


# Spotting Pot Beetles

## Survey Report and Habitat Recommendations

January 2019

Alasdair Lemon and Scott Shanks

Scottish Natural Heritage
Dualchas Nàdair na h-Alba
nature.scot

*Saving the small things that run the planet*

**Summary**

Pot beetles (genus *Cryptocephalus*) are a fascinating group of beetles. Of the 19 species found in the UK, eleven have been recorded in Scotland and eight of these have conservation designations.

Scottish Natural Heritage (SNH) provided funding to Buglife through the 'Spotting Pot Beetles' project to run surveys and workshops to raise awareness and improve participants identification skills of the different species of pot beetles and their leaf beetle relatives.

During the summer of 2018 surveys with volunteers were carried out at Kirkconnell Flow Site of Special Scientific Interest (SSSI) in Dumfries and Galloway to survey for the Six-spotted pot beetle (*Cryptocephalus sexpunctatus*) and at the Black Wood of Rannoch in Perthshire to survey for the Ten-spotted pot beetle (*Cryptocephalus decemmaculatus*). The 2018 surveys successfully found Ten-spotted pot beetles in a new 1km square within the Black Wood of Rannoch, however, no Six-spotted pot beetles were recorded at Kirkconnell Flow.

Finnart Estate, the owners of the Camghouran site in the Black Wood of Rannoch have been contacted through local SNH area officers John Burrows and Colin Castle to enquire about undertaking habitat management work to benefit the Ten-spotted pot beetle on the site in the future.

Guidance is provided within this document on managing habitat at both Kirkconnell Flow and Black Wood of Rannoch for their pot beetles to ensure the long term survival of both species in Scotland.

**Contents Page**

## 1. Introduction to pot beetles

Pot beetles are a fascinating and charismatic group of beetles that are in the subfamily Cryptocephalinae within the leaf beetle Chrysomelidae family. These amazing beetles get their common name from the protective shell-like cocoon or 'pot' that the larvae live in, that are created using the beetles own faeces (Figure 1) (Hubble, 2017). The pots are initially built by the female during and immediately after egg laying, with the egg being held between the rear metatarsi and covered by the female's faeces, the precise structure of the pot varies between the different pot beetle species (Hubble, 2017). Once covered, the pots are dropped to the ground amongst leaf litter and this often forms much of the larval diet. Another key feature of pot beetles is that the head of the adults is hidden under their bulging pronotum, which is the source of the scientific name for the genus '*Cryptocephalus'* meaning 'hidden head'.

Figure 1. A larvae of the Hazel pot beetle (*C. coryli*); image © Eakringbirds.

There are 19 species of pot beetle currently known to occur in the UK, with the Violet pot beetle (*C. violaceus*) recently being described as extinct and no longer on the UK list (Table 1) (Hubble, 2014). At least eleven species are thought to occur in Scotland (six of these have recent records on the NBN atlas and five have historic records that date pre-1979 or even before the 1900s) (Table 1). Many species of pot beetle have suffered declines in their distribution across the UK and are now quite rare. Six species are described as Endangered and two as Vulnerable in the recent status review (Table 1) (Hubble, 2014). Additionally, nine are described as Nationally Rare and five as Nationally Scarce within Great Britain (Table 1). In Scotland, two are on the Scottish Biodiversity List, the Six-spotted pot beetle (*C. sexpunctatus*) and the Ten-spotted pot beetle (*C. decemmaculatus*) (Table 1).

Table 1. List of *Cryptocephalus* pot beetles known to occur in the UK. With notes on when the species was described and those recorded in Scotland; records taken from NBN Atlas and Cox, 2007. Notes also include reference to rarity designations for each species as described by Natural England (Hubble, 2014) including IUCN status - Critically Endangered (Possibly Extinct): CR (PE), Endangered: EN, Vulnerable: VU and Near Threatened NT; Great Britain rarity- Nationally Rare NR and Nationally Scarce NS; and whether the species is on the Scottish Biodiversity List: SBL.

| Scientific Name | Common Name | Notes |
|---|---|---|
| *Cryptocephalus aureolus* (Suffrian, 1847) | | Historic records and a more recent record from 2015 in South Ayrshire. |
| *Cryptocephalus biguttatus* (Scopoli, 1763) | | VU, NR |
| *Cryptocephalus bilineatus* (Linnaeus, 1767) | | NS |
| *Cryptocephalus bipunctatus* (Linnaeus, 1767) | Two-spotted pot beetle | Historic records for this species in Scotland. Found at Kirkconnell Flow SSSI in June 2017. NS |
| *Cryptocephalus coryli* (Linnaeus, 1767) | Hazel pot beetle | One old record from Kincraig from 1946. No recent records. EN, NR |
| *Cryptocephalus decemmaculatus* (Linnaeus, 1767) | Ten-spotted pot beetle | Recorded in Scotland at Black Wood of Loch Rannoch. EN, NR, SBL |
| *Cryptocephalus exiguous* (Schneider, 1792) | Pashford pot beetle | CR (PE), NR |
| *Cryptocephalus frontalis* (Marsham, 1802) | | NT, NR |
| *Cryptocephalus fulvus* (Goeze, 1777) | | |
| *Cryptocephalus hypochaeridis* (Linnaeus, 1758) | | LC, NS |
| *Cryptocephalus labiatus* (Linnaeus, 1761) | Black birch pot beetle | Recorded at several sites across Scotland |
| *Cryptocephalus moraei* (Linnaeus, 1758) | | Old record pre-1979 for site in southern Scotland. No recent records in Scotland. |
| *Cryptocephalus nitidulus* (Fabricius, 1787) | Shining pot beetle | EN, NR |
| *Cryptocephalus parvulus* (Müller, 1776) | | At least two old records from pre-1979 in Scotland. NS |
| *Cryptocephalus primarius* (Harold, 1872) | Rock-rose pot beetle | Old records from Scotland from pre 1900s and none show on NBN Atlas. EN, NR. |
| *Cryptocephalus punctiger* (Paykull, 1799) | Blue pepper-pot beetle | At least two old records from pre-1979 in Scotland. No recent records in Scotland. VU, NR |
| *Cryptocephalus pusillus* (Fabricius, 1777) | | Recorded in Scotland in Dumfriesshire and Highlands. |
| *Cryptocephalus quercetin* (Suffrian, 1848) | | EN, NR |
| *Cryptocephalus sexpunctatus* (Linnaeus, 1758) | Six-spotted pot beetle | Recorded in Scotland. EN, NR, SBL |

## 2. Spotting Pot Beetles

Scottish Natural Heritage (SNH) provided funding to Buglife to run the 'Spotting Pot Beetles' project during 2017 and 2018. There is a dedicated page for this project on the Buglife website: https://www.buglife.org.uk/spotting-pot-beetles.

Year one of the project was successful in recording target species of pot beetle, the Six-spot at Kirkconnell Flow SSSI and Ten-spot at Loch Rannoch. Additionally the project engaged with 47 people in year one in surveys and training workshops that raised awareness of pot beetles and their leaf beetle relatives.

