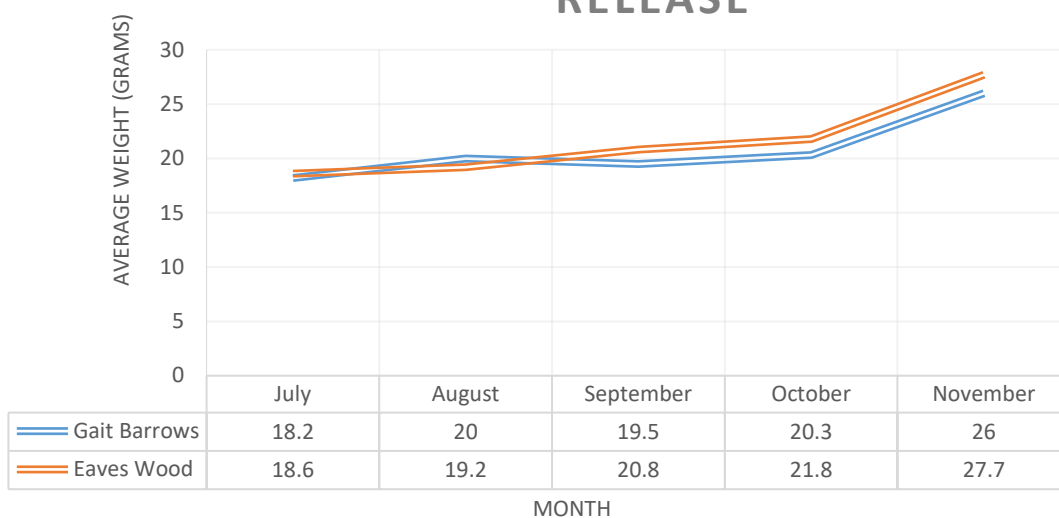


Figure 9.9. A line graph showing the average weight of adult dormice in the months immediately after initial release.

