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The status of the gipsywort weevil *Datonychus arquatus* on Pembrey Air Weapons Range in 2016

Adrian Fowles

NRW Evidence Report No. 180

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Maes Arfau Awyr Pen-bre (SN3604) yw'r unig le yn Ynysoedd Prydain lle y gwyddys fod gwiddonyn llysiau'r sipsiwn *Datonychus arquatus*, a ddosberthir ym Mhrydain fel Llyfr Data Coch: Amhendant, i'w gael, sef y fan y'i darganfuwyd gyntaf yn 1997. Mae'n Nodwedd SoDdGA Annibynnol Gymwys o SoDdGA Arfordir Pen-bre/Pembrey Coast ac mae Amcan Cadwraethol wedi'i ddatblygu (Boyce 2007). Nod y contract hwn oedd ailadrodd y gwaith monitro a wnaed yn 2006 er mwyn asesu Cyflwr presennol y Nodwedd SoDdGA.

Gwelwyd bod Tair Gorsaf yn 2006 yn cynnal digonedd o'r planhigyn bwyd, llysiau'r sipsiwn Lycopus europaeus, ac yn ôl y targedau 'Cyflwr Ffafriol' mae'n ofynnol i bob un o'r Gorsafoedd hyn gael eu hasesu. Fodd bynnag, roedd llystyfiant y gors yng Ngorsafoedd 1 a 2 wedi'i dorri wythnos cyn i'r arolwg gael ei gynnal, ac fe fyddai hynny wedi arwain at golli is-boblogaethau o *D. arquatus* yn y llecynnau hyn. Daeth arolwg o'r tir pori caeedig cyfagos o hyd i ddarn ychwanegol o gynefin addas, ac aseswyd hwn yn ychwanegol at Orsaf 3. Cofnodwyd cyfanswm o saith *arquatus* llawndwf – pump yng Ngorsaf 3 a dau yn y llecyn newydd, a elwir yma'n Orsaf 4. Cofnodwyd deg llecyn mawr o'r planhigyn bwyd, ond ym mhedwar o'r rhain roedd y planhigion naill ai'n rhy fyr neu roedd maint y llecyn yn rhy fach. Roedd colli Gorsafoedd 1 a 2 yn gwneud y canlyniad '**Anffafriol: Yn dirywio**' yn anochel, ac nid yw Gorsaf 4 yn ddigon mawr i wneud yn iawn am golli'r cynefin yn y gorsafoedd hyn.

Cyflwynir argymhellion rheoli ar gyfer pob Gorsaf, sy'n cynnwys yr angen i ganiatáu i'r llystyfiant cors adfer yng Ngorsafoedd 1 a 2 trwy stopio'r arfer bresennol o dorri'r llystyfiant. Yng Ngorsafoedd 3 a 4 fe fydd angen rheoli rhywfaint ar y prysgwydd er mwyn sicrhau na chaiff llecynnau o lysiau'r sipsiwn eu colli'n sgil prysgwydd ymledol. Dylid parhau i bori'r tir yn ysgafn yn y mannau caeedig wrth ymyl Gorsaf 2 er mwyn ceisio cynnal cyflwr agored y gors.

Ymwelwyd hefyd â Fferm Ffrwd gerllaw, sef gwarchodfa Ymddiriedolaeth Natur De a Gorllewin Cymru, i samplu poblogaethau llysiau'r sipsiwn ar gyfer *D. arquatus*. Yma, mae'r gwartheg yn pori cymaint ar y tir nes cyfyngu llysiau'r sipsiwn i fannau gwarchodedig dan ffen helyg sydd wedi hen sefydlu ac ati, er y gall rhannau eraill o'r warchodfa heb anifeiliaid pori, na chawsant eu harolygu yn ystod yr ymweliad, fod â phoblogaethau iachach o'r planhigyn bwyd. Ni ddaethpwyd o hyd i enghreifftiau o *D. arquatus*, ond argymhellir y dylid cynnal arolygon pellach.

2. Executive Summary

The gipsywort weevil *Datonychus arquatus*, currently classified in Britain as Red Data Book: Indeterminate, is known in the British Isles only from Pembrey Air Weapons Range (SN3604) where it was first discovered in 1997. It is an Independently Qualifying SSSI Feature of the Arfordir Pen-bre/ Pembrey Coast SSSI and a Conservation Objective has been developed (Boyce 2007). This contract sought to repeat the monitoring of 2006 to assess the current Condition of the SSSI Feature.

Three Stations were identified in 2006 as supporting an abundance of the foodplant, gipsywort *Lycopus europaeus*, and the targets for Favourable Condition require assessment of each of these Stations. However, all of the fen vegetation in Stations 1 & 2 had been mown in the week prior to survey, which would have caused the loss of any sub-populations of *D. arquatus* in these areas had they been present. Survey of the adjacent grazing enclosure revealed an additional area of suitable habitat and this was assessed in addition to Station 3. A total of seven adult *arquatus* was recorded – five in Station 3 and two in the newly-discovered area, here designated as Station 4. Ten large patches of foodplant were recorded in total, but in four of these the plants were either too short or the area of the patch was insufficient. The loss of Stations 1 & 2 meant that an outcome of **Unfavourable: Declining** was inevitable and Station 4 is not big enough to compensate for the loss of habitat in those Stations.

Management recommendations are given for each Station, which include the need to allow fen vegetation to recover in Stations 1 & 2 by stopping the current practice of mowing. In Stations 3 & 4 regular small-scale management of scrub encroachment will be needed to ensure that gipsywort patches are not lost to succession. Light grazing should be continued in the enclosure alongside Station 2 to help maintain open fen conditions.

A visit was also made to the nearby Ffrwd Farm WTSWW reserve to sample gipsywort populations there for *D. arquatus*. Here cattle grazing is sufficiently high to restrict gipsywort to protected situations underneath established willow carr etc., although other parts of the reserve without grazing stock, which weren't surveyed on this visit, may have healthier populations of the foodplant. No examples of *D. arquatus* were found but further surveys are recommended.

3. Introduction

The ceutorhynchine weevil *Datonychus arquatus* (Coleoptera: Curculionidae) is one of the rarest species occurring in Wales. Prior to the discovery of a single specimen on Pembrey Air Weapons Range in 1997 it had not been seen in either Britain or Ireland for at least 50 years and probably much longer. Although there are two unconfirmed reports of the species from Norfolk & Essex in the 1940s, definite British records are restricted to the end of the nineteenth century when it was known from several localities in Surrey, Lincolnshire, Nottinghamshire and Lancashire (Figure 1). In Ireland it was formerly known from a single locality on the shores of Lough Neagh, where it was last recorded in 1923. Further details of the historic records are given by Fowles & Morris (1999). The reasons behind its apparent decline are unknown, but as this is a wetland species (which breeds in the stems of gipsywort *Lycopus europaeus*) it is feasible that habitat loss due to drainage was the cause.