Through the success of year one of the project, in 2018 our aims were to:

- Organise and run three training workshops to raise awareness and improve participant's identification skills of the different species of pot beetles and their leaf beetle relatives in Scotland.
- Organise and run a survey day with volunteers to search for the Six-spotted pot beetle at Kirkconnell Flow SSSI in Dumfriesshire
- Organise and run two habitat management days for the Ten-spotted pot beetle at Loch Rannoch in Perthshire, which would involve surveys for the beetle.

## 3. Six-spotted pot beetle

The Six-spotted pot beetle has a reddish-yellow thorax and elytra with usually three black spots (sometimes four) on each elytral wing case (Figure 2) (Douglas, 2001b; Hubble, 2012). Adult beetles are between 4.5-6.5 millimetres (mm) in size (Douglas, 2001b). This species has been found on a number of plant species including Aspen (*Populus tremula*), Crack willow (*Salix fragilis*), Hawthorn (*Crataegus monogyna*) as well as young oak (*Quercus* species) and birch (*Betula* species) (Cox, 2007). Adults have also been seen on the flowers of Wood spurge (*Euphorbia amygdaloides*) and yellow Asteraceae species (Cox, 2007).

Figure 2. Six-spotted pot beetle recorded at Kirkconnell Flow SSSI in June 2017.

Adults typically emerge in mid to late May and females lay their eggs in low foliage before dropping them into the leaf litter below (Douglas, 2001b). Eggs take about 3-4 weeks to hatch and the larvae take between 12-21 months to develop before anchoring themselves to a leaf, sealing the pot and pupating (Douglas, 2001b). When ready to emerge from their pot, the beetle cuts a hole at one end.

This species was once widespread in southern England with scattered records as far north as Ayrshire in Scotland (Douglas, 2001b; Piper, 2002; Anon., 2010a). The current status of the beetle is that it now has an extremely localised distribution in the UK with only one known site in Scotland at Kirkconnell Flow SSSI and one known site in England at Stockbridge Down in Hampshire and another potential site at Shrawley Wood in Worcestershire (Douglas, 2001b; Piper, 2002; Anon., 2010a). At Stockbridge Down, despite repeated searches, only a few individuals have been recorded since 1990 (Piper, 2002). The pot beetle was recorded at Kirkconnell Flow SSSI in the late 1990s and two adults were rediscovered during year one of the project with the help of volunteers in June 2017 (Burgess and Shanks, 2017).

Current threats to the Six-spotted pot beetle include the loss of broad-leaved woodland and inappropriate woodland management including the neglect of coppicing which has led to the development of high forest with little regeneration of young trees (Douglas, 2001b; Piper, 2002). Habitat fragmentation has led to isolation of populations of this species. There is a potential concern that this isolation is causing reproductive failure. This was noted at Stockbridge Down by Piper (2002) when collecting data for his PhD thesis where eggs that were collected failed to hatch and were deemed non-viable.

### 3.1. Kirkconnell Flow SSSI

Located 6 kilometres (km) south of Dumfries, Kirkconnell Flow SSSI is a raised bog that lies on the flood plain of the River Nith (Figure 3). Due to the dramatic decline in the area of raised bog habitat across Europe since the start of the nineteenth century, it is important that sites recognised as having ‘active’ raised bogs are protected and managed appropriately. The UK, along with Finland, Sweden and Ireland, has several large raised bogs and therefore has a particular responsibility for conserving them. In the UK, there are very few active raised bogs that remain undamaged and this includes Kirkconnell Flow. Most raised bogs have been affected by activities such as peat cutting, forestry and drainage over the last two hundred years.

Figure 3. The open area of peat bog at Kirkconnell Flow NNR.

The impact of past land use at Kirkconnell Flow has reduced the original dome of the raised bog. The cutting of peat and the excavation of drainage ditches have lowered the water table and this has changed the types of plants found on the bog, with mosses such as *Sphagnum* being lost to heather (*Calluna vulgaris* and *Erica* species) and sedges (Anon., 2019c). As a result the central area of the bog is a mosaic with active areas that are still forming peat and degraded areas that are unable to form peat (Anon., 2019c). The drier areas within the degraded patches have allowed trees such as Silver birch (*Betula pendula*) and Scot's pine (*Pinus sylvestris*) to develop (Anon., 2019c).

The trees have further exacerbated the damage to this bog by lowering the water table and shading out bog mosses. The drier the bog becomes, the more conditions favour tree growth and therefore more trees can colonise the bog surface. Due to its raised bog status, Kirkconnell Flow was designated a NNR in 1959 and was bought by SNH in 1998 (Anon., 2019c). When bought by SNH a large-scale programme was developed to help restore the site to ultimately raise the water table and re-wet the bog and this would allow it to regenerate (Anon., 2019c). Part of the programme involved clearing woodland from across the site and blocking drains to make the bog wetter (Anon., 2019c). A fringe of woodland was left around the site to reduce visual impact on the landscape that clearing the woodland within the central area may have caused (Anon., 2019c). It is this area of remaining mixed woodland, where young birch and oak are allowed to germinate and grow that has provided habitat for the Six-spotted pot beetle. The site was de-designated as an NNR in May 2018.

Due to its 'active' raised bog, the site has several other conservation designations. Kirkconnell Flow is a Site of Special Scientific Interest (SSSI), it lies within the Solway Mosses North Special Area of Conservation (SAC) which covers an area of 652 hectare and lies within the National Scenic Area (NSA) of the River Nith (Anon., 2019c).

### 3.2. Six-spotted pot beetle volunteer survey

In 2017 the Spotting Pot Beetles project was successful in finding two adults of Six-spotted pot beetles at Kirkconnell Flow SSSI (Burgess and Shanks, 2017). Prior to this the species had not been recorded at Kirkconnell Flow since the late 1990s.

Following the successful rediscovery of the species at Kirkconnell Flow, Buglife organised a follow up survey day to take place on 23rd June 2018; this was the same weekend that the survey had been organised in 2017 (Burgess and Shanks, 2017). A member of Buglife staff along with six volunteers visited the site to see if the species could be found again and to determine the health of the population at the site (Figure 4).

Figure 4. Volunteers and Buglife staff after surveying Kirkconnell Flow SSSI for the Six-spotted pot beetle.

The weather on the day was dry and warm. Volunteers initially targeted birch scrub surrounding the path from the carpark and the area where the Six-spotted pot beetle had been recorded in June 2017. Sweep nets were used to sample invertebrates present on the birch and surrounding vegetation. In the afternoon the survey was widened to check other areas of birch scrub, including small trees invading the edge of the bog. No pot beetles were recorded during the survey day at Kirkconnell Flow SSSI; however a wide range of other invertebrates were recorded (See Table 2).

