Dyfi NNR - Cors Fochno

Contact: justin.lyons@cyfoethnaturiolcymru.gov.uk

The Dyfi National Nature Reserve covers a large area that includes the Dyfi Estuary, Ynyslas sand dune and the large estuarine raised bog of Cors Fochno, covering an area of over 700ha. The majority of the Cors Fochno SAC is within the Dyfi NNR. Cors Fochno as well as supporting a large area of active and degraded raised bog is also home to many species that are SSSI features. The following is a summary of the designated features on Cors Fochno and their present condition.

Feature	Condition	Last Assessed
SAC Active Raised Bog –EFC 7110	Unfavourable recovering	2020
SAC Degraded Raised Bog – EFC 7120	Unfavourable recovering	2020
Quaternary of Wales (Stratigraphy) SSSI feature	Favourable Maintained	2021
Bryophyte assemblage SSSI feature	Favourable recovered	2020
Pallavicinia lyellii Qualifying SSSI feature	Favourable	2019
Vascular plant assemblage SSSI feature	Favourable	2019 - 2021
Brown beak sedge Qualifying SSSI feature	Favourable Maintained	2021
Rosy marsh moth SSSI feature	Favourable Maintained	2022
Bog bush-cricket SSSI feature	Favourable Maintained	2022
Large heath butterfly SSSI feature	Favourable Maintained	2022
Small red damselfly SSSI feature	Monitoring in progress - unknown	-
Heliophanus dampfi SSSI feature	Monitoring in progress - unknown	-
Lasaeola prona SSSI feature	Monitoring in progress - unknown	-
Reptile assemblage SSSI feature	Favourable Maintained	2019 - 2021
Breeding bird assemblage of lowland open waters and their margins SSSI feature	Unfavourable declining	2021

Monitoring of *Sphagnum austinii* and *S. beothuk* at Cors Fochno

Des Callaghan, Bryophyte Surveys Ltd, Bristol, UK
Report for Natural Resources Wales

From NRW commissioned evidence Report No 471 – 2020

Monitoring was undertaken as part of a condition assessment for the two rare hummock forming Sphagna species (*S. beothuk* and *S. austinii)* that are part of the SSSI bryophyte assemblage feature. The condition of both species is also part of the reporting element of the Active raised bogs (EU Habitat Code: 7110) SAC feature. The Core Management Plan for Cors Fochno SAC 2011states that:

- The rare hummock forming bog mosses Sphagnum austinii and S. fuscum (beothuk) will have stable or increasing populations.

1. Methods

The two species are found exclusively on the best quality ombrotrophic mire of the site. Three monitoring approaches were undertaken.

- Repeat monitoring of a permanent 12 ha plot established in 2001 (Newton) using the same methodology. Location and hummock dimensions were recorded, and differences analysed.
- Random timed search of 32 OS 100m grid cells selected from the core170ha of the site. Location and hummock dimensions were recorded, and statistical analysis undertaken.
- All present and historic locations of *S. austinii* were monitored.

2. Results: Permanent Plot

Locations of hummocks of *S. austinii* and *S. beothuk* within the permanent plot in 2001 and 2020 are shown in Figure 1, and a boxplot of the size of hummocks is shown in Figure 2.

- *Sphagnum austinii* is rare but shows a 114% increase in the number of hummocks, from seven to 15, and a 265% increase in the summed area of all hummocks, from 5443 to 19,849 cm^2. The average size of *S. austinii* hummocks increased from 777 cm^2 (range = 276–1495; *n* = 7) to 1323 cm^2 (range = 82–4656; *n* = 15), though due to the small sample size this is not statistically significant (W = 48, *p* = 0.783).

- *Sphagnum beothuk* is much more frequent. There is a 38% increase in the number of its hummocks, from 60 to 83, and a 192% increase in the summed area of all hummocks, from 51,466 to 150,417 cm^2. The average size of *S. beothuk* hummocks underwent a 111% increase, from 858 cm^2 (range = 110–4893; *n* = 60) to 1812 cm^2 (range = 38–8482; *n* = 83), which is statistically significant (W = 1493, *p* <0.01).