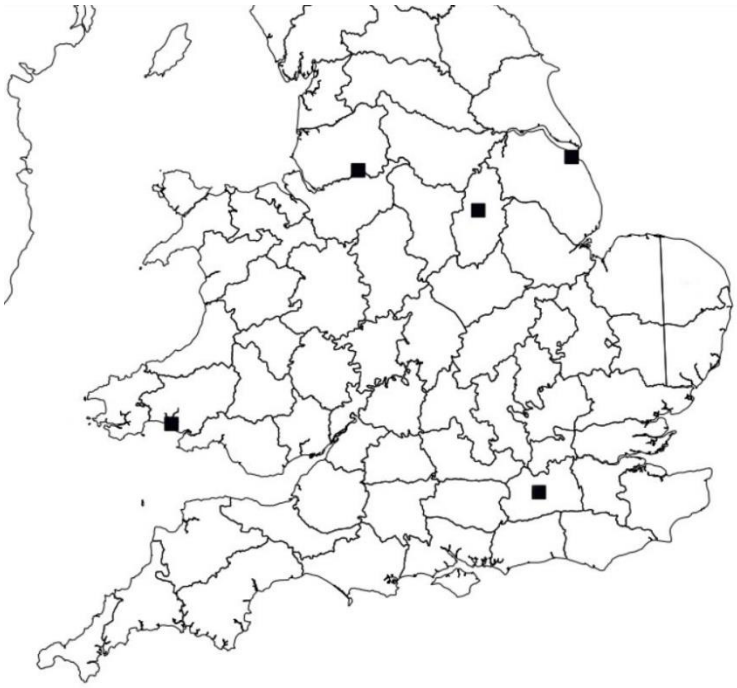

Figure 1. British distribution of *Datonychus arquatus*
[unconfirmed records are not mapped]

In 1998 a survey of Pembrey Air Weapons Range (Fowles & Morris 1999) detected a small population associated with localised stands of gipsywort on the margins of willow and alder carr. Recognition that *D. arquatus* was established on the SSSI led to its inclusion as an Individually Qualifying Feature for the Arfordir Pen-bre/ Pembrey Coast SSSI. Boyce (2007) found a second locality for the species on Pembrey Sands in 2006 when undertaking Common Standards Monitoring. He drew attention to the extensive scrub management that had recently occurred as part of SSSI management on the first location and recommended that "*recovery of the weevil will be best achieved by preventing further disturbance of the three sample stations that support the majority of its habitat*".

To gauge how well the weevil and its habitat had recovered from the scrub clearance work, this contract was let in June 2016, with the following specification: "*A survey for the weevil will be undertaken in July to August 2016. The current survey should follow that of the 2006 work by initially mapping the extent of suitable stands of gipsywort and searching for* Datonychus arquatus*, being careful to separate specimens from the similar* Datonychus melanostictus*. Once completed, an assessment should be made of the current condition of the population using the conservation objective thresholds. A record should be made of any management actions required and any actions damaging to the population".*

4. Methods

4.1. *Datonychus arquatus* monitoring

The aim of this contract was to repeat the Common Standards Monitoring developed and carried out by Boyce (2007) and as such the methodology adheres to the Conservation Objective guidance presented in that report. Timed one-hour searches were carried out in each sampling station (but see below, section 5.1), during which the majority of gipsywort plants encountered were sampled. Although a selection of smaller plants was investigated, effort was targeted towards taller plants (> 30 cms) in clumps as this is the situation which has produced specimens in the previous surveys. Gipsywort plants exhibit a range of heights in relation to soil moisture, competition and grazing pressure and as such there are many short plants in each sample station.

The technique employed involved placing a plastic tray (35 cms x 25 cms) underneath the foliage of gipsywort plants or clumps, bending a single plant (or handful if they are close together) over the tray, and then running the other hand up the stems to shake off any weevils. An initial attempt to use a beating tray to capture a greater surface area of plants proved inefficient amongst the fen vegetation and was rapidly abandoned.

The tray contents were examined after each sample and any weevils present were recorded. Inevitably some water mint *Mentha aquatica* plants were disturbed at times during sampling, as this plant is widespread amongst the gipsywort in the sample stations, and hence care was taken to ensure that the related species *D. melanostictus* was not mistaken for *D. arquatus*. *D. melanostictus* was present but it is readily identified in the field with experience by its more elongate body shape and the less clear, mottled, look to the patterning on its elytra.

4.2. Habitat Quality monitoring

The Habitat Attribute of the Conservation Objective focuses on evident clumps of gipsywort in which cover is greater than 50% and plants are greater than 70 cms tall. During the timed weevil searches each clump that appeared to qualify was measured to obtain a value for its area and to determine whether or not the plants were taller than 70 cms. As mentioned above, patches of gipsywort contain plants at a range of heights and the Objective does not make it clear if it is the tallest plant that counts or if a median or average value is required. For this survey the height reached by the

majority of tall plants in a patch was recorded and this may have been exceeded in some instances by individual taller plants.

For both stations investigated it was possible to sample the whole distribution of gipsywort plants and a zig-zag approach, recommended by Boyce (2007), was not necessary.

5. Results

5.1. Sample Stations

The specification required that the three sample stations designated by Boyce (2007) should be assessed to determine the condition of the *D. arquatus* Feature on the SSSI. Unfortunately it proved impossible to carry out any surveys on Stations 1 & 2.

