The Status of Dillwyn's Dung Beetle *Onthophagus nuchicornis* on Morfa Harlech in 2019

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NRW Evidence Report No. 421

Morfa Harlech, looking north

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Contents

List of tables

List of figures

1. Crynodeb gweithredol

Cyn hyn roedd Chwilen Dom Dillwyn *Onthophagus nuchicornis* i'w chael yn lleol ond yn eang ei gwasgariad drwy Gymru a Lloegr. Mae wedi dirywio'n ddramatig yn Lloegr ac ers 2000 mae'n bodoli mewn dim ond pump o'r 40 lleoliad y gwyddys amdanynt. Yng Nghymru, mae'r rhywogaeth hon wedi llwyddo'n well ond mae wedi'i chyfyngu i systemau twyni tywod arfordirol sy'n cael eu pori. Gwyddwn ei bod i'w chael ar bymtheg safle yn y gorffennol ac roedd yn dal yn bodoli yn hanner y rhain yn 2017. Mae'r chwilen yn bwydo ar dail amrediad o famaliaid ond ar gyfer bridio mae'n debyg ei bod yn ddibynnol ar dail llysysyddion o faint canolig i fawr megis gwartheg, merlod a defaid.

Darganfu arolwg a wnaed yn 2017 o'r holl safleoedd hysbys yng Nghymru fod *Onthophagus nuchicornis* i'w chael mewn saith ardal – Cynffig (975 oedolyn), Tywyn Merthyr Mawr (36), Morfa Harlech (1), Twyni Tywod Oxwich (4), Twyni Pen-bre (32), Twyni Pennard (4) a Thwyni Whiteford (5). Mae'r awduron yn ystyried mai'r poblogaethau yn Nhwyni Cynffig a Merthyr Mawr yw'r rhai gorau yn y DU. Mewn mannau eraill, mae cysylltiad cryf rhwng eu habsenoldeb a lefelau poblogaeth isel a'r ffaith fod pori wedi dod i ben a maint ac ansawdd y tail sydd i'w gael ar dywod.

Yn dilyn arolwg 2017, cynhaliwyd arolwg mwy dwys o Forfa Harlech, sy'n cynrychioli poblogaeth ogleddol anhygyrch y chwilen, yn 2019 i bennu statws *Onthophagus nuchicornis* yn y safle hwn. Er gwaethaf chwiliadau gweledol dwys a thrapio, ni chanfuwyd unrhyw unigolion yn ystod yr arolwg hwn.

Mae rhannau gogleddol a dwyreiniol Morfa Harlech yn cynnig y cynefin mwyaf addas ar gyfer *O. nuchicornis* gan fod yno lecynnau mwy cyfnewidiol o dywod agored gyda thwyni symudol. Yn ystod yr arolwg roedd gwartheg yn pori yn gyffredin ar draws y safle ond roedd hyn yn amlwg wedi'i ganolbwyntio ar y llaciau twyni mewnol. Byddai gwella cynefin i greu rhagor o ardaloedd tywod agored ac annog gwartheg i bori ar y twyni symudol yn sicr yn fanteisiol i *Onthophagus nuchicornis.*

2. Executive summary

Dillwyn's Dung Beetle *Onthophagus nuchicornis* was formerly local but widespread across England and Wales. It has declined dramatically in England and since 2000 is extant at just five of the forty known locations. In Wales, this species has fared better but is restricted to grazed coastal sand dune systems. Historically known from fifteen sites, it was still present at half of these in 2017. The beetle feeds on the dung of a range of mammals but is probably dependent for breeding on medium to large herbivore dung such as cattle, ponies and sheep.

A survey in 2017 of all the known sites in Wales found *Onthophagus nuchicornis* at seven localities – Kenfig Burrows (975 adults), Merthyr Mawr Warren (36), Morfa Harlech (1), Oxwich Burrows (4), Pembrey Burrows (32), Pennard Burrows (4) and Whiteford Burrows (5). The authors regard the populations at Kenfig Burrows and Methyr Mawr to be the best in the UK. Elsewhere, absence and low population levels are strongly correlated to the cessation of grazing and the quantity and quality of available dung on sand.

Following the 2017 survey, a more intensive survey of Morfa Harlech, which represents a northern outlier for the beetle, was undertaken in 2019 to determine the status of *Onthophagus nuchicornis* at this site. Despite intensive visual searches and trapping, no individuals were found during this survey.

The northern and eastern sections of Morfa Harlech offer the most suitable habitat for *O. nuchicornis* due to more disturbed areas of open sand with mobile dunes. Cattle grazing during the survey was widespread across the site but was noticeably concentrated on the inner dune slacks. Habitat improvement to create further open sand areas and encouraging cattle to graze in the mobile dunes would undoubtedly benefit *Onthophagus nuchicornis*.

3. Introduction

3.1. *Onthophagus nuchicornis*

Dillwyn's Dung Beetle *Onthophagus nuchicornis* (Figure 2) is widespread in the Palaearctic Region and recorded from Albania, Armenia, Austria, Belgium, Bosnia Herzegovina, Bulgaria, Belarus, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Great Britain, Germany, Georgia, Greece, Hungary, Italy, Kazakhstan, Latvia, Liechtenstein, Lithuania, Luxembourg, Moldavia, Netherlands, Norway, Poland, Romania, Portugal, Russia (Central European Territory South European Territory, North European Territory), Slovakia, Spain, Sweden, Switzerland, Turkey, Ukraine and Yugoslavia. It is known from Kazakhstan, Mongolia, Russia (West Siberia), Turkmenistan, Turkey and China (Beijing Province, Xinjiang Province) in Asia, and has been introduced into the Nearctic Region (Löbl & Löbl, 2016). Across its range, it is most often associated with open habitats usually with sandy soils.

Onthophagus nuchicornis was formerly widespread but local across central-southern England and coastal dunes in Wales. An accurate historical distribution is hard to assess due to misidentifications of the more widespread and abundant *O. similis* as *O. nuchicornis* and the confusion and use of the names in the early literature (e.g. Fowler, 1890). The National Recording Scheme for Scarabaeoidea (NRS) contains 110 verified Welsh records for *O. nuchicornis* across eleven 10km grid squares enabling the most accurate distribution map (Figure 1). The NBN Atlas contains 107 occurrence records (https://species.nbnatlas.org/species/NBNSYS0000011525), however this does include a number of known erroneous and several unvalidated records, including at least four from Wales. These latter records have been flagged on the NBN Atlas by the authors. Therefore, it is imperative that records of this species are confirmed by examination of voucher specimens, especially at new or atypical sites.

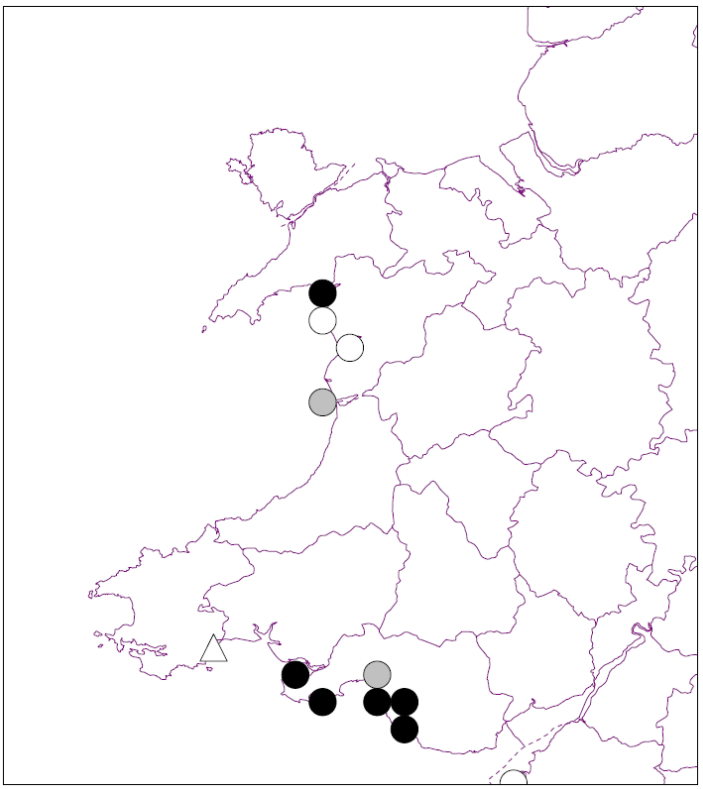

Figure 1. Distribution map for verified Welsh *Onthophagus nuchicornis* records.

