

## ***Adiantum capillus-veneris* (Maidenhair Fern) along the Vale of Glamorgan Coastline, South Wales, UK: a comparison of surveys over 30 years**

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### **Introduction**

*Adiantum capillus-veneris* (Maidenhair Fern), occurs on all continents except the Antarctic, and is considered stable worldwide (Lansdown & Bilz, 2013). In the UK the vascular plants red data list reports the status of *A. capillus-veneris* as of 'least concern' (Cheffings *et al.*, 2005). Native populations occur mainly in crevices or on tufa deposits, limited to a few scattered coastal localities (Stewart *et al.*, 1994). Wales is home to about 25% of the UK's native population (Dines, 2008) mainly concentrated along the Vale of Glamorgan Coastline and to a lesser extent in Pembrokeshire and Carmarthenshire. The earliest record (Llwyd, 1698), at Jacksons Bay, Barry Island suggest populations have been persistent for at least 300 years. Historical records for *A. capillus-veneris* can also be found for Porthkerry; 1838, Dunraven Bay; 1849, Aberthaw; 1862 and Font-y-Gary, 1927 and *A. capillus-veneris* is still present at all of the aforementioned sites. *A. capillus-veneris*'s natural habitat in South Wales is primarily restricted to active post glacial tufaceous cliff face seepages which are frequently, but not entirely, associated with the Jurassic Lias bedrock that defines the Vale of Glamorgan 'Heritage Coast'. The interbedded nature of the Jurassic Lias rocks, with relatively impermeable, thinly interbedded limestones and calcareous mudstones (Wilson *et al.*, 1990), favours the slow diffuse seepage of groundwater across large areas of cliff face supporting the formation of tufa. Tufa forms when groundwater, supersaturated with calcium carbonate dissolved from the bedrock aquifer, re-deposits the material on contact with the atmosphere.

Three surveys across the Vale of Glamorgan coastline have been undertaken, the first by

Peter S. Jones (1983-4) then Kate Pryor 1996 (reported in Pryor, 2001) and again in 2015 by the authors. Molecular studies of several populations along the coast (Pryor, 2001 & Pryor *et al.*, 2001) provide insight into the genetics of satellite populations, however further discussion of this is outside of the scope of this note. The aim of this survey was to collate and compare the locations of populations recorded over the last 30 years. It is hoped that this will serve as a useful baseline for repeat surveys in the future.

### **Methods**

The 2015 survey incorporated the entire Vale of Glamorgan coastline from Penarth to Ogmere (~ 45 km). This area was larger than the 1983 (P.S Jones) and 1996 (K. Pryor) surveys. For each site a 10 Figure Grid Reference (+/-10m accuracy) was recorded using a hand held GPS. When it was not safe to approach the cliff the grid references were corrected using aerial photography and 1:10,000 Ordnance Survey Maps. There was no defined methodology applied to characterising population sizes during the 2015 survey, thus any comparison with earlier surveys (P.S Jones, 1983 and Pryor, 1996) was not possible. Estimates of the elevation and accessibility of the populations were made although no direct measurements of elevation were made. Areas of tufa without populations of *A. capillus veneris* were also recorded, although they are not detailed in this report. Identification using binoculars was often the only safe method of survey due to cliff instability, estimates of the population sizes were made and sites were described as small, medium or large based on relative population sizes. Locations were numbered west to east from 1 to 54 with individual numbers assigned to each separate

population regardless of size (Fig. 1 (p. 33); Table 1 (p. 31)). Thus small dispersed populations received individual numbers, as did contiguous large populations. Each population was assigned to a lithology based on the British Geological Surveys 1:50,000 bedrock geology map.

### Results

*Adiantum capillus-veneris* can occur from the base to the top of the cliffs, and in all locations it was associated with groundwater seepages and tufa formation. Only ten of the recorded populations were safely accessible from ground level (Sites 19, 37, 38, 41, 48, 50-54), the remaining populations were only possible to identify via binoculars. In areas where sea spray can reach the cliff face the fern appears to grow higher, possibly out of the potential spray zone for salt water. Where cliff faces did not have an obvious seepage area, *A. capillus-veneris* was absent, suggesting the location of the fern is influenced by local hydrogeological conditions. The largest populations of the fern can be found at: Porthkerry (Site 44–51); East Aberthaw/Font-y-Gary (Site 37); Stout Point (22-23); W of Aberthaw (Sites 24-36); St Donat's (Site 19) and Nash Point (Site 10) (Fig. 1 p. 33).