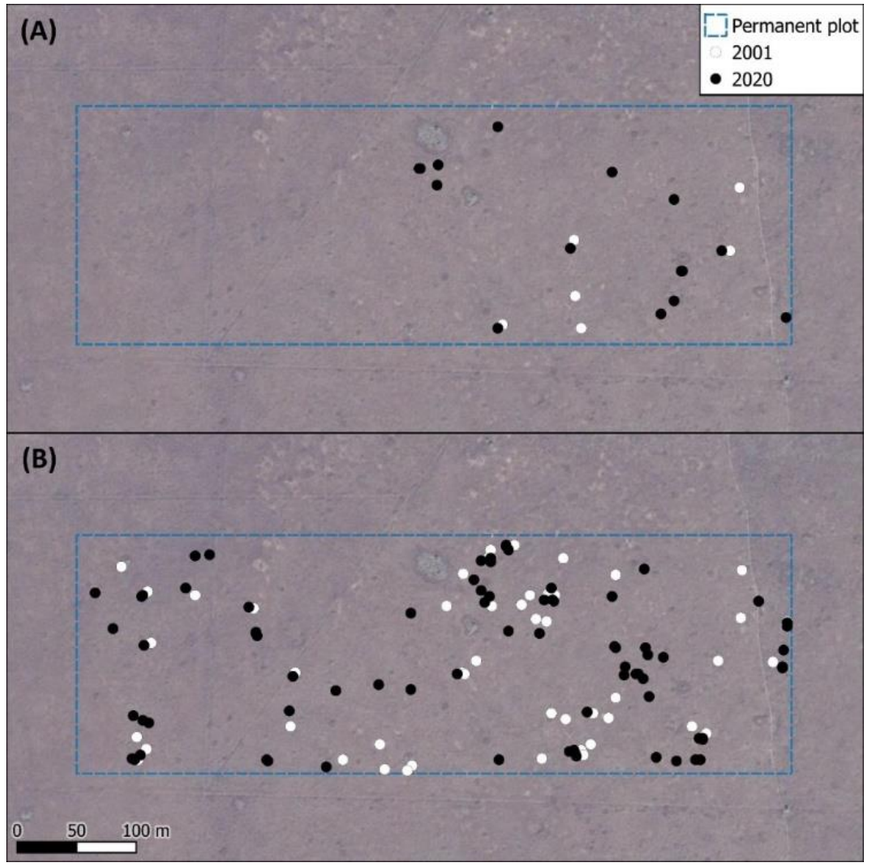


Figure 1. Locations of hummocks of (A) *Sphagnum austinii* and (B) *S. beothuk* within the permanent sample plot at Cors Fochno in 2001 and 2020. Note, locations of hummocks outside the plot are not marked. Satellite image © Google, DigitalGlobe

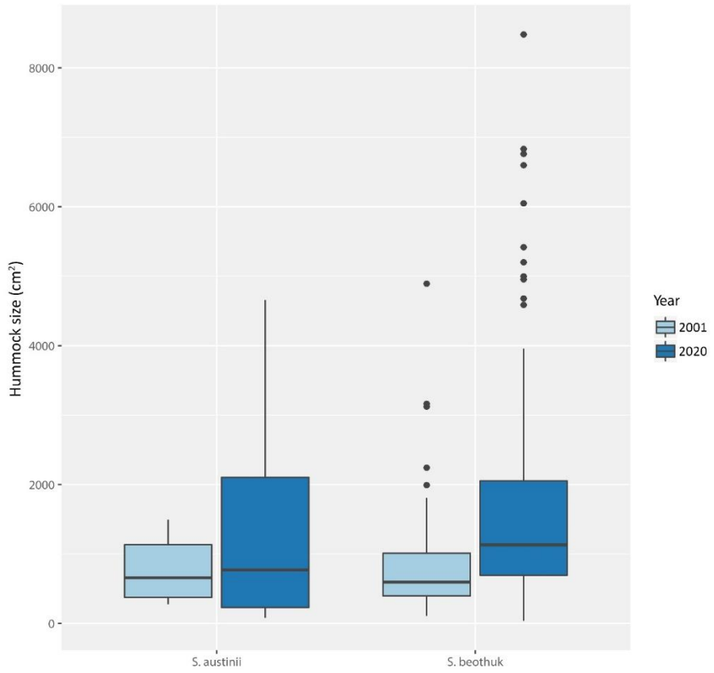


Figure 2. Boxplot of size of hummocks of *Sphagnum austinii* and *S. beothuk* in 2001 and 2020 within the permanent sample plot at Cors Fochno.