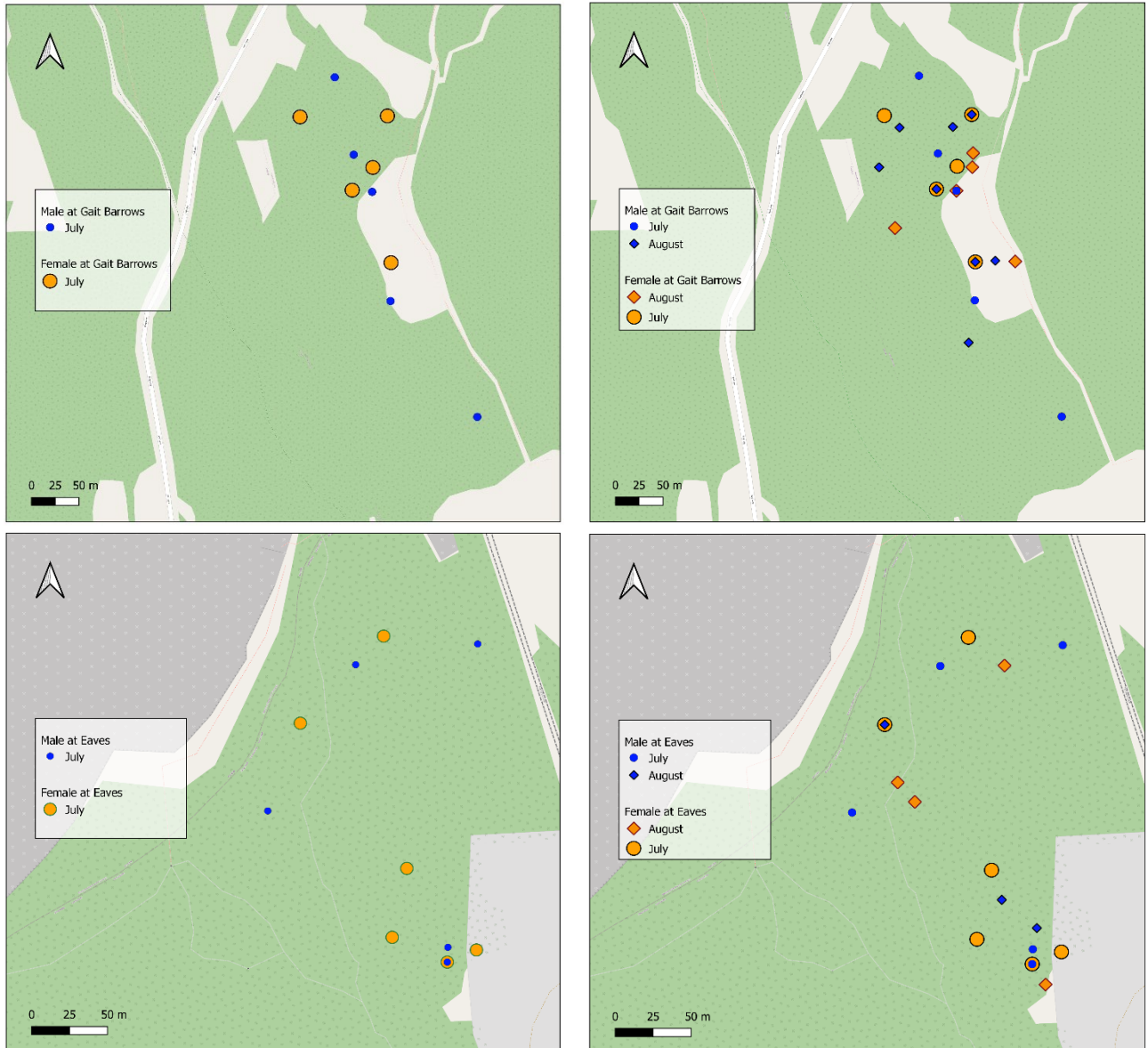


Figure 9.10. Top left, map of male (blue) and female (orange) dormice found on box check in July 2021, one month after release at Gait Barrows. Top right map of male and female dormice found in July and August 2021, two months after release. Bottom left, map of male (blue) and female (orange) dormice found on box check in July 2021, one month after release into Eaves Wood. Bottom right, map of male and female dormice found in July and August 2021, two months after release. In July, females were found an average 17m away from nearest male at Eaves Wood and 26m at Gait Barrows. In August, females were found an average of 56m away from their nearest male at Eaves Wood and 37.5m away at Gait Barrows.

9.5 Tunnel Results

To be completed

10.0 Community Engagement

10.1 Volunteers

Recruiting and training volunteers was a crucial step for initial success of the dormouse reintroduction but also for generating a legacy of monitoring the project into the future. The BOOM team used a focussed approach to recruitment, recruiting volunteers from the local area, ideally between 3-5 miles of the planned reintroduction sites as the time commitment expected from individuals was high and we wanted to reduce the amount of travel. Our recruitment process attracted over 100 expressions of interest, of which we initially selected 25 individuals based on proximity to project and time availability. Over 30% of our volunteers had a desire to apply for a Dormouse Handling Licence and were carefully trained by licenced staff members during box checks.

- Currently 28 active volunteers
- 12 people have been granted Dormouse Level 1 Survey Class Licence CL10a
- Another nine are in continued licence handling training
- 610 volunteer days in total
- 108 volunteer activities
- Achieving £60,385.26 in volunteer time

10.2 Volunteer activities

- Preparation of sites: building and installing nest boxes at both sites, putting up footprint tunnels and soft release cages.
- Data Collection: monthly nest box surveys and bi-weekly footprint tunnel checks.
- Daily feeding and monitoring during soft release cage stages
- Data analysis, reporting and presenting at end of season events
- Community engagement and education: volunteers serve as ambassadors for dormouse conservation within their communities. They are able to raise awareness about the importance of dormouse reintroduction and conservation.

10.3 Licence handling training

An initial aim of the dormouse project was to obtain a pool of volunteers with handling licences, to reduce pressure on licenced staff members and to ensure a monitoring legacy into the future. In normal circumstances it can take many years to gain enough experience to be awarded a licence by Natural England so the BOOM team was in a fortunate position to have funding for external training and to offer many more opportunities for handling as part of a reintroduction project. BOOM offered the following training for volunteers and staff:

- Two days of residential training with Ian White from PTES in the isle of Wight in dormouse handling and survey methods
- Two days of residential training with Hazel Ryan from the Wildwood Trust in dormouse handling and survey methods
- Training surveys with Ian Court from Yorkshire Dales National Park.
- Three online training courses and webinars covering dormouse ecology, habitat management, survey methods, data collection and ethical considerations
- Handling opportunities during ZSL lead health check of dormice in the release cages
- Continued nest box surveys with handling opportunities supervised by licenced staff.