Table 2. List of invertebrate species recorded at Kirkconnell Flow SSSI on 23rd June 2018.

| **Common Name** | **Scientific Name** |
|---|---|
| **Beetle** | **Coleoptera** |
| Solider beetle | *Cantharis decipiens* |
| Green tiger beetle | *Cicindela campestris* |
| Hieroglyphic ladybird | *Coccinella hieroglyphica* |
| Four-banded longhorn beetle | *Leptura quadrifasciata* |
| Heather leaf beetle | *Lochmaea suturalis* |
| Willow leaf beetle | *Lochmea caprea* |
| a leaf beetle | *Luperus longicornis* |
| Green leaf weevil | *Phyllobius maculicornis* |
| A weevil | *Polydrusus pterygomalis* |
| Fourteen spot ladybird | *Propylea quattuordecimpunctata* |
| **Dragonfly** | **Odonata** |
| Large red damselfly | *Pyrrhosoma nymphula* |
| **Bees, wasps, ants and sawflies** | **Hymenoptera** |
| White tailed bumblebee | *Bombus lucorum* |
| a sawfly | *Tenthredo mesomela* |
| **Butterfly and moths** | **Lepidoptera** |
| Common Wave | *Cabera exanthemata* |
| **True bugs** | **Hemiptera** |
| Alder spittlebug | *Aphrophora alni* |
| a planthopper | *Ditropis pteridis* |
| Birch shieldbug | *Elasmostethus interstinctus* |
| Common green capsid | *Lygocoris pabulinus* |
| Bracken bug | *Monalocoris filicis* |
| Marsh damsel bug | *Nabis limbatus* |
| Red-legged shieldbug | *Pentatoma rufipes* |

### 3.3. Habitat management recommendations for Six-spotted pot beetle

Habitat management recommendations produced by Buglife in 2017 have been followed by SNH staff who are managing Kirkconnell Flow. SNH and Butterfly Conservation have organised volunteer work parties at the site through their 'Bog Squad'. These groups have removed birch saplings from the peat bog itself whilst ensuring that young birch saplings around the periphery of the site are left. This will help ensure that there is an ongoing food of young birch trees for the Six-spotted pot beetle.

The following actions have been provided as further advice in managing Kirkconnell Flow SSSI for the Six-spotted pot beetle.

**1.**
**Action** - Ensure that a plentiful supply of young birch saplings is maintained at Kirkconnell Flow SSSI.
**Reason** - The two adults of the Six-spotted pot beetle found during the survey in June 2017 were swept from saplings of Silver birch ranging in height from 1.5-3 metres (m). Silver birch is a problem on the bog itself but it is important not to remove it from across the entire site to ensure that a range of heights and ages of birch trees as well as other tree species are available.

**2.**
**Action** - Maintain good structural diversity and species within woodland along the edge of the site by creating glades and cutting areas in rotation to create sheltered micro-climates.
**Reason** - Adult Six-spotted pot beetles are known to feed on a range of plant species and require open glades. Within the woodland border it is important to ensure there is a diversity of tree species and areas where new growth can occur. This will benefit not only the Six-spotted pot beetles but also other invertebrates and wildlife that require a varied structure and range of species in a woodland setting.

**3.**
**Action** - Minimise ground disturbance during the spring (April-June) when adults are seen.
**Reason** - Fully-grown larvae may be in the leaf litter at this time and may be more sensitive to trampling if there is very heavy disturbance. Any planting or habitat work in the area should be carried out in autumn or winter and avoid trampling and disturbance of leaf litter around existing young birch.

### 4. Ten-spotted pot beetle

The Ten-spotted pot beetle is characterised by five black spots on each yellow-orange elytron and a black pronotum with a distinctive yellow mark in the centre (Figure 5) (Douglas, 2001a; Cox 2007). The markings of this species are highly variable, displaying a range of spot sizes. Melanic forms with completely black elytra but retaining the yellow mark on the pronotum are known from the UK (known as subspecies *C. decemmaculatus bothnicus*) (Piper, 2002). Around 30% of both male and female individuals found at Camghouran at Loch Rannoch during the survey visit in year one of the Spotting Pot Beetle project displayed this colour mutation (Burgess and Shanks. 2017).

Figure 5. Ten-spotted pot beetle at Camghouran in Loch Rannoch in July 2017. Clockwise from top right: Mating pair (with melanic *bothnicus* female); mating pair (showing range of spotted forms); Ten-spotted pot beetle male; melanic *bothnicus* form male.

Clear sexual dimorphism is non-apparent, although female beetles are often slightly bulkier reaching 4 mm in length, whereas males can reach 3 mm, females have relatively shorter prothoracic limbs and antennae (Hubble, 2012). Adults of both sexes have wings, and will readily fly if disturbed, but studies of dispersal indicate they generally don't fly great distances. The larvae of this species are brownish white with a black sclerotised head capsule and prothorax (Piper, 2002).

The Ten-spotted pot beetle is associated with willow (*Salix* species) growing in sheltered *Sphagnum* covered heathland habitat on hillsides on the edges of quaking bogs. Favoured host plants in Scotland appear to be small specimens (under 1 m tall) of Eared willow (*Salix aurita*). Grey willow (*Salix cinerea*) and Goat willow (*Salix caprea*), and occasionally Downy birch (*Betula pubescens*) have been recorded as being used in England (Douglas, 2001a; Cox, 2007).

Adults of this species are usually found in May and June in England, although individuals have been found through to the end of August at the well-studied Wybunbury Moss NNR (Piper, 2002). Observations of wild larvae show that the immature stages of this species can be found beneath the adult host plants feeding on leaf litter of the adult host plant. In captivity larvae seem to prefer the leaves of Grey willow (Piper, 2002). Larval development generally takes two years in the wild, with some years very few adults emerging.

Only two sites are currently known to support Ten-spotted pot beetles in the UK, Wybunbury Moss NNR in Cheshire and Camghouran on the south side of Loch Rannoch in Perthshire (Piper and Compton, 2013; Piper, 2013; Piper, 2015). Single specimens have previously been recorded from two other sites in Scotland: at Muir of Dinnet in Aberdeenshire in 1986, and within 'the Braemer area' in Aberdeenshire in 1959, however the exact locations of both sites are unknown (Douglas, 2001a).

### 4.1. Camghouran and the Black Wood of Rannoch, Loch Rannoch

The Black Wood of Rannoch is an area of ancient woodland growing along the south shore of Loch Rannoch between Dall and Camghouran in Perthshire. This ancient forest holds some of the oldest pines in Scotland, with some estimated at over 400 years old (Anon., 2019a; Anon., 2019b). It is thought that woodland has been growing on this site virtually undisturbed since the end of the last Ice Age 10,000 years ago.

The various habitats within Black Wood of Rannoch support a diverse array of species. It is due to these diverse habitats that the site has been designated as a SSSI and a SAC, protecting the many special plants and animals that live among the pine trees and wetland areas (Anon., 2019a; Anon., 2019b). The site is particularly rich in lichens, fungi and rare vascular plants, and has been designated as an internationally Important Plant Area (IPA) (Anon., 2019b). In addition to Caledonian woodland, the area holds a mix of other habitats including bogs, fens, marsh, heath, scrub and dry grassland and riparian habitats, supporting a plethora of rare invertebrates (Anon., 2019a).