2. Results: Random Plots

Locations of hummocks of *S. austinii* and *S. beothuk* within random plots in 2020 are shown in Fig 3.

- As in the permanent plot, *S. austinii* was rare within the random plots, with only eight hummocks found, averaging 0.25 hummocks plot^{-1} (range = 0–3; *n* = 32), with a mean size of 999 cm^2 (range = 236–3101; *n* = 8).

- In contrast, *S. beothuk* was relatively frequent, with a total of 99 hummocks found within the random plots, averaging 3.1 hummocks plot^{-1} (range = 0–17; *n* = 32), with a mean size of 1955 cm^2 (range = 86–15161; *n* = 99). The total population estimate for *S. beothuk* throughout Cors Fochno is 559 hummocks (*CI*95% = [341,778]).

A reliable population estimate for *S. austinii* across Cors Fochno is not possible due to its rarity. However, a total of 59 hummocks were found in 2020, including those within the permanent plot (*n* = 15), random plots (*n* = 9) and elsewhere (*n* = 35).

3. Conclusion and Discussion

This study shows that a large population of *S. beothuk* presently occupies Cors Fochno, one of only two surviving sites in Wales, and that during 2001–2020 it underwent a significant increase. The period coincides with two environmental changes that have improved habitat conditions of the primary mire, cessation of fires and partial restoration of the water table.

This study shows the population of *S. austinii* across Cors Fochno remains small, though a modest increase from 2001 appears to have occurred. Slater and Slater (1978) documented a large population of this species at Cors Fochno in 1973, with 168 hummocks in a 16ha area of the mire. By 1977, following a severe fire in 1974, there were only 39 hummocks in the same area (Slater and Slater 1978), in 1992 there were two (Hale 1992) and in 2001 there were six (Newton 2001).

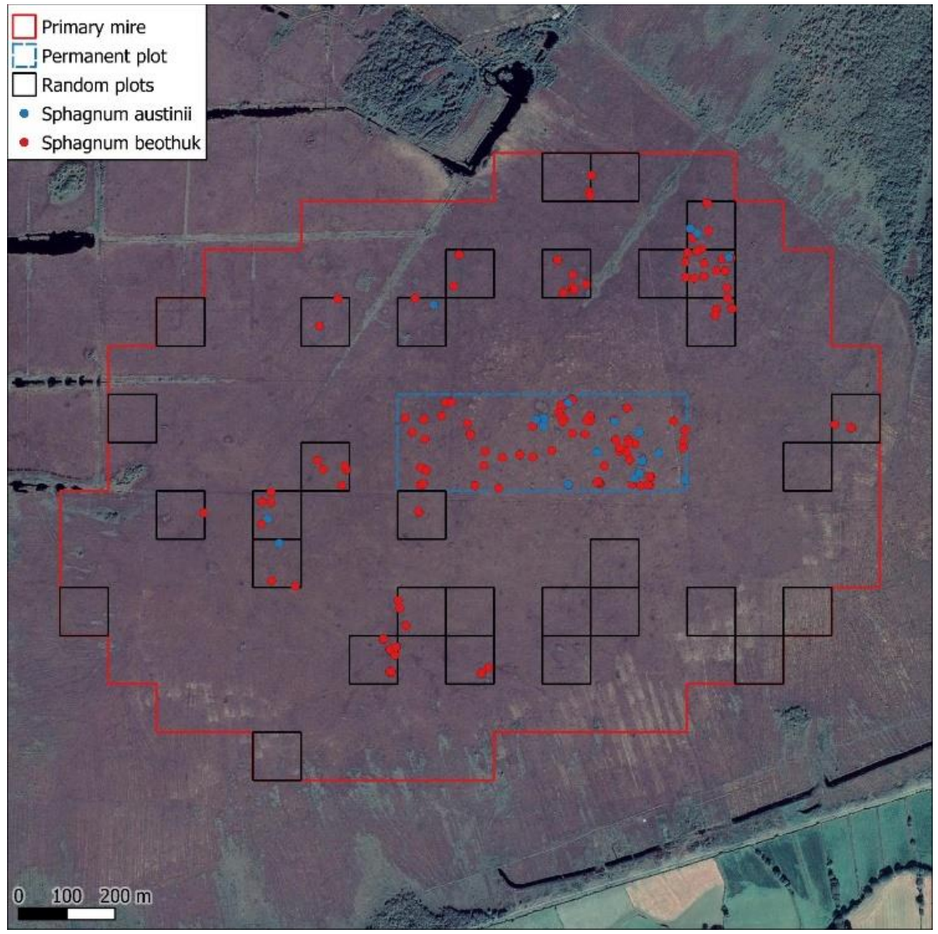


Figure 3. Locations of hummocks of *Sphagnum austinii* and *S. beothuk* within all sample plots at Cors Fochno in 2020. Satellite image © Google, DigitalGlobe.