In the most recent review of the conservation status of UK Scarabaeoidea (Lane & Mann, 2016), this species qualified as Vulnerable, VU under B2ab(ii)(iv)(v) as it is undergoing continued decline and is recently (post 1990) known only from 14 locations across the UK, with an Area of Occupancy of less than 2000km^2. It is clear from the current trend noted by the authors during survey work (2015-2019) for this species at all known UK sites, that it has become locally extinct at many and in most has suffered significant population declines.

Onthophagus nuchicornis is a 6-9mm paracoprid (Figure 2), creating a brood ball at the end of a tunnel 5-10cm deep directly under the dung source. In laboratory studies, it has a thermal tolerance from egg-to-adult development of between 16 and 30°C, and average development time ranged from 30 days at 30°C to 115 days at 16°C (Floate *et al*., 2015). In terms of feeding ecology, *O. nuchicornis* is a generalist coprophage. Adults have been found to feed on all types of mammal dung, although it is unclear if adults will create brood and successfully breed in dung other than that from medium to large herbivores (e.g. sheep, cattle, horse). At sites where there is a scarcity of suitable dung, *O. nuchicornis* can be found feeding in dog faeces (e.g. Cooter, 1990), though it is unlikely be able maintain healthy populations.

Figure 2. Dillwyn's Dung Beetle *Onthophagus nuchicornis*
2a. Female. 2b Male.

The biology and ecology of *Onthophagus nuchicornis* are not well known, but across most its range it is almost exclusively associated with sandy soils in open habitats (e.g. Ljungberg, 2002; Lumaret, 1990). In the UK, all known sites are from sandy soils, primarily coastal sand dune systems. Field observations in the UK during the last seven years strongly indicate that this species requires a mosaic of bare sand and low sward height, typically found on grazed fore/yellow dunes. There is a significant reduction in abundance towards grey dunes with dense vegetation and dune slacks with high soil moisture (Mann & Mann, unpub. obs.). Where there has been a noticeable decline in population, this is correlated to either cessation of grazing, disruption in dung continuity or significant reduction in the area of bare sand and short sward grassland.

Decline is continuing in England and Wales and only at a few sites is this species known to be thriving. Since 1990, *O. nuchicornis* has been recorded from seven of its fifteen known sites in Wales and can still be found in large numbers at Kenfig Burrows NNR (Watkins & Mann, 2018). This contrasts with the situation in England, where it is now recorded infrequently, and often as singular individuals, in only five of the 40 historic English localities. Drivers of this decline are the scarcity of suitable dung through cessation or disruption of grazing, habitat degradation, stabilisation of dunes, lack of disturbance, land use changes e.g. conversion of dune systems to golf courses or holiday parks and the increased use of veterinary parasiticides such as avermectins.

A data search from museum collections, the NRS and published literature provided just four records of *O. nuchicornis* for Morfa Harlech. Harrison appears to have been the first recorder at Morfa Harlech, with a single male being recorded in 1996 (data from NRS). Loxton recorded eight individuals in 2015 through pitfall trapping (Loxton, 2018) and Spence found a single individual, also in 2015 (Data from NRS, specimen examined). During the survey of Welsh dunes for *O. nuchicornis* (Watkins & Mann, 2017), a single

example was found through live baited pitfall trapping on 3rd June 2017. Details are given in Table 1 and a distribution map is given in Figure 3.

Table 1. Verified records of *Onthophagus nuchicornis* from Morfa Harlech.

Grid ref	Quantity	Date	Recorder	Method	Comment	Source
SH563331	1	09 July 1996	Harrison, T.D.	Hand searching	One male found walking up bare sandy slope	National Recording Scheme. Specimen not examined by authors.
SH558348	8	15 June 2015	Loxton, R.	Dung	-	Loxton, 2018. Specimens not examined by authors.
SH570316	1	30 August 2015	Spence, S.A.	Captured	Found walking on path to the beach	Fieldwork. Specimen examined.
SH567319	1	03 June 2017	Mann, D.J. & Watkins, C.M.	Dung baited pitfall trap	-	Survey

Figure 3. Distribution of *Onthophagus nuchicornis* on Morfa Harlech.

3.2. Objectives of 2019 survey

The aim of the survey was to determine the current status and distribution of the dung beetle *Onthophagus nuchicornis* on Morfa Harlech dunes and to recommend appropriate management strategies to encourage the conservation of *O. nuchicornis*.

4. Methods

Field work was carried out between 15th and 20th July 2019. An extensive survey across the NNR and SSSI areas of Morfa Harlech was undertaken. Weather conditions were favourable throughout the survey period, except for last day when it rained heavily. A range of sampling techniques were used during the survey, and these are detailed below.

4.1. Visual search

A visual scan of the area was performed during daylight hours to locate dung deposits. When a dung source was located, the dung was held over a white laboratory tray and manually broken up to look for beetles inside. In each instance, the ground beneath the dung pile was examined for signs of dung beetle activity such as burrows in the ground (Figure 4) and the sub surface layers were gently exposed to uncover tunnelling beetles.

Figure 4. *Onthophagus similis* burrows under a dung pat.

4.2. Dung sieving

Dung sieving was used for cattle dung, badger and dog faeces. No horse dung was found on site. Dung was roughly broken up and sieved with a 10mm mesh size sieve into a white laboratory tray. Rabbits often defaecate in discrete latrine areas, usually near the burrow entrance or on top of a prominent feature such as an ant hill. In large middens, droppings of different ages and decay stages are present and can yield several dung beetle species. Rabbit middens are not thought to be of great importance for *O. nuchicornis* but were included in the search to cover all possibilities.

4.3. Baited pitfall traps

Dung-baited pitfall traps are often the best method to attract hard to find dung beetle species, particularly in areas where dung supply is scarce. A 10mm gauge wire mesh was placed over the pit fall container to prevent the capture of small mammals and to support a fist sized ball of dung bait (Figure 5a). An upturned plastic plate secured with tent pegs was used as a rain guard (Figure 5b). At Morfa Harlech we used live trapping methodology to limit the impact on dung beetle populations. This differs from traditional trapping by using a cut-off funnel to reduce escape and a 30-45mm layer of local sand in the trap container for beetles bury in (Figure 5c). The sand is then sieved to separate the catch (Figure 5d).

The traps were baited with horse dung. Dung was collected prior to the survey from an organic source and frozen for a period of at least 24 hours at -20℃ for biocontrol purposes. All traps were placed on day 1 or 2 of the survey and remained in-situ for a minimum of 48 hours.