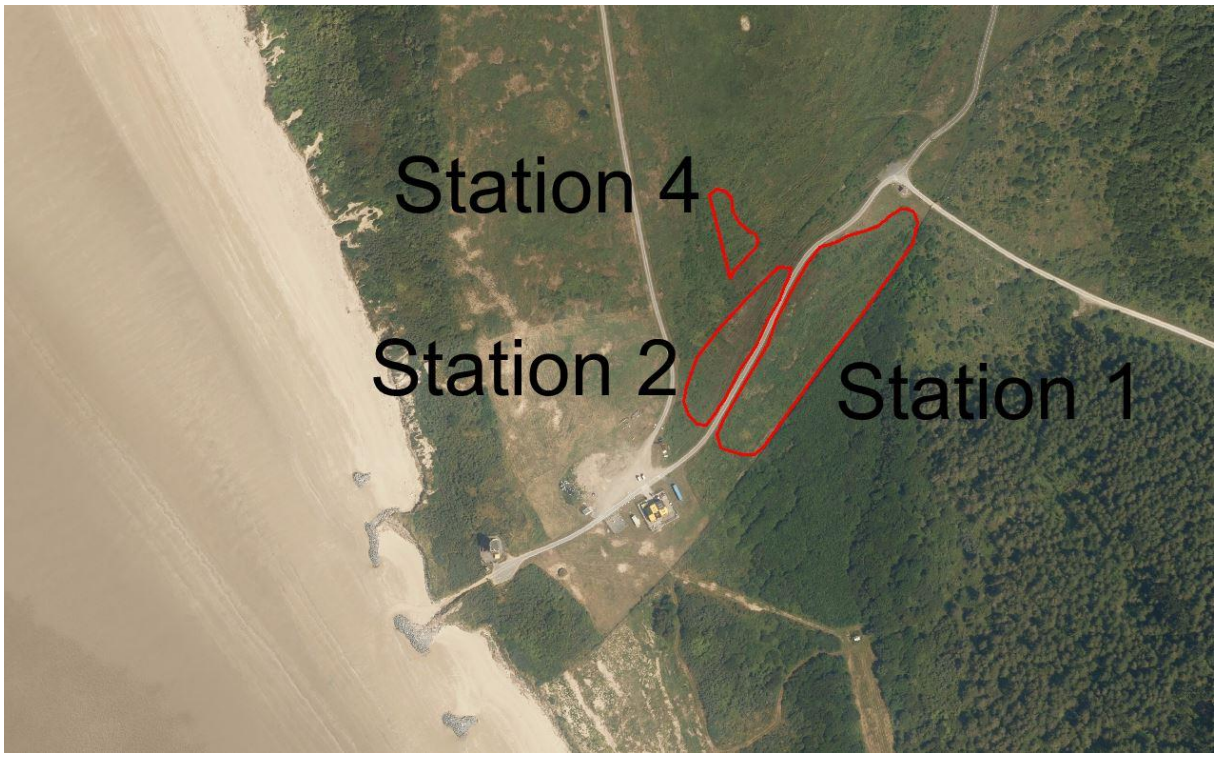

Figure 2. Sample Stations 1, 2 & 4: Pembrey Air Weapons Range

Following on from the scrub clearance reported by Boyce (2007), the entire area of fen on both sides of the tarmac road between the entrance gate and the workshop was mown in early August 2016 (see section 6.1). Twelve individual gipsywort plants were found along the fenceline on the north-western side of Station 2 but in the fen itself there were only scattered remnants of mown plants about 10 cms tall. In Station 1 there were 28 plants along the fenceline adjacent to Pembrey Forest (with a further 17 just inside the forest edge). Each plant was sampled for weevils without success.

Without the possibility of sampling Stations 1 & 2 the opportunity was taken to explore the grazing enclosure to the north of Station 2. This is lightly cattle grazed and, for a hundred metres or so out from the fence, consists of rank fen with

regenerating scrub. At the south-west corner a belt of alder carr has formed parallel with the fence that runs north to the target area and to the immediate east of the scrub is a damp area with abundant gipsywort (named here as Station 4). This was surveyed as an addition to the Conservation Objective, which may now need to be amended in light of the management of Stations 1 & 2 (see section 6).

Station 3 lies north of the target areas and is largely undisturbed. Boyce (2007) had drawn a rough ellipse indicating the location of this Station and this approximately equates to the distribution of gipsywort here. A more accurate representation is presented in Figure 3.

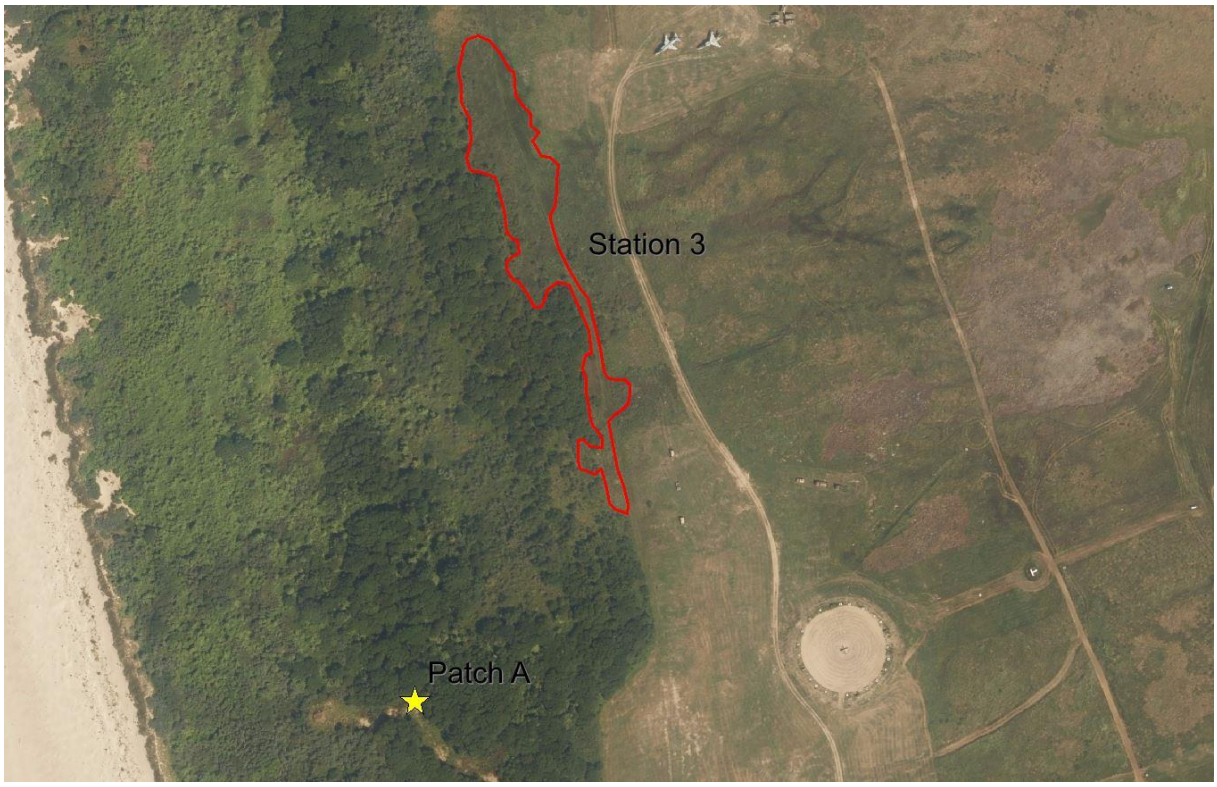

Figure 3. Sample Station 3: Pembrey Air Weapons Range

Gipsywort is frequent along the entire length of the willow carr, to the east of the track, from the current landrover targets to the fighter jets. It occupies a band of fen meadow vegetation about 10 metres broad, with several extensive patches. In places gipsywort is also present as under-storey beneath the willow carr, generally as short sparse plants, but no weevils were recorded there. Between the mown track running alongside the willow carr and the access track to the jets, gipsywort is sparsely distributed with one larger patch towards the southern end. South of here, a large patch of gipsywort, 2.5 metres by 2.0 metres (Patch A), was located underneath willow and hawthorn scrub at the edge of the sandy track to the pillbox. No weevils were recorded on this patch but it suggests the possibility that other gipsywort patches may occur throughout the dense scrub that runs parallel to the dunes. It would require a separate survey to confirm this.

5.2. *Datonychus arquatus*

No weevils were found when sampling the small number of plants (40 altogether) surviving along the fencelines of Stations 1 & 2. In Station 4, 321 plants were sampled and two specimens of *D. arquatus* were recorded (Figure 4), along with two *D. melanostictus*. The *arquatus* specimens were recorded from clumps of gipsywort with tall plants (105 & 70 cms), immediately adjacent to the line of alder bushes. In Station 3, 511 plants were sampled: five specimens of *D. arquatus* were recorded (Figure 5) and three *D. melanostictus* were also seen. Four of the *arquatus* specimens were recorded from clumps bordering the willow carr at the rear of the fen meadow (plant heights between 90 and 95 cms) but the fifth (the northernmost) was tapped off a large patch in the open alongside the mown track (Figure 15), with plants up to 50 cms tall (Table 1).