Within Black Wood of Rannoch, the Ten-spotted pot beetle (only the larvae) was last recorded in 2002 within an area of mixed broadleaved and coniferous woodland at grid reference NN5455 (Piper, 2002). This area lies to the west of the Allt Camghouran burn which cascades down the north-facing slope towards Loch Rannoch, passing the open area of hillside known as Camghouran. Piper (2002) described the area of suitable habitat for the beetle at this site as being ~60 $m^2$ in size with parts being dominated by birch with very few sallows present. It was in this area that seven adult beetles were found during year one of the Spotting Pot Beetles project in July 2017. We returned to this area in July 2018 to estimate the amount of habitat present in surrounding 1 km squares; see 4.2 below for more information.

In the area of suitable habitat, despite being on a north-facing slope, some areas are fairly flat, and the ground layer is saturated. Carpets of *Sphagnum* mosses (mainly *Sphagnum fallax, Sphagnum capillifolium* and *Sphagnum palustre*) are widespread, between tussocks of Purple moor grass (*Molinia caerulea*) and in drier areas there are large patches of Bracken (*Pteridium aquilinum*). There were several species of orchid (*Dactylorhiza* species) alongside Bog Asphodel (*Narthecium ossifragum*) present in the clearings.

### 4.2. Ten-spotted pot beetle volunteer survey

For year two of the Spotting Pot Beetle protect we aimed to organise and run two habitat management days for the Ten-spotted pot beetle at Loch Rannoch in Perthshire, which would involve surveys for the beetle. Unfortunately and at the last minute it was not possible to get landowner permission for habitat management work at Black Wood of Rannoch in 2018. As the weekend had already been organised with volunteers, we carried out two days of survey work to survey for the Ten-spotted pot beetle at new 1 km squares to determine the distribution of the species at the site and to make notes on suitable habitat.

The weekend was planned for the 7th and 8th of July 2018. During this weekend there were four volunteers and a member of Buglife Scotland staff that searched seven Ordnance Survey (OS) 1 km squares within the Black Wood of Rannoch SSSI for Ten-spotted pot beetles (squares visited were NN5353, NN5354, NN5356, NN5455, NN5456, NN6257 and NN6357). Notes were taken on the location and extent of suitable habitat encountered in each 1 km square. Equipment consisted of a handheld GPS device, sweep nets, pots, a white tray and a sieve for checking leaf litter for larvae.

Over the two days, six adult Ten-spotted pot beetles (one female and five males) were recorded (Figure 6 and 7; Table 3). Two empty larval 'pots' were also recorded by sweeping vegetation (Table 3). Two of the adults and one of the larval pots were recorded from heavily browsed shrubs in square NN5455 (Figure, 6, 7 and 8). The remaining four adults were recorded from the sallows along the wayleave in NN5456, which is a new 1km record for the species (Figure 6 and 7). One of the males was of the melanic *C. decemmaculatus bothnicus* form. During the survey notes were taken on the habitat (Table 3).

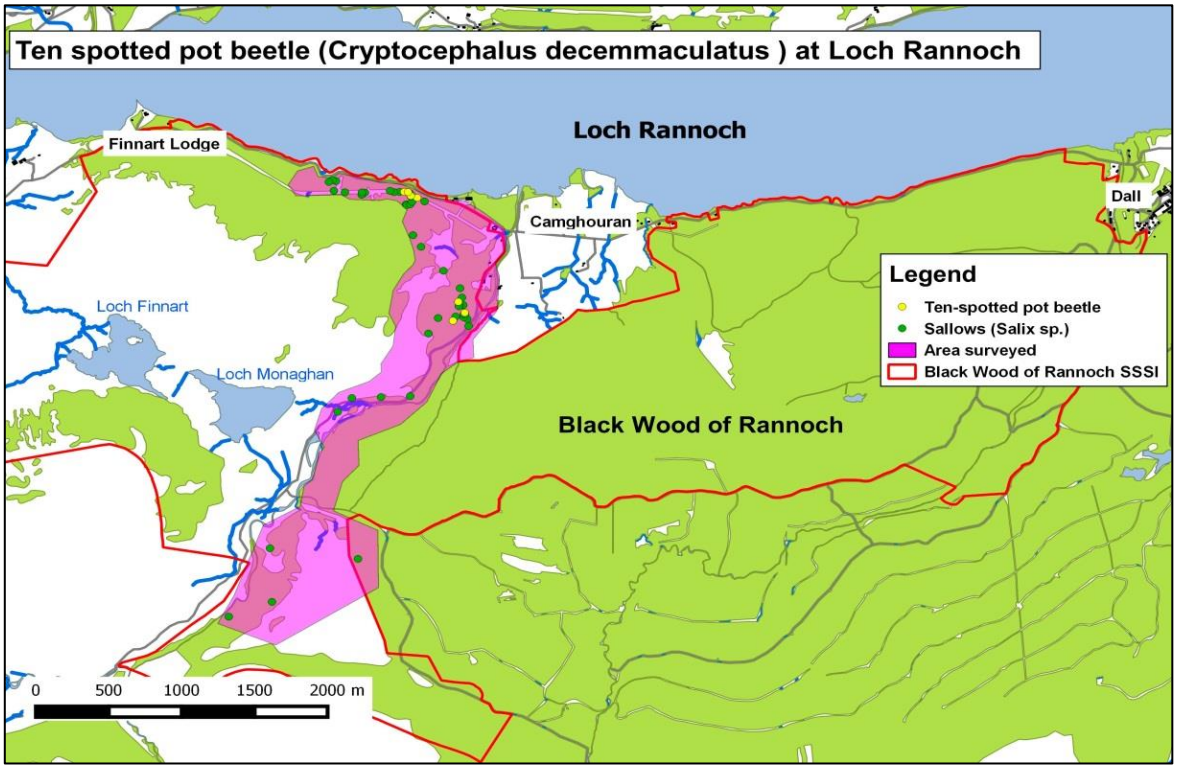

Figure 6. Woodland habitat surveyed at Black Wood of Rannoch in July 2018.