Three new sites were located (Sites 18, 40 & 54) each being very small (<1m<sup>2</sup>) suggesting the fern has not colonised any significant new locations over the last 30 years. Two of the three sites were within the original extent of the 1983 survey (Sites 18 & 40) suggesting they may have formed after 1983 or overlooked. The small population of just four plants in rock crevasses on the Penarth Beach (Site 54) was outside of the 1983 and 1996 survey and may be a relic of a once larger population known to have been present in the area. The loss of the fern in the Penarth area may have resulted from coastal erosion or due to its easy accessibility for enthusiastic Victorian fern collectors. The Penarth population is considered to be at risk due to its small size.

Eight sites (Sites 3, 12, 13, 14, 16, 17, 20 & 21) from the original 1983 survey could not be relocated during the 2015 survey. The loss of these sites is attributed to natural coastal erosion, evidenced by fresh looking cliff faces.

Natural cliff face instability is considered to be putting a further 9 sites at risk (4-9, 22 & 23) and it is at these sites where the loss of populations is most likely in the future.

*Adiantum capillus-veneris* occurs only in areas with water seepage and active tufa formation; however there are numerous areas of actively forming tufa that do not currently support *A. capillus-veneris*, and large areas that only have a few small populations. There were at least 28 additional areas of actively forming tufa (not shown on map) ranging in size from <1m to 10's of square meters without any evidence of *A. capillus-veneris*. It is not known why some areas of tufa appear to be favoured by *A. capillus-veneris* and others not, or indeed if these areas represent potential habitat for future expansion.

### Discussion

*Adiantum capillus-veneris* is most commonly, but not exclusively, found on the Jurassic Lias cliffs in the Vale of Glamorgan. Pryor (2001) notes its absence from other coastal areas in South Wales (e.g. the Carboniferous Limestone of Gower) and suggests that both moisture (groundwater seepage) and low winter temperatures may be important ecological controls for its distribution. The ability of the local bedrock and hydrogeology to support localised tufa formation is also considered a key factor and populations have been recorded on lithologies including: Triassic Blue Anchor Formation and Mercia Mudstone Group at Barry Island, Jacksons Bay (Sites 52-53); Triassic Blue Anchor Formation at Penarth (Site 54), and Carboniferous Avon Group at Craig Ddu, Carmarthenshire (BSBI, 2000), where they are associated with localised active tufa formation. This suggests that *A. capillus-veneris* is not restricted to the Jurassic Lias, and that it can, when conditions are suitable, occur on other geological formations. New surveys along the South Wales coast, especially where tufa is known to form, even in the smallest of areas, may have the potential to identify previously unknown populations.

### Conclusions

*Adiantum capillus-veneris* favours areas where groundwater seepage and tufa formation

occurs. There has been little change in the main locations of *A. capillus-veneris* populations along the Vale of Glamorgan coastline over the last 30 years. We report the loss of 8 sites between 1983 and 2015. The driver for this loss has been attributed to natural coastal erosion, evidenced by fresh cliff faces resulting from rock falls. Only three new populations were identified and all were considered small, i.e. <1m<sup>2</sup>. The fourth ‘new’ site at Penarth is outside of the 1983 and 1996 survey areas and may be the last remaining relic of a once much larger population. Populations outside of the Jurassic Lias coastline in Wales, namely Barry Island, Carmarthen, Pembrokeshire and Penarth, suggest there is potential for the fern to occur across a range of lithologies where groundwater seepage and active tufa formation occur.