Reasons why the former large population of *S. austinii* has not become re-established at Cors Fochno, even after a prolonged period of improved habitat conditions and at a time when the ecologically similar *S. beothuk* has increased substantially, are unclear and deserve further investigation.

A repeat assessment of these 2 species of the assemblage will take place in 2025, when repeat monitoring of 32 new random plots for *S. beothuk* and *austinii* and all known hummocks of *austinii* is to be carried out. The permanent 12ha plot will be surveyed again in 2030. Ad-hoc records of newly found hummocks of both species in the intervening period are added to a working spreadsheet.

4. References

See Callaghan DA. 2020. Monitoring of Sphagnum austinii and S. beothuk at Cors Fochno and Bryum marratii at Ynyslas. NRW Evidence Report No: 471, 28 pp, Natural Resources Wales, Bangor.

Monitoring of the Large Heath Butterfly (*Coenonympha tullia*) on Cors Fochno 1986 - 2022

Photo: John Ibbotson

From Justin Lyons, NRW evidence Report (Draft) – 2022

The Large Heath Butterfly, *Coenonympha tullia* is a feature on the Dyfi SSSI. The Large Heath is normally associated with mires (lowland raised, blanket bogs and acidic moorland) in Northern Britain and Ireland with a few isolated sites in Central England and Wales that support its primary host plant Hares-tail Cotton grass, *Eriophorum vaginatum*. The large colonies found at the two large, raised mires in Ceredigion, Cors Caron and Cors Fochno lie at the southern limit of the species' distribution in Britain, and may therefore be particularly susceptible to climate change.

- Listed on Section 7 of the Environment (Wales) Act 2016
- UK Red List of Butterflies – Endangered (Butterfly Conservation 2022)

Monitoring of the population at Cors Fochno SAC with respect to current SSSI attributes is discussed and further analysis of the data is explored.

1. Methods

Since 1986 Large Heath have been monitored during its flight period annually at Cors Fochno SAC along a 2km transect split (Fig1) into 5 sections using the UK Butterfly Monitoring Scheme methodology. The total annual count is assessed against the following attributes for the SSSI feature.

Lower limit: A population index of above 60 (averaged over any 3 consecutive year period), based on the sum of all counts during its flight period.

An additional attribute assessing, the population distribution across a larger part of the site is also made.

Lower limit: Two or more adults in total recorded from 4 specified compartments, over the current and previous 2 years, either by ad-hoc recording or searching.

In 2022 analysis of the transect section data has been made to further understand potential changes over this relatively long data set. The analysis of the annual and transect sections has been based on a population index, calculated from the number of butterflies recorded per 100m for each season, this was necessary due to the transect sections being unequal in length.

2. Results – Current SSSI Assessment for attributes for 2020 – 2022

- **Population Index**: Exceeds the lower limit of 60.

Year	2020	2021	2022	**Mean**
Population Index	102	113	119	**111.3**

- **Population distribution**: Passed with the presence of 2 or more adults in the 4 specified compartments in the current and preceding 2 years, all from casual records.