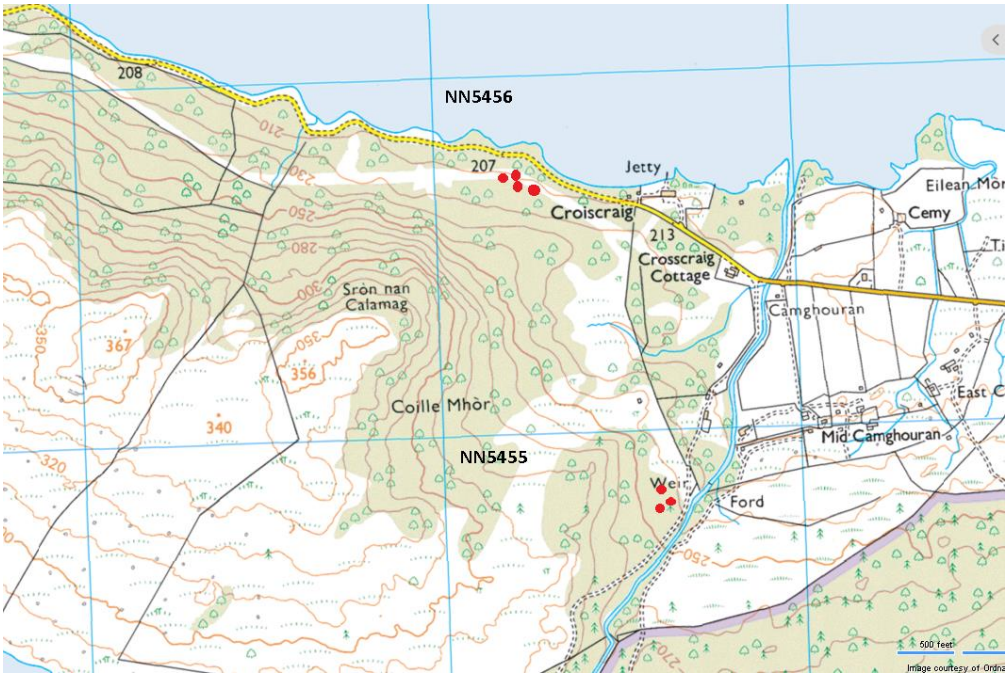


Figure 7. Ordnance Survey 1 km squares (NN5456 and NN5455) that the Ten-spotted pot beetle was recorded from. Table 3 (page 16) has description of the habitat for each record. Map taken from Ordnance Survey (2019).

Figure 8. Volunteer sweeping vegetation for pot beetles at Camghouran. Many of the sallows encountered had been heavily grazed by deer, with little lower vegetation; however a male Ten-spotted pot beetle was discovered at the base of this shrub.

Initially on the 7th of July, we returned to the clearing at grid reference NN544557 where seven adults were recorded in 2017. Unfortunately, the sallows here had been heavily browsed by deer in the intervening time, and no adults were found (Figure 9). However an empty pot beetle larval pot was swept from the remaining stems.

Figure 9. Clearing at Camghouran with dwarf sallows where Ten-spotted pot beetles were discovered in 2017. Image on left shows the area in 2017. Image on right shows the site in 2018 with heavy browsing by deer.

Sallows were found to be infrequent in most of the seven 1 km squares surveyed during this weekend. Those that were found were mainly 'leggy' and surrounded by birch scrub that was dense in places (Table 3). The majority of sallows showed signs of browsing by deer, probably Red deer (*Cervus elaphus*) and/or Roe deer (*Capreolus capreolus*), with stripped lower vegetation and heavier canopies.

The best habitat was a ~100m broken strip of Eared sallows growing along either edge of a powerline wayleave just south of the C450 Bridge of Gaur - Kinloch Rannoch Road within NN5456 (Figure 6 and 7). The ground here was carpeted with *Sphagnum* mosses. A deer fence running south of the wayleave has protected the sallows to the north from deer browsing. A number of small regenerating multi-stem sallows were present within the wayleave, which appears to have been cut or flailed within the last few years. Ten-spotted pot beetles were found on these small sallows within the wayleave and also along the south-facing aspect of the 'hedge' of sallows lining the wayleave. Not all of the wayleave had suitable habitat as it passed through areas of rocky drier ground that were dominated by birch and Bracken within the wayleave (particularly NN5356).

During the weekend, one of the volunteers who was very experienced with surveying for pot beetles visited squares NN5353 and NN5354 on the 8th July. Few sallows were noted from both squares and no Ten-spotted pot beetles were found. A stretch of powerline wayleave was also surveyed near the Alt Druide carpark (OS 1km squares NN6257 and NN6357) to the west of the Black Wood of Rannoch, but despite sallows being present, no Ten-spotted pot beetles were found. No larvae or larval pots were found by sorting through *Sphagnum* and fallen leaves beneath small sallows, however 2 empty larval pots were found

by sweeping sallows. This surprising result suggests that some of the larvae may be at least partly arboreal and may pupate above ground.

As well as identifying habitat for the Ten-spotted pot beetle, whilst looking for the beetles themselves other invertebrates were recorded (Table 4).

Table 3. Habitat notes from Black Wood of Rannoch on the 7th & 8th July 2018.

| Location | OS Grid ref | Eared willow | Area ($m^2$) | Ten spot PB present | Notes |
|---|---|---|---|---|---|
| 1 | NN5461855708 | Y | 9 | | Surrounded by tall birches, moor grass (*Molinia* species). Area is heavily browsed. Tall: 2.5 m |
| 2 | NN5461055762 | Y | 10 | | 2-3 m tall. Multi-stem. Moor grass (*Molinia* species) and *Sphagnum*. Deer browsing on low stems. Partly in shade. |
| 3 | NN5458755774 | Y | 6 | | Shaded. Deer browsing low down. 2.2 m tall. |
| 4 | NN5451255751 | Y | 6 | larval pot | 90 cm height, but heavy deer browsing. *Sphagnum capilifollium* and *Sphagnum fallax* in undergrowth. |
| 5 | NN5441155775 | Y | 0.6 | | 80 cm tall. Browsed. Surrounded by Bog myrtle (*Myrtica gale*). |
| 6 | NN5453255782 | Y | 5 | | 2.5 m tall. Heavily browsed lower stems. |
| 7 | NN5458855796 | Y | 3 | | Five tall leggy stems. Heavily grazed below. |
| 8 | NN5459555808 | Y | 2 | one male | 2.2 m tall and leggy. Heavily browsed lower stems probably by Red and Roe deer. |
| 9 | NN5459755800 | Y | 1 | | 2.5 m tall heavily browsed below. |
| 10 | NN5458455864 | Y | 3 | | Two trees that are 3 m apart and 1.8 m tall. Heavy browsing. |

| Location | OS Grid ref | Eared willow | Area ($m^2$) | Ten spot PB present | Notes |
|---|---|---|---|---|---|
| 11 | NN5458755866 | Y | 5 | | 2.5 m tall. Nice tree with plenty of leaves, but in shade. |
| 12 | NN5456255866 | Y | 1 | | 1.8 m tall. Heavy browsing by deer. |
| 13 | NN5455655858 | Y | 5 | | Five trees that are 2 m tall, with leggy and browsed stems. |
| 14 | NN5455455891 | Y | 2 | one male (melanistic) from sweeping small sallows | A 2.2 m tall browsed stem. Few small heavily browsed sallows below. |
| 15 | NN5458055922 | Y | 6 | | Tall leggy, browsed tree. Area is shaded. |
| 16 | NN5456955992 | Y | 2 | | Tall leggy tree about 3 m. Area is shaded |
| 17 | NN5446056126 | Y | 8 | | Small heavily browsed sallows (50 cm) and one leggy (2.2 m tall) together. Open area. Potentially good habitat area |
| 18 | NN5431356310 | Y | 1.5 | | 80 cm tall. Browsing damage |
| 19 | NN5426156398 | Y | 2 | | Leggy 3 m tall. Browsed below. |
| 20 | NN5422156629 | Y | 2 | | Very leggy sparse leaves. Area has been browsed. |