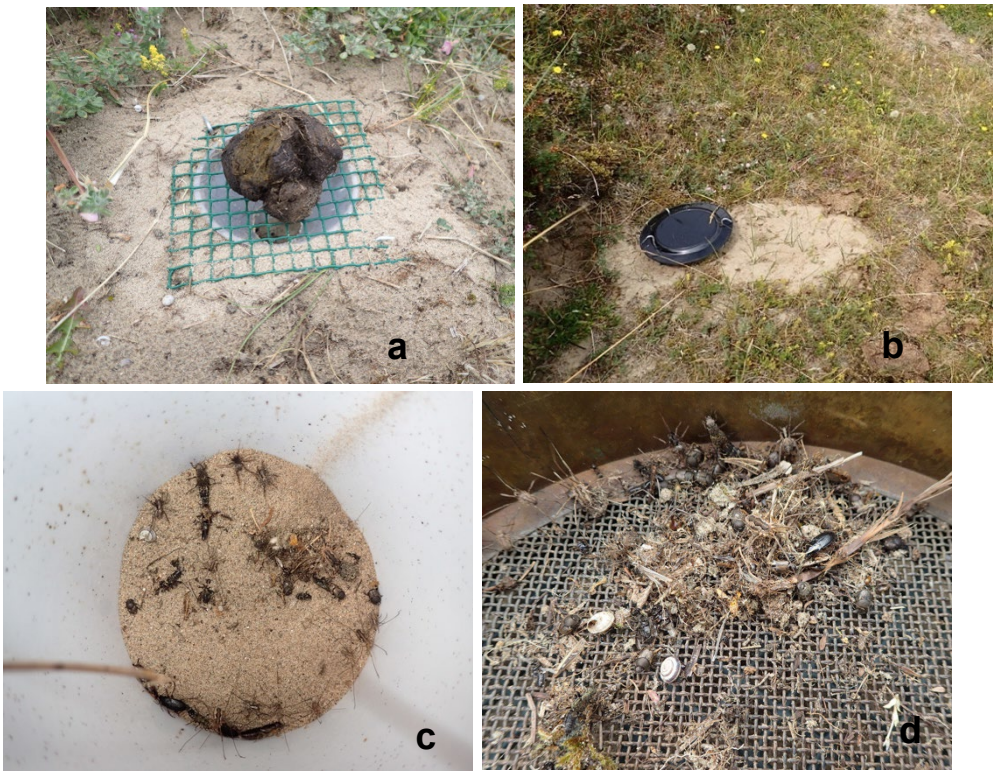

Figure 5. Dung baited pitfall trap.
5a. Wire mesh supporting a dung ball. 5b. Rain guard in situ.
5c. Sand in the base of the trap. 5d. Sieving to separate the catch.

4.4. Site coverage

A total of twelve live traps were used. Trap locations are shown in Figure 6. Sampling points are shown in Figure 7. Sample points represent either a single isolated dung pat or multiple dung pats in proximity rather than all ground covered. Several sample points represent non-dung feeding Scarabaeoidea records. The central area of salt marsh and dense scrub was surveyed to a lesser degree as this area had little open sand of a suitable nature for *O. nuchicornis*. All suitable habitat was thoroughly surveyed. Two local sites with grazing and public access were checked in addition to Morfa Harlech NNR to determine if any other populations were present in the wider area.

Figure 6. Map showing the location of live baited pitfall traps during 2019 survey.

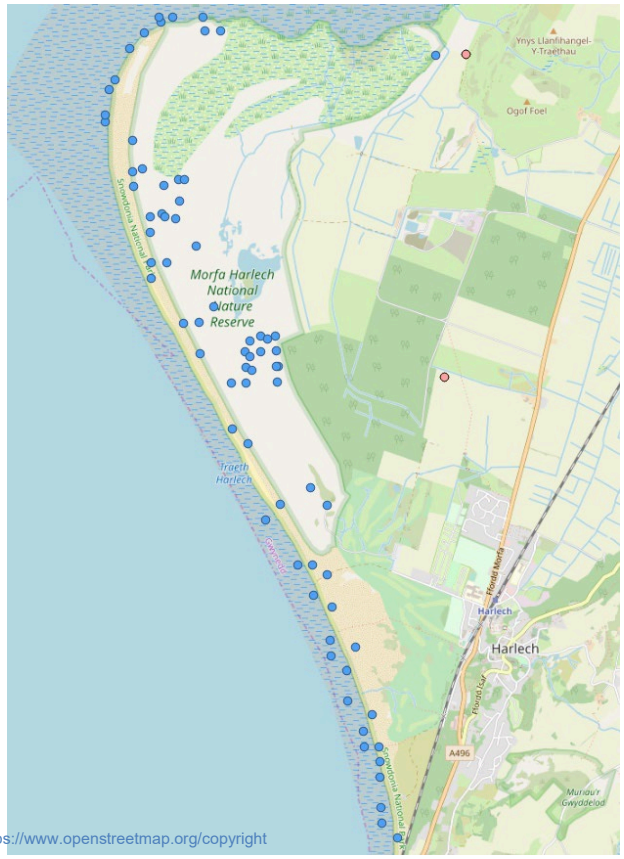

Figure 7. Map showing the location of the sampling points during the 2019 survey.

5. Results

5.1. *Onthophagus nuchicornis*

No individuals were found during the 2019 survey despite intensive efforts with more than 70 sample points across the site. The authors have visited the site on four occasions in recent years (16/10/15; 25/5/17; 3/6/17; 15-18/7/19) and found just a single *O. nuchicornis* in a baited pitfall trap. This would indicate that if the beetle is still present on site, it is at a critically low population level.

During the 2017 survey, a lack of fresh dung at Morfa Harlech was observed, although old and dry cattle and sheep dung was found. It should be noted, however, that the far north of the site was not surveyed at that time. During the 2019 survey, there was good quality cattle dung on site (Figure 8) but the cattle appear to focus their grazing in the central fixed dunes and slacks where the habitat is less suitable for *O. nuchicornis*. The cattle are likely to spend most of their time in the slacks where the foliage is denser and richer than the mobile dune area. Whilst a fenced compartment system is in operation, the cattle were able to roam across most of the reserve, thus able to choose lusher grazing in preference.

As the cattle move around the fixed dunes, a trodden route desire line is formed, and dung is often deposited on the bare sand of these paths (Figure 9). Under such circumstances, individual dung pats are suitable for *O. nuchicornis*. However, dung beetles locate dung using olfactory receptors on the antennae and interference with the odour stream inhibits dung finding and subsequent colonization. Dung pats on desire lines may be more difficult for *O. nuchicornis* to locate due to their isolated nature and position in a 'trough' between steep sided banks.

Figure 8. Good quality cattle dung found on site.

Figure 9. Dung deposited on a desire line.

Areas of mobile dune with high levels of disturbance that provide open sand represent optimal conditions for *O. nuchicornis*. Figure 10 highlights the areas of the reserve that are the most and least promising in terms of habitat suitablilty for *O. nuchicornis*.

A. An unsuitable area of salt marsh, this area is too wet.
B. An unsuitable area of grey dune slack which is fixed with limited exposed sand.

C. An exposed area of sand surrounding a water trough. This may be suitable for colonization but is curently isolated from other areas of suitable habitat.
D. A view of the beach and fixed fore dunes at the south of the reserve. This area is heavily used by the public as it is closest to the car park and is adjacent to the golf club. The area is not grazed and fenced along the access to the beach, dividing it from the central and northern section of the reserve.
E. Similar to B, an unsuitable area of fixed dune slack with little exposed sand.
F. An area of short sward grasses with smaller pockets of exposed sand in mosaic. This area has potential for *O. nuchicornis* but would benefit from additional disturbance to increase the level of open sand.
G. The most suitable habitat area for *O. nuchicornis* found at Morfa Harlech with a good level of exposed sand, mixed sward heights and fresh dung evident.
H. A northern compartment with reasonable levels of open sand especially along the fenceline, thus suitable in terms of habitat. However, less fresh dung was found in this area, indicating the cattle visit this area less frequently.