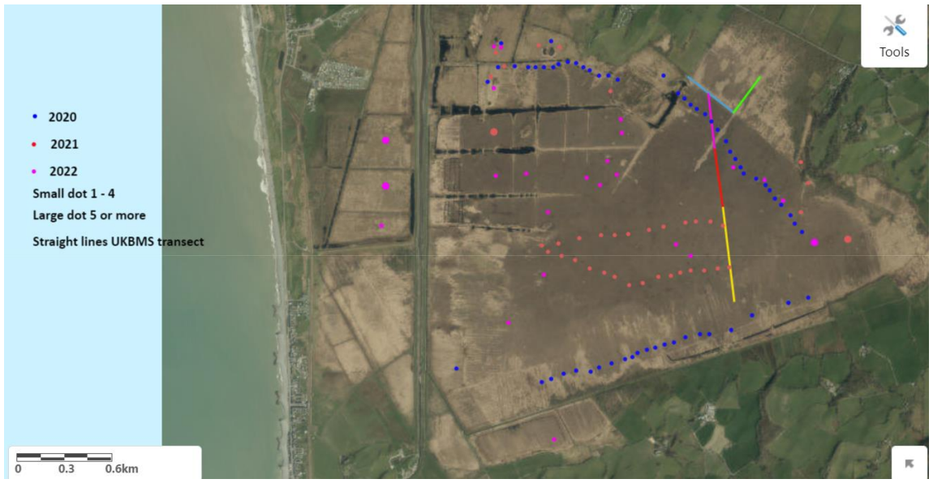


Fig 1: Casual records Large Heath Butterfly 2020 – 2022, Contains OS data © Crown Copyright, and database

2. Results: Analysis 1986 – 2022

An assessment of the annual population index (Figure 2) for the 5 transect sections shows there is a marked difference between the 5 sections. Section 3 has the highest median value of 9.5 butterflies per 100m, sections 1 and 2, 5.7 and 5.4 respectively and sections 4 and 5, 2.8 and 2.1 respectively.

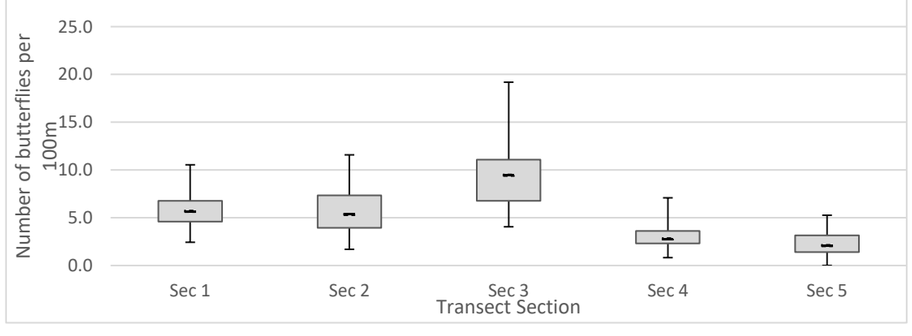


Figure 2: Number of butterflies per 100m for each transect section for period 1990 to 2022. The dash shows the median, boxes show inter-quartles and the whiskers show range.

Peak Count Assessment

The number of years with peak counts falling on week 12 or before, for the 3 time periods 1986-1997, 1998-2009 and 2013-2021 are 6,11 and 10 respectively.

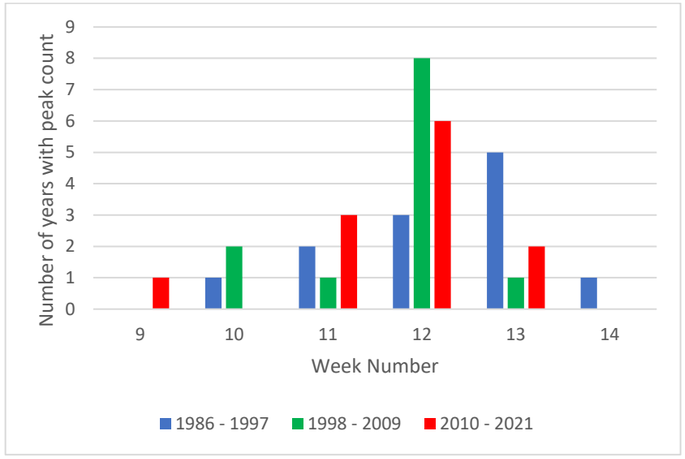


Figure 3: Annual recording week with peak Large Heath count for 3 time periods between 1986 – 2022

A conservative assessment of total population size based on the mean of peak counts per ha of the survey area multiplied by available suitable habitat gives a total of 10048 butterflies annually.

Total Transect Assessment For 3 Time Periods

(Kruskal-Wallis test)

An assessment of total annual population index (number of butterflies per 100m) for three equal time periods of 11 years was made. There is no statistical difference in the population for the 3 time periods between 1990 and 2022.