| Location | OS Grid ref | Eared willow | Area ($m^2$) | Ten spot PB present | Notes |
|---|---|---|---|---|---|
| 21 | NN5422656624 | Y | 10 | | Large shrub 3-5 m tall. But low branches have been browsed. |
| 22 | NN5425056629 | Y | 2 | | 2 m tall, leggy. Heavily browsed by deer. |
| 23 | NN5426356647 | Y | 15 | | Leggy. Browsed below. Large trunk with spindly stems. |
| 24 | NN5425556689 | Y | 50 | | Wayleave north of deer fence line (close to road) looks good. Lots of sallows with *Sphagnum fallax and Sphagnum palustre* underneath. |
| 25 | NN5421256723 | Y | 10 | one male | Beetle on 75 cm tall small bush. On wayleave/ lots of good habitat here. |
| 26 | NN6303757335 | Y | 1 | | Near wayleave near Alt Druidhe carpark. 2 m, not grazed, but shaded by birch regeneration. |
| 27 | NN6303357358 | Y | 1.5 | | Alt Druidhe, 1.7 m tall bushy shrubs. |
| 28 | NN6293057336 | Y | 30 | | Group of seven 3 m tall, bushy willows between road and wayleave. |
| 29 | NN6292157319 | Y | 15 | | Near wayleave. Five 1.8-2 m tall bushy shrubs, surrounded by Bracken. |
| 30 | NN5434956647 | Y | 15 | | Near wayleave. Three tall 2.5 m tall shrubs and line of eight smaller bushy shrubs. |

| Location | OS Grid ref | Eared willow | Area ($m^2$) | Ten spot PB present | Notes |
|---|---|---|---|---|---|
| 31 | NN5434155662 | Y | 8 | | Wayleave. Six good tall sallows that are 2 m. Lots of low vegetation. No sunshine. |
| 32 | NN5429956676 | Y | 10 | one female and one larval pot | Line of good sallows between deer fence and wayleave in sunshine. With lots of low vegetation in sunshine. |
| 33 | NN5425856687 | Y | 10 | | 1.7 m tall bushes and five along edge of wayleave. Open to sunshine. |
| 34 | NN5425656692 | Y | 15 | one male | Sheltered 'horse-shoe' scallop of sallows, 2-3 m tall. Good foliage close to ground. Facing south along wayleave edge. |
| 35 | NN5425156711 | Y | 4 | | Small <1.5 m tall scattered sallows along wayleave. |
| 36 | NN5423856720 | Y | 7 | one male | Small <90 cm tall sallows. Wide patch in wayleave. Open area in sunshine. |
| 37 | NN5418056724 | Y | 1.5 | | 2.5 m tall single bush. |
| 38 | NN5414256723 | Y | 2 | | 2 m tall bush. |
| 39 | NN5411556734 | Y | 5 | | Lots of small scattered bushes. |
| 40 | NN5394356726 | Y | 5 | | Lots of small bushes in between bog myrtle |
| 41 | NN5392056711 | Y | 10 | | Five 2-2.5 m tall shrubs but bushy at base. |

| Location | OS Grid ref | Eared willow | Area ($m^2$) | Ten spot PB present | Notes |
|---|---|---|---|---|---|
| 42 | NN5392356729 | Y | 5 | | <1.5 m tall and scattered. Goat willow also recorded from area. |
| 43 | NN5380656734 | Y | 2 | | Leggy, browsed low down. Scattered small sallows but tall dense Bog myrtle. Doesn't look suitable habitat. Patches of Bracken. |
| 44 | NN5373156748 | Y | 10 | | Tall leggy sallows that are 2.5-3 m tall. Lots of tall grasses and Bog myrtle. |
| 45 | NN5374856819 | Y | 20 | | Few big shrubs. Overcast. |
| 46 | NN5372456828 | Y | 30 | | Tall trees on wayleave. Some deer browsing |
| 46 | NN5369956815 | Y | 20 | | Tall leggy trees. Browsing and shaded. |
| 47 | NN5354 | Y | Not measured | | Few sallows seen. Mainly birch. |
| 48 | NN5353 | Y | Not measured | No, but *C. labiatus* on birch | Few sallows seen. Mainly birch. |

Table 4. A list of invertebrate species recorded at Black Wood of Rannoch in 2018.

| **Common Name** | **Scientific name** |
|---|---|
| **Beetles** | **Coleoptera** |
| Woodland dor beetle | *Anoplotrupes stercorosus* |
| Cream-spot ladybird | *Calvia quattuordecimguttata* |
| Figwort weevil | *Cionus scrophulariae* |
| a weevil | *Cleopus pulchellus* |
| Seven spot ladybird | *Coccinella septempunctata* |
| Ten-spotted pot beetle | *Cryptocephalus decemmaculatus* |
| Black birch pot beetle | *Cryptocephalus labiatus* |
| a weevil | *Deporaus betulae* |
| Willow leaf beetle | *Lochmaea caprea* |
| a leaf beetle | *Luperus longicornis* |
| a soldier beetle | *Malthodes guttifer* |
| a leaf beetle | *Phratora vulgatissima* |
| a reed beetle | *Plateumaris discolor* |
| **Dragonflies and damselflies** | **Odonata** |
| Golden-ringed dragonfly | *Cordulegaster boltonii* |
| Large red damselfly | *Pyrrhosoma nymphula* |
| **Bees, wasps and ants** | **Hymenoptera** |
| Common carder bee | *Bombus pascuorum* |
| Hairy wood ant | *Formica lugubris* |
| Common wasp | *Vespula vulgaris* |
| **Butterflies and moths** | **Lepidoptera** |
| Dark green fritillary | *Argynnis aglaja* |
| Dotted border moth | *Agriopis marginaria* |
| Ringlet butterfly | *Aphantopus hyperantus* |
| Puss moth | *Cerura vinula* |
| Garden grass-veneer | *Chrysoteuchia culmella* |
| Hook-streak grass-veneer moth | *Crambus lathoniellus* |
| Small argent & sable moth | *Epirrhoe tristata* |
| Northern eggar moth | *Lasiocampa quercus* subspecies *callunae* |
| Smoky wainscot moth | *Mythimna impura* |
| Pebble prominent moth | *Notodonta ziczac* |
| Green-veined white butterfly | *Pieris napi* |
| Silver-ground carpet moth | *Xanthorhoe montanata* |
| **Scorpionflies** | **Mecoptera** |
| Scorpionfly | *Panorpa germanica* |
| **Lacewings** | **Neuroptera** |

| **Common Name** | **Scientific name** |
|---|---|
| a brown lacewing | *Hemerobius lutescens* |
| **True bugs** | **Hemiptera** |
| Alder froghopper | *Aphrophora alni* |
| a lacehopper | *Cixius nervosus* |
| Marsh froghopper | *Neophilaenus lineatus* |
| Common froghopper | *Philaenus spumarius* |
| **Spiders** | **Araneae** |
| Strawberry spider | *Araneus alsine* |
| Four-spotted orb weaver | *Araneus quadratus* |
| Cucumber spider | *Araniella cucurbitina* sensu stricto |
| a long-jawed spider | *Tetragnatha extensa* |
| Common crab spider | *Xysticus cristatus* |
| **True fly** | **Diptera** |
| a hoverfly | *Eristalis intricarius* |
| a hoverfly | *Eristalis nemorum* |
| Notch-horned cleg | *Haematopota pluvialis* |
| a marsh fly | *Ilione albiseta* |
| a marsh fly | *Limnia paludicola* |
| a hoverfly | *Melanostoma scalare* |
| a cranefly | *Pedicia rivosa* |
| Down-looker snipe fly | *Rhagio scolopaceus* |
| a hoverfly | *Sericomyia silentis* |
| a hoverfly | *Syrphus ribesii* |
| a marsh fly | *Tetanocera phyllophora* |
| a cranefly | *Tipula lunata* |
| a cranefly | *Tipula scripta* |
| a hoverfly | *Xylota segnis* |