Figure 10.1. Photo of BOOM volunteer team with Ian White PTES completing dormouse handling training in the Isle of Wight. Photo credit: Deborah Brady

10.4 General volunteer training

Other than nest box surveys and dormouse handling, there was a variety of other skills needed for the efficient running of the dormouse project and a successful release. All volunteers were trained in the following skills and techniques

- Navigation using a GPS and compass (this is beneficial for location boxes and tunnels in a dense woodland)
- Footprint tunnel survey techniques
- Dormouse footprint identification
- Three day first aid training
- Dormouse feeding and monitoring in release cages by Ian White from PTES and BOOM team (dormouse feeding occurs daily for ten days and then every other day for a further 10, it does not require a dormouse licence and is therefore a good activity for those not pursuing a dormouse licence).
- All volunteer were trained in aspects of the release day to ensure efficient placement of the animals with minimal disturbance.



Figure 10.2. Volunteers Peter and Ray installing nest boxes at Eaves Wood. Photo credit: Ellie Kent

10.5 Volunteer considerations

One factor limiting volunteer participation was the challenging terrain. Both woodlands are situated on limestone pavement, meaning there are holes hidden by moss and rock are notoriously slippery when wet. This sort of terrain was not suitable for some individuals and some volunteers were unable to join. However, these volunteers did support the Officers by writing social media updates and a monthly blog. A home-based volunteering role, for those who become unable to participate in strenuous activity was made available where possible. Recognising and appreciating volunteers' contributions can boost morale and retention rates. As part of this project, we held two events for volunteers to attend each year as part of a “thank you” and a celebration of the project achievements. We believe involving local communities fosters a sense of ownership and responsibility for conservation efforts, ensuring long-term sustainability.

10.6 General community engagement and education

Raising awareness of conservation efforts in a particular area in regards to a dormouse reintroduction can be sensitive, as dormice are an attractive and popular creature. Advertising the sites to the wider public could unintentionally increase risk through habitat disturbance by visitors actively seeking to view an adult dormouse or pinks inside a box. Although we see engagement as an integral part of conservation, we were careful not to directly disclose the location of the dormice to the general public unless in a closed group situation with people we could trust i.e. during guided walks for project partners. During the BOOM project we organised the following engagement events:

- 12 presentations talks to local wildlife groups or students
- A guided walk for the National AONB conference.
- Guided walk for the BOOM steering group members
- A guided visit for a local primary school, Great Wood School
- Supervised dormouse feeding for College students from Barrow in Furness as part of the BOOM sixth form conference.
- Three radio interviews on BBC Cumbria and two television appearances, including Channel 4 and Border TV.
- Articles for local magazines and news outlets including the Countryman and Cumbria Life.
- Ongoing social media content.

10.7 Release day Media

With help from PTES and the University of Cumbria, media coverage on both dormouse release days (2021 and 2022) was a resounding success. In total we were included in 374 news items (217 in 2021 and 157 in 2022) with an audience reach of 1.7 billion (1.5 billion in 2021 and 217 million in 2022). Below is a breakdown of media reach in for the release into Eaves Wood in 2022:

- Broadcast: 11
- National papers: 5
- Regional papers: 4
- Magazines (regional and national): 0
- Online (regional and national): 137

10.8 Social Media

In this current digital age, harnessing the power of social media was an essential tool for promoting and celebrating the success of the dormouse project. We maximised our efforts by utilising three platforms; Facebook, Instagram and Twitter. Engaging and informative content, such as photos and videos, extends to a broader audience, including individuals who may not have been aware of the conservation efforts otherwise. Increased awareness often translates to support, both in terms of volunteer involvement or financial contributions. BOOM posts relating to dormice have been seen over 425,000 times.