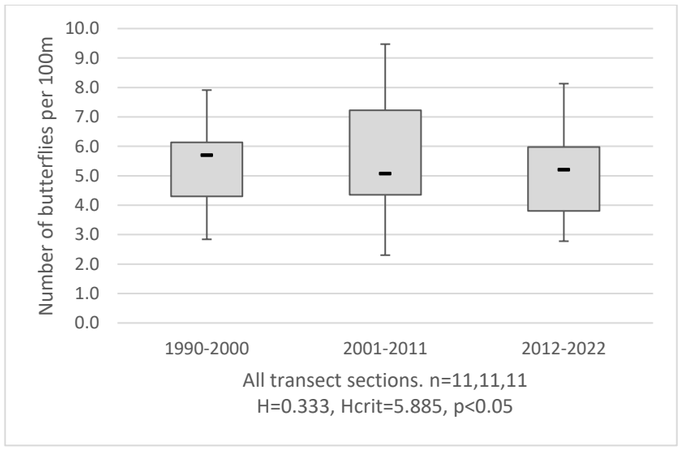
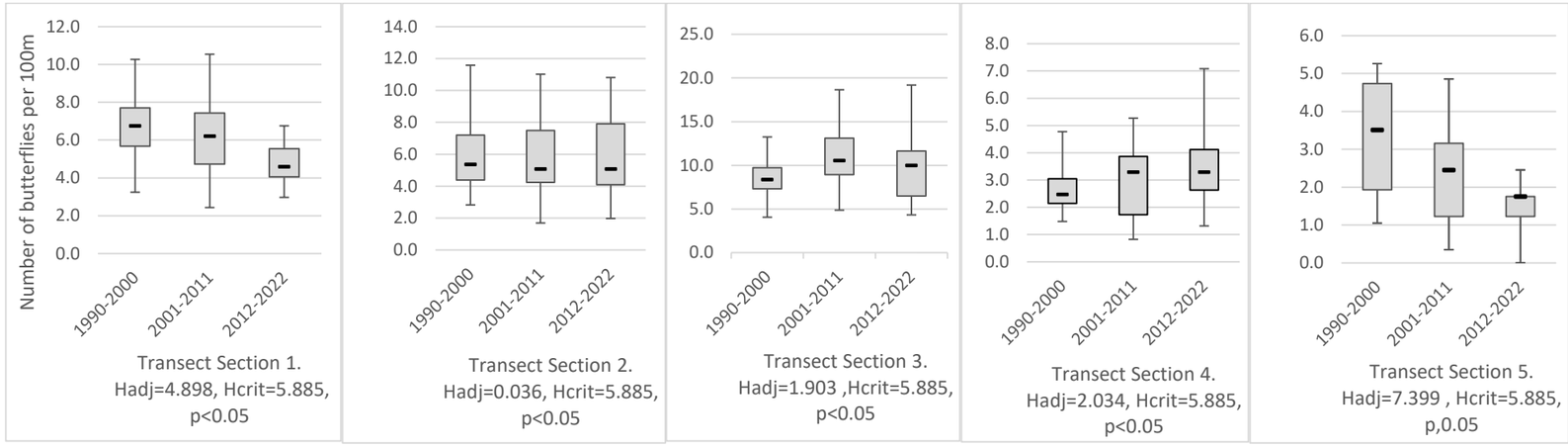


Figure 4: Number of butterflies per 100m for three time periods between 1990 and 2022. The dash shows the median, boxes show inter-quartles and the whiskers show range.

Transect Section Assessment For 3 Time Periods (Kruskal-Wallis test)

An assessment of annual population index for three equal time periods of 11 years for each of the 5 transect sections. For sections 1- 4, there is no statistical difference in the population for the 3 time periods. For sections 5, there is a statistical difference between the 3 samples at p<0.05, there is therefore a statistical difference in the population with a decline between 1990 - 2022.