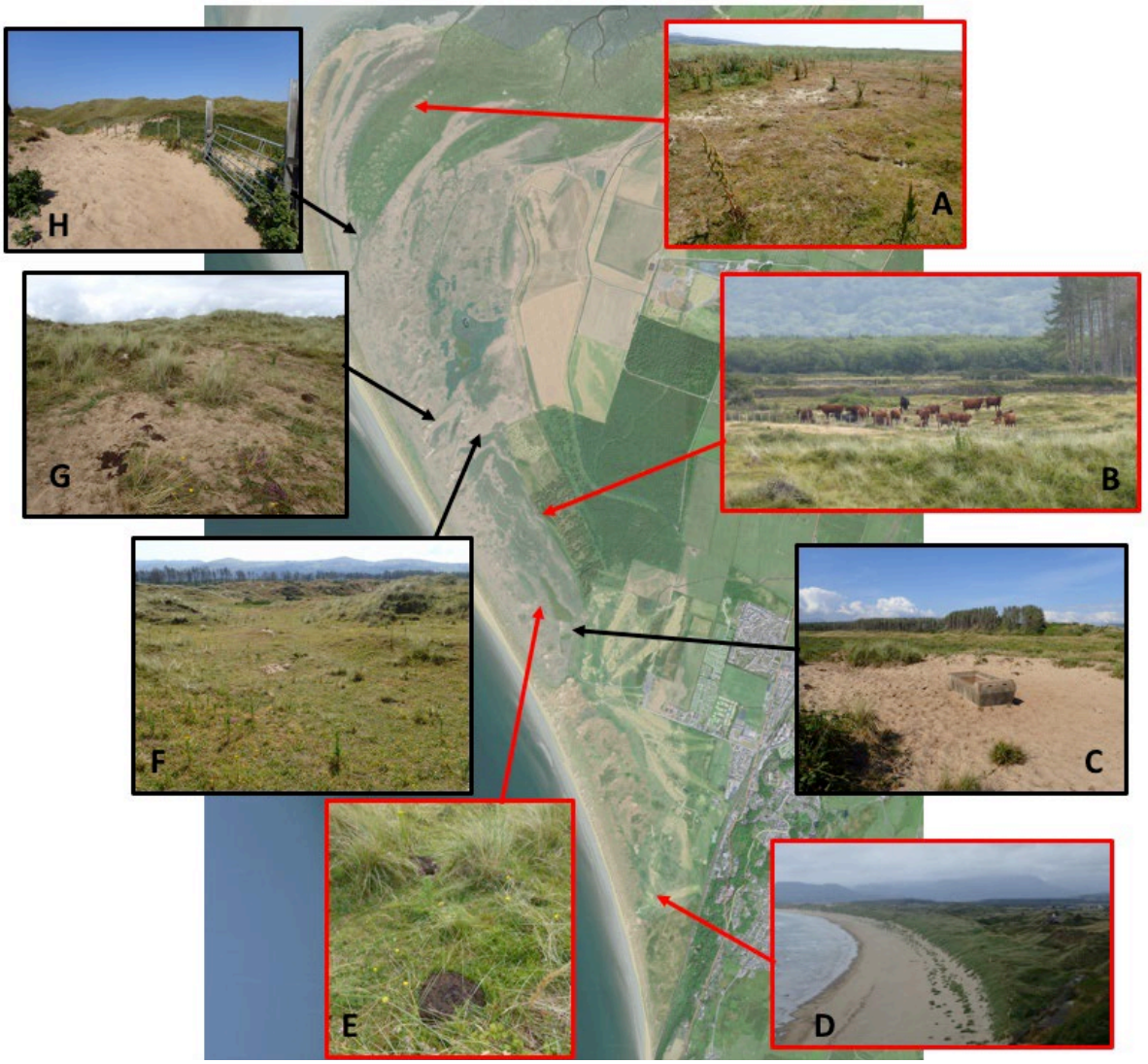

Figure 10. Areas of suitable and unsuitable habitat for *O. nuchicornis* at Morfa Harlech. Black arrows indicate suitable habitat and red arrows unsuitable.

To the south-west of the Rabbit Warren (SH562337), a fresh dung pat was found with several dead *Lucilla sericata* flies (Diptera: Calliphoridae) on top (Figure 11). The reason for the fly fatalities was unclear but may have been due to the use of veterinary parasiticides such as ivermectin for intestinal worm control. There is compelling evidence to support the damaging effects of parasiticides on dung fauna at lethal and sub-lethal levels because the chemical residues are largely unmetabolized and retain insecticidal properties when excreted in dung. For example, O'Hea *et al.* (2010) report a significant reduction of larval developmental rates and survival for *Acrossus rufipes* and *Agrilinus ater* when exposed to ivermectin treated dung. Conforti *et al.* (2018) concluded that adult sepsid flies were unable to distinguish between ivermectin treated and untreated dung and noted pronounced lethal and sublethal effects (adult fecundity and longevity) on exposure

at ecological relevant concentrations. Whilst a contractual agreement with graziers may prohibit the use of chemical wormers on grazing livestock, it can be difficult to enforce.

Figure 11. Dead flies found on a cow pat near the rabbit warren.

5.2. Non-target Dung Beetle species

A total of 230 records of 562 individuals of eighteen Scarabaeoidea species were recorded during the survey period. A summary of these are shown below in Table 2. Species descriptions are given in Appendix 1 and a list of all records given in Appendix 2. Of note were the number of *Esymus merdarius* recorded, a species that has undergone a decline and is considered Nationally Scarce. Also, the first modern record of *Bodilopsis ictericus* since Skidmore's record of 9th September 1972 (NRS, 2020) and probable new site records for *Acrossus luridus, Esymus pusillus* and *Planolinus borealis*.

Table 2. A summary of the non-target dung beetle species recorded.

Taxon	Quantity	Taxon	Quantity
Acrossus depressus	5	*Bodilopsis ictericus*	56
Acrossus luridus	1	*Bopilopsis rufa*	7
Acrossus rufipes	98	*Esymus merdarius*	34
Aegialia arenaria	68	*Esymus pusillus*	1
Agilinus ater	3	*Onthophagus similis*	89
Anomala dubia	29	*Otophorus haemorrhoidalis*	27
Aphodius fimetarius	7	*Planolinus borealis*	3
Aphodius foetidus	6	*Rhodaphodius foetens*	56
Aphodius pedellus	42	*Teuchestes fossor*	30
-	-	-	562

6. Management recommendations

The feeding and breeding requirements of *O. nuchicornis* need to be met in order to support a healthy population. Although the beetle is often found in dog faeces (e.g. Cooter, 1990; Mann & Mann, unpub. obs.), it is unlikely that this source of food could sustain healthy populations, especially considering the recent trend of bagging dog faeces and the anti-fouling legislation and enforcement. *O. nuchicornis* may also gain some nutritional benefit from large rabbit middens and badger faeces but breeding requirements are unlikely to be met from these food sources. *O. nuchicornis* requires good quality dung on exposed dry sand on which to breed.

It is therefore essential that continuity of grazing is maintained as the greatest threat comes from the reduction or cessation of dung availability in areas of suitable habitat, particularly during the breeding season between April and September. The cessation of grazing for just one season, or even part of the breeding season, would have devastating effects on the dung beetle's population.

In order to support both the feeding and breeding requirements of *O. nuchicornis*, the following recommendations are suggested:

- maintain continuity of the current levels of cattle grazing as a minimum. This is particularly important during the beetles breeding season between April and September;
- encourage dung deposition in areas of suitable habitat. If possible, by restricting access to the less favourable habitat for short periods of time so that grazing animal welfare needs are not compromised;
- increase disturbance to create more areas of open sand particularly along the fore dunes to the north-west of the rabbit warren. Mechanical disturbance has been used to great effect at Kenfig and Merthyr Mawr reserves, both of which have retained good population levels of *O. nuchicornis*;
- treatment of livestock on-site with veterinary products should be avoided or at the least minimised. The use of macrocyclic lactone treatments such as ivermectin on livestock should be actively discouraged. Worm burden should be monitored through faecal egg counts and treatment should only be carried out when necessary. Treatment of livestock, when required, should be conducted off-site and the animals not returned for at least 14 days;
- a targeted reintroduction programme could be considered with a small number of 50-60 individuals relocated from either Kenfig or Merthyr Mawr, with the proviso that habitat suitability is increased, and grazing continuity is maintained;
- raise public awareness on the importance of livestock on dune systems and the wider ecological benefits of dung beetles. This may be via an on-site notice board, online information or targeted events such as walk and talk tours.

7. Acknowledgements

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9. Appendices

Appendix 1. Non-target Dung Beetles recorded at Morfa Harlech in 2019.

Below is an alphabetical list with descriptions for the non-target species recorded during the 2019 survey. Full data is available in Appendix 2.

Acrossus depressus (Kugelann, 1792)
Aphodius depressus (Kugelann, 1792)

Status: Native, widespread **Activity Period:** April-June **Comments:** A widespread species across the UK. It occurs in grassland habitats and utilises the dung of cattle, sheep, and horse. Size = 6-9mm.

Acrossus luridus (Fabricius, 1775)
Aphodius luridus (Fabricius, 1775)

Status: Native, widespread **Activity Period:** June-September **Comments:** A widespread species across the UK. It occurs in well drained grassland habitats and utilises the dung of cattle and sheep. Size = 6-9mm.