### 4.3. Habitat management recommendations for Ten-spotted pot beetle

Deer browsing on sallows within the Black Wood of Rannoch is having a negative impact on available habitat for the Ten-spotted pot beetle. The small area of open sunny habitat with dwarf sallows where the pot beetles were recorded in 2017, had been heavily browsed and trampled by deer during the winter of 2017/2018. No adult pot beetles were recorded in this clearing during the 2018 survey. Protecting small patches of sallows in open sunny positions could be achieved by using deer exclusion enclosures.

The beetle has poor mobility. Mark and recapture studies of Ten-spotted pot beetles by Piper and Compton (2013) indicated that the majority of adults move very short distances during their short lives, average of 17 days for males and 27 days for females. Around 60%

of both males and females from that study had moved only 1-4 m over four days. The furthest any beetle was recorded as moving in this time was less than 50 m. This highlights the vulnerability of the beetle to local extinction events when even small patches of isolated habitat are lost.

A strip of good habitat with adult pot beetles was discovered along the powerline wayleave just south of the C450 Road. The proximity of a deer fence to the south and the road to the north may have worked to reduce browsing pressure (Figure 10). Regular maintenance of the wayleave will help reduce birch regeneration and keep a sunny south-facing edge open, however care needs to be taken not to remove all the sallows along the edges of the wayleave. The beetles appear to favour the lower branches of sallows and small sallows, cutting sallows within the wayleave itself may benefit the beetles in the long term.

Figure 10. Line of sallows along the southern edge of an electricity powerline wayleave (facing east). The deer fence to the south and road to the north of the wayleave has helped reduce deer browsing here.

A considerable amount of habitat management has been carried out at Wybunbury Moss that appears to have benefited the Ten-spotted pot beetles there, and has led to large increases in the population at that site (Piper, 2013; Piper 2015). The following recommendations are therefore based on proven management techniques.

**1.**
**Action** - Ensure that existing patches of dwarf sallows in open sunny clearings are protected from deer browsing. Deer fence exclosures installed around small groups of sallows could help to stabilise, and increase the existing pot beetle population, which is threatened by browsing by deer.
**Reason** - Browsing by deer threatens remaining fragments of suitable Ten-spotted pot beetle habitat. Ten-spotted pot beetles depend on sallow leaves, which are also favoured by deer. This can result in isolated pockets of sallows that support populations of beetles being heavily browsed and stripped of leaves before the adult beetles emerge. Creation of a stepping stone network of exclosures in sheltered sunny clearings will help stabilise the

beetle population and help fragmented populations within the Black Wood of Rannoch to reconnect.

**2.**
**Action** - Ensure areas currently supporting the beetle are open to the maximum amount of sunlight, without exposure to excessive winds. Create open clearings around existing sallows by removing tall birch scrub shading them, but don't completely remove scrub as this offers shelter.
**Reason** - Adult beetles are often found basking on willow trees in open, sunny, but sheltered locations. Larvae develop in the fallen leaves beneath the food plant. In the wet boggy habitats where this beetle is found, basking locations are likely to be important to increase body temperature above a threshold required for various activities such as mating, egg development, escape from predators, and for larval development.

**3.**
**Action** - Attempt to expand the area of suitable habitat by planting preferred host plants of the Ten-spotted pot beetle including Eared willow and/or Grey willow and remove potential barriers to dispersal, such as tall birch scrub. Volunteers helped to map the distribution of sallows at the core area in 2018.
**Reason** - The number of suitable sallows in this 1 km square appeared to be very low, and is likely a major population-limiting factor. No Ten-spotted pot beetles were recorded on birches, which were abundant in the area. Increasing the density and choice of food plants for the adults and larvae is a good strategy for increasing the beetle population.

**4.**
**Action** - Minimise ground disturbance during the spring and when adults are seen.
**Reason** - Fully-grown larvae may be in the leaf litter at this time and may be more sensitive to trampling if there is very heavy disturbance. Any planting or habitat work in the area should be carried out in autumn or winter, and avoid trampling and disturbance of sphagnum and leaf litter around existing sallows.

**5.**
**Action** - Scallop woodland edges to create sheltered micro-climates for Ten-spotted pot beetle.
**Reason** - Cutting back birch and other trees and shrubs (including non-sallows, Bog myrtle and Bracken) to create sunny south-facing scallops or small clearings around favoured food plants would open them up to sunshine, while protecting them from too much wind.

## 5. Further recommendations

As well as the suggested habitat management recommendations described above for both the Six-spotted pot beetle and Ten-spotted pot beetle, there are a number of other considerations for both species.

**1.**
**Action** - Monitor beetles at Black Wood of Rannoch (Ten-spotted pot beetle) and Kirkconnell Flow SSSI (Six-spotted pot beetle) to establish population size and health.
**Reason** - 2017 was the first year that Six-spotted pot beetles had been recorded at Kirkconnell Flow SSSI since the late 1990s and Ten-spotted pot beetles hadn't been recorded at Black Wood of Rannoch since 2002. Due to the limited numbers of adults seen of both species and the fact that no larvae have been recorded it is important to continue to survey and monitor for both species at both sites. Due to the likelihood of a two year lifespan it is strongly recommended that there are further surveys at both sites in 2019 and onward that aim to establish the size and health of the population. Continued surveys to monitor population size and health are also recommended by Anon. (2010a; 2010b).

A volunteer who participated in the surveys for the Ten-spotted pot beetle in July 2018 is keen to visit the site during the summer of 2019 to help determine the health and distribution of the pot beetle at Black Wood of Rannoch. This volunteer, who is from the local community, has also stated that they will try to get others from the local community to help with the surveys.

**2.**
**Action** - Expand searches for suitable habitat to surrounding 1 km squares and attempt to find further sub-populations in the local area of Dumfriesshire for the Six-spotted pot beetle and Loch Rannoch for the Ten-spotted pot beetle. This was successful at Loch Rannoch in 2018 doubling the number of known 1km squares in Scotland (Figure 6 and 7).
**Reason** - Checking for suitable habitat in surrounding areas should be attempted to assess how localised the population is within Kirkconnell Flow SSSI (Six-spotted pot beetle) and Camghouran and Loch Rannoch (Ten-spotted pot beetle) and the surrounding areas.

