TARGETED SURVEY AND HABITAT ASSESSMENT FOR THE BROWN DIVING BEETLE (*Agabus brunneus*) AT SELECTED STREAMS IN THE NEW FOREST.

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Surrey Wildlife Trust Ecology Services

Forestry England

EXECUTIVE SUMMARY

A targeted search and habitat assessment for the Vulnerable and Section 41 Species of Principle Importance (SPI) Brown Diving Beetle *Agabus brunneus* was undertaken in June 2023 at two stoney-bottomed stream sites in the New Forest, South Hampshire (Vice County 11) selected by Natural England. Both streams selected have historic records of the target species.

The project brief was as follows:

- Description of methods.
- Description of habitat suitability, vegetation cover and structure within each survey site.
- Record of where each species was present and absent during the field survey.
- The location and extent of each identified site and/or meta-population mapped and presented in ARC GIS shapefile and pdf maps at the 1:10000 scale.
- Identify other suitable habitat nearby.
- Notes on competing species if present.
- Estimation of size of each meta-population.
- Assessment of the current status of the population of each species within the New Forest.
- A discussion of the threats and risks to the populations of each species around the New Forest is to be provided in the write-up.

The selected sites were visited on the 14th & 23rd June 2023 by two experienced invertebrate ecologists, Scotty Dodd MSc MCIEEM MRES and Dr. Jonty Denton Bsc (Hons) FRES FLS CEcol MCIEEM. Dr Denton is also the County Recorder for Coleoptera (beetles) for Hampshire (VC11 & VC12).

The Brown Diving Beetle *Agabus brunneus* was recorded at both of the sites visited in 2023, namely Milking Pound Bottom / Widden Bottom and Linford Brook.

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INTRODUCTION

BACKGROUND

A targeted search and habitat assessment for the Vulnerable and Section 41 Species of Principle Importance (SPI) Brown Diving Beetle *Agabus brunneus* was undertaken in June 2023 at two stoney-bottomed stream sites in the New Forest, South Hampshire (Vice County 11) selected by Natural England. Both streams selected have historic records of the target species, This survey was commissioned by Forestry England via Surrey Wildlife Trust Ecology Services.

The Brown Diving Beetle *Agabus brunneus* (Fabricius, 1798), (Coleoptera: Dytiscidae), is a complex of species centred on the Mediterranean, reaching northern Europe in southern England and Belgium. The type form, which occurs in Britain, was recently recognised as part of a species complex, the other members coexisting with it in the Mediterranean area. In the UK the species is *Agabus brunneus* sensu strictu, the most widely distributed of the species complex and the most tolerant of cooler climates (Foster *et al*., 2016). The UK distribution is distinctly southern with populations known from West Cornwall, South Wiltshire, Dorset and South Hampshire. In South Hampshire (VC11) the species is restricted to the New Forest which is considered to be a historical stronghold for the species. Being at the extremity of its northern range in southern England the species has not yet taken advantage of a changing climate (Foster *et al*., 2016). According to Foster *et al*. (2016) this might be because it is a poor flier (and therefore potentially a poor disperser) or due to the scarcity of suitable clean lowland streams in southern England.

Within the New Forest *Agabus brunneus* is known from Milking Pound Bottom / Widden Bottom near Setley and the Linford Brook near Linwood. In the New Forest surveys have been undertaken by Dr. Jonty Denton in 2001 (Denton, 2001) where the species was recorded at the three aforementioned sites, by Paul Brock in 2011(for Forestry England) in Roe Inclosure that found one individual at SU196089, and on 14th June 2022 Paul Brock, Fred Giles and Bill Unwin recorded three at Stoney Moors at SZ214995.

In Britain the species was regarded as Vulnerable (Red Data Book 2) by Shirt (1987) who gave the localities of the New Forest area, south Wiltshire, south Devon and west Cornwall. The subsequent review by Foster (2010) retains the Vulnerable status applied by Shirt (1987) but uses the IUCN Red List system. The species was also considered to be a priority species in the UK Biodiversity Action Plan, which is largely superseded by the Section 41 of the NERC act (2006) list of Species of Principle Importance (SPI).