Acrossus rufipes (Linnaeus, 1758)
Aphodius rufipes (Linnaeus, 1758)

Status: Native, widespread **Activity Period:** June-September **Comments:** This is one of the most widespread and abundant species in the UK. Occurring in all types of habitats and utilises the dung of cattle, sheep, and horse. This species is also attracted to light. Size = 9-13mm.

Aegialia arenaria (Fabricius, 1787)

Status: Native, widespread **Activity Period:** April-October **Comments:** This species is restricted to coastal dune systems, where it can often be abundant. A saprophagous species that is often seen wandering on loose sand or in sand at the base of plants. Size = 2-4mm.

Agrilinus ater (De Geer, 1774)
Aphodius ater (De Geer, 1774)

Status: Native, widespread **Activity Period**: April-July **Comments:** A widespread and abundant species in the UK, occurring in all habitats, though most abundant on open grasslands. It will feed on all dung types but prefers sheep dung. Size = 4-6mm.

Anomala dubia (Scopoli, 1763)
Anomala aenea (DeGeer, 1774)
Anomala frischii (Fabricius, 1775)

Dune Chafer
Status: Native, local **Activity Period**: May-July **Comments:** The dune chafer is restricted to sandy soils, and almost exclusively to coastal sand dune systems. It is expected to be widespread across the dunes in Wales. Size = 12-15mm.

Aphodius fimetarius (Linnaeus, 1758)

Status: Native, widespread **Activity Period**: March-October **Comments:** A widespread and abundant species in the southern half of the UK, becoming local in the North. A species of most habitats, but most abundant on open grasslands with light soils. It will feed on all dung types but prefers old cattle dung. Size = 5-8mm.

Aphodius foetidus (Herbst, 1783)

Aphodius foetidus (Herbst, 1783)
Aphodius scybalarius auct. nec (Fabricius, 1781)

Status: Native, widespread **Activity Period**: April-July; October **Comments:** Widespread. It is associated with open grasslands and shows a preference for sandy soils, feeding on most types of dung. Size = 5-8mm.

Aphodius pedellus (De Geer, 1774)

Aphodius fimetarius sensu auctt. partim non (Linnaeus, 1758)

Status: Native, widespread **Activity Period**: March-October **Comments:** A widespread and abundant species in the UK, occurring in all habitats. It will feed on all dung types but prefers old cattle dung. Size = 5-8mm.

Bodiloides ictericus (Laicharting, 1781)

Aphodius ictericus (Laicharting, 1781)

Status: Native, **Nationally Scarce** **Activity Period**: June-October **Comments:** This species occurs in all types of dung but is often associated with older dry dung and shows a strong preference for exposed habitats with light soils. Size = 3-6mm

Bodilopsis rufa (Moll, 1782)
Aphodius rufus (Moll, 1782)
Aphodius rufesens (Fabricius, 1801)

Status: Native, Widespread **Activity Period**: June-September **Comments:** A widespread and abundant in the UK. It is one of most variable species, ranging in colour from almost black to straw yellow. Such variation makes it one of the more difficult species to identify. It is summer active, occurring in a range of habitats in all types of dung. Size = 5-7mm.

Esymus merdarius (Fabricius, 1775)
Aphodius merdarius (Fabricius, 1775)

Status: Native, **Nationally Scarce** **Activity period:** May-August **Comments:** This species has undergone a decline in the UK, likely due to the increase of 'poo picking' from horse grazed pasture. An open grassland species with a preference for fresh horse dung. Size = 4-5mm.

Esymus pusillus (Herbst, 1789)
Aphodius pusillus (Herbst, 1789)

Status: Native, widespread **Activity period:** April-July **Comments:** A species of open grassland occurring in all types of dung, with a preference for sheep dung. Size = 3-5mm.

Onthophagus similis (Scriba, 1790)

Onthophagus fracticornis sensu auctt. Brit. non (Preyssler, 1790)

Status: Native, widespread in southern England and Wales. Absent from Scotland **Activity Period**: April-September **Comments:** This species occurs in all types of dung including dog faeces in a wide variety of habitats but prefers well drained soils.
Size = 4-7mm.

Otophorus haemorrhoidalis (Linnaeus, 1758)

Aphodius haemorrhoidalis (Linnaeus, 1758)

Status: Native, widespread **Activity Period**: May-August **Comments:** This species occurs in all types of dung on open grasslands, with a preference for medium aged cattle dung. Size = 4-5mm

Planolinus borealis (Gyllenhal, 1827)

Aphodius borealis (Gyllenhal, 1827)

Status: Native, local **Activity Period**: May-September **Comments:** This species occurs in all types of dung including deer droppings in shaded habitats and occasionally dunes in the north and west. Size = 3-6mm.

Rhodaphodius foetens (Fabricius, 1787)

Aphodius foetens (Fabricius, 1787)

Aphodius aestivalis Stephens, 1839

Status: Native, widespread **Activity Period**: June-September **Comments:** This summer active species occurs widely in the UK, preferring open grasslands. It can be found in all types of dung, though it prefers older cattle and horse dung. Size 5-7mm.

Teuchestes fossor (Linnaeus, 1758)

Aphodius fossor (Linnaeus, 1758)

Status: Native, widespread **Activity Period**: May-August **Comments:** A widespread and often abundant species associated with all grassland habitats and feeds on most dung types but appears to only breed in cattle dung. Size = 8-11mm.

Appendix 2. Dung beetle records from the 2019 survey.

Species	Site	Quantity	Date	Method
Aphodius fimetarius	Glan-y-morfa (SH580350)	2	16-Jul-19	Cattle Dung
Aphodius pedellus	Glan-y-morfa (SH580350)	2	16-Jul-19	Cattle Dung
Onthophagus similis	Glan-y-morfa (SH580350)	5	16-Jul-19	Cattle Dung
Teuchestes fossor	Glan-y-morfa (SH580350)	6	16-Jul-19	Cattle Dung
Aegialia arenaria	Morfa Harlech NNR (SH556346)	1	16-Jul-19	Cattle Dung
Bodiliodes ictericus	Morfa Harlech NNR (SH556346)	2	16-Jul-19	Cattle Dung
Bodilopsis rufa	Morfa Harlech NNR (SH556346)	1	16-Jul-19	Cattle Dung
Bodiliodes ictericus	Morfa Harlech NNR (SH556348)	12	16-Jul-19	Cattle Dung
Bodiliodes ictericus	Morfa Harlech NNR (SH557349)	21	16-Jul-19	Cattle Dung
Aphodius pedellus	Morfa Harlech NNR (SH558340)	2	16-Jul-19	Cattle Dung
Planolinus borealis	Morfa Harlech NNR (SH558340)	1	16-Jul-19	Cattle Dung
Rhodaphodius foetens	Morfa Harlech NNR (SH558340)	4	16-Jul-19	Cattle Dung
Acrossus rufipes	Morfa Harlech NNR (SH558342)	26	16-Jul-19	Cattle Dung
Agrilinus ater	Morfa Harlech NNR (SH558342)	1	16-Jul-19	Cattle Dung
Aphodius fimetarius	Morfa Harlech NNR (SH558342)	3	16-Jul-19	Cattle Dung
Aphodius foetidus	Morfa Harlech NNR (SH558342)	2	16-Jul-19	Cattle Dung
Aphodius pedellus	Morfa Harlech NNR (SH558342)	3	16-Jul-19	Cattle Dung
Bodiliodes ictericus	Morfa Harlech NNR (SH558342)	1	16-Jul-19	Cattle Dung
Bodilopsis rufa	Morfa Harlech NNR (SH558342)	2	16-Jul-19	Cattle Dung
Onthophagus similis	Morfa Harlech NNR (SH558342)	3	16-Jul-19	Cattle Dung
Otophorus haemorrhoidalis	Morfa Harlech NNR (SH558342)	1	16-Jul-19	Cattle Dung
Rhodaphodius foetens	Morfa Harlech NNR (SH558342)	8	16-Jul-19	Cattle Dung
Teuchestes fossor	Morfa Harlech NNR (SH558342)	2	16-Jul-19	Cattle Dung
Acrossus rufipes	Morfa Harlech NNR (SH558343)	3	16-Jul-19	Cattle Dung
Bodiliodes ictericus	Morfa Harlech NNR (SH558343)	1	16-Jul-19	Cattle Dung
Otophorus haemorrhoidalis	Morfa Harlech NNR (SH558343)	1	16-Jul-19	Cattle Dung
Bodiliodes ictericus	Morfa Harlech NNR (SH558345)	1	16-Jul-19	Cattle Dung
Rhodaphodius foetens	Morfa Harlech NNR (SH558345)	1	16-Jul-19	Cattle Dung
Bodiliodes ictericus	Morfa Harlech NNR (SH558351)	1	16-Jul-19	Cattle Dung
Esymus pusillus	Morfa Harlech NNR (SH558351)	1	16-Jul-19	Cattle Dung
Onthophagus similis	Morfa Harlech NNR (SH558351)	1	16-Jul-19	Cattle Dung
Otophorus haemorrhoidalis	Morfa Harlech NNR (SH558351)	1	16-Jul-19	Cattle Dung
Acrossus rufipes	Morfa Harlech NNR (SH559336)	1	18-Jul-19	Cattle Dung
Onthophagus similis	Morfa Harlech NNR (SH559336)	1	18-Jul-19	Cattle Dung
Rhodaphodius foetens	Morfa Harlech NNR (SH559336)	1	18-Jul-19	Cattle Dung
Acrossus rufipes	Morfa Harlech NNR (SH559337)	4	18-Jul-19	Cattle Dung
Rhodaphodius foetens	Morfa Harlech NNR (SH559337)	2	18-Jul-19	Cattle Dung
Acrossus rufipes	Morfa Harlech NNR (SH559339)	1	18-Jul-19	Cattle Dung
Aphodius pedellus	Morfa Harlech NNR (SH559339)	2	18-Jul-19	Cattle Dung