3. Conclusion and Discussion

- The population index and distribution of the Large Heath Butterfly at Cors Fochno for the period 2020 - 2022 exceed the lower limits for the SSSI feature and at present is in a favourable condition.
- Transect section 3 has a much higher population index, some of the better quality raised bog habitat can be found along this section (NRW, Cors Fochno SAC monitoring report 2020).
- For the period 1998 to 2021 the proportion of peak counts on or before week 12 has increased by over 70% compared to the period 1986 to 1997. Using peak counts as a proxy for emergence time, this implies emergence time is earlier and maybe a consequence of climatic change.
- Cors Fochno supports a large colony of Large Heath butterflies in excess of 10000 individuals annually.
- Encouragingly the total population index assessment for the whole transect shows that there has been no statically significant change in the population for the last 33 years.
- The sectional transect assessment for last 33 years shows that there has been no statistical change for 4 of the sections over the period but for section 5 there has been a decline that is statistically significant. Section 5 is across an area with extensive peat cuttings where, due to its Common Land status it has not been possible to date to undertake suitable management. Subsequently there has been a decline in the habitat quality suitable for Large Heath with the spread of Purple Moor Grass *Molinia caerulea* and Birch *Betula pubescens*. Although not statistically significant currently, for section 4 the critical value is close to the Kruskal-Wallis test and may indicate that this area is becoming less suitable for Large Heath; this section is adjacent to section 5. It is important in the coming years to secure appropriate management for this area of Cors Fochno for both the Large Heath population and the raised bog habitat.

  The findings of these assessments are to be shared with NRWs invertebrate ecologist to assess whether a review of the current SSSI feature assessment for the Large Heath on Cors Fochno is required.

4. References

Butterfly Conservation. Large Heath, Fact Sheet

Fox, R., Dennis, E.B., Brown, A.F. & Curson, J. (2022) A revised Red List of British butterflies. Insect Conservation and Diversity, 1–11

Sutton M, Lyons J. 2020. SAC Cors Fochno Monitoring Report, NRW, Unpublished

Development of a monitoring project for the rare spider *Heliophanus dampfi* on Cors Fochno SAC

Adult female *Heliophanus dampfi* showing distinctive yellow-green palps

Richard C Gallon

From NRW commissioned evidence Report (Draft – 2022)

Heliophanus dampfi Schenkel, 1923 is a Nationally Rare, Vulnerable salticid spider. In Britain it is restricted to raised bogs. It is typically found on the unmodified, uncut bog areas where it is associated with Bog Myrtle *Myrica gale*, ericoid dwarf shrubs like Heather *Calluna vulgaris* and Cross-leaved Heath *Erica tetralix* and *Molinia*.

Cors Fochno was the first place in Britain where *H. dampfi* was identified, it is found at just 14 bogs in the UK. It is a Qualifying Feature of the Dyfi SSSI.

H. dampfi has been formally monitored on site by a standardised sweep-netting method since 2000 several times. Although useful it was found to be heavily weather dependant and time consuming. For the future a new structured, efficient and repeatable monitoring method needed to be developed.

1. Survey Method Trial and Results – A Win for the Petrol Vacuum Sampler.

To test the efficiency of different sampling methods a comparison was made for three sampling methods at three sample points on the bog where *H. dampfi* had been found in the recent past.

Sweep-netting bog vegetation (2-minute duration).
Battery-powered vacuum sampler - Black & Decker's 36v Lithium-ion GWC3600L20 (2-minute duration).
Petrol vacuum sampler - Stihl SH56C (2-minute duration).

Across all three sample points a total of six minutes of sweep-netting produced 3 *H. dampfi*. Whereas battery- and petrol-vacuuming yielded 6 and 16 specimens respectively in the same amount of time. Based on this data battery-vacuum sampling is twice as efficient as sweeping and petrol-vacuuming is just over five times as efficient as sweeping.

