Conserving the red-barbed ant (*Formica rufibarbis*) in the United Kingdom

Project Report 2008

Nikki Gammans, B.Sc, P.h.D
6 Woodend Close
St. Johns, Woking
Surrey GU21 7RJ

Contents page

1. Introduction and background to the project

Current status

Formica rufibarbis is possibly the rarest animal resident in mainland Britain, with only three (one potentually a satellite) remaining colonies at Chobham Common (NNR), Surrey (Pontin 2005). It is one of the most thermophilous species of the *Formica* genus (Pontin 1996) and it requires an open habitat in order to obtain sufficient warmth through insulation (www.ukbap.org.uk/UKPlans.aspx?ID=312). It is a common species in many parts of Europe ranging across the Palearctic and is present in southern and central Europe as far north as 62 degrees latitude and spreads into Asia minor (Pontin 1996; Czechowski *et al* 2002; www.ukbap.org.uk/UKPlans.aspx?ID=312; Czechowski & Radchenko 2006). Yet the only other British location is the Isles of Scilly, where it predominantly remains on St. Martins (Pontin 2005; Beavis 2007, refer to maps 1, 2 and 3 in appendix 1). All of the mainland British sites are (or were formerly) Surrey heaths (www.ukbap.org.uk/UKPlans.aspx?ID=312). Donisthorpe (1927) lists records of *F. rufibarbis* nests around Weybridge, Reigate and Ripley pre 1920 and there are also reports of one nest in Oxshott (1964) and one at Chobham Common (1967) (Pontin 2005). More recently in 1992 a nest was found on Stickledown which is now extinct due to a raid from the slave making ant *Formica sanguinea* in 2002 (Pontin 1996; Pontin 2002, refer to map 4 in appendix 1). Pre 2008 only one nest was thought to remain at Chobham Common, however two *F. rufibarbis* nests were located on a road side verge within 1m of each other (suggesting a satellite/budding nest, which is a common mode of propagation in ants (Seppa et al 2008)).

In Britain, the species nests in short, lowland grass and heather or maritime heath overlying loose or sandy soils (for detailed discussions refer to literature review). Nests are excavated in the ground or under rocks/stones (Czechowski *et al* 2002; Beavis 2007; www.ukbap.org.uk/UKPlans.aspx?ID=312). Each nest may contain a colony of a few thousand workers along with one or more queens plus brood (Czechowski *et al* 2002). In mature and healthy colonies a new sexual generation containing gynes and/or males is

usually produced each year, with mating flights most commonly occurring in late June early July (Czechowski *et al* 2002; www.ukbap.org.uk/UKPlans.aspx?ID=312). Mating takes place on a (predominant) stem near to the maternal nest, where the winged gyne 'calls' to males using a pheromone scent (Pontin 1996; 2005). Prior to the further two nests being discovered at Chobham Common in 2008, the original remaining *F. rufibarbis* nest produces only female alates (sexuals), is thought to be a monogyne colony (one queen) and approximately 12 years old (queens are thought to live for up to 15 years) (Kutter & Stumper 1969; Pontin 1998; 1999; 2000). To date it is unknown whether the two new nests produce male/female or both sexual alates. The workers usually forage singly for invertebrate prey or carrion, such as moths, spiders, beetles, woodlice and other dead ant species from midden piles (Gammans & Dodd *per obs*), they will also take nectar and aphid honey-dew (Pontin 1996; www.ukbap.org.uk/UKPlans.aspx?ID=312).

In Great Britain *F. rufibarbis* is classified as Endangered Red Data Book 1 (Falk 1991), it is a UK Biodiversity Action Plan (UK BAP) priority species and has its own Species Action Plan (SAP) that coordinates its conservation (View SAP appendix 1).

Causes of loss or decline of *F. rufibarbis*

The main factors which are thought to have caused the loss or decline of *F. rufibarbis* are (taken from www.ukbap.org.uk/UKPlans.aspx?ID=312);-

- Loss of suitable heathland habitat through urban or industrial development, agricultural improvement and afforestation.
- Inappropriate heathland management i.e growth of vegetation and shading of nests (Pontin 1998)
- Excessive or untimely disturbance of nests through, for example, trampling, off-road vehicles, digging, and inappropriate mechanised scrub or heather clearance.
- Frequent, untimely or intensive heathland fires (although appropriate light burning may be beneficial).
- Population size to small for genetic viability (Pontin 1998)

The main threat to *F. rufibarbis* is the loss of suitable heathland habitat. Lowland heathland is a priority for nature conservation because it is a rare and threatened habitat. In England only one sixth of the heathland present in 1800 now remains and Britain contains about 20% of the international total of this habitat (www.ukbap.org.uk/UKPlans.aspx?ID=15). In the past heathland was lost primarily to agriculture, forestry, mineral extraction and development. The main factors affecting the habitat at present are (taken from www.ukbap.org.uk/UKPlans.aspx?ID=312):

- Encroachment of trees and scrub and the simplification of vegetation structure due to a lack of conservation management such as light grazing, controlled burning and cutting.
- Nutrient enrichment, particularly deposition of nitrogen compounds.
- Fragmentation and disturbance from developments such as housing and road constructions.
- Agricultural improvement including reclamation and overgrazing.

Loss of traditional heathland management has meant the uniformity of age classes of heather and deciduous scrub, loss of bare ground creation, vegetation succession to woodland, loss of habitat mosaic structure and isolation and fragmentation of habitat (www.buglife.org.uk; www.arkive.org/red-barbed-ant/formica-rufibarbis/info.html).

The presence of the facultative slave-making ant *Formica sanguinea* is thought to be a serious threat to *F. rufibarbis* colonies (Mori *et al* 2001; Pontin 2002; Czechowski & Radchenko 2006). *F. sanguinea* forms a co-ordinated army to attack a *F. rufibarbis/fusca* or *cunicularia* nest to steal the brood (larvae and pupae), which is either reared or eaten, this can result in the death of the slave provider nest (Pontin 2005).

Conservation

The Zoological Society of London (ZSL) was awarded a Heritage Lottery Grant of £49,900 in November 2006 to work towards the conservation of *F. rufibarbis* in Great Britain. Along with partners Natural England, Isles of Scilly and Surrey Wildlife Trusts, Hymettus and myrmecologists Dr John Pontin, Dr Nicola Gammans and Dr Ian Beavis

they are currently undertaking actions for the protection and recovery of this species as part of its Species Action Plan.

2. Objectives of project *Formica rufibarbis*

Aims

The final year of the project should concentrate on achievable aims. The focus of the project should be on collecting queens from the Isles of Scilly, creating the ideal habitat for them at the release sites and releasing colonies to establish a self sufficient population at Chobham Common and potentially 1 other site. Targets should be set if money becomes available or when seeking further grants to continue the project. First is a list of the achievable aims for the HLF project to fund.

- Maintain populations at all known sites in the UK
- Assess the threats to released *F. rufibarbis* queens
- Complete vegetation surveys of nests found in the Isles of Scilly and Chobham Common
- Investigate combining queens for release and test tube matings?
- Complete survey of *F. rufibarbis* diet
- Create the 'ideal' habitat for *F. rufibarbis* at release sites
- Complete codes of practice for
    - Locating and monitoring *F. rufibarbis* nests
    - Queen collection Isles of Scilly
    - Queen overwintering protocol
    - Release site criteria
    - Site preparation and management
    - Monitoring released *F. rufibarbis* colonies
- Identify locations and abundance of *F. rufibarbis* on the Isles of Scilly

- Reintroduce sufficient numbers of colonies back onto Chobham Common to be self-sufficient
- Begin releasing colonies at one other site e.g. Lightwater Country Park, Wisley and Ockham Common or Sunningdale golf course
- Complete literature review on *F. rufibarbis*
- Impart preliminary genetic analysis on IOS and Surrey Populations
- Undertaken steps on public awareness and understanding
- Promoted the project to a variety of relevant academic forums
- Complete survey of Chobham Common for *F. rufibarbis* nests.

3. Legislative and policy context

The Biodiversity Steering Group report, published in 1995, provided the start for implementing Biodiversity Action Plans. Targets were set for Endangered species and habitats, in the form of action plans. Each action plan provides a description of the species or habitat and any threats to it. It sets targets for recovery and lists the actions required to meet these targets (www.english-nature.org.uk/Baps/sah.htm).

The action plans are published in a series of Tranche 2 Action Plan volumes. Natural England (formerly English Nature) currently implements 93 Species Action Plans (SAPs) and 15 Habitat Action Plans (HAPs) (www.english-nature.org.uk/Baps/sah.htm). *Formica rufibarbis* is a UK biodiversity action plan (UK BAP) priority species and has its own SAP that coordinates its conservation. An action plan was prepared in 1996 and forms part of the Natural England Species Recovery Programme. This plan aims to maintain all current populations, and restore the species to sites within the former range by 2010, (www.arkive.org/red-barbed-ant/formica-rufibarbis/info.html). *F. rufibarbis* is currently classified as Endangered Red Data Book 1in Britain (Faulk 1991; www.ukbap.org.uk/UKPlans.aspx?ID=312). For the purpose of this project Natural England requires licences for the collection of workers from Chobham Common (SSSI) and the removal of queens, workers and males from the Isles of Scilly (SSSI).