Species	Site	Quantity	Date	Method
Bodilopsis rufa	Morfa Harlech NNR (SH559339)	1	18-Jul-19	Cattle Dung
Rhodaphodius foetens	Morfa Harlech NNR (SH559339)	1	18-Jul-19	Cattle Dung
Acrossus depressus	Morfa Harlech NNR (SH559340)	1	18-Jul-19	Cattle Dung
Aphodius fimetarius	Morfa Harlech NNR (SH559340)	1	18-Jul-19	Cattle Dung
Onthophagus similis	Morfa Harlech NNR (SH559340)	1	18-Jul-19	Cattle Dung
Otophorus haemorrhoidalis	Morfa Harlech NNR (SH559340)	2	18-Jul-19	Cattle Dung
Planolinus borealis	Morfa Harlech NNR (SH559340)	1	18-Jul-19	Cattle Dung
Rhodaphodius foetens	Morfa Harlech NNR (SH559340)	3	18-Jul-19	Cattle Dung
Acrossus rufipes	Morfa Harlech NNR (SH559352)	1	16-Jul-19	Cattle Dung
Acrossus rufipes	Morfa Harlech NNR (SH559352)	1	16-Jul-19	Cattle Dung
Aphodius pedellus	Morfa Harlech NNR (SH559352)	1	16-Jul-19	Cattle Dung
Bodilopsis rufa	Morfa Harlech NNR (SH559352)	1	16-Jul-19	Cattle Dung
Rhodaphodius foetens	Morfa Harlech NNR (SH559352)	1	16-Jul-19	Cattle Dung
Acrossus rufipes	Morfa Harlech NNR (SH560337)	1	16-Jul-19	Cattle Dung
Aphodius pedellus	Morfa Harlech NNR (SH560337)	3	16-Jul-19	Cattle Dung
Rhodaphodius foetens	Morfa Harlech NNR (SH560337)	1	16-Jul-19	Cattle Dung
Rhodaphodius foetens	Morfa Harlech NNR (SH560339)	1	16-Jul-19	Cattle Dung
Acrossus rufipes	Morfa Harlech NNR (SH560340)	2	18-Jul-19	Cattle Dung
Aphodius fimetarius	Morfa Harlech NNR (SH560340)	1	18-Jul-19	Cattle Dung
Bodilopsis rufa	Morfa Harlech NNR (SH560340)	1	18-Jul-19	Cattle Dung
Rhodaphodius foetens	Morfa Harlech NNR (SH560340)	3	18-Jul-19	Cattle Dung
Acrossus rufipes	Morfa Harlech NNR (SH560342)	1	16-Jul-19	Cattle Dung
Aphodius fimetarius	Morfa Harlech NNR (SH560342)	1	16-Jul-19	Cattle Dung
Aphodius pedellus	Morfa Harlech NNR (SH560342)	3	16-Jul-19	Cattle Dung
Onthophagus similis	Morfa Harlech NNR (SH560342)	1	16-Jul-19	Cattle Dung
Onthophagus similis	Morfa Harlech NNR (SH560342)	2	16-Jul-19	Cattle Dung
Rhodaphodius foetens	Morfa Harlech NNR (SH560342)	4	16-Jul-19	Cattle Dung
Teuchestes fossor	Morfa Harlech NNR (SH560352)	1	16-Jul-19	Cattle Dung
Acrossus rufipes	Morfa Harlech NNR (SH560353)	1	16-Jul-19	Cattle Dung
Aphodius foetidus	Morfa Harlech NNR (SH560353)	2	16-Jul-19	Cattle Dung
Bodiliodes ictericus	Morfa Harlech NNR (SH560353)	1	16-Jul-19	Cattle Dung
Bodiliodes ictericus	Morfa Harlech NNR (SH560353)	5	16-Jul-19	Cattle Dung
Bodilopsis rufa	Morfa Harlech NNR (SH560353)	1	16-Jul-19	Cattle Dung
Planolinus borealis	Morfa Harlech NNR (SH560353)	1	16-Jul-19	Cattle Dung
Acrossus rufipes	Morfa Harlech NNR (SH561333)	6	18-Jul-19	Cattle Dung
Aphodius foetidus	Morfa Harlech NNR (SH561333)	1	16-Jul-19	Cattle Dung
Rhodaphodius foetens	Morfa Harlech NNR (SH561333)	3	16-Jul-19	Cattle Dung
Rhodaphodius foetens	Morfa Harlech NNR (SH561333)	2	18-Jul-19	Cattle Dung
Onthophagus similis	Morfa Harlech NNR (SH561340)	1	18-Jul-19	Baited Pitfall Trap
Rhodaphodius foetens	Morfa Harlech NNR (SH561340)	1	18-Jul-19	Baited Pitfall Trap