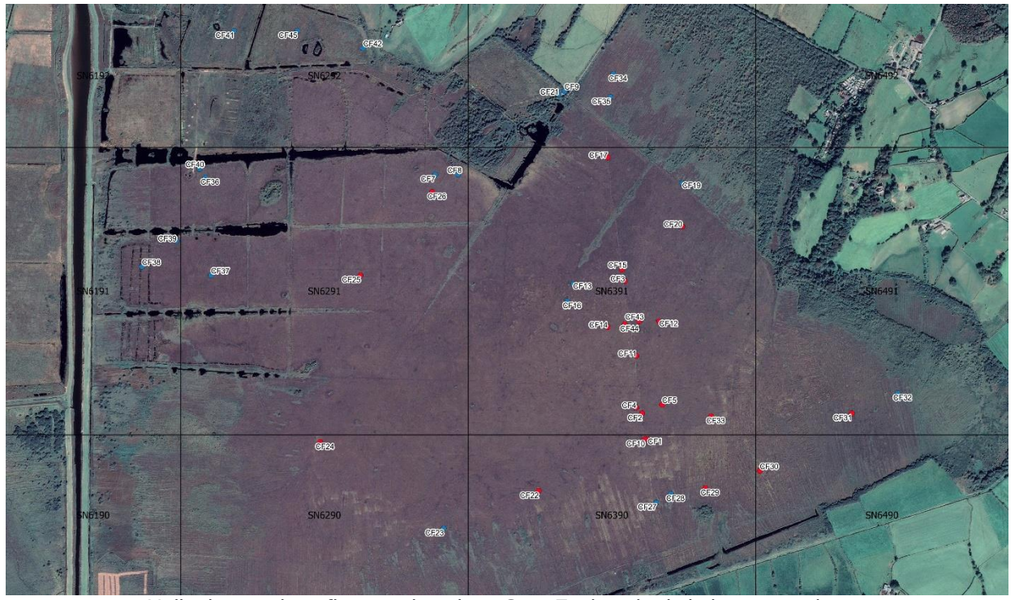
The superiority of the petrol vacuuming can be explained by its greater ability to sample lower down in the shrub layer right down to the moss layer.

Due to the spiders sealing themselves in webs at night and possibly during inclement daytime weather then any planned monitoring should only occur in fine, warm sunny weather, avoiding early-morning or early-evening surveys to maximise the chances of encountering active spiders outside of their silk-cells.

2. Method and Results

Sampling was undertaken for 2 minutes at 48 locations across the raised bog habitat with the petrol vacuum. The survey targeted finding *H. dampfi* (and *Lasaeola prona*) in areas where previous records were known and to record from new unsampled parts of the bogs to gain a better understanding of their site distribution. Other species of arachnid were also recorded.

- 118 *H. dampfi* specimens were found at 27 of the 48 sampling locations.
- June–August sessions (108 specimens in 22 out of 30 sessions; 73% session success rate)
- September (10 specimens in 5 out of 18 sessions; 28% session success rate)



Heliophanus dampfi survey locations Cors Fochno (red circles present).

H. dampfi was largely restricted to the central, un-cut area of the raised bog. The vegetation structure within areas where specimens were found varied from the patterned surface found at the very centre of the bog (left photo) to a more uniform one further from the centre (right photo).

3. Conclusion and Discussion

H. dampfi was frequently found using the standardised 2-minute petrol vacuum sampling method in the central uncut over area of the raised bog being present in 18 of 20 areas sampled.

It is recommended that standardised monitoring for *H. dampfi* at Cors Fochno should be undertaken using the standardised 2-minute petrol vacuum sampling method every 3 years.

Monitoring should be conducted between June and early August on dry, sunny, warm (+20°C), preferably still days. Surveys are to be conducted between 10am and 5pm to maximise the chances of finding this thermophilic, diurnal species.

Monitoring is recommended to be conducted at 9 locations widely distributed along the monitoring boardwalk and the wider site, it is estimated that the monitoring should be able to be undertaken in 1 field day by an experienced arachnid surveyor.

Setting of attributes: With only one round of monitoring, it would be difficult to set definitive lower limits. However, based on the 2021 survey data at the 9 recommended locations future monitoring of *H. dampfi* using this methodology would be expected to locate at least 32 specimens in at least 6 out of the 9 sample points. Both adults and immatures should be present in the year to confirm successful recruitment.

Bog Psuedoscorpion detective work

On the eastern section of old peat cuttings at Cors Fochno, a patch of habitat was observed whilst undertaking the monitoring for *H.dampfi* that looked like where the Bog Psuedoscorpion, *Microbisium brevifemoratum* had been found at Bettisfield Moss in 2017 (Gallon, 2018a, 2018b). The *Sphagnum*-lawn Island hummocks were vacuumed for 2-minutes and produced a single *M. brevifemoratum*.

This is a very rare Pseudoscorpion which in the UK is only known from single records at three high quality bogs. In Danish bogs Lissner (2019) notes it is found by sieving *Sphagnum medium* a moss which occupies areas intermediate between the top of the hummocks and the wet parts of the hollows.

4. References

See Gallon R. (2022), NRW Evidence Report No. (Yet to be assigned number)