While social media and marketing are powerful tools for species reintroduction projects, they come with challenges:

- Resource allocation: managing social media and marketing efforts requires time, expertise, and potentially financial resources, which may compete with other project needs.
- Accuracy and ethical considerations: ensuring the accuracy of information and respecting ethical considerations in the portrayal of wildlife is vital to maintain credibility.
- Balancing outreach and conservation: Striking a balance between outreach efforts and on-the-ground conservation work is essential to ensure that marketing efforts don't detract from the primary mission.

11.0 Legacy

It is difficult to be certain that this dormouse reintroduction was a success before completing ten years of post-translocation monitoring (at least), as this would be the desired minimum monitoring timescale if project funding were not a constraint (Chanin, 2014; IUCN, 2013). Chanin, 2014, stated that only 56% of dormouse reintroduction projects were successful in the long term, i.e. beyond ten years post reintroduction (Chanin, 2014). This emphasises the importance of legacy, for us as a project to understand our success or failure and to also present recommendations to future projects. Without an understanding of success or failure, it is near impossible to give evidence-based advice and conservation efforts may be done in vain.

The initial aim for legacy was to develop the volunteer group into a self-organising, autonomous body to manage the project going forward. The volunteers already had a developed sense of custodianship over the dormice and had the skills and managerial ability amongst the team to make it a success. This would have been a strong outcome for the BOOM project and for dormice in south Cumbria. However, this aim was ambitious. For simplicity, and to reduce the weight of responsibility on voluntary individuals, the plan evolved, becoming a joint operation between the National Trust and Natural England; to guide the volunteer group through future monitoring and co-lead the project going forward. This was a hugely positive outcome after some initial uncertainty.

There has been clear communication with both partners and a full hand over document has been written and fully discussed to ensure a smooth transition of leadership. Staff at both organisations are fully trained in dormouse handling and have been advised and trained in monitoring methodologies. Staff at RSPB, Challan Hall, are fully trained in the application of footprint tunnel surveys and considering the use of boxes in the future. They have been given advice and pointed to resources if they are to take this on.

12.0 Summary

In summary, despite some challenges to overcome, the dormouse project has excelled in the past four years of BOOM. Below is a bullet pointed list of notable achievements evidenced in this document:

- Successful release of 69 captive bred dormice into adjacent sites in Arnside and Silverdale AONB in 2021 and 2022.
- Completed site set up of 184 nest boxes at Eaves Wood and 196 nest boxes at Gaitbarrows.
- Completed 29 nest box surveys post release to evidence short-term translocation success.
- *Footprint tunnel results to be completed*
- Documented the spread of released dormice (across a road) into adjacent site, Challan Hall (RSPB), through footprint tunnel surveys.
- Documented 449 occurrences of dormice at Gait Barrows, and 109 at Eaves Wood since release.
- Successfully recruited and trained more than 28 volunteers
- Successfully trained 12 volunteers to gain their Dormouse Level One Survey Class Licence CL10a, with nine others ready to apply next season.
- Developed a strong partnership with the National Trust and Natural England to secure legacy for the project, the volunteers, and the dormice in south Cumbria and Lancashire.
- Ensured a smooth collaboration of a landscape scale, multi-partner project with a large network of stakeholders.
- Provided the opportunity for novel academic research and dissertations
- Engaged the community through guided walks, talks and conference presentations.
- Raised awareness of dormouse conservation, with a media reach of 1.7 billion

13.0 Discussion and conclusion

As this project reaches its first and second year post reintroduction, the data collected shows reproduction and dispersal rates that echo those seen in successful dormouse reintroduction projects across the country (White, 2019). Since 1993, there has been 24 reintroduction projects across England and Wales that were reviewed by Ian White (PTES), in 2019. Of these, 12 are thought to be stable after five to ten years and nine have achieved long term success. All projects that declared long term success recorded less than ten mature dormice per 50 boxes in the first two years post release (White, 2019). The highest recorded was around eight mature adults per 50 boxes, at two sites (White, 2019). In comparison, Gaitbarrows recorded 13.7 dormice per 50 boxes and Eaves Wood recorded 2.7 dormice.