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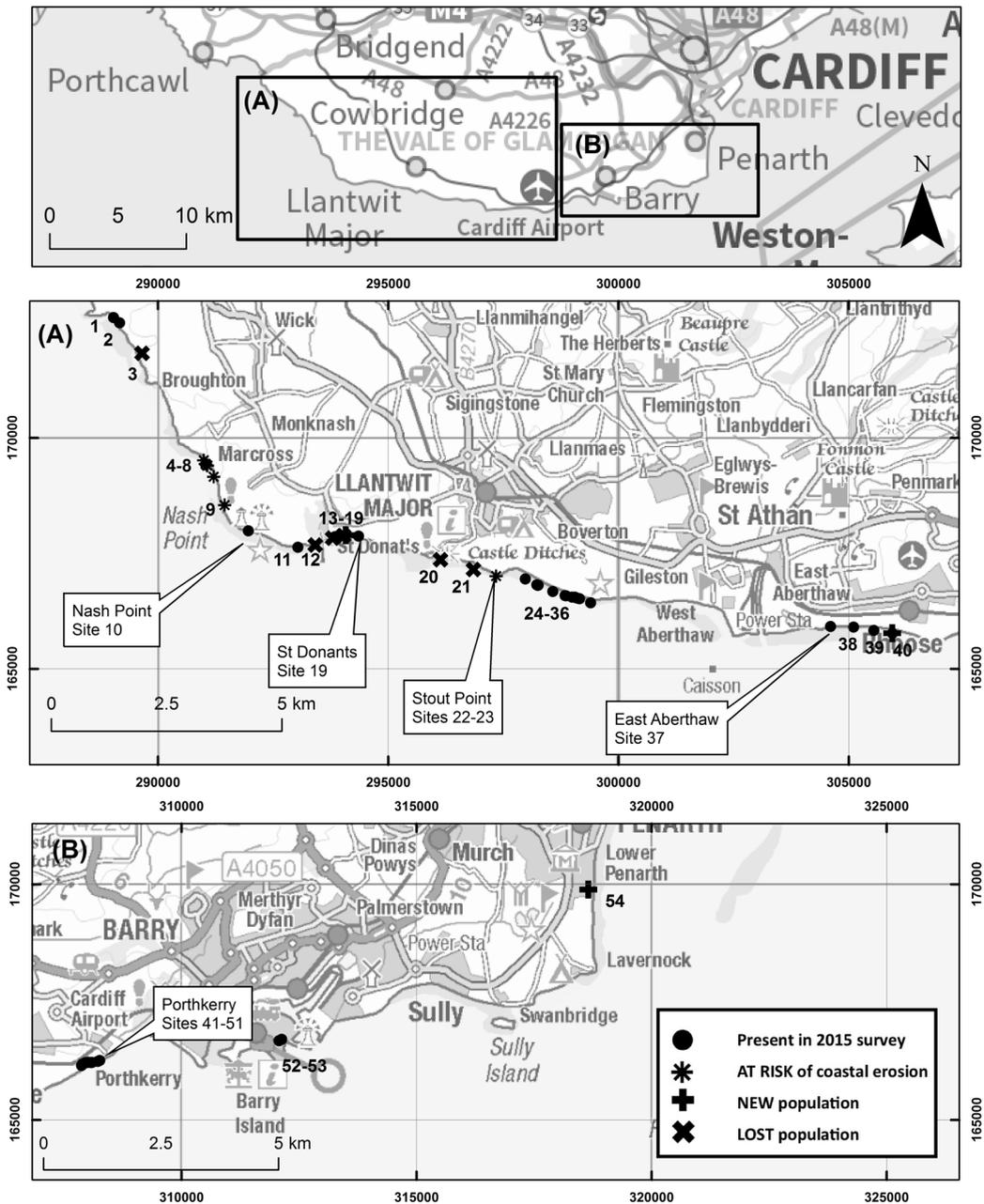
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**Table 1.** Summary of surveys for *A. capillus-veneris* from 1983, 1996 and 2015 (1983 and 2015 data registered with SEWBReC and BSBI and 1996 data from Pryor, 2001)

| Site | Site Name          | Easting | North-ing | 1983 Survey | 1996 Survey | 2015 Survey | Status as of 2015              |
|------|--------------------|---------|-----------|-------------|-------------|-------------|--------------------------------|
| 1    | West of Cwm Mawr   | 289038  | 172608    | ●           | ●           | ●           | Present                        |
| 2    | West of Cwm Mawr   | 289170  | 172491    | ●           | ●           | ●           | Present                        |
| 3    | Nant Cwm Bach      | 289654  | 171836    | ●           | ●           |             | LOST post 1996                 |
| 4    | Monknash Coast     | 290996  | 169518    | ●           | ●           | ●           | Present. At risk of cliff fall |
| 5    | West of Nash Point | 291035  | 169439    | ●           | ●           | ●           | Present. At risk of cliff fall |
| 6    | West of Nash Point | 291063  | 169407    | ●           | ●           | ●           | Present. At risk of cliff fall |
| 7    | West of Nash Point | 291078  | 169402    | ●           | ●           | ●           | Present. At risk of cliff fall |
| 8    | West of Nash Point | 291213  | 169162    | ●           |             | ●           | Present. At risk of cliff fall |