The three remaining *F. rufibarbis* mainland colonies are found on lowland heath, in Surrey, Chobham Common. Lowland heaths have a Habitat Action Plan (HAP) which coordinates their conservation and management (www.english-nature.org.uk/Baps/sah.htm). Lowland heathland is a priority for nature conservation because it is a rare and threatened habitat. The UK has some 58,000 ha of lowland heathland of which the largest proportion (55%) is found in England (www.ukbap.org.uk/UKPlans.aspx?ID=312). A large proportion of the lowland heathland habitat has been classified as SSSI, which included Chobham Common, this ensures *F. rufibarbis* is included in site management documents. Chobham Common is also a National Nature Reserve (NNR) and therefore *F. rufibarbis* receives a degree of protection from this. Any release sites should include *F. rufibarbis* in their management plans.

The IUCN published a position statement on translocations of living organisms in 1987. This gave an outline programme regarding re-introduction of a species, which should consist of a feasibility study, a preparation phase, a release or induction phase and a follow up phase (which includes monitoring of released animals). Due to the increase of re-introduction programmes a further guideline was produced for re-introductions by the IUCN/SCC in 1998. This included guidelines on feasibility and background research (what is the species specific needs), choice of release site and type (sites should be within historic range of the species), evaluation of re-introduction site (does it meet the species requirements), availability of released stock (must not Endangered the wild population) and post release activities (monitoring of nests and behavioural and ecological studies).

4. Best practice approaches to Conservation Action

The reintroduction of *F. rufibarbis* colonies to new sites is clearly the critical stage in this project. As this is the first project of its kind, there is no published literature on release methodology, monitoring of released nests, or nest establishment following a release. This is a pioneering project and a work in progress and all our results are new results. A

monitoring programme has been proposed to survey the current status of released colonies.

4.1 Genetic analysis

Understanding the social structure and breeding systems of *F. rufibarbis* is vital for implementing a successful reintroduction programme. Prior to the start of this project nothing was known about *F. rufibarbis* colony genetics or social structure, this information is crucial for the reintroduced population's viability. By undertaking genetic studies it gave us preliminary information on (adapted from Sumner *et al in prep*);

- Whether the St. Martins population is experiencing inbreeding. If they are inbred, is this because of a population bottle-neck or due to poor dispersal by newly mating queens?
- Are *F. rufibarbis* colonies monogynous (one queen) or polygynous (two or more queens)? This will tell us what the effective population size is (i.e. this is the number of queens, *not* the number of workers), and enable us to predict the level of genetic diversity in a population for a given number of nests (assuming the same colony structure). Monogynous colonies (low effective population size) may require a larger area than polygynous colonies in order to support the same genetic diversity. Are the queens mated multiply? If so (and if they are not inbred), then introducing naturally mated queens to the Surrey site will provide a founder population with high genetic diversity. If they are singly mated, a larger number of mated queens will need to be introduced to ensure a genetically viable founding population.
- Investigating *F. rufibarbis* population genetic structure. Are neighbouring nests related? If so, how or what is the range of colony boundaries? How far do queens/males disperse? Many *Formica* species found colonies by budding (a queen + workers leave on foot to found a new colony near by), and this can result in polydomous colonies (networks of related colonies that exchange workers). If this is the case for *F. rufibarbis*, the reintroduction programme needs to ensure

large areas of contiguous suitable habitat are available in order that nests can expand. Also, if queen dispersal distance is short, the impact of physical barriers (such as thick vegetation or hills) on population expansion may be exacerbated.

- Comparison of sequence data for individuals from St. Martins and Chobham Common populations will confirm the deductions from morphology that it is the same species in both places, that the two populations have only recently been separated and that the St. Martins population is representative of the UK population rather than a continental one. In other words, these analyses will confirm that the St. Martins population is a suitable founder stock for the reintroduction programme.

Highly polymorphic genetic markers can be used for estimating important genetic parameters for studying sociality in insects. Polymorphic microsatellite markers can be developed to study genetic population structure and mating structure with varying social organisations (Gyllenstrand *et al* 2002). Microsatellite analyses using polymerase chain reaction (PCR) were completed by ZSL on 20-40 workers from 14 nests from St. Martins and 20 workers from the one remaining Chobham Common nest (as thought at the time of collection) and sequence data was obtained for individuals. A detailed account of methodology is given in Sumner *et al* in prep (refer also to Gyllenstrand *et al* 2002; Hannonen & Sundstorm 2002, 2003).

The preliminary results of the analysis suggest;-

- Workers collected from a total of 14 nests parentage was analysed on COLONY and results showed a total of 30 putative queens from these 14 nests. Half of these queens were singly mated and the other half was multiply mated (with up to 6 males). The males were not related to the queens they mated with, but breeding males were related to each other, suggesting brothers mate with a single queen.
- Of the 14 nests, there was on average 2.78$\pm$ 0.42 queens reproducing per nest. Only four nests were detected with one queen reproducing. None of the queens were monopolising reproduction was equally shared. In polygynous nests queens

were unrelated to each other, suggesting daughters are not adopted by their maternal nest. Nestmate workers were closely related but are unlikely to be full sisters.

- The inbreeding coefficient was not significantly different from zero, suggesting no inbreeding of *F. rufibarbis* occurs on St. Martins.
- Preliminary results showed a high degree of variation between the Chobham Common and St. Martins population, suggesting they could be genetically distinct. However the sequence quality is poor and new primers and sequence data are needed to establish any further conclusions.

The results of this analysis suggest that *F. rufibarbis* queens are multiply mated, this could imply there is limited dispersal of queens, however polyandry (multiple male matings) can help maintain genetic diversity. Genetic analysis showed that queens within a 'nest' are unrelated yet the males they mate with (multiple matings) are related i.e. brothers. This suggests that queens join other existing queens by pleiometrosis (cofounding) rather than adoption of queens in subsequent years or daughters remaining within the maternal nest.

Genetic analysis also showed there is limited polydomous (budding) nest spreading. However on the 2008 Isle of Scilly expedition, nests were observed to have satellites within 30cm of each other. A new *F. rufibarbis* colony was found on Chobham common on a road side verge which had two nests within 50cm of each other, also suggesting one nest is a satellite. Clearly continuing research is required (refer recommendations).

Population viability analysis determined there was no inbreeding on the Isles of Scilly. Preliminary genetic data suggest that the Chobham Common and Isles of Scilly populations may differ in their origins, however few colonies were sampled and the locations of the Isle of Scilly nests from which workers were collected is unknown and workers were only collected from one colony on mainland UK. A colony is now found at Chobham Common and further genetic studies are needed to clarify the situation.

Recommendations

Cleary more genetic work needs to be completed to clarify the questions arisen from the study. In 2008 colleagues found approximately 70 nests on the Island of St. Martins (Gammans & Dodd unpublished data) and there are reported nests on Great Ganily, Tean and Nor Nour (which have yet to be quantified (Beavis 2007)). It is recommended in 2009 a survey is completed of these surrounding islands and workers collected along with workers from at least 50 colonies from St. Martins. Potentially a PhD or masters student could complete this work (Newell, Gammans & Shepherd *pers comm*).

A further *F. rufibarbis* nest has been located on a road side verge of Chobham Common. An inspection of Chobham Common will be undertaken by experienced entomologists in 2009 to survey for any undetected *F. rufibarbis* nests. This should be completed in the 'ideal' *F. rufibarbis* foraging conditions (refer to monitoring protocol). Every person undertaking the survey should use the same methodology for searching for ants, baiting is the suggested method but direct observation and pitfall trapping are alternatives (King *et al* 1998; Agrosti *et al* 2000; Underwood & Fisher 2006) but a detailed methodology should be planned before commencing. Ideally volunteers could complete the surveys; however there is a small amount of money available from the HLF or alternatively Hymettus may fund the survey. A survey of Chobham Common is needed to determine whether more nests of *F. rufibarbis* are present, if so these can be used for further genetic comparisons between populations.

The genetic results suggest *F. rufibarbis* queens accept other queens when starting new nests (co-founding). When queens are collected on St. Martins in 2009 two queens should be placed in the same universal tube as a preliminary trial. The tube should be watched closely for the first 30 minutes to see if any fighting or aggression takes place i.e. biting, butting of heads, tugging on legs or antennae with mandibles or crouching postures (Hannonen & Sundstrom 2002). Queens should be left if no aggression is observed. This can be repeated a number of times to access the co-founding theory. Queens should only be stored together if they are collected from different site locations (to keep genetic

diversity). An increase of queens between the numbers of 1-4 (polygyny) should increase the colonies brood production, therefore produce workers at a higher rate compared to a monogyne colony, possibly aiding release colony success rate (Deslippe & Savolainen 1995).