In terms of species ecology, *Agabus brunneus* is an aquatic predator associated with stoney bottomed streams, where the adult beetle is able to crawl within the coarse gravel substrate making it difficult to detect. Adults can be found by digging into the gravel substrate to flush the beetles out and may also be found under large stones. Beetles are easiest to find when stream beds are all but dried out with only small pools remaining among the exposed substrate. Adult beetles have been found in association with such streams in more open heathland habitats as well as shaded woodland. Denton (2001) remarks that “The surrounding habitats are remarkably different, with extensive shading dominant from mixed woodland along the Linford Brook contrasting with open heathland conditions along much of Milking

Pound Bottom. Widden Bottom falls somewhere in between as it flows through dense tall gorse for much of its length".

PROJECT AIMS

The project brief was as follows:

- Description of methods.
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SAMPLING COMPARTMENTS

14th June 2023

- Milking Pound Bottom & Widden Bottom – SZ 2932 9952

23rd June 2023

- Linford Brook – SU 1965 0913

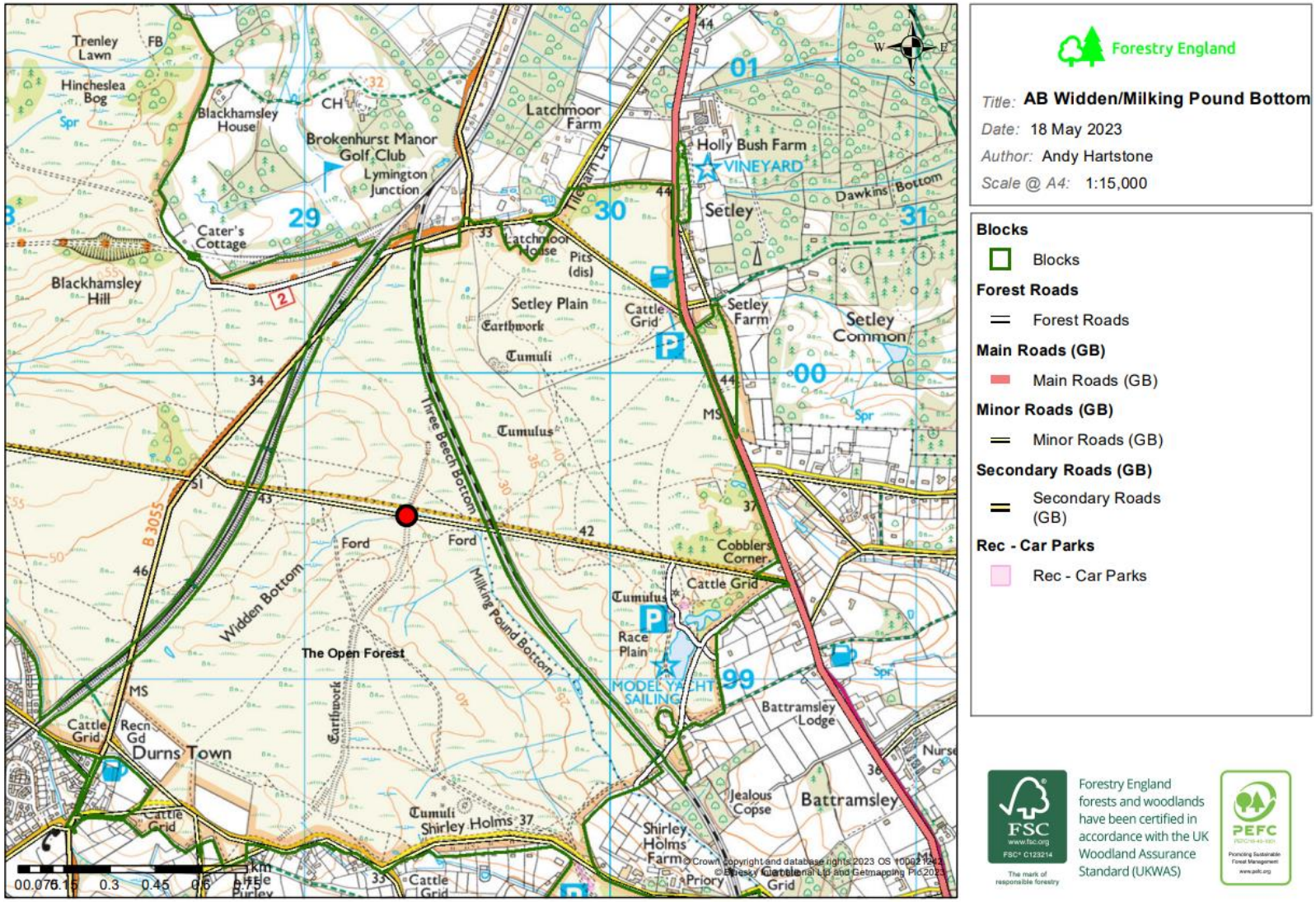


Figure 1. New Forest sampling compartments for Brown Diving Beetle in 2023 – Milking Pound Bottom & Widden Bottom – SZ 2932 9952