Sample Station	Patch No.	area (cm x cm)	height (cm)	*D. arquatus*
4	**1**	140x102	105	1
4	**2**	80x43	70	1
3	**1**	263x280	95	1
3	**2**	480x100	90	2
3	**3**	90x70	90	1
3	**4**	310x150	50	1

Table 1. Details of *D. arquatus* specimens recorded from sample stations

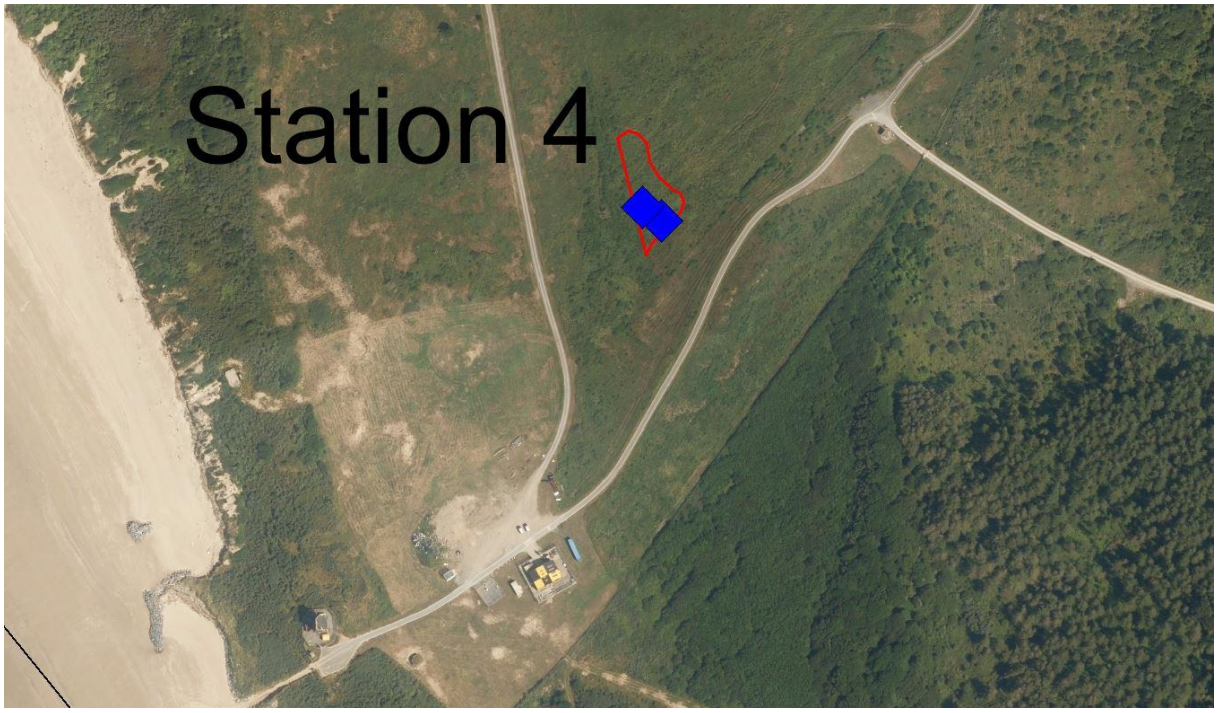

Figure 4. Location of *D. arquatus* adults in Station 4

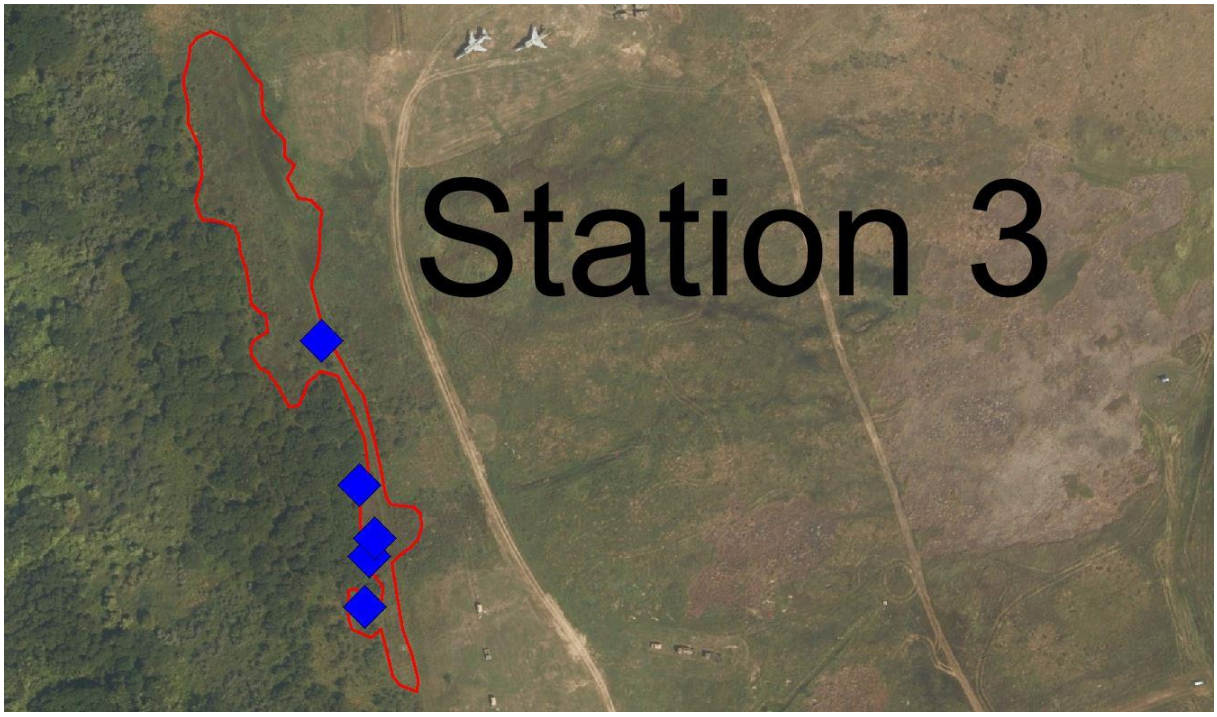

Figure 5. Location of *D. arquatus* adults in Station 3

5.3. Habitat Quality

Within Stations 3 & 4 a total of ten gipsywort patches were encountered that were potentially large enough to qualify as Suitable (as defined in the Objective) – two in Station 4 and eight in Station 3 (Table 2). All measured patches except one (patch 3: 8) were within two metres of nearby willow or alder bushes and there was no evidence of brash or bare ground in either of the Stations.

Sample Station	Patch No.	area (cm xcm)	height (cm)
4	**1**	140x102	105
4	**2**	80x43	70
3	**3**	263x280	95
3	**4**	480x100	90
3	**5**	90x70	90
3	**6**	220x230	60
3	**7**	260x150	90
3	**8**	310x150	50
3	**9**	90x70	95
3	**10**	130x90	85

Table 2. Significant patches of gipsywort in sample stations 3 & 4

One of the patches in Station 4 was less than a square metre in area (0.34 m^2), although a specimen of *D. arquatus* was recorded from this patch, and two of the eight patches in Station 3 were less than one square metre (both 0.63m^2), one of

which had a single *arquatus* specimen. Four of the patches in Station 3 were large enough and tall enough to qualify as suitable patches.