It is recommended that *F. rufibarbis* workers are collected from the European range to be sent over for genetic analysis. *F. rufibarbis* is abundant in Brittany (France) and Regensburg (Germany) (Pontin 1996, 1998; Guerrieri & d'Ettorre 2008). Specimens should be compared to the Chobham Common and Isles of Scilly populations. If there is genetic relatedness between European and mainland UK populations, queens, brood and even whole colonies could putatively be collected and released in the UK. It is suggested collaborations be sort with European universities which have researchers working on social insects. Further grants should be applied to, to complete this work, again potentially a masters or PhD student could complete this study.

4.2 Site and donor colony selection

Receptor site selection

Below is a recommended approach, which is to be considered for potential *Formica rufibarbis* release sites. This criteria is based on current literature relating to *F. rufibarbis* and ant conservation approaches. Which are thought to be suitable for *a F. rufibarbis* release must refer to these points before making a decision. Please refer to section 4.6 on long term management for a detailed discussion of the points raised. .

- Amount of bare ground and early successional heathland habitat, which is available for *F. rufibarbis* nesting and foraging (Pontin 2002)
- Vegetation composition - dry heath is preferable as does not flood.
- Release site drainage, it is a potential threat to *F. rufibarbis* nests if a site floods or has standing water (Pontin 1996)

- A high density of the slavemaker ant *Formica sanguinea.* No nests of *F. sanguinea* should be within 100m of a released *F. rufibarbis* nest (Pontin 1998)
- Location with regards to other release sites (fragmentation) (Underwood & Fisher 2006)
- Size of receptor site. How fragmented is the site? Is there surrounding habitat available for colonisation, can corridors be created? (Pimm 1991; Underwood & Fisher 2006)
- Density of aphid bearing plants e.g. sapling of silver birch (*Betula pendula*) and pine (*Pinus sylvestris*) (Pontin 1998)
- Visitation levels, risk of trampling
- Any release nests should be conspicuously hidden from main paths to avoid vandalism (Pontin 1998)
- Ideally a release site should be of a south facing aspect as the nests will receive more direct sunlight (Pontin 1998)
- Land managers available time e.g. creating scrapes, managing *F. sanguinea* population
- Grazing levels/density. Is the site grazed, what time of year and at what density?
- Conflicting interests e.g. other BAP species on release site
- What is the long term security of site e.g. designation on the site

Current donor colony selection methodology and criteria

Queens are collected by hand by searching suitable locations around known nesting sites. It is not possible to determine which the queens have emerged from unless directly observed. Queens are collected when they are de-alated (have bitten their wings off implying they are mated). Collection of a queen should depend on the site location and nest density within the site. If the site location is fragmented with no suitable habitat for colonisation surrounding it, more queens can be collected. If suitable habitat surrounds the site and low nest density is observed fewer queens should be collected to allow the species to colonise.

Queens which are collected with their wings intact should be stored in a universal tube and a male should be collected from under a tiled nest, preferably from a different ‘site’ (to avoid interbreeding). The pair should be kept together in the universal tube until either the queen removes her wings or on return to ex-situ rearing facility.

Queens should be kept in universal tubes with a gauze lid for aeration, tissue should be placed inside for temporary nest construction and two pieces of damp sponge should be supplied, one with sugary water and the other clean drinking water. The universal tube should be regularly checked for mould and fungal growths, tissues and sponge should be changed regularly to avoid contamination. Queens may begin to lay eggs on the sponge or tissue paper, so this must be checked before discarding. The tubes should be stored in a cool box with freezer packs to maintain a cool temperature (not in direct contact).

Recommendations for improvements to collection protocol

It is recommended that worker pupae are collected from tiled nests and placed into the universal tube with queens to help increase colony numbers. Nests which are tiled will bring their brood to the surface to bask, when lifting up the tile it is possible to count the number of pupae. It is thought that removal of approximately 10-15% of worker pupae can be collected without having a detrimental effect on the donor colony (Beavis, Pontin & Gammans pers com). A mitigation step to compensate for the removal of worker pupae should be two teaspoons of granulated sugar placed under or near to the tile.

It is also recommended when collecting newly mated queens they should be stored in universal tubes in pairs. Genetic analysis completed by ZSL (Sumner *in prep*) highlighted that *F. rufibarbis* may found new colonies by co-founding (i.e. by more than a single queen). This may increase brood production and in the long term help colony defence (Deslippe & Savolainen 1995). Approximately 50% of the queens collected should be kept in pairs. Please refer to the genetics section 4.1 for a more detailed explanation.

4.3 *Ex situ* rearing

An over wintering and colony maintenance plan for *F. rufibarbis* has been adapted from

Date	Temperature	Feeding	Frequency
September Friday 12th	16°C – 24°C	Sugar + protein	Twice weekly
October Friday 3rd	16°C - 22°c	Sugar + protein	Twice weekly
October Friday 17th	16°C - 20C	Sugar + protein	Twice weekly
October Friday 24th	12°C - 18°C	Sugar + protein	Twice weekly
November Friday 7th	10°C - 16°C	Sugar + protein	Twice weekly
November Friday 14th	8°C - 14°C	Sugar + protein	Twice weekly
November Friday 21st	6°C - 12°C	Sugar + protein	Once weekly
November Friday 28th	5°C - 10°C	Sugar	Once weekly
December Friday 5th	5°C – 8°C	Sugar	Once a fortnight
December Friday 12th	5°C – 8°C	Sugar	Once a fortnight
December Friday 19th	4°C - 6°C	Sugar	Once a fortnight
December Friday 26th	4°C - 6°C	Sugar	Once a fortnight
January Friday 2nd	4°C - 6°C	Sugar	Once a fortnight
January Friday 9th	4°C - 6°C	Sugar	Once a fortnight
January Friday 16th	4°C - 6°C	Sugar	Once a fortnight
January Friday 23rd	4°C - 6°C	Sugar	Once a fortnight
January Friday 31st	4°C - 6°C	Sugar	Once a fortnight
February Friday 6th	4°C - 6°C	Sugar	Once a fortnight
February Friday 13th	6°C - 8°C	Sugar	Once weekly
February Friday 20th	8°C - 12°C	Sugar + protein	Once weekly
February Friday 21st	10°C - 14°C	Sugar + protein	Once weekly
February Friday 28th	12°C - 16°C	Sugar + protein	Twice weekly
March Friday 6th	14°C - 18°C	Sugar + protein	Twice weekly
March Friday 13th	16°C - 20°C	Sugar + protein	Twice weekly
March Friday 21st	16°C - 20°C	Sugar + protein	Twice weekly
March Friday 27th	18°C - 20°C	Sugar + protein	Twice weekly
April Friday 3rd	18°C - 22C	Sugar + protein	Twice weekly
April Friday 10th	18°C - 24°C	Sugar + protein	Twice weekly
April Friday 17th continue	18°C – 26°C	Sugar + protein	Twice weekly

Table 1; Temperature and feeding regime for overwintering *Formica rufibarbis* colonies

Elmes & Wardlaw (1983), Elmes (1989), Wardlaw (1991), Elmes *et al.* (2004) and Gammans *et al*. (2005, 2006). Table 1 outlines the temperature and feeding regime, which has been incorporated for overwintering *F. rufibarbis* colonies.

Temperature A regime should be incorporated, which accounts for fluctuations experienced in natural conditions. Temperatures should be split from 7am- 9pm high temp and 9pm-7am low temperature (Elmes & Wardlaw 1983; Elmes 1989; Gammans *et al*. 2005 & 2006).

Feeding In the wild *F. rufibarbis* are scavengers that prey on small insects (Pontin 2005), if available they are thought to tend aphids and collect nectar. Preliminary data from the Island of St. Martin's suggests *F. rufibarbis's* diet consists mainly of moths, wood lice, beetles, spiders and other dead ants left on midden piles (Dodd & Gammans unpublished data).

A protein diet should be supplied to all colonies as eggs begin to be laid, this can be either *Drosphilla melanogaster* larvae or fish eggs. A sugar solution (sugar dissolved in water) should be supplied all year (Elmes & Wardlaw 1983; Elmes 1989; Wardlaw 1991; Elmes *et al.* 2004 and Gammans *et al*. 2005 & 2006). Protein is used to feed the larvae and workers use the sugar for energy (Holldobler & Wilson 1990). A protein diet should be given as soon as ants become active, they will begin to 'rouse' at about 12^{o}C, but food should be provided from 8-12^{o}C. Water should be available at all times and changed when cleaning. Any excess food should be removed from the nest boxes to avoid contamination and larger nest boxes should be wiped with a damp tissue as frequently as fed (Gammans *et al* 2005 & 2006).