During discussions with volunteers and staff, there has been concern about the lower numbers of mice recorded at Eaves Wood in comparison to Gaitbarrows. However, when comparing the results with national average, it is Gaitbarrows that is the exception, recording higher than any other project in the first two years post release. Whilst Eaves Wood reassuringly records similar to other projects with evidenced long term success.

Nevertheless, Eaves Wood has consistently recorded lower numbers of dormice during box check than at Gaitbarrows despite nine more dormice initially being reintroduced. When isolating the data to just the months post release, it highlights a difference in breeding. There was no young recorded at Eaves Wood until September, whereas Gaitbarrows recorded 18 young in August. The young at Gaitbarrows then went on to have a second generation of their own, we are aware of this because non-micorchipped, lactating juvenile females were found with young in the nest. This is thought to be fairly unusual and in other studies it has been inversely related to the amount of females that over wintered that year becoming the main dynamic in restoring a decreased population density (Juškaitis, 2014). This accelerated breeding behaviour at Gaitbarrows is likely the reason for such a successful first two seasons, yet it is unclear why Eaves Wood did not achieve similar results.

The average weight of adult dormice at each site in months post release was almost indiscernible, with no statistical significant difference, suggesting that there was an adequate food source available at both sites and malnutrition unlikely to be the reason for the differing numbers.

In August, male dormice at Eaves Wood were found an average of 18.5m further away from their closest female than at Gaitbarrows, which could explain the limited breeding at Eaves Wood. However, this distance is small, and in general the male and female dormice were found well within the expected dispersal range, (100m), implying there was potential for breeding (Bright and Morris, 1991), it is simply that the numbers are lower. This is also clear in the reduced number of nests found in boxes at Eaves Wood compared to Gaitbarrows.

Apart from food availability and breeding potential other possibilities affecting the numbers at Eaves Wood could be habitat quality and abundance of predators. Tawny Owls are the main predator of hazel dormice in Europe (Juškaitis, 2023), and is attributed to high summer mortality in the species (Juškaitis, 2008). Although both woodlands have similar management techniques with rotational hazel coppice, Eaves Wood coppice is in an earlier succession and is fragmented by mature yew woodland. This higher abundance of open space could allow easier access for predators such as tawny owls, of which there is an observable and anecdotal high number (Ranger comm.). Goodwin (2018), found that a greater abundance of dormice was related to a greater abundance of yew, amongst other plants, although many studies also

relate a high abundance of dormice with a higher understory (Bright and Morris, 1991; Mortensen et al., 2022; Panchetti et al., 2007), which is not typical of a yew woodland. However, no scientific investigation into habitat structure has been conducted at either site and would make an interesting research project for those involved in the future. Lastly, not all dormice use boxes. It may be that the higher canopy at Eaves Wood is playing host to many dormice, away from the reach of surveying volunteers, which is not uncommon (Bright and Morris, 1991).

The BOOM team are proud of what has been accomplished in this dormouse reintroduction project and value Natural England and the National Trust's dedication to progress the project into the future. When considering what could be achieved within a limited timescale and during a global pandemic, this project has been a success. This is demonstrated through the ecological evidence in this document, the continued support from partners and the inspiring commitment from volunteers and the community.