6. Management recommendations

Each of the four Sample Stations considered here needs management input to ensure that *D. arquatus* survives in its sole British locality.

6.1. Stations 1 & 2

Complete removal of the scrub in these Stations in the years following discovery of the *D. arquatus* population here in 1998 was extremely damaging, such that Boyce (2007) was unable to find any examples of the weevil during his survey. However, the fen vegetation was still present in 2006 and if limited amounts of scrub had been allowed to regenerate then recolonisation by *arquatus* was anticipated. The mowing that has taken place subsequently has removed any possibility of that happening under current conditions and more sympathetic management needs to be put in place with immediate effect. Ideally, these two areas should now be left to recover and herb-rich fen allowed to develop. As scrub moves back in then this should be managed sensitively such that bushes are left where they are adjacent to patches of gipsywort. Over time these will need to be managed by selective cutting to maintain the necessary connections with gipsywort whilst preventing encroachment on open fen.

Figure 6. Mown fen, Station 1

Figure 7. Mown fen, Station 1

Figure 8. Mown fen, Station 2

Figure 9. Mown fen, Station 2

6.2. Station 4

By contrast, scrub management and the introduction of light cattle grazing to the enclosure adjacent to Station 2 has facilitated the recovery of open fen vegetation in what is presumably an old dune slack. Gipsywort has recovered well and currently there is an abundance of healthy plants adjacent to a stand of dense alder regeneration in the south-west corner.

Figure 10. Station 4

Figure 11. Gipsywort patch with *D. arquatus*, Station 4

Figure 12. Gipsywort, Station 4

This is, however, a relatively small area of perhaps 0.1 hectares in total and further scrub encroachment will threaten the existing gipsywort patches. For this Station, light grazing needs to be maintained at current levels (any increase could see more of the gipsywort grazed down) and there needs to be regular management of scrub to maintain open areas of fen. Perhaps every three or four years the Station should be assessed and scrub cut back where it is not currently providing shelter to gipsywort patches. This needs to be done sensitively with full regard paid to the conditions required by *D. arquatus*.

6.3. Station 3

There is no grazing (other than by rabbits) on this part of the Range and as such the narrow band of fen adjacent to the willow carr is vulnerable to encroachment. At its widest this is no more than ten metres wide up to the mown track that runs north from the Target areas to the dunes at the Point. Although stretching for about 250 metres, not all of the carr edge is suitable for gipsywort as some parts are presumably too dry and others are covered by dense creeping willow *Salix repens*. In the middle there is a 40 metre stretch (Figure 16) where the carr has already extended to the mown track and this would be a prime candidate for immediate management, cutting the willow back for about 8 metres to allow fen vegetation to recolonise.

In the medium term Station 3 should be managed in the same manner as Station 4 above, though without grazing, in that periodic assessments of scrub encroachment should take place and willow cut back where this does not have a fringe of gipsywort. In the longer term it would be useful to explore the interior of this belt of carr to see if

glades with gipsywort fen exist or if there are suitable wet hollows that can be opened up to extend the habitat available to *D. arquatus*.

Figure 13. Carr edge fen, Station 3

Figure 14. Gipsywort patch on carr edge with *D. arquatus*, Station 3

Figure 15. Gipsywort patch with *D. arquatus* alongside mown track, Station 3

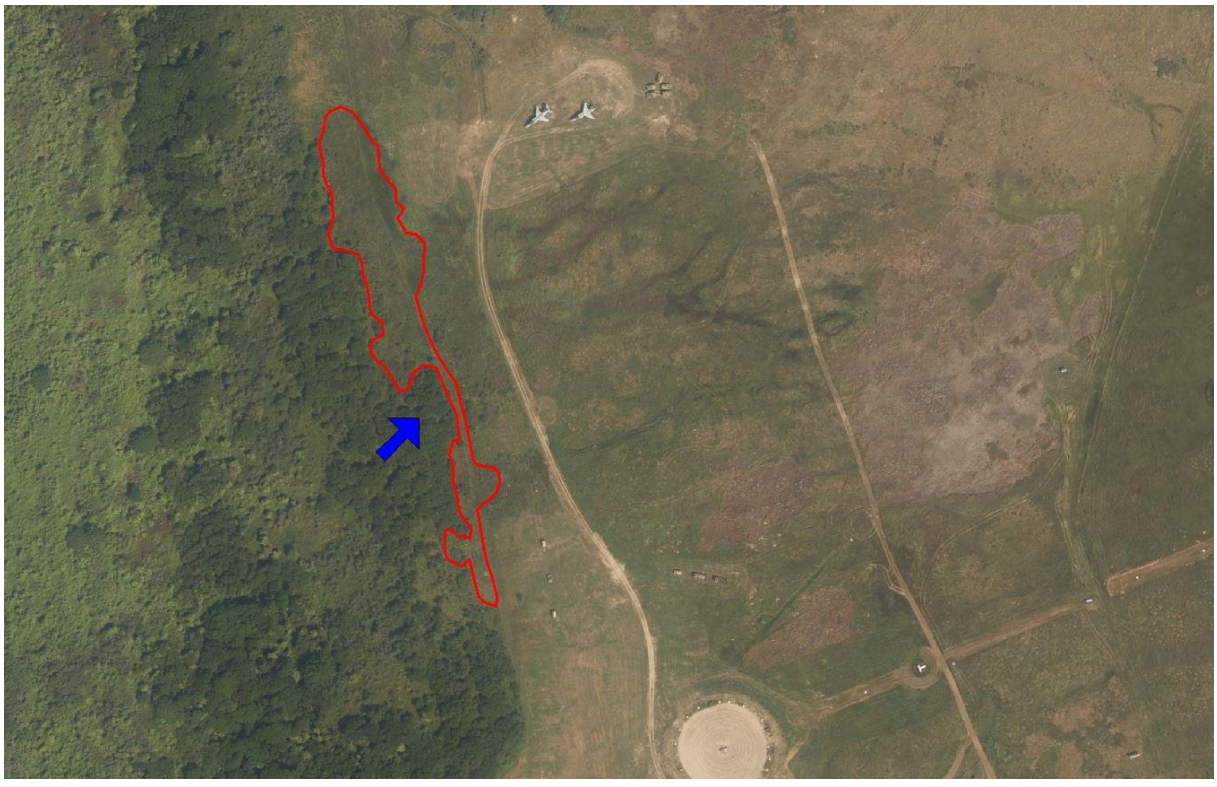

Figure 16. Suggested area of willow carr to be cut back (arrowed), Station 3

7. Discussion

The current state of Sample Stations 1 & 2 means that the only possible outcome of this monitoring exercise is **Unfavourable: Declining**. Sample Station 3 had the required four patches of Suitable habitat and *D. arquatus* was recorded there in the timed search, but with no habitat remaining in Stations 1 & 2 it was inevitable that the Conservation Objective would fail to be achieved. It is critical to allow these areas to recover in order to provide suitable conditions for the weevil.