Figure 2. New Forest sampling compartments for Brown Diving Beetle in 2023 – Linford Brook – SU 1965 0913

METHODOLOGY

SITE VISITS

The selected sites were visited on the 14th & 23rd June 2023 by two experienced invertebrate ecologists, Scotty Dodd MSc MCIEEM MRES and Dr. Jonty Denton Bsc (Hons) FRES FLS CEcol MCIEEM.

SAMPLING WITHIN THE COMPARTMENTS

The following search methods were implemented following Denton (2001):

Sites were sampled using a 0.5mm mesh bagged frame net (G.B.Nets Todmorden). In addition, a small spade was used to dig into the gravel. Stones and net samples were emptied out onto a white sheet, and beetles sorted from the stones. Larger stones in the damper sections of the steam beds were lifted and any beetles found beneath noted. Dams were created to trap water and the gravel disturbed to float out any beetles.

CONSTRAINTS

Surveys best carried out when streambed substrate exposed, both sites provided optimal conditions.

RESULTS

Milking Pound Bottom & Widden Bottom

The streambed was mostly dry with a few small, shallow pools remaining. A single Brown Diving Beetle *Agabus brunneus* was dug / flushed from the stony substrate of a residual pool at Milking Pound Bottom SZ29259951 on the 14th June 2023, confirming that the species is still present in Milking Pound Bottom / Widden Bottom catchment.

The stream section would have been overshadowed by scrub but this had recently burnt (see Photograph 1). The wider habitat is an open heathland scrub / mosaic with wet flushes and the stoney stream running along the valley bottom.

Other invertebrates noted:

Table 1. Invertebrate records from Milking Pound Bottom & Widden Bottom.

Order	Family	Taxon	Vernacular	Status
Coleoptera	Dryopidae	*Dryops striatellus*	a water beetle	RDB3
Coleoptera	Dytiscidae	*Agabus bipustulatus*	a water beetle	
Coleoptera	**Dytiscidae**	***Agabus brunneus***	**Brown Diving Beetle**	**VU**

Order	Family	Taxon	Vernacular	Status
Coleoptera	Dytiscidae	*Agabus didymus*	a water beetle	
Coleoptera	Dytiscidae	*Agabus paludosus*	a water beetle	
Coleoptera	Dytiscidae	*Dytiscus semisulcatus*	a water beetle	
Coleoptera	Dytiscidae	*Rhantus suturellus*	a water beetle	
Coleoptera	Hydrophilidae	*Anacaena lutescens*	a water beetle	
Heteroptera	Veliidae	*Velia caprai*	Water Cricket	

Photograph 1. Milking Pound Bottom *Agabus brunneus* site close to the road on open, recently burnt heath & scrub mosaic.

Linford Brook

The streambed was partially dry with small residual pools and several larger, deeper pools remaining. A single Brown Diving Beetle *Agabus brunneus* was found under a large stone in a larger residual pool close to the footbridge at Linford Brook SU19650914 on the 23rd June 2023, confirming that the species is still present in Linford Brook catchment.