**3.**
**Action** - Carry out searches for suitable habitat and the species at known historic locations across Scotland.
**Reason** - Checking for suitable habitat at locations where the species has been recorded in the past may enable remnant populations to be rediscovered. For example there is a record on the NBN Atlas for a single individual of Six-spotted pot beetle recorded by the Royal Horticultural Society within their insect reference collection from 2008 at Grantown-on-Spey at grid reference NJ0326. The Ten-spotted pot beetle has previously been recorded near Braemar and Muir of Dinnet in the Cairngorms. Visits in June and early July would be recommended for both species, and as well as searching for the beetles themselves the surveys could also focus on searching for preferred host plants and the condition of habitat. Searching an area with trained volunteers has proven to be very successful in the current survey.

**4.**
**Action** - Potential captive breeding of both species for re-introduction to known sites and potential historically known sites.
**Reason** - Captive rearing of the Ten-spotted pot beetle was undertaken in the past by Piper (2002). A captive breeding programme could help to boost numbers of both the Six-spotted pot beetle and Ten-spotted pot beetle from the incredibly low population size at present,

while habitat management work is taking place. The Royal Zoological Society of Scotland's Native Species Conservation Programme has expressed interest in working with this species. If successful, adults or mature larvae could be returned to the site to help strengthen the local population, and potentially help recolonise other sites.

## 6. Conclusions

Over centuries our landscape has been shaped and tamed by human hands and livestock, so that very few ancient habitats now remain. Lowland raised bogs and associated damp boggy habitats have escaped relatively untouched for thousands of years, until recently (last 200 years), when technology has facilitated the exploitation of these wet peatlands through drainage for agriculture, forestry and/or peat extraction. This has led to the loss of over 80% of our lowland raised bogs in Scotland. It has also meant that species associated with boggy habitats such as the Ten-spotted pot beetle and Six-spotted pot beetle have found their refuges under threat.

Pot beetles in general exhibit a low ability to disperse and often high genetic diversity between nearby populations, indicating a lack of gene-flow between close populations. This has led to many species existing in small, isolated populations, which greatly increases their risk of local extinction (Piper and Compton, 2013). The small population size and poor dispersal ability may be an adaption to living in specialised niches, where it doesn't pay to disperse too far from the original colony. It also suggests that some colonies may be dependent on particular individual host plants on one site for successive generations.

Small changes in the management of bogs and woodland hosting these species, such as indiscriminate scrub clearance, a local increase in livestock grazing density or change in deer management may be responsible for loss of these species from their only known sites. Without some protection and positive management to increase local populations and to help the species recolonise/expand their range to new areas and hopefully reconnect with other isolated populations, both of these species are at high risk of local extinction in Scotland.

With the help of volunteers, surveys in 2017 and 2018 for both the Six-spotted pot beetle and Ten-spotted pot beetle through this project have been successful. However due to the low numbers of adults seen at both Kirkconnell Flow SSSI (two in 2017 and no records in 2018) and pressure from deer grazing at Black Wood of Rannoch it is important to continue monitoring these populations in future years to identify population size and health. Additionally it is important to manage both sites appropriately to ensure the long term survival of both these species of pot beetles in Scotland.

**References**


Anon. (2010a). UK priority species pages- version 2: Six-spotted pot beetle *Cryptocephalus sexpunctatus*. Joint Nature Conservation Committee, Peterborough. Available: http://jncc.defra.gov.uk/_speciespages/251.pdf (accessed 24/01/2019).

Anon. (2010b). UK priority species pages- version 2: Ten-spotted pot beetle *Cryptocephalus decemmacultus*. Joint Nature Conservation Committee, Peterborough. Available: http://jncc.defra.gov.uk/_speciespages/247.pdf (accessed 24/01/2019).

Anon. (2019a). Black Wood of Rannoch; Site of Special Scientific Interest Citation. Available: https://sitelink.nature.scot/site/218 (accessed 24/01/2019).

Anon. (2019b) Important Plant Area: Black Wood of Rannoch Information Sheet. Plantlife, Salisbury. Available: http://www.plantlifeipa.org/site/factsheet/1087 (accessed 24/01/2019).

Anon. (2019c). Kirkconnell Flow SSSI; Site of Special Scientific Interest Citation. Available: https://sitelink.nature.scot/site/868 (accessed 24/01/2019).

Burgess, S. and Shanks, S. (2017). Spotting Pot Beetles: Survey report and habitat recommendations. Buglife. Available: https://www.buglife.org.uk/sites/default/files/Spotting%20pot%20beetle%20survey%20report%20final_0.pdf (accessed 24/01/2019).

Cox, M. L. (2007). Atlas of the seed and leaf beetles of Great Britain and Ireland. Pisces Publications, Newbury.

Douglas, G. (2001a). Information Invertebrate Species Dossier: *Cryptocephalus decemmaculatus* a leaf beetle. Available: http://www.snh.gov.uk/docs/C207565.pdf (accessed 05/10/2017- currently not available on line).

Douglas, G. (2001b). Information Invertebrate Species Dossier: *Cryptocephalus sexpunctatus* a leaf beetle. Available: http://www.snh.gov.uk/docs/C207567.pdf (accessed 05/10/2017- currently not available on line).

Hubble, D. (2012). Key to the adults of seed and leaf beetles of Britain and Ireland. Field Study Council.

Hubble, D. (2014). A review of the scarce and threatened beetles of Great Britain: the leaf beetles and their allies, Chrysomelidae, Megalopodidae and Orsodacnidae. Species Status No. 19. Available: http://publications.naturalengland.org.uk/file/6244884977549312 (accessed 24/01/2019).

Hubble, D. (2017). Naturalists' handbook No. 34 Leaf Beetle. Pelagic Publishing.

Piper, R. (2002). Conservation Biology of *Cryptocephalus* species and other threatened UK beetles. PhD thesis. University of Leeds. Available:

www.rosspiper.net/wp-content/uploads/2013/05/Ross-Piper-PhD-thesis-2002.pdf (accessed 24/01/2019).

Piper, R. and Compton, S. G. (2013). How limited is dispersal in the rare beetle, *Cryptocephalus decemmaculatus* (Chrysomelidae, Cryptocephalinae)? Journal of Insect Conservation 17 (6): 1229-1235

Piper R, W. (2013) *Cryptocephalus decemmaculatus* at Wybunbury Moss, Cheshire. Natural England Research reports.

Piper R, W. (2015) *Cryptocephalus decemmaculatus* at Wybunbury Moss, Cheshire. Natural England Research reports.

All images within this document not credited are taken and owned by Buglife.

Contact us: Buglife, Balallan House, 24 Allan Park,
Stirling, FK8 2QG

www.buglife.org.uk

Tel: 01786 447504

Email: scotland@buglife.org.uk

@buzz_dont_tweet

Buglife would like to thank Scottish Natural Heritage for their support with this project.

Front cover photo credits L-R; Ladybird spider *(Eresus sandaliatus)* © S. Dalton, Jellyfish © D. Huffman, Tansy beetle (*Chrysolina graminis*) © S. Falk and Large garden bumblebee (*Bombus ruderatus*) © S. Falk

***Saving the small things that run the planet***

Buglife - The Invertebrate Conservation Trust is a registered charity at The Lindens, 86 Lincoln Road, Peterborough PE1 2SN
Company no. 4132695, Registered charity no. 1092293, Scottish charity no. SC040004