If ants are removed from cold storage to clean and feed they may start to become active in turn becoming hungry and if no food is available they will use stored resources. To minimise this happening, the time removed from cold storage should be kept short, removing the nest to be fed and cleaned one nest at a time and sugary water should be available all year round.

Humidity Desiccation is a serious threat to laboratory ant colonies, in the wild ant colonies live in nests with atmospheric humidity at almost 100% (Holldobler & Wilson 1990; Wardlaw 1991; Elmes *et al.* 2004). It is essential to maintain a high humidity above 80% and colonies to have access to drinking water at all times, this can be provided by cotton-wool or sponge-cloth pads i.e. wettex (Wardlaw 1991). The nest boxes should have good ventilation to prevent condensation formation and the growth of moulds; this can be easily achieved by creating holes within the nest box and covering with fine mesh or gauze.

Light A natural diurnal and seasonal photoperiodic is favourable for the ant colonies. All nesting chambers should be permanently kept in the dark, which can be achieved by using an upturned plant pot saucer. The foraging area should be exposed to daylight, although this should not be direct sunlight (blinds should be placed over windows) (Wardlaw 1991; Gammans *et a*l 2005 & 2006).

4.4 Release and monitoring protocols

The three remaining queens from the 2007 Isle of Scilly collection were released at Burnt Hill (SU968 663) on the 15th August 2008 as a trial release. The colonies consisted of a single queen with brood. All nests were tiled and dug to a depth of 5 cm and buried within their next boxes (See photograph 1). A hand trowel was used to extract the soil and was crumbled back over the top when the nest box was buried (See photograph 2). A week after being released, the nest tiles were lifted to check the colonies progress (refer Appendix 1 table 2). After this trial it was decided that all colonies should be released with a minimum of ten workers plus brood due to the risk of being attacked by other ant species i.e. *Lasius niger* (refer to table 2 in appendix 1). Deslippe & Savolainen (1995) have also found that small colonies of *Formica podzolica* are readily attacked and eliminated by established ant colonies. It is recommended that the 2009 Isle of Scilly trip collects between 10-15% of worker pupae from each tiled nest. The pupae should be equally shared between collected queens.

Photograph 1; Queen with brood in nest box being buried 15th September

Photograph 2; Digging the pit for *F. rufibarbis* colonies to be buried 15th September

On September 15th 2008 a further 20 *F. rufibarbis* colonies were released at Chobham Common, National Nature Reserve. Prior to the release, individual locations for each colony were selected in early September by staff from Surrey Wildlife Trust and Dr Pontin. Each location was marked with a GPS location and staked. Ten queens were released at Burnt Hill (SU968 663) and a further ten at Staple Hill (SU973 647). Each released colony consisted of a minimum of ten workers plus pupae and larvae. Worker survival was considerably low as to be expected with first laid brood. The nest boxes also contained a small number of fish eggs for food and an extra drainage hole was drilled into the bottom of the box.

The colonies were released according to Pontins methodology used on the prior release (see photographs 1 and 2). It was considered that other ant species might be attracted to the tiles over the top of the nests after two trial release colonies were thought to have

been attacked by *Lasius niger* (refer appendix 1 table 2). The precautionary decision was therefore taken to tile half the nests and to leave the other remaining nests with just topsoil.

Monitoring protocol

The released colonies should be given one week to acclimatise to their new surroundings. Baiting is recommended as a technique as it attracts ants to the baiting source and species composition can be counted. This will give us an indication of release success. Baiting should commence around the nest, under the following conditions;-

- Ambient temperatures should be above 20^{oc} on clear sunny days (Pontin 1998)
- Baiting should commence on days with ideal weather conditions this could begin as early as the end of April and should continue until the end of the summer (Pontin & Gammans *pers com*)
- The bait should be a sugar/cheese lump placed underneath an upturned plant pot saucer. If sugar or cheese is found not to suitable then other baits can be tried such as honey, peanut butter or tuna (Agosti *et al*.2000)
- The bait should be placed as close to the last known nest location as possible
- The bait should be left for a period of 30 minutes and checked regularly. If after a number of visits 30 minutes is not deemed appropriate then the time should be adjusted
- Number of workers of *F. rufibarbis* should be recorded along with any other ant species present
- If no workers of *F. rufibarbis* are observed after five separate visits then the whole site containing the released colonies should be baited (to account for movement of nests)
- If no workers of *F. rufibarbis* are seen after a period of 10 separate visits the nest tile or topsoil may be lifted to establish whether the queen and workers are still present or whether there are any visible excavation signs

Recommendations

Two *F. rufibarbis* nests were located on a road side verge of Chobham Common. An inspection of Chobham Common will be undertaken in 2009 by experienced entomologists to survey for *F. rufibarbis*. Sampling methods vary in effectiveness for particular species; a variety of techniques can be used along with baiting such as direct observations and pitfall trapping (King *et al* 1998; Underwood & Fisher 2006). A detailed methodology should be composed before surveying commences (refer to genetics for further explanation).

4.5 Health surveillance

The translocation (reintroduction) of *F. rufibarbis* may also introduce its associated parasites (Davidson & Nettles 1992). In any such case novel or alien parasites maybe introduced to a previously unexposed population (Molenaar & Sainsbury 2008). Captive rearing could potentially expose *F. rufibarbis* to a variety of pathogens. Therefore it is essential to have a disease risk analysis in place (Cunningham 1996; Molenaar 2008). Prior to the project commencing, a disease risk analysis was completed, which established risk reduction at each stage of the project. This included quarantine of the queens at the Zoological Society of London after collection from the Isles of Scilly in the purpose build Native Insect Quarantine Unit (NIQU).

In situ NIQU

Good management practises are necessary to ensure that the ants in NIQU and elsewhere are maintained in the healthiest state as possible. The chances of a fungal infection in a laboratory colony are much greater than in the wild (Wardlaw 1991). If fungal pathogens are identified within a colony it is advised to thoroughly disinfect and dry the nest box, NIQU and environmental cabinet (Molenaar & Sainsbury 2007). Individual nest boxes should be washed with washing up liquid, scrubbed (non abrasive) and thoroughly rinsed with clean water (Wardlaw 1991; Gammans *et al* 2006). Any excess food should be

removed from the nest boxes to avoid contamination and larger nest boxes should be wiped with a damp tissue as frequently as fed (Gammans *et al* 2005; 2006). The use of exotic food items must be avoided to prevent alien pathogen introductions (Molenaar 2007). Before entering the NIQU it is required that all persons wear a water-resistant overall with hood and wellington boots. Wash their hands with disinfectant gel and step into an iodine solution on entering the NIQU. The NIQU and all equipment used should be regularly cleaned with a weak solution of sodium dichlorophen "panacide" or bleach (Wardlaw 1991; Molenaar 2008).

Any dead worker and queen specimens should be sent to pathology for a post mortem at ZSL London Zoo. The following post mortem examination has been adapted from Molenaar (2007) and Molenaar & Sainsbury (2007) refer to Molenaar (2008) for detailed methodology.

- Weigh and measure specimen
- For external examination use a dissection microscope or a binocular visor
    - Examine cuticle for discolouration, imperfections of colour, shape or size and for fungal elements.
    - Examine head for abnormalities of the antennae and mouth parts
    - Alitrunk and extremities examine for deformities and trauma
    - Examine the gaster for swellings, deformities and cyst-like bodies.
- Crush ant between microscope slides and examine under light microscopy.
- Culture ant on Sabouraud's agar for mycological examination
- Remains should be stored in 70% ethanol pending microsporidial examination
- Air-borne fungal elements should also be tested for in the NIQU. This can be achieved by placing Sabouraud's agar plates on the worktops and in the incubator. These should be positioned for various time periods for example, 1, 6, 12 and 24 hours.
- Fungi samples can be sent to CABI Wallingford, Oxford.

Ex situ

It is necessary to establish if releasing *F. rufibarbis* will have an effect on the health and welfare of other resident ant species within the release site (Cunningham 1996; Molenaar & Sainsbury 2007). To avoid translocating any pathogens a thorough examination should be completed when collecting the queens on the Isles of Scilly, on return to ZSL London Zoo and prior to release (Molenaar & Sainsbury 2007). Examinations of different ant species should take place at the release sites before (1 month) and after (1 -3 months) the release of *F. rufibarbis*. A sample of 30 workers of each resident ant species should be examined. Ants can be collected using a pooter, although not recommended for formicines. A x10 or x20 hand lens should be used to examine the gaster and head for fungal pathogens, any colour abnormalities on the cuticle, deformities of the body, change from normal movement or weakness and partial paralysis should be noted.