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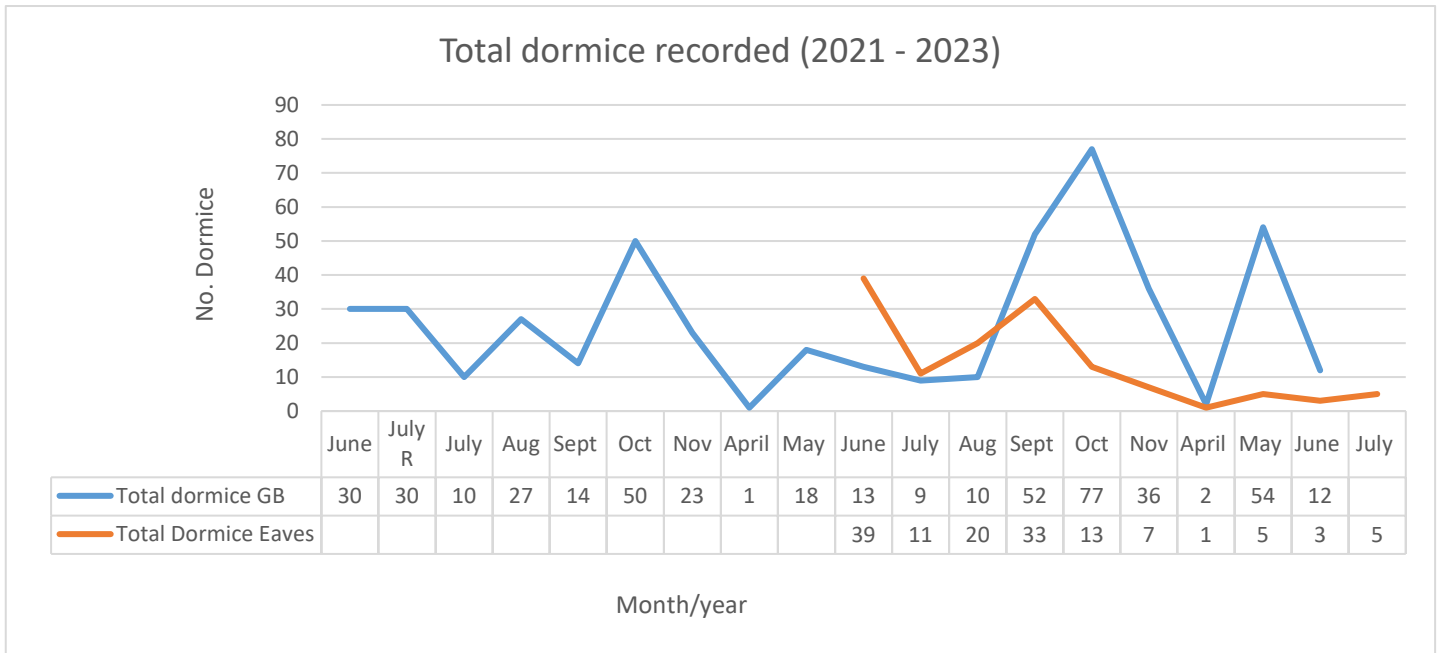
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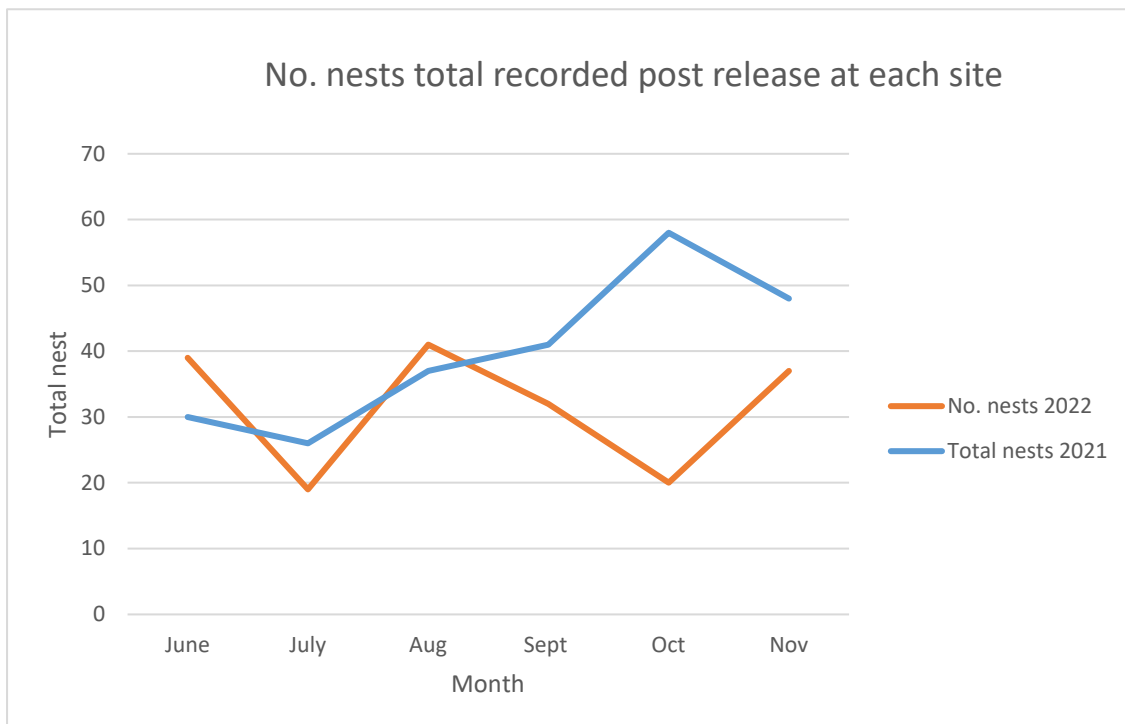
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Appendices