Species	Site	Quantity	Date	Method
Aphodius pedellus	Morfa Harlech NNR (SH561341)	1	16-Jul-19	Cattle Dung
Onthophagus similis	Morfa Harlech NNR (SH561341)	1	16-Jul-19	Cattle Dung
Teuchestes fossor	Morfa Harlech NNR (SH561342)	2	16-Jul-19	Cattle Dung
Aphodius foetidus	Morfa Harlech NNR (SH562331)	1	16-Jul-19	Cattle Dung
Onthophagus similis	Morfa Harlech NNR (SH562331)	5	16-Jul-19	Cattle Dung
Onthophagus similis	Morfa Harlech NNR (SH562331)	1	18-Jul-19	Baited Pitfall Trap
Rhodaphodius foetens	Morfa Harlech NNR (SH562331)	1	16-Jul-19	Cattle Dung
Rhodaphodius foetens	Morfa Harlech NNR (SH562333)	1	18-Jul-19	Cattle Dung
Acrossus rufipes	Morfa Harlech NNR (SH562335)	1	18-Jul-19	Baited Pitfall Trap
Esymus merdarius	Morfa Harlech NNR (SH562335)	1	18-Jul-19	Baited Pitfall Trap
Acrossus rufipes	Morfa Harlech NNR (SH562338)	6	18-Jul-19	Cattle Dung
Aphodius pedellus	Morfa Harlech NNR (SH562338)	2	18-Jul-19	Cattle Dung
Esymus merdarius	Morfa Harlech NNR (SH562338)	4	18-Jul-19	Baited Pitfall Trap
Onthophagus similis	Morfa Harlech NNR (SH562338)	6	18-Jul-19	Baited Pitfall Trap
Rhodaphodius foetens	Morfa Harlech NNR (SH562338)	4	18-Jul-19	Cattle Dung
Rhodaphodius foetens	Morfa Harlech NNR (SH562338)	1	18-Jul-19	Baited Pitfall Trap
Aphodius pedellus	Morfa Harlech NNR (SH562352)	1	16-Jul-19	Cattle Dung
Bodiliodes ictericus	Morfa Harlech NNR (SH562352)	1	16-Jul-19	Cattle Dung
Teuchestes fossor	Morfa Harlech NNR (SH562352)	1	16-Jul-19	Cattle Dung
Acrossus rufipes	Morfa Harlech NNR (SH563334)	3	16-Jul-19	Cattle Dung
Aphodius pedellus	Morfa Harlech NNR (SH563334)	1	16-Jul-19	Cattle Dung
Rhodaphodius foetens	Morfa Harlech NNR (SH563334)	1	16-Jul-19	Cattle Dung
Bodiliodes ictericus	Morfa Harlech NNR (SH563352)	4	16-Jul-19	Cattle Dung
Otophorus haemorrhoidalis	Morfa Harlech NNR (SH563352)	1	16-Jul-19	Cattle Dung
Acrossus rufipes	Morfa Harlech NNR (SH564326)	1	18-Jul-19	Cattle Dung
Teuchestes fossor	Morfa Harlech NNR (SH564326)	1	18-Jul-19	Cattle Dung
Anomala dubia	Morfa Harlech NNR (SH564329)	1	18-Jul-19	Found dead
Esymus merdarius	Morfa Harlech NNR (SH564329)	3	18-Jul-19	Baited Pitfall Trap
Acrossus rufipes	Morfa Harlech NNR (SH564352)	1	16-Jul-19	Cattle Dung
Aphodius fimetarius	Morfa Harlech NNR (SH564352)	1	16-Jul-19	Cattle Dung
Teuchestes fossor	Morfa Harlech NNR (SH564352)	1	16-Jul-19	Cattle Dung
Acrossus rufipes	Morfa Harlech NNR (SH565325)	1	18-Jul-19	Cattle Dung
Aphodius pedellus	Morfa Harlech NNR (SH565325)	1	18-Jul-19	Cattle Dung
Teuchestes fossor	Morfa Harlech NNR (SH565325)	1	18-Jul-19	Cattle Dung
Acrossus rufipes	Morfa Harlech NNR (SH565329)	1	15-Jul-19	Cattle Dung
Acrossus rufipes	Morfa Harlech NNR (SH565329)	4	18-Jul-19	Cattle Dung
Agrilinus ater	Morfa Harlech NNR (SH565329)	2	15-Jul-19	Cattle Dung
Aphodius pedellus	Morfa Harlech NNR (SH565329)	1	15-Jul-19	Cattle Dung
Bodiliodes ictericus	Morfa Harlech NNR (SH565329)	2	15-Jul-19	Cattle Dung
Onthophagus similis	Morfa Harlech NNR (SH565329)	4	15-Jul-19	Cattle Dung

Species	Site	Quantity	Date	Method
Otophorus haemorrhoidalis	Morfa Harlech NNR (SH565329)	3	15-Jul-19	Cattle Dung
Otophorus haemorrhoidalis	Morfa Harlech NNR (SH565329)	1	18-Jul-19	Cattle Dung
Teuchestes fossor	Morfa Harlech NNR (SH565329)	1	18-Jul-19	Cattle Dung
Acrossus depressus	Morfa Harlech NNR (SH565330)	2	15-Jul-19	Cattle Dung
Acrossus rufipes	Morfa Harlech NNR (SH565330)	1	15-Jul-19	Cattle Dung
Bodiliodes ictericus	Morfa Harlech NNR (SH565330)	2	15-Jul-19	Cattle Dung
Esymus merdarius	Morfa Harlech NNR (SH565330)	1	18-Jul-19	Cattle Dung
Onthophagus similis	Morfa Harlech NNR (SH565330)	3	15-Jul-19	Cattle Dung
Otophorus haemorrhoidalis	Morfa Harlech NNR (SH565330)	1	15-Jul-19	Cattle Dung
Rhodaphodius foetens	Morfa Harlech NNR (SH565330)	1	18-Jul-19	Cattle Dung
Teuchestes fossor	Morfa Harlech NNR (SH565330)	1	18-Jul-19	Cattle Dung
Acrossus rufipes	Morfa Harlech NNR (SH565331)	4	15-Jul-19	Cattle Dung
Aphodius pedellus	Morfa Harlech NNR (SH565331)	1	15-Jul-19	Cattle Dung
Onthophagus similis	Morfa Harlech NNR (SH565331)	2	15-Jul-19	Cattle Dung
Otophorus haemorrhoidalis	Morfa Harlech NNR (SH565331)	1	15-Jul-19	Cattle Dung
Rhodaphodius foetens	Morfa Harlech NNR (SH565331)	1	15-Jul-19	Cattle Dung
Rhodaphodius foetens	Morfa Harlech NNR (SH565331)	1	15-Jul-19	Cattle Dung
Teuchestes fossor	Morfa Harlech NNR (SH565331)	1	15-Jul-19	Cattle Dung
Teuchestes fossor	Morfa Harlech NNR (SH565331)	1	15-Jul-19	Cattle Dung
Anomala dubia	Morfa Harlech NNR (SH566320)	1	18-Jul-19	Found dead
Acrossus rufipes	Morfa Harlech NNR (SH566331)	2	16-Jul-19	Cattle Dung
Acrossus rufipes	Morfa Harlech NNR (SH566331)	2	18-Jul-19	Cattle Dung
Aphodius pedellus	Morfa Harlech NNR (SH566331)	2	15-Jul-19	Cattle Dung
Esymus merdarius	Morfa Harlech NNR (SH566331)	1	18-Jul-19	Cattle Dung
Esymus merdarius	Morfa Harlech NNR (SH566331)	9	18-Jul-19	Baited Pitfall Trap
Onthophagus similis	Morfa Harlech NNR (SH566331)	3	16-Jul-19	Badger dung
Onthophagus similis	Morfa Harlech NNR (SH566331)	1	18-Jul-19	Cattle Dung
Onthophagus similis	Morfa Harlech NNR (SH566331)	20	18-Jul-19	Baited Pitfall Trap
Otophorus haemorrhoidalis	Morfa Harlech NNR (SH566331)	1	15-Jul-19	Cattle Dung
Otophorus haemorrhoidalis	Morfa Harlech NNR (SH566331)	1	16-Jul-19	Cattle Dung
Rhodaphodius foetens	Morfa Harlech NNR (SH566331)	2	16-Jul-19	Cattle Dung
Rhodaphodius foetens	Morfa Harlech NNR (SH566331)	2	18-Jul-19	Cattle Dung
Teuchestes fossor	Morfa Harlech NNR (SH566331)	1	15-Jul-19	Cattle Dung
Teuchestes fossor	Morfa Harlech NNR (SH566331)	1	16-Jul-19	Cattle Dung
Onthophagus similis	Morfa Harlech NNR (SH566332)	14	16-Jul-19	Cattle Dung
Otophorus haemorrhoidalis	Morfa Harlech NNR (SH566332)	1	16-Jul-19	Cattle Dung
Acrossus rufipes	Morfa Harlech NNR (SH567321)	3	18-Jul-19	Cattle Dung
Otophorus haemorrhoidalis	Morfa Harlech NNR (SH567321)	2	18-Jul-19	Cattle Dung
Teuchestes fossor	Morfa Harlech NNR (SH567321)	4	18-Jul-19	Cattle Dung
Aphodius pedellus	Morfa Harlech NNR (SH567329)	5	18-Jul-19	Cattle Dung