Any ants which are perceived to have pathogens are to be submitted to pathology ZSL for post mortem examination complete with a submission form. This includes identification of the ant's origin (free living or captive breed), six figure grid reference, date and description of location found, finder's details and description of ant including any deformities/ abnormalities. The specimen should be double freezer bagged with freezer packs and placed in a suitable cardboard box and sent to the Pathology department, Institute of Zoological, Zoological Society of London with same day or next day delivery. If immediate submission is not possible the sample should be stored in a fridge and preserved in 70% ethanol and submitted at nearest convenience. Each ant must be stored separately (Molenaar 2007; Molenaar & Sainsbury 2007).

Recommendations- European collection

If grant sources are secured, it will be possible to complete genetic studies on European populations of *F. rufibarbis* for comparison to the British populations. It may then be possible to collect queens and pupae from Europe to release in Surrey. A full risk assessment of this should be completed by the pathology department before collection

begins. Samples of workers for genetic and pathogen sampling should be collected and analysed at the first stage (IUCN 1998).

It is recommended that a training course is provided by the pathogen department of The Zoological Society of London for all project *F. rufibarbis* members and any volunteers that work with rearing the ants, collecting the queens from the Isles of Scilly and releasing and monitoring their progress at release sites (refer to project outline). This will allow members of the group to identify ant pathogens and therefore not collect queens or workers, which they feel may be infected reducing the risk of pathogen spread.

4.6 Long-term management of sites and species

As *F. rufibarbis* may have limited dispersal it is suggested any release sites selected should contain available potential 'ideal' habitat corridors to aid dispersal and colonisation. Release sites should not be fragmented from each other to avoid future inbreeding (refer receptor site location).

St. Martins has the problem of encroaching bracken onto many of the heathland sites where *F. rufibarbis* is found. It is suggested that bracken is controlled by grazing (i.e. trampling by cattle/sheep) or Asulox/Brack N which is directly applied to the fronds in June- July (Wragg & Dodd *pers com (*refer to long term management)).
Heathlands are an important invertebrate habitat, supporting many rare species that are at the edge of their European range for example *F. rufibarbis* (www.buglife.org.uk). The main threats which are affecting lowland heaths are afforestation, development, succession, atmospheric nitrogen deposition, agricultural improvement and a decline in traditional heathland management (Joint Nature Conservation Committee 1999; Sedlakova & Chytry 1999; Hardtle *et al* 2006; Niemeyer *et al* 2007). A reintroduction of some of the traditional management techniques will create heathland mosaic vegetation which benefits a range of wildlife including *F. rufibarbis* (McGibbon 1999).

Many invertebrates depend upon a warm microclimate and sheltering conditions providing 'hot spots', the creation of bare ground and banks are particularly important (Pontin 1996; McGibbon 1999). Bareground on heathlands are part of the ideal foraging and nesting habitat for *Formica rufibarbis*, which is a thermophilic species that forages at high soil temperatures (Pontin 1996; www.ukbap.org.uk/UKPlans.aspx?ID=312; www.buglife.org.uk). Bare ground creation (for example turf stripping) restarts succession and removes excess nitrates from the soil (Hardtle *et al* 2006; Niemeyer *et al* 2007) and can benefit other BAP priority species such as wood lark, *Lullula arborea*, sand lizard, *Lacerta agilis* (and other reptiles), the mottled bee fly, *Thyridanthrax fenestratus*, heath tiger beetle, *Cicindela sylvatica*, and Hornet robberfly, *Asilus crabroniformis*.

Recommended heathland management for Formica rufibarbis

Scrapes/turf cutting to create bare ground

Management should aim to create similar areas of re-vegetating ground in a larger area of more mature vegetation, this ought to include occasional small birch and pine (McGibbon 1999) as these provides a source for *F. rufibarbis* to tend aphids (Hymettus *pers com*). This should be achieved by creating shallow, linear scrapes within the taller vegetation and allowing these to re-colonise naturally. Scrapes should run approximately along the contours, be sloping or vertical (to aid drainage) (Joint Nature Conservation Committee 1999; Hymettus *pers com*), face south (Pontin 1996; Joint Nature Conservation Committee 1999; www.buglife.org.uk) and should be about 3m X 6m in width. All scrapes should be dug to the mineral soil and remove the humus layer (Sedlakova & Chytry 1999; Hardtle *et al* 2006; Niemeyer *et al* 2007). Areas for scrapes should be essentially dry heath; standing water will have a negative impact on *F. rufibarbis* colonies and scrapes may be colonised by *Molinia caerulea* (Pontin 1996; Hymettus *pers com*).

Scrapes should be created close to existent scrapes and leave buffers of more established vegetation in between. Bare, sandy ground on heathland can be created by scraping shallow pits or even bulldozing the vegetation away and creating mounds or banks with the humus layer removed and leaving the mineral soil (Hymettus & Wragg *pers com*). Scrapes should be completed on a cycle around the release site, every five to eight years depending on the original vegetation type, recolonising vegetation type and nutrient levels within the soil. Approximately 10% per quarter hectare should have a scrape created once every five to eight years (Shepherd, Gammans & Lee *pers com*). Vegetative re-colonisation of the scrapes depends on soil depth of scrape, surrounding vegetation, nutrient content of soil (especially nitrogen levels) and wetness of the soil (Wragg & Dodd *pers com*; Sedlakova & Chytry 1999).

Controlling succession

It is necessary to ensure that excessive scrub encroachment such as broom, pine, gorse and birch is controlled to avoid shading out of other heathland communities and to maintain open conditions (www.buglife.org.uk). However, small groups of birches and pines should be kept as they harbour important habitats for invertebrates and are potential aphid tending *for F. rufibarbis* (Pontin 1996; Sedlakova & Chytry 1999). Heathlands should contain no more than 10-15% of scattered scrub (Joint Nature Conservation Committee 1999). The introduction of grazing may prevent invasion of shrubs and trees (Bullock & Pakeman 1996).

Bracken can be controlled through winter grazing/trappling (Sedlakova & Chytry 1999), cutting or application of the herbicide Asulox. The latter should be applied when the fronds are open in June-July and applied directly (Wragg & Dodd *pers com*). Asulox is a water based chemical and present no harm to *F. rufibarbis*.

Grazing

Grazing is a potential management option for maintaining a heathland mosaic, but it is important to ensure appropriate stocking levels (Bullock & Pakeman 1996). Cattle are

preferred as they tend to produce a more varied vegetation structure than that in sheep-grazed areas. Their greater weight will suppress bracken growth, enhance species richness (Sedlakova & Chytry 1999), create uneven aged heathland (Sedlakova & Chytry 1999) suppresses growth of *Molinia caerulea* and provide areas of disturbed ground (Bullock & Pakeman 1996). Although in some cases the introduction of grazing has increased the spread of Bracken due to being avoided by grazers and reduced competition from other species (Bullock & Pakeman 1996).

In Europe *F. rufibarbis* has been reported in grazed and cultivated fields (Gomez *et al* 2003; Suvak 2007). However sites where establishment of *F. rufibarbis* is attempted should not be grazed by heavy animals, as this risks destruction of the nests. Should establishment be successful then a careful experimental introduction of grazing over a proportion of the established nests may then be considered. This would need strict monitoring (Hymettus *pers com*). The impact of grazing is variable and complex and it is difficult to predict ant responses (Underwood & Fisher 2006).

Burning

Burning on lowland heathland is a less favourable method of management as results can be variable and the effect of fire on invertebrate groups is not fully understood (Lake *et al* 2001; Underwood & Fisher 2006). However burning potentially can be beneficial to most invertebrate species and create a heterogeneous habitat (especially if combined with grazing). If burning is implemented on a site it should be completed during the winter and within small patches on a rotation. Care should be taken next to urban areas.

Public access

Moderate trampling from walkers can be a management tool in helping to maintain sandy paths/areas, but heather is susceptible to death from excessive trampling.

Formica rufibarbis management

To individually feed each released *F. rufibarbis* colony would be too time consuming and costly and left out food may attract other ant species to *F. rufibarbis* nests. At the time of the release the colonies are thought to be too small to be able to defend themselves. It is hoped after initial intense monitoring of the nests, the colonies will become self-sufficient (refer to release and monitoring protocol).

Formica sanguinea management

Formica sanguinea should be controlled in the short term at any release site to create a window of opportunity for *F. rufibarbis* to become established (Hymettus *pers com*). If a *F. sanguinea* nest is found it should be determined to whether it can be translocated or if the nest density is too high an alternative release site should be sought, as a last result control of *F. sanguinea* can be completed by poison (baiting). Baiting *F. sanguinea* nests should begin in early spring when the colony is at its most hungry, using manufactured ant poisons or borax and honey. *F. sanguinea* nests should be monitored for three to five years within a 100m radius of the release site (Pontin 1996; Hymettus & Shepherd *pers com*). It is hoped by short- term control of *F. sanguinea* the *F. rufibarbis* population will become establish and eventually live side by side.