When surveyed in 1998, the area here delineated as Station 4 consisted of rank tall fen amongst sparse alder and willow scrub. Gipsywort was present but mainly occurred as scattered straggly plants amongst the bushes and it was not considered worth expending a great deal of effort on to detect *D. arquatus*. The subsequent scrub removal and introduction of light grazing has opened up this area and it is encouraging that gipsywort is now well-established over an area of about 60 metres by 20 metres amongst a pocket of M28 *Iris pseudacorus* – *Filipendula ulmaria* mire (Rodwell 1991) where this abuts a dense stand of alder regrowth at the south-western corner of the enclosure. The cattle do graze the gipsywort but the current stocking levels are light enough to allow some suitable patches to prosper. This is a welcome addition and without it *D. arquatus* may have become extremely restricted on Pembrey Air Weapons Range. Station 4 is relatively small and does not compensate for the loss of a much greater area of suitable habitat in Stations 1 & 2, but clearly it needs to be considered in discussions about the future objectives for biodiversity conservation on Pembrey Air Weapons Range.

Boyce (2007) drew attention to the vulnerability of the *D. arquatus* population in Section 2 and advised against further management input to allow the fen vegetation to recover from the disturbance caused by scrub management. The recent mowing of Sections 1 & 2 has resulted in further deterioration of habitat quality for the weevil. There is also a strong likelihood that this action will have impacted negatively on the narrow-mouthed whorl snail *Vertigo angustior* that is also known to occur here. Small numbers of this EC Habitats Directive Annex II species were recorded in Station 2 in 2006 (Harper 2007) & in Station 1 in 2014 (Harper 2014).

Datonychus arquatus has now been recorded on four occasions from Pembrey Air Weapons Range: 14 June 1997 – 1 adult; 28 August 1998 – 11 adults; 17 September 2006 – 2 adults; 12 August 2016 – 7 adults. It is impossible to conclude how strong the population is on the basis of these records, but as the habitat occupied is less than 0.3 hectares in total we can assume that the population is small and vulnerable. Of course, all of the occupied habitat may not have been located and it is possible that other suitable pockets remain to be found. It would be desirable to consult NVC maps and check likely vegetation communities for the presence of gipsywort. Although *D. arquatus* is present in two separate locations, both are vulnerable to succession and the detection of other locations before they succumb to scrub encroachment is an urgent priority.

This survey has resulted in recognition of a new location for *D. arquatus*, albeit adjacent to the known site at Station 2. NRW should now consider if the Conservation Objective needs to be amended in light of this new information. It would not be appropriate to abandon targets for Stations 1 & 2, despite the damage that

has occurred, and Station 4 should be incorporated into the existing Objective. It would also be worth looking at the definition of Suitable habitat. Three of the seven *D. arquatus* adults recorded in this survey were tapped off gipsywort plants in patches that did not meet the definition and four of the ten measured patches in Stations 3 & 4 failed the definition. Boyce (2007) developed the draft Conservation Objective on limited information from the presence of two adults in 2006 and this may have been too restrictive. *D. arquatus* won't be entirely confined to patches that meet the definition, but larger stands are at least indicative that there is plenty of foodplant available and I would recommend that the definition is relaxed to include stands where the majority of plants are greater than 50 cms tall. The condition regarding proximity to brash or bare ground may be removed as their effect on breeding suitability is unknown.

Conservation Objective (for when the feature is in favourable condition)	**To maintain the weevil *Datonychus arquatus* at Pembrey Coast SSSI in favourable condition where**
Lower limit	The weevil is present in two of the three sample stations during one-hour timed searches.
	and
Habitat quality **Lower limit**	20 patches of suitable habitat recorded from within the four sample stations, with at least 12 of these patches occurring within two metres of the edge of overhanging willow or alder canopy. Two of the four sampling stations should contain a minimum of four patches of suitable habitat.
Definition of suitable *Datonychus arquatus* habitat	A patch of tall, dense gipsywort growing in undisturbed wetland vegetation. Patches must be at least one metre square, with this plant comprising at least 50% percentage cover and most of the patch is 50cm tall or greater.

Table 3. Revised Conservation Objective

8. Acknowledgements

I am grateful to Dr Mike Howe (NRW Invertebrate Ecologist) for arranging this contract and organising the provision of GIS layers. Major Martyn Alexandre (Training Safety Officer) at Pembrey Air Weapons Range is thanked for enabling access to the Pembrey Range. Thanks also to Val Monaghan for assisting with measurements of gipsywort patches during the survey. Dr Lizzie Wilberforce gave permission to visit Ffrwd Farm WTSWW Reserve and supplied vegetation maps.

9. References

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10. Appendix 1: Invertebrate Records

Order	Family	Taxon	Site	Gridref	Recorder	Date	Quantity	sex	Comment
Coleoptera	Apionidae	*Apion frumentarium*	RAF Pembrey	SN36260552	Fowles, A.P.	12/08/2016			Station 3
Coleoptera	Apionidae	*Cyanapion spencii*	RAF Pembrey	SN36260552	Fowles, A.P.	12/08/2016	1	female	Station 3
Coleoptera	Apionidae	*Eutrichapion ervi*	RAF Pembrey	SN36260552	Fowles, A.P.	12/08/2016	1	male	Station 3
Coleoptera	Apionidae	*Eutrichapion viciae*	RAF Pembrey	SN36620463	Fowles, A.P.	12/08/2016	1	female	Station 4
Coleoptera	Apionidae	*Eutrichapion viciae*	RAF Pembrey	SN36640452	Fowles, A.P.	12/08/2016			Station 1, fenceline
Coleoptera	Apionidae	*Ischnopterapion modestum*	RAF Pembrey	SN36620463	Fowles, A.P.	12/08/2016			Station 4
Coleoptera	Apionidae	***Oxystoma cerdo***	RAF Pembrey	SN36640452	Fowles, A.P.	12/08/2016			Station 1, fenceline **(Notable B)**
Coleoptera	Apionidae	*Perapion hydrolapathi*	RAF Pembrey	SN36260552	Fowles, A.P.	12/08/2016	1	female	Station 3
Coleoptera	Apionidae	***Squamapion vicinum***	RAF Pembrey	SN36260552	Fowles, A.P.	12/08/2016	1	male	Station 3 - new to Carms **(Notable B)**
Coleoptera	Apionidae	*Stenopterapion meliloti*	RAF Pembrey	SN362056	Fowles, A.P.	12/08/2016			tapped off melilot
Coleoptera	Apionidae	*Synapion ebeninum*	RAF Pembrey	SN36260552	Fowles, A.P.	12/08/2016	2		Station 3
Coleoptera	Chrysomelidae	*Aphthona nonstriata*	RAF Pembrey	SN36260552	Fowles, A.P.	12/08/2016			Station 3
Coleoptera	Chrysomelidae	*Aphthona nonstriata*	RAF Pembrey	SN36620463	Fowles, A.P.	12/08/2016			Station 4
Coleoptera	Chrysomelidae	*Chrysolina polita*	RAF Pembrey	SN36260552	Fowles, A.P.	12/08/2016			Station 3
Coleoptera	Chrysomelidae	*Chrysolina polita*	RAF Pembrey	SN36620463	Fowles, A.P.	12/08/2016			Station 4
Coleoptera	Chrysomelidae	*Phyllobrotica quadrimaculata*	RAF Pembrey	SN36260552	Fowles, A.P.	12/08/2016			Station 3
Coleoptera	Chrysomelidae	*Phyllobrotica quadrimaculata*	RAF Pembrey	SN36620463	Fowles, A.P.	12/08/2016			Station 4
Coleoptera	Coccinellidae	*Rhyzobius litura*	RAF Pembrey	SN36260552	Fowles, A.P.	12/08/2016			Station 3
Coleoptera	Curculionidae	*Anthonomus rubi*	RAF Pembrey	SN36260552	Fowles, A.P.	12/08/2016	2		Station 3, off *Potentilla anserina*
Coleoptera	Curculionidae	***Datonychus arquatus***	RAF Pembrey	SN36260552	Fowles, A.P.	12/08/2016	5		Station 3, off *Lycopus*
Coleoptera	Curculionidae	***Datonychus arquatus***	RAF Pembrey	SN36620463	Fowles, A.P.	12/08/2016	2		Station 4, off *Lycopus*
Coleoptera	Curculionidae	*Datonychus melanostictus*	RAF Pembrey	SN36260552	Fowles, A.P.	12/08/2016			Station 3, new to Carms
Coleoptera	Curculionidae	*Datonychus melanostictus*	RAF Pembrey	SN36620463	Fowles, A.P.	12/08/2016	2		Station 4, off *Mentha*
Coleoptera	Curculionidae	*Rhamphus pulicarius*	RAF Pembrey	SN36260552	Fowles, A.P.	12/08/2016	1		Station 3
Coleoptera	Curculionidae	*Tachyerges salicis*	RAF Pembrey	SN36260552	Fowles, A.P.	12/08/2016			Station 3
Coleoptera	Curculionidae	*Tachyerges salicis*	RAF Pembrey	SN36620463	Fowles, A.P.	12/08/2016	1		Station 4, off *Salix repens*
Coleoptera	Curculionidae	*Tychius meliloti*	RAF Pembrey	SN362056	Fowles, A.P.	12/08/2016	1		tapped off melilot