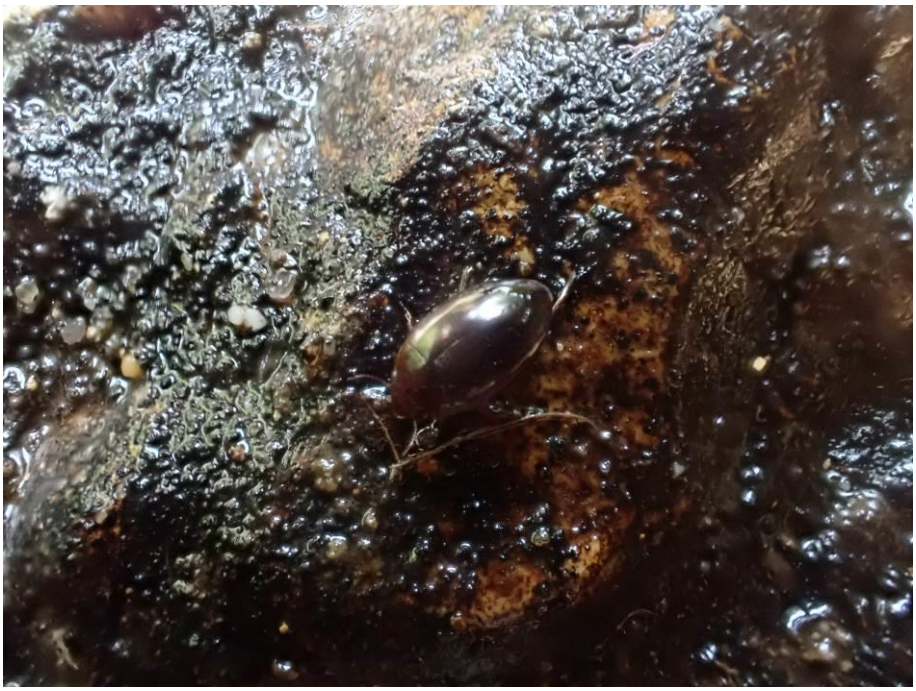
In stark contrast to Milking Pound Bottom / Widden Bottom the Linford Brook stream runs through heavily shaded mixed woodland with dense Bracken *Pteridium aquilinum* fringing the steeply sided stream edges.

Other invertebrates noted:

Order	Family	Taxon	Vernacular	Status
Araneae	Tetragnathidae	*Tetragnatha extensa*	a spider	
Araneae	Tetragnathidae	*Tetragnatha montana*	a spider	
Coleoptera	Cerambycidae	*Rhagium bifasciatum*	a longhorn beetle	
Coleoptera	Dytiscidae	*Agabus bipustulatus*	a water beetle	
Coleoptera	**Dytiscidae**	***Agabus brunneus***	**Brown Diving Beetle**	**VU**
Coleoptera	Dytiscidae	*Agabus guttatus*	a water beetle	
Coleoptera	Gyrinidae	*Gyrinus substriatus*	Common Whirlygig Beetle	
Heteroptera	Veliidae	*Velia caprai*	Water Cricket	
Odonata	Aeshnidae	*Aeshna cyanea*	Southern Hawker	

Photograph 2. Linford Brook *Agabus brunneus* site in shaded woodland.

Photograph 3. Linford Brook – large stone in pool under which *Agabus brunneus* was found.



Photograph 4. Linford Brook –*Agabus brunneus*.

ECOLOGICAL ASSESSMENT

Denton (2001) noted that monitoring for *Agabus brunneus* is very difficult in flowing streams and that searching sites which have dried down to isolated pools is the better strategy for finding *A.brunneus* and this strategy was adopted for the 2023 survey with positive results at both sites. As the method for finding *A.brunneus* in the stream substrate is potentially destructive and disruptive the survey sought only to establish continued presence rather than multiple destructive samples to approximate a population size.

The continued presence of the target species in the shaded section of Linford Brook suggests that other shaded woodland sites with stoney bottom streams sites may have potential for the target species to be present, e,g, feeder streams to Linford Brook and the stream at Millyford Bridge. The stoney stream at Burley Rocks also has some potential if the water levels become low enough.

THREATS

Foster in Shirt (1987) states that the threats to the species survival at the known sites is ‘unknown’ but goes on to speculate that disturbance might be an issue.

Foster (2010) expands upon the threat from ‘disturbance’ as disturbance from the development of former heathland sites, in particular via silt contamination of gravel beds.

Extreme hot weather and drought events in successive years may also prove to be problematic in the future with streambeds drying at crucial times of development.

Pollution of streams might also be detrimental.

FURTHER WORK

Futther surveys work could look at other stoney stream sites, for example feeder streams to Linford Brook, the stream at Millyford Bridge and the stoney stream at Burley Rocks that also has some potential if water levels become low enough.