F. sanguinea can be surveyed by visual searching (above 20^{o}C on clear sunny days), baited pitfull traps or baiting with sugar and cheese etc under an up turned plant pot saucer (Agrosti *et al* 2000). Timing and frequency of sampling is largely weather dependant but temperatures in late April/early May should be sufficient for surveying to commence. Several visits to each potential receptor site will be required to ascertain the presence or absence of *F. sanguinea* prior to releasing *F. rufibarbis* nests.

5. Public engagement and media coverage

To date the project has had excellent press coverage with very positive results. Over 30 volunteers have been involved with project to date. Over the next year the project is

aiming to continue and increase its press coverage and public engagement thus raising awareness of invertebrate, heathland, ant, bare ground and habitat conservation, generating publicity for all partners involved, encouraging European collaborators, increasing the potential for volunteer recruitment, and increasing future grant sponsorship. Below is a detailed account of all media coverage to date. Plans for media and public engagement targeting in 2009 are listed in appendix one, these examples can also be used for future reference.

Press coverage	**Action**
Television	Inside out, BBC and London Tonight, ITV
Newspapers	Telegraph, Surrey Advertiser, The Metro
Radio	Isles of Scilly radio, BBC Radio Cornwall
Web Sites	http://news.bbc.co.uk/2/hi/uk_news/england/cornwall/7643516.stm
	http://www.surreywildlifetrust.co.uk
	http://www.wildlifeextra.com/go/news/red_barbed-ants.html
	http://www.weyriver.co.uk/theriver/wildlife_3_insects.htm
	http://news.bbc.co.uk/1/hi/sci/tech/6303273.stm
	http://www.zsl.org/info/media/press-releases/null,1853,PR.html
	http://article.wn.com/view/2008/09/30/Island_ant_colony_helps_species
Articles and leaflets	Surrey Nature (SURREY WILDLIFE TRUST publication), Isles of Scilly (*Formica rufibarbis* leaflet), Wild About (ZSL publication), Surrey Biological Records Centre (newsletter), BWARS (newsletter)
Talks and posters	BWARS (talk), SBRC (talk), IUSSI (poster), Insect week ZSL (talks and posters), Byfleet care agm (talk)
Interpretation boards	ZSL London Zoo
Wildlife Photographer	Heather Angel has taken fantastic photos which can be used in all our press releases

6. Conclusions and further recommendations

An outline plan has been constructed for the remaining year of the current *Formica rufibarbis* project (refer to appendix one). This outline may also be incorporated into future years if funding is secured. The outline can also be amended with current information from the project. All plans set out in 2009 may not be achievable; therefore grants should be secured to continue the work. Below is a list of work which is thought to be essential for safeguarding the future on *F. rufibarbis* in the UK and achieving the redeveloped SAP (see below).

Future grant applications can target

- Acquire stock from appropriate different continental populations i.e. Russia, Brittany, Germany and Italy for genetic analysis comparison to IOS and Surrey populations.
- Explore the ecology and behaviour of the continental and British *Formica rufibarbis* populations.
- After genetic analysis if possible collect queens, worker pupae and colonies of *F. rufibarbis* from Europe for release in the UK
- Develop long term monitoring for British populations (IOS and release sites).
- Establish viable, self sufficient *F. rufibarbis* populations at three separate Surrey sites within the species historic range by 2013.
- Investigate specific ecological issues
    - Interaction of *F. rufibarbis* with *F sanguinea* in continental populations
    - Autoecological observations of Isle of Scilly, Chobham Common and Europe
- Identify benefits to biodiversity from habitat creation for *F rufibarbis.*
- Continue public engagement to relevant forums
- Application of grants for continental field work and genetic analysis.

Proposed redeveloped Species Action Plan for *F. rufibarbis*

The current SAP for *F. rufibarbis* has been updated and amended to include current project progress and literature on the species (please refer to Appendix one for former SAP). The action plan objectives and targets have included continuing survey work on Chobham Common and the Isles of Scilly for any undiscovered populations. Restoring populations to suitable sites has been amended with regards to current information; this has been prolonged to three sites by 2013, instead of five sites by 2010. If future funding is secured genetic analysis of European populations of *F. rufibarbis* for comparison to British populations should be completed.

Under site safeguard and management it is asked that *F. rufibarbis* is included in management plans of all potential release sites. That all existing and potential release sites have available habitat for dispersal and colonisation.

Action plan objectives and targets

Maintain populations at all known sites in the UK.
Survey remaining *F. rufibarbis* mainland UK site, Chobham Common, for nests in 2009.
Survey all Islands in the Isles of Scilly were *F. rufibarbis* has been previously recorded by 2010.
Restore populations to suitable release sites in order to maintain three viable, self sufficient populations within the historic range by 2013.
Begin genetic analysis of *F. rufibarbis* European range for comparison to Isle of Scilly and Chobham Common populations by 2010.
Establish long term monitoring protocol for *F. rufibarbis* at release sites by 2010.

Proposed actions with lead agencies

Policy and legislation

Where appropriate, include the requirements of the species when preparing or revising prescriptions for agri-environment schemes. (ACTION: NE, MAFF)

Site safeguard and management

Where possible, ensure that all occupied and nearby potential habitat is appropriately managed, in particular that nests are not shaded by over-hanging vegetation or subjected to excessive disturbance. (ACTION: NE, MAFF)

Ensure existing and released nests have available habitat for dispersal and colonisation. Where possible maintain corridors between released sites. (ACTION: NE)

Ensure *F. rufibarbis* is included in site management documents for all relevant SSSIs and any other release sites. (ACTION: NE)

Species management and protection

Reintroduce the red barbed ant to a series of sites within the former range in order to ensure that there are a total of three viable, self sufficient populations by 2013. (ACTION: NE)

Advisory

Advise landowners and managers of the presence of the species and the importance of beneficial management for its conservation. (ACTION: NE)

Future Research and Monitoring

Conduct targeted autecological research on Isles of Scilly and in European range to inform habitat management. (ACTION: NE, JNCC)

Develop a methodology for captive rearing. (ACTION: NE)

Establish a post-release monitoring programme for this species. (ACTION: NE)

Pass information gathered during survey and monitoring of this species to a central database for incorporation in national and international databases. (ACTION: NE)

Encourage research into the ecology and conservation of this species on an international level, and use the experience gained towards its conservation in the UK. (ACTION: NE, JNCC)

Communications and Publicity

Promote opportunities for the appreciation of the species and the conservation issues associated with its habitat. This should be achieved through articles within appropriate

journals and newsletters; television, newspaper and radio interviews; talks to interested parties; production of leaflets and information boards at release sites (ACTION: NE)

Links with other action plans

Link with lowland heath Habitat Action Plan.

Lead partner(s)

The Zoological Society of London
Surrey Wildlife Trust
Hymettus
Dr David Sheppard, Natural England

Local implementation

The following LBAPs are working on *Formica rufibarbis*:
Cornwall's Biodiversity vol 1, 2 and 3

Publication details

Originally published in: UK Biodiversity Group Tranche 2 Action Plans - Volume IV: Invertebrates (March 1999, Tranche 2, Vol IV, p245)

Related links

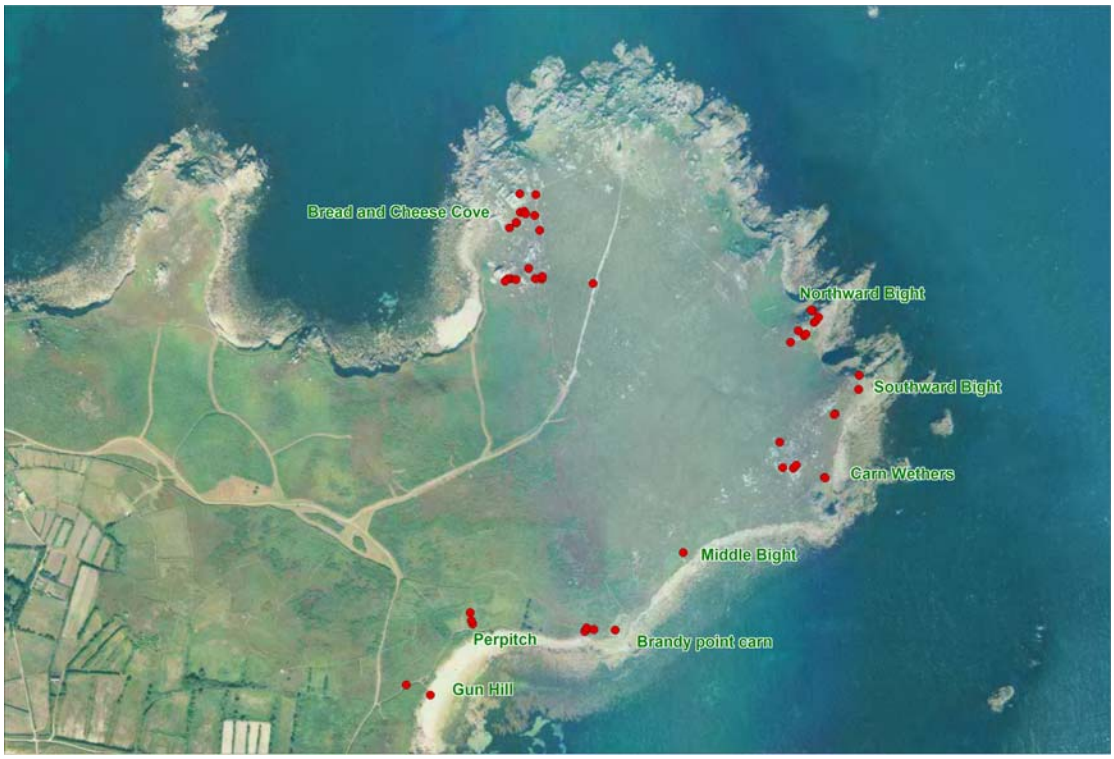
Visit the ARKive website to view images and further information relating to this species