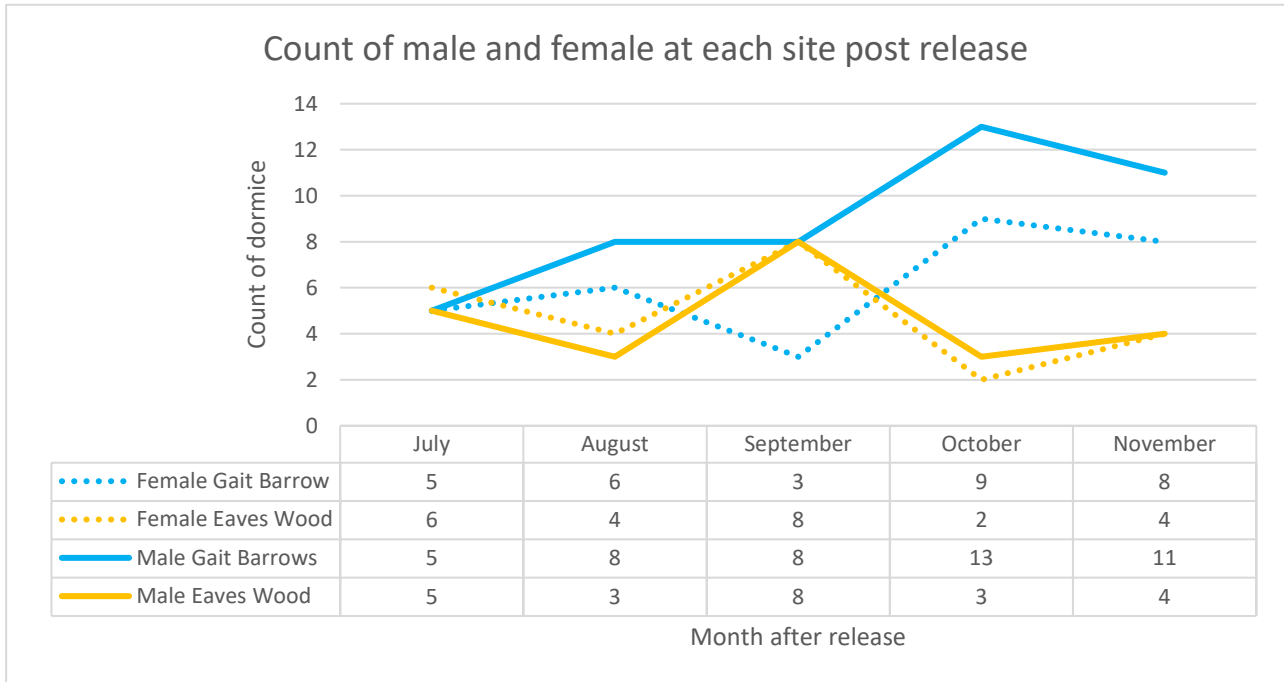
Appendix 1



Appendix 2



Appendix 3



Site Name	Year	Month	Total Adults found on survey	% of total released
Gait Barrows	2021	July	10	33.3
Gait Barrows	2021	August	11	36.7
Gait Barrows	2021	September	7	23.3
Gait Barrows	2021	October	7	23.3
Gait Barrows	2021	November	2	6.7
Eaves Wood	2022	July	10	25.6
Eaves Wood	2022	August	7	17.9
Eaves Wood	2022	September	8	20.5
Eaves Wood	2022	October	4	10.3
Eaves Wood	2022	November	3	7.7