Species	Site	Quantity	Date	Method
Rhodaphodius foetens	Morfa Harlech NNR (SH567329)	2	18-Jul-19	Cattle Dung
Teuchestes fossor	Morfa Harlech NNR (SH567329)	2	18-Jul-19	Cattle Dung
Acrossus depressus	Morfa Harlech NNR (SH567330)	1	15-Jul-19	Cattle Dung
Acrossus rufipes	Morfa Harlech NNR (SH567330)	1	15-Jul-19	Cattle Dung
Acrossus rufipes	Morfa Harlech NNR (SH567330)	4	15-Jul-19	Cattle Dung
Acrossus rufipes	Morfa Harlech NNR (SH567330)	6	15-Jul-19	Cattle Dung
Aphodius pedellus	Morfa Harlech NNR (SH567330)	1	15-Jul-19	Cattle Dung
Aphodius pedellus	Morfa Harlech NNR (SH567330)	1	15-Jul-19	Cattle Dung
Onthophagus similis	Morfa Harlech NNR (SH567330)	3	15-Jul-19	Cattle Dung
Onthophagus similis	Morfa Harlech NNR (SH567330)	1	15-Jul-19	Cattle Dung
Onthophagus similis	Morfa Harlech NNR (SH567330)	3	18-Jul-19	Cattle Dung
Otophorus haemorrhoidalis	Morfa Harlech NNR (SH567330)	2	18-Jul-19	Cattle Dung
Rhodaphodius foetens	Morfa Harlech NNR (SH567330)	1	15-Jul-19	Cattle Dung
Acrossus depressus	Morfa Harlech NNR (SH567331)	1	15-Jul-19	Cattle Dung
Acrossus luridus	Morfa Harlech NNR (SH567331)	1	15-Jul-19	Cattle Dung
Bodiliodes ictericus	Morfa Harlech NNR (SH567331)	1	15-Jul-19	Cattle Dung
Onthophagus similis	Morfa Harlech NNR (SH567331)	3	15-Jul-19	Cattle Dung
Otophorus haemorrhoidalis	Morfa Harlech NNR (SH567331)	1	15-Jul-19	Cattle Dung
Acrossus rufipes	Morfa Harlech NNR (SH567332)	2	15-Jul-19	Cattle Dung
Acrossus rufipes	Morfa Harlech NNR (SH567332)	2	15-Jul-19	Cattle Dung
Acrossus rufipes	Morfa Harlech NNR (SH567332)	4	15-Jul-19	Cattle Dung
Aphodius pedellus	Morfa Harlech NNR (SH567332)	6	15-Jul-19	Cattle Dung
Aphodius pedellus	Morfa Harlech NNR (SH567332)	1	15-Jul-19	Cattle Dung
Otophorus haemorrhoidalis	Morfa Harlech NNR (SH567332)	1	15-Jul-19	Cattle Dung
Rhodaphodius foetens	Morfa Harlech NNR (SH567332)	1	15-Jul-19	Cattle Dung
Teuchestes fossor	Morfa Harlech NNR (SH567332)	4	15-Jul-19	Cattle Dung
Aegialia arenaria	Morfa Harlech NNR (SH568317)	1	18-Jul-19	Crawling on sand
Anomala dubia	Morfa Harlech NNR (SH569315)	4	15-Jul-19	In flight
Anomala dubia	Morfa Harlech NNR (SH569316)	4	15-Jul-19	In flight
Esymus merdarius	Morfa Harlech NNR (SH569316)	2	17-Jul-19	Baited Pitfall Trap
Aphodius pedellus	Morfa Harlech NNR (SH569317)	3	15-Jul-19	Cattle Dung
Esymus merdarius	Morfa Harlech NNR (SH569318)	1	17-Jul-19	Baited Pitfall Trap
Acrossus rufipes	Morfa Harlech NNR (SH569322)	1	15-Jul-19	Cattle Dung
Onthophagus similis	Morfa Harlech NNR (SH569322)	4	15-Jul-19	Cattle Dung
Otophorus haemorrhoidalis	Morfa Harlech NNR (SH569322)	4	15-Jul-19	Cattle Dung
Anomala dubia	Morfa Harlech NNR (SH570311)	1	15-Jul-19	Found dead
Aegialia arenaria	Morfa Harlech NNR (SH570312)	2	17-Jul-19	Crawling on sand
Anomala dubia	Morfa Harlech NNR (SH570314)	2	15-Jul-19	In flight
Esymus merdarius	Morfa Harlech NNR (SH570320)	8	17-Jul-19	Baited Pitfall Trap
Onthophagus similis	Morfa Harlech NNR (SH570320)	3	17-Jul-19	Baited Pitfall Trap

Species	Site	Quantity	Date	Method
Otophorus haemorrhoidalis	Morfa Harlech NNR (SH570320)	1	15-Jul-19	Cattle Dung
Otophorus haemorrhoidalis	Morfa Harlech NNR (SH570320)	1	17-Jul-19	Cattle Dung
Teuchestes fossor	Morfa Harlech NNR (SH570320)	1	17-Jul-19	Cattle Dung
Aegialia arenaria	Morfa Harlech NNR (SH571308)	1	15-Jul-19	Found dead
Aegialia arenaria	Morfa Harlech NNR (SH571310)	30	17-Jul-19	Crawling on sand
Anomala dubia	Morfa Harlech NNR (SH571311)	1	15-Jul-19	In flight
Esymus merdarius	Morfa Harlech NNR (SH571313)	1	17-Jul-19	Baited Pitfall Trap
Onthophagus similis	Morfa Harlech NNR (SH571313)	1	17-Jul-19	Baited Pitfall Trap
Anomala dubia	Morfa Harlech NNR (SH572305)	3	15-Jul-19	In flight
Aegialia arenaria	Morfa Harlech NNR (SH572306)	10	17-Jul-19	Crawling on sand
Aegialia arenaria	Morfa Harlech NNR (SH572307)	1	15-Jul-19	Found dead
Anomala dubia	Morfa Harlech NNR (SH572307)	7	15-Jul-19	In flight
Esymus merdarius	Morfa Harlech NNR (SH572307)	3	17-Jul-19	Baited Pitfall Trap
Anomala dubia	Morfa Harlech NNR (SH573300)	1	17-Jul-19	Crawling on sand
Aegialia arenaria	Morfa Harlech NNR (SH573301)	10	17-Jul-19	Crawling on sand
Aegialia arenaria	Morfa Harlech NNR (SH573303)	6	17-Jul-19	Crawling on sand
Anomala dubia	Morfa Harlech NNR (SH573303)	1	17-Jul-19	Crawling on sand
Aegialia arenaria	Morfa Harlech NNR (SH573304)	2	17-Jul-19	Found dead
Anomala dubia	Morfa Harlech NNR (SH573304)	1	17-Jul-19	Found dead
Anomala dubia	Morfa Harlech NNR (SH573305)	1	15-Jul-19	Found dead
Aegialia arenaria	Morfa Harlech NNR (SH574299)	4	17-Jul-19	Crawling on sand
Anomala dubia	Morfa Harlech NNR (SH574299)	1	17-Jul-19	Dead (found)
Aphodius fimetarius	Morfa Harlech NNR (SH578350)	1	16-Jul-19	Cattle Dung
Aphodius pedellus	Morfa Harlech NNR (SH578350)	1	16-Jul-19	Cattle Dung
Bodiliodes ictericus	Morfa Harlech NNR (SH578350)	1	16-Jul-19	Cattle Dung
Onthophagus similis	Morfa Harlech NNR (SH578350)	1	16-Jul-19	Cattle Dung
Rhodaphodius foetens	Morfa Harlech NNR (SH578350)	1	16-Jul-19	Cattle Dung
Teuchestes fossor	Morfa Harlech NNR (SH578350)	4	16-Jul-19	Cattle Dung
Agrilinus ater	Ty Canol Farm field (SH578329)	3	18-Jul-19	Sheep Dung
Bodiliodes ictericus	Ty Canol Farm field (SH578329)	4	18-Jul-19	Sheep Dung
Onthophagus similis	Ty Canol Farm field (SH578329)	8	18-Jul-19	Sheep Dung

10. Data Archive Appendix

The data archive contains:

[A] The final report in Microsoft Word and Adobe PDF formats.

[B] Species records, which are held on the NRW Recorder 6 database.

Metadata for this project is publicly accessible through Natural Resources Wales' Library Catalogue http://libcat.naturalresources.wales or http://catllyfr.cyfoethnaturiol.cymru by searching 'Dataset Titles'. The metadata is held as record no. 124735.