7. Acknowledgements

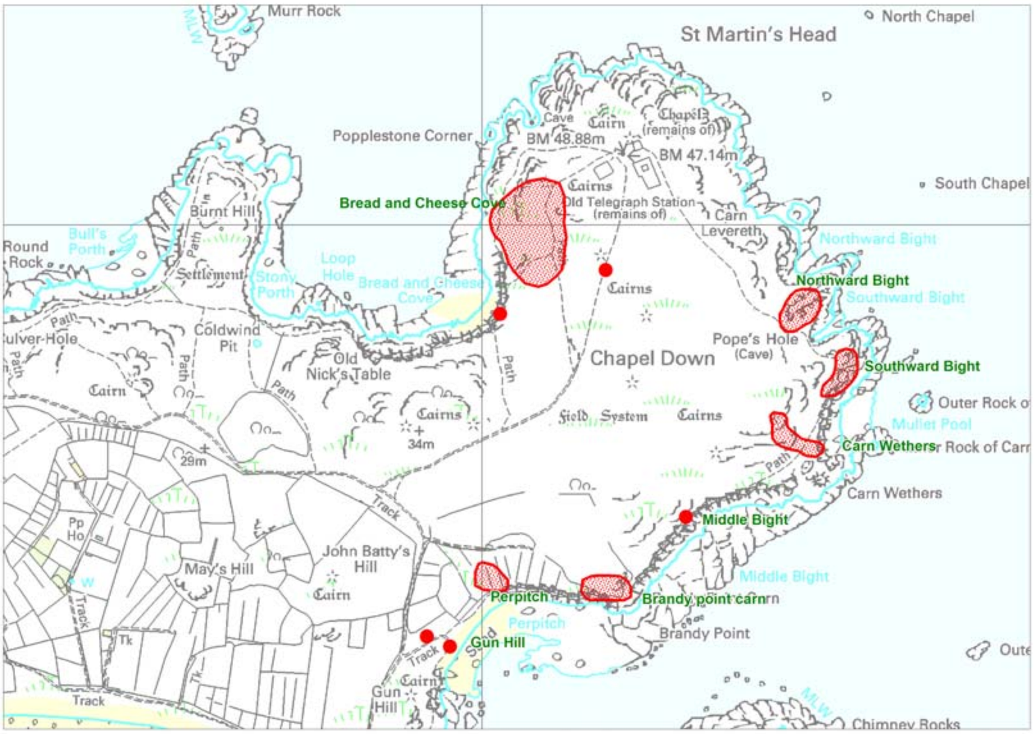
Many thanks to Surrey Wildlife Trust for all their invaluable help, encouragement and support in particular Scotty Dodd and Simon Newell. Thank you to all the staff of ZSL who have worked so hard in organising and obtaining the original grant Paul Pearce Kelly, Matthew Robertson, Alison Debney, David Clarke, Fieke Molennar and Serian Sumner. Special thanks to Dr Ian Beavis and Dr John Pontin who have both given vital knowledge and support to the project. To the Isles of Scilly Trust, in particular David Mawer, for taking us around St. Martins island and showing us the *F. rufibarbis* nests and also for all the administration help. Finally to David Sheppard and Paul Lee for their ideas, inputs and belief into the project!

Appendix one

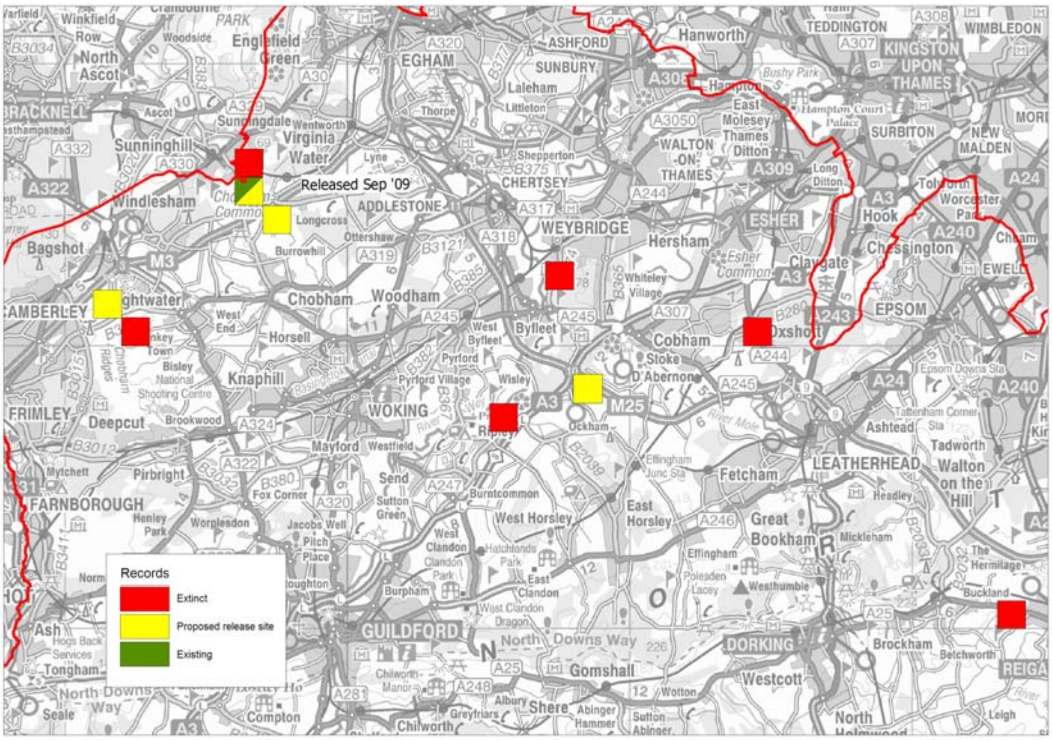
Map 1; location of *Formica rufibarbis* nests on St. Martins Island, Isles of Scilly 2007



Map 2; location of *Formica rufibarbis* nests on St. Martins Island, Isles of Scilly 2008



Map 3; OS map of St. Martins, Isles of Scilly showing nest locations of *Formica rufibarbis*



Map 4; Surrey map of *Formica rufibarbis* existing, extinct nests and potential release sites

Current *Formica rufibarbis* Species Action plan

Current status

The red barbed ant is one of the most thermophilous species of the *Formica* genus; it requires an open habitat in order to obtain sufficient warmth through insolation. In Britain, the species nests in short, lowland grass and heather or maritime heath overlying loose or sandy soils. Nests are excavated in the ground or under stones; a small solarium of soil and vegetation fragments may be raised around a supporting grass tussock. Each nest may contain a colony of a few thousand workers along with one or more queens plus brood. In mature and healthy colonies a new sexual generation containing gynes and/or males is usually produced each year, with mating flights most commonly occuring in July. The workers usually forage singly for invertebrate prey or carrion; they will also take nectar and aphid honey-dew.

The red barbed ant has been considered a rare species since it was first found in Britain in 1896. It was previously recorded from six mainland British sites and one in the Scilly Isles on Chapel Down, St Martins. All of the mainland sites are (or were formerly) Surrey heathlands. The known distribution of the species is now restricted to two sites in Surrey, Chobham Common and the Bisley ranges, supporting as few as seven and two colonies respectively. The species was still present on St Martins in 1997. The red barbed ant ranges across the Palearctic and is present in southern and central Europe as far north as 62 degrees latitude.

In Great Britain this species is classified as *Endangered.*

Current factors causing loss or decline

Loss of suitable heathland habitat through urban or industrial development, agricultural improvement and afforestation.
Inappropriate heathland management.
Excessive or untimely disturbance of nests through, for example, trampling, off-road vehicles, digging, and inappropriate mechanised scrub or heather clearance.

Frequent, untimely or intensive heathland fires (although appropriate light burning may be beneficial).