Coleoptera	Nanophyidae	*Nanophyes marmoratus*	RAF Pembrey	SN36260552	Fowles, A.P.	12/08/2016		Station 3
Coleoptera	Nanophyidae	*Nanophyes marmoratus*	RAF Pembrey	SN36620463	Fowles, A.P.	12/08/2016		Station 4
Hemiptera	Pentatomidae	*Rhacognathus punctatus*	RAF Pembrey	SN36620463	Fowles, A.P.	12/08/2016	1	Station 4
Mollusca	Vertiginidae	*Vertigo pygmaea*	RAF Pembrey	SN36260552	Fowles, A.P.	12/08/2016	1	Station 3
Mollusca	Vertiginidae	*Vertigo pygmaea*	RAF Pembrey	SN36620463	Fowles, A.P.	12/08/2016	2	Station 4, tapped off low herbs in fen

11. Appendix 2: Brief survey of Ffrwd Farm WTSWW reserve (SN4102)

The National Biodiversity Network was consulted to see where gipsywort *Lycopus europaeus* had been recorded in the vicinity of Pembrey in the hope that an additional population of *Datonychus arquatus* might be found. There are records from nine localities, but only one of these (Ffrwd Farm) has records since 1990 (Table 4). Ginst Point and Ffrwd Farm are the nearest sites to Pembrey Air Weapons Range, both about six kilometres away, but gipsywort has not been recorded from Ginst since 1970 so Ffrwd was chosen for survey. In the future MoD Pendine Range would be worth surveying as this extensive site may have similar conditions to Pembrey Sands and has received little attention from entomologists because of the restricted access.

Site	Grid ref	Year recorded
Pendine	SN270080	1982
Ginst Point	SN3207	1970
Ffrwd Farm Mire	SN418027	2009
Ffrwd Farm Mire	SN419023	2009
Ffrwd Farm Mire	SN420024	2009
Ffrwd Farm Mire	SN421025	2009
Llandyry	SN432050	1972
Afon Morlais	SN433053	1986
Gwendraeth Fawr	SN447073	1988
Glyn Abbey	SN457074	1984
Ashpits Pond	SN458010	1979
Glyn Abbey	SN458072	1979

Table 4. Records of gipsywort in the vicinity of Pembrey

Ffrwd Farm was visited on 13 August 2016 and two hours were spent surveying the eastern half of the southernmost field (SN419023), shown in red on Figure 17. This area of fen-meadow has herb-rich *Phragmites* reedswamp that is moderately grazed by cattle and bordered by willow and alder carr. Towards the north-east corner of the enclosure the water table was high and gipsywort is scattered throughout in small clumps of a few tall plants. These are usually within the protection of tall *Phragmites* or underneath sparse willow bushes. Gipsywort is clearly sensitive to grazing and is largely restricted here to protected locations where the cattle don't normally graze. Along the eastern edge of the swamp there are patches of more established willow carr and here gipsywort occurs more frequently in clumps of tall plants (outlined blue in Figure 18). Compared to Pembrey Sands these clumps are less extensive but nonetheless they provide a reasonable amount of habitat that *D. arquatus* could occupy.

All gipsywort plants encountered that were above about 30 cms tall were sampled but no *D. arquatus* were found. *D. melanostictus* (off water mint *Mentha aquatica*) was, however, present in small numbers. If *D. arquatus* was (or still is) present in this

enclosure then it is likely that the level of cattle grazing is too high to sustain a large population. It would be worth investigating similar fen-carr associations elsewhere on the reserve where grazing stock are excluded. From aerial imagery it would seem that the southern margin of the reserve is the most likely area to survey (outlined green in Figure 19) and if gipsywort occurs here then cattle should be excluded until the area can be checked for *D. arquatus*. Gipsywort may occur elsewhere on the reserve (there is a 2009 record from near the boardwalk at SN418027) but the green area looks the most promising because of the extant willow carr. If scrub encroachment threatens areas of gipsywort here then it should be managed to maintain open fen, but retaining scrub where this is adjacent to gipsywort stands.