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APPENDIX 1. Status categories for rare and Notable species

Red Data Book Category 1 (RDB 1) – Endangered

Definition.
Taxa in danger of extinction *in Great Britain* and whose survival is unlikely if the causal factors continue operating.

Included are those taxa whose numbers have been reduced to a critical level or whose habitats have been so dramatically reduced that they are deemed to be in immediate danger of extinction. Also included are *some* taxa that are *possibly* extinct.

Criteria.
Species which are known *or believed to occur* as only a single population within one 10 km square of the National Grid.

Species which only occur in habitats known to be especially vulnerable.

Species which have shown a rapid or continuous decline over the last twenty years and are now *estimated* to exist in five or fewer 10 km squares.

Species which are *possibly* extinct *but have been recorded this century* and if rediscovered would need protection.

Red Data Book Category 2 (RDB 2) - Vulnerable

Definition.
Taxa *believed* likely to move into the endangered category in the near future if the causal factors continue operating.

Included are taxa of which most or all of the populations are decreasing because of *over-exploitation*, extensive destruction of habitat or other environmental disturbance; taxa with populations that have been seriously depleted and whose ultimate security is not yet assured; and taxa with populations that are still abundant but are under threat from serious adverse factors throughout their range.

Criteria.
Species declining throughout their range.

Species in vulnerable habitats.

Red Data Book Category 3 (RDB 3) – Rare

Definition.
Taxa with small populations *in Great Britain* that are not at present endangered or vulnerable, but are at risk.

These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range.

Criterion.
Species which are estimated to exist in only fifteen or fewer 10 km squares. *This criterion may be relaxed where populations are likely to exist in over fifteen 10 km squares but occupy small areas of especially vulnerable habitat*

Nationally Scarce Category A - Notable A (Na)

Definition.
Taxa which do not fall within **RDB** categories but which are none-the-less uncommon in Great Britain and are thought to occur in 30 or fewer 10 km squares of the National Grid or, for less well recorded groups, within seven or fewer vice-counties.

Nationally Scarce Category B - Notable B (Nb)

Definition.
Taxa which do not fall within **RDB** categories but which are none-the-less uncommon in Great Britain and are thought to occur in between 31 and 100 10 km squares of the National Grid or, for less well recorded groups, within eight and twenty vice-counties.

Nationally Scarce - Notable (N)

Definition.
Taxa which do not fall within **RDB** categories but which are none-the-less uncommon in Great Britain and are thought to occur in between 16 to 100 10 km squares of the National Grid. Species within this category are often too poorly known for their status to be more precisely estimated.

Summary of the IUCN categories and criteria.

- **REGIONALLY EXTINCT (RE)**
  A taxon is Extinct when there is no reasonable doubt that the last individual has died. In this review the last date for a record is set at fifty years before publication.
- **CRITICALLY ENDANGERED (CR)**
  A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered.
- **ENDANGERED (EN)**
  A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered.
- **VULNERABLE (VU)**
  A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable.
- **NEAR THREATENED (NT)**
  A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

- **LEAST CONCERN (LC)**

A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.

- **DATA DEFICIENT (DD)**

A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate.

- **NOT EVALUATED (NE)**

A taxon is Not Evaluated when it is has not yet been evaluated against the criteria.

GB Rarity Status categories and criteria

- **Nationally Rare (NR)**

Native species which have not been recorded from more than 15 British hectads since 31st December 1979 and where there is reasonable confidence that exhaustive recording would not find them in more than 15 hectads. This category includes species which are probably extinct.

- **Nationally Scarce (NS)**

Native species which are not regarded as Nationally Rare AND which have not been recorded from more than 100 British hectads since 31st December 1979 and where there is reasonable confidence that exhaustive recording would not find them in more than 100 hectads.

Other species status terminology.

- **Local**. Species that are restricted in distribution either geographically or by habitat. Also used for species that are widespread but infrequently encountered, e.g. encountered in no more than 300 10km squares of the national Ordnance Survey grid since 1970. Or those species listed as such, based upon modern geographical data, by ISIS (2010) and/or relevant recording schemes.
- **Widely Scattered.** Generally distributed but at low densities.
- **Southern.** Mainly or completely confined to southern England and/or its westerly or easterly regions – as indicated.
- **Common.** Generally widespread throughout the UK.
- **Unknown**. Usually indicates a lack of available data for difficult taxa but may also imply recent taxonomic confusion.