Current action

Both Chobham Common and Bisley ranges are SSSIs; Chobham Common is an NNR.

Management action at Chobham Common rests with NE, the Surrey Wildlife Trust, and Surrey County Council. Some management of vegetation immediately around nests, and positioning of roofing tiles to encourage nest building, has occurred.

The red barbed ant is the subject of an NE Species Recovery Programme, for which an action plan was prepared in 1996.

Action plan objectives and targets

Maintain populations at all known sites.

Enhance the population size at all known sites by 2005.

Restore populations to suitable sites in order to maintain five viable populations within the historic range by 2010.

Proposed actions with lead agencies

Policy and legislation

Where appropriate, include the requirements of the species when preparing or revising prescriptions for agri-environment schemes. (ACTION: NE, MAFF)

Site safeguard and management

Where possible, ensure that all occupied and nearby potential habitat is appropriately managed, in particular that nests are not shaded by over-hanging vegetation or subjected to excessive disturbance. (ACTION: NE, MAFF)

Ensure that the species is included in site management documents for all relevant SSSIs. (ACTION: NE)

Species management and protection

Reintroduce the red barbed ant to a series of sites within the former range in order to ensure that there is a total of five viable populations by 2010. (ACTION: NE)

Advisory

Advise landowners and managers of the presence of the species and the importance of beneficial management for its conservation. (ACTION: NE)

Future Research and Monitoring

Conduct targeted autecological research to inform habitat management. (ACTION: NE)

Develop a methodology for captive rearing. (ACTION: NE)

Establish a regular monitoring programme for this species. (ACTION: NE)

Pass information gathered during survey and monitoring of this species to a central database for incorporation in national and international databases. (ACTION: NE)

Encourage research into the ecology and conservation of this species on an international level, and use the experience gained towards its conservation in the UK. (ACTION: NE, JNCC)

Communications and Publicity

Promote opportunities for the appreciation of the species and the conservation issues associated with its habitat. This should be achieved through articles within appropriate journals, as well as by a publicity leaflet. (ACTION: NE)

Links with other action plans

None given.

Lead partner(s)

Dr David Sheppard, Natural England

Paul Lee, Hymettus

Local implementation

The following LBAPs are working on *Formica rufibarbis*:

Cornwall's Biodiversity vol 1, 2 and 3

Publication details

Originally published in: UK Biodiversity Group Tranche 2 Action Plans - Volume IV: Invertebrates (March 1999, Tranche 2, Vol IV, p245)

Related links

ARKive Visit the ARKive website to view images and further information relating to this species

Media and public engagement plans for 2009

- Planned talks at Hymettus (January), Aculeate Conservation Rothamstead Research (April), British Ecological Society (September), BWARS (September), IUSSI (November).
- Television targeting The One Show, News Round, spring watch, Country File and Blue Peter.
- Radio shows IOS radio, local Surrey radio stations and London stations
- Planned paper in British Wildlife magazine, short communication BBC Wildlife?
- Community bug hunts at Chobham Common, including invertebrate conservation and habitat creation. Target school ages 6-12 year olds. Scott Dodd.
- Local village talks about heathland conservation. Simon Newell and Andy Wragg.
- Creation of giant bare ground ‘ant’ at Chobham Common
- End of 2009 preparation of scientific paper
- Interpretation boards planned for Chobham Common, Lightwater and other release sites.
- End of 2009 beginning 2010 organise an invertebrate conservation conference, this will primarily focus on heathland projects.

Outline plan for 2009

Month	Objectives
January	• Habitat preparation Burma Road (after November and December viewing if site floods), continuing into March • Construct bare ground 'ant' at Chobham Common, continuing into March • Write grants for future funding • Talk at Hymettus
February	• Work shop on identifying *Formica rufibarbis* and *F. sanguinea* and pathogens on ants. • Write article for British Wildlife and BBC wildlife magazines • Competition in Surrey Nature/Wild About for Children to draw an ant. Prize to be 4 ant worlds. • Village hall talks about heathland conservation
March	• Begin viewing potential release sites • Village hall talks about heathland conservation • Interpretation boards
April	• If conditions are right begin Chobham Common survey for *F. rufibarbis* nests continuing through summer • Begin baiting around released *F. rufibarbis* nests • Release remaining over wintering queens (2008) • Continue press interest e.g. The one show, country file, blue peter, news round • Continue viewing release sites
May	• Continue baiting around 2008 release queen sites and monitoring of release queens • Begin survey for *F. sanguinea* at potential release sites • Obtain workers from Europe for genetic studies
June	• Survey of and control of *F. sanguinea* at release sites • Bug hunt around Chobham Common specialising on invertebrate conservation • Insect week activities at ZSL London Zoo and SURREY WILDLIFE TRUST • Isle of Scilly trip (mid June depending on spring temperatures) o Relocate 2007/8 *F. rufibarbis* nests and assess alate production o Begin searching for newly mated queens o Begin vegetation survey of *F. rufibarbis* nests and site areas o *F. rufibarbis* diet and invertebrate survey
July	o Continue searching for newly mated queens o Continue vegetation survey of ant nests and site areas o *F. rufibarbis* diet and invertebrate survey o Survey surrounding islands for *F. rufibarbis* populations o Return Isles of Scilly mid July • Release half queens and larvae collected from Isles of Scilly

	• Monitor queens regularly firstly by opening tiles etc and if excavating begin to bait
August	• Release IOS queens with the most workers • Begin over wintering of remaining queens • Monitor all released queens by either opening tiles or by baiting • Bug hunt around Chobham Common specialising on invertebrate conservation
September	• Continue monitoring released queens • Talk at BES and BWARS
October	• Continue monitoring released queens until first frosts • Preparation scientific paper
November	• Grant applications for future funding • Talk at IUSSI • Heathland invertebrate conference
December	• Grant applications for future funding

Colony number	Site	Tiled/ Non tiled	Other ant species present	Observations
1	BH	T	Large numbers of *Lasius niger* foraging around nest	Queen and workers not present in nesting box 19/08/08
2	BH	T	*Lasius niger* workers (approx 30-40) found under tile.	Queen and workers not present in nesting box- presumed dead? 19/08/08
3	BH	T	Single *Myrmica* foraging	19/08/08 a *F. rufibarbis* worker observed under tile. Further observations of next box revealed no queen or workers present. Newt observed under tile end September.

Table 2; Status of 3 *F. rufibarbis* colonies released on the 15th August and checked on the 19th August 2008.

Colony Number	Site	Q	W	P	Tiled/non tiled	Other ant species present	Observations
1	BH	1	6		T		Heavy condensation in nest box, small pool of water on base. Mould on fish eggs. Foraging box changed.
2	BH				T	*M. ruginodis*	Queen in box with no workers

						foragers	24/09/08. Nest vandalised 19/10/08.
3	BH				NT	*F. fusca* and *M. ruginodis* foragers in area	Nest vandalised 19/10/08
4	BH	1	7		NT	*L. niger* foragers	Condensation in box. No fish eggs preset.
5	BH	1	9		T	*M. ruginodis* and *L. niger* foragers	Heavy condensation, water pooled at bottom. Mould on fish eggs, foraging box changed.
6 Q83	BHR				T	*L. niger* foragers around nest	Queen and workers vacated nest box 2/10/08.
7 Q71	BHR	1	7		T	*Formica fusca* forager	Mould on fish eggs. Wood lice in chamber. Changed foraging box. Gaster of worker in box.
8 Q87	BHR	1	6		NT	*M. ruginodis and F. fusca* foragers	Small amount condensation.
9 Q60	BHR				NT		Queen and workers vacated nest box 23/09/08 Newt present in hole.
10 Q88	BHR	1	3		NT	*M. ruginodis* and *F. fusca* foragers	Nest mounded with soil.
1 Q68	SH				T	*F. fusca* foragers	Queen and workers vacated nest box 19/10/08
2	SH	1	9		T		Small amount condensation. Mould on fish eggs. Foraging box changed.
3	SH	1	8		NT		Small amount of condensation. Mould on fish eggs, foraging box changed.
4 Q67	SH				T		Queen and workers not present in nesting box 2/10/08
5 Q64	SH				T	*Formica fusca* and *M. ruginodis* in vicinity	Queen and workers not present in nesting box 2/10/08. Small excavations observed.
6	SH	1	7		NT		Fish eggs still present no mould.
7	SH				NT		Queen and workers vacated nest box 19/10/08.
8	SH				T		Queen and workers vacated nest box 19/10/08.
9	SH				T	*L. niger* workers (approx 30-40) found under tile.	Queen and workers vacated nest box (1 pupae left) 20/09/08. Fungi present on fish eggs
10	SH	1	5	7 (3 bare)	T		Mould on fish eggs. Condensation with small pool of water.

Table 3; The progress of 20 *F. rufibarbis* colonies released on the 15th September and frequently checked until the 19th October 2008.