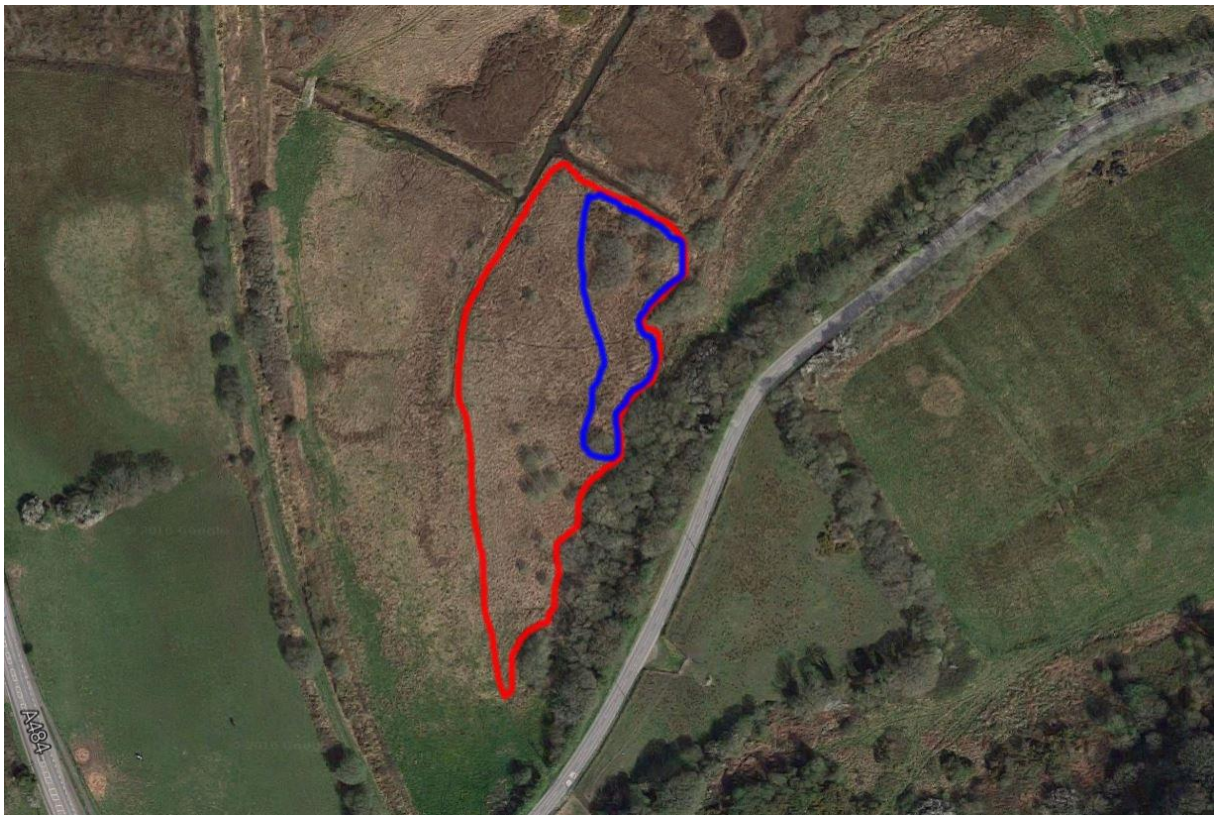

Figure 17. Survey area (red) and gipsywort distribution (blue) on Ffrwd Farm

Figure 18. Gipsywort along carr margin, Ffrwd Farm

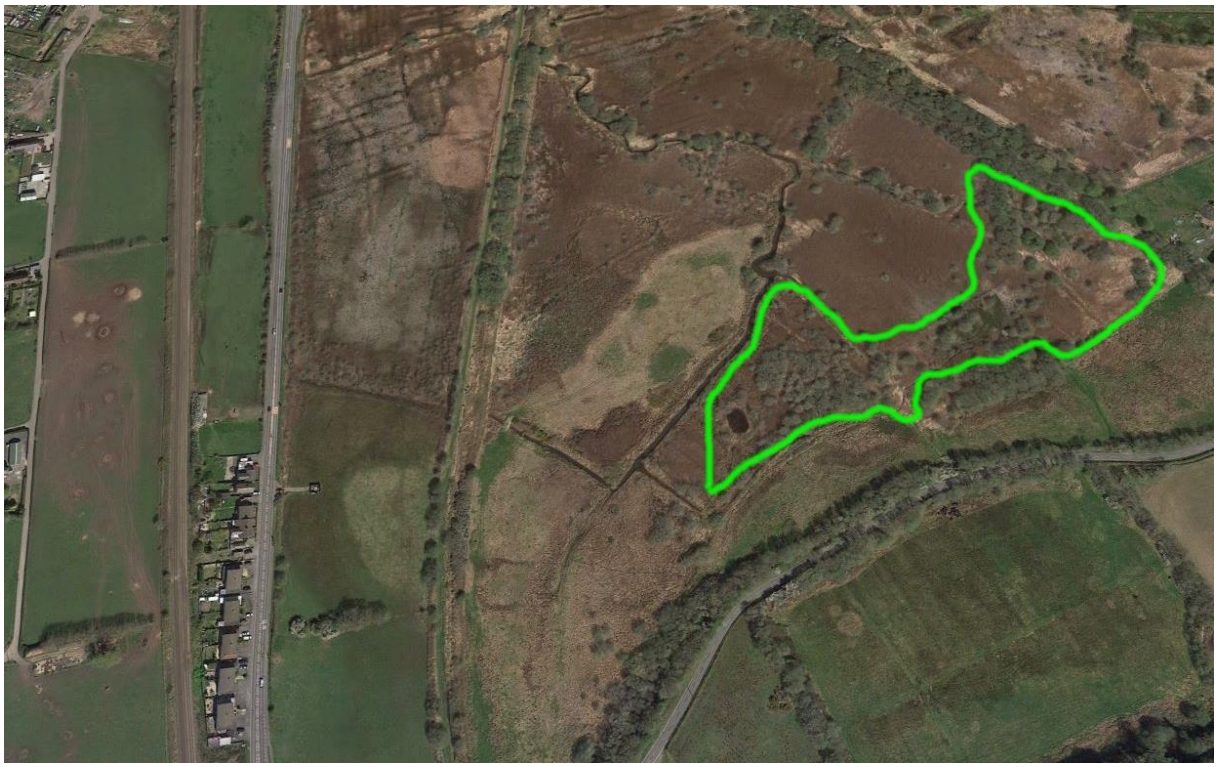

Figure 19. Potential survey area, Ffrwd Farm

Invertebrates recorded:

Order	Family	Species	Site	Grid Ref	Recorder	Date
Coleoptera	Apionidae	*Eutrichapion ervi*	Ffrwd Farm	SN419023	Fowles, A.P.	13/08/2016
Coleoptera	Apionidae	*Oxystoma subulatum*	Ffrwd Farm	SN419023	Fowles, A.P.	13/08/2016
Coleoptera	Carabidae	*Paradromius linearis*	Ffrwd Farm	SN419023	Fowles, A.P.	13/08/2016
Coleoptera	Chrysomelidae	*Chrysolina polita*	Ffrwd Farm	SN419023	Fowles, A.P.	13/08/2016
Coleoptera	Chrysomelidae	*Hydrothassa marginella*	Ffrwd Farm	SN419023	Fowles, A.P.	13/08/2016
Coleoptera	Curculionidae	*Datonychus melanostictus*	Ffrwd Farm	SN419023	Fowles, A.P.	13/08/2016
Coleoptera	Nanophyidae	*Nanophyes marmoratus*	Ffrwd Farm	SN419023	Fowles, A.P.	13/08/2016
Coleoptera	Staphylinidae	*Paederus riparius*	Ffrwd Farm	SN419023	Fowles, A.P.	13/08/2016
Lepidoptera	Nymphalidae	*Maniola jurtina*	Ffrwd Farm	SN419023	Fowles, A.P.	13/08/2016
Lepidoptera	Nymphalidae	*Pararge aegeria*	Ffrwd Farm	SN419023	Fowles, A.P.	13/08/2016
Odonata	Libellulidae	*Sympetrum striolatum*	Ffrwd Farm	SN419023	Fowles, A.P.	13/08/2016
Orthoptera	Tettigoniidae	*Pholidoptera griseoaptera*	Ffrwd Farm	SN419023	Fowles, A.P.	13/08/2016

12. Appendix 3: 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 116797.

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