| Site | Site Name                     | Easting | North-<br>ing | 1983<br>Survey                  | 1996<br>Survey              | 2015<br>Survey | Status as of 2015                                      |
|------|-------------------------------|---------|---------------|---------------------------------|-----------------------------|----------------|--|
| 9    | West of Nash Point            | 291449  | 168547        | ●                               | ●                           | ●              | Present. At risk of cliff fall                         |
| 10   | Nash Point                    | 291964  | 167994        | ●                               | ●                           | ●              | Present  |
| 11   | St Donat's West               | 293040  | 167639        | ●                               | ●                           | ●              | Relocated  |
| 12   | St Donat's West               | 293414  | 167683        | ●                               | ●                           |                | LOST post 1996   |
| 13   | St Donat's West               | 293414  | 167683        | ●                               | ●                           |                | LOST post 1996   |
| 14   | ST Donat's East               | 293789  | 167832        | ●                               |                             |                | LOST post 1983   |
| 15   | St Donat's East               | 293845  | 167864        | ●                               |                             | ●              | Present  |
| 16   | St Donat's East               | 294008  | 167879        | ●                               | ●                           |                | LOST post 1996   |
| 17   | St Donat's East               | 294029  | 167885        | ●                               | ●                           |                | LOST post 1996   |
| 18   | St Donat's East               | 294078  | 167896        |                                 |                             | ●              | New  |
| 19   | East of St Donat's            | 294355  | 167879        | ●                               | ●                           | ●              | Present  |
| 20   | St Donat's East               | 296137  | 167366        | ●                               | ●                           |                | LOST post 1996   |
| 21   | St Donat's East               | 296852  | 167156        | ●                               | ●                           |                | LOST post 1996   |
| 22   | Stout Point                   | 297342  | 167010        | ●                               | ●                           | ●              | Relocated at risk of cliff fall                        |
| 23   | East of Stout Point           | 297342  | 167010        | ●                               | ●                           | ●              | Relocated at risk of cliff fall                        |
| 24   | West of Aberthaw              | 297977  | 166950        | Reported as one larger area     | Reported as one larger area | ●              | Present  |
| 25   | West of Aberthaw              | 298230  | 166823        |                                 |                             | ●              | Present  |
| 26   | West of Aberthaw              | 298250  | 166813        |                                 |                             | ●              | Present  |
| 27   | West of Aberthaw              | 298259  | 166814        |                                 |                             | ●              | Present  |
| 28   | West of Aberthaw              | 298578  | 166679        |                                 |                             | ●              | Present  |
| 29   | West of Aberthaw              | 298844  | 166591        |                                 |                             | ●              | Present  |
| 30   | West of Aberthaw              | 298861  | 166586        |                                 |                             | ●              | Present  |
| 31   | West of Aberthaw              | 298998  | 166558        |                                 |                             | ●              | Present  |
| 32   | West of Aberthaw              | 299056  | 166556        |                                 |                             | ●              | Present  |
| 33   | West of Aberthaw              | 299081  | 166543        |                                 |                             | ●              | Present  |
| 34   | West of Aberthaw              | 299136  | 166526        |                                 |                             | ●              | Present  |
| 35   | West of Aberthaw              | 299157  | 166525        |                                 |                             | ●              | Present  |
| 36   | West of Aberthaw              | 299399  | 166434        |                                 |                             | ●              | Present  |
| 37   | Font-y-Gary                   | 304607  | 165924        | ●                               | ●                           | ●              | Present  |
| 38   | Font-y-Gary Lifeguard Station | 305105  | 165911        | ●                               | ●                           | ●              | Present  |
| 39   | Rhoose below disused quarry   | 305544  | 165839        | ●                               | ●                           | ●              | Present  |
| 40   | Rhoose                        | 305943  | 165776        |                                 |                             | ●              | New  |
| 41   | Font-y-Gary nr path           | 305949  | 165773        | Reported as one larger area     | Reported as one larger area | ●              | Present  |
| 42   | Porthkerry                    | 307873  | 166154        |                                 |                             | ●              | Present  |
| 43   | Porthkerry                    | 307894  | 166186        |                                 |                             | ●              | Present  |
| 44   | Porthkerry                    | 307955  | 166216        |                                 |                             | ●              | Present  |
| 45   | Porthkerry                    | 307986  | 166216        |                                 |                             | ●              | Present  |
| 46   | Porthkerry                    | 308001  | 166223        |                                 |                             | ●              | Present  |
| 47   | Porthkerry                    | 308050  | 166222        |                                 |                             | ●              | Present  |
| 48   | Porthkerry (Bulwarks)         | 308077  | 166216        |                                 |                             | ●              | Present  |
| 49   | Porthkerry                    | 308097  | 166219        |                                 |                             | ●              | Present  |
| 50   | Porthkerry                    | 308219  | 166243        |                                 |                             | ●              | Present  |
| 51   | Porthkerry                    | 308259  | 166264        |                                 |                             | ●              | Present  |
| 52   | Barry Island Jacksons Bay     | 312072  | 166680        | ●                               | ●                           | ●              | Present  |
| 53   | Barry Island Jacksons Bay     | 312128  | 166711        | ●                               | ●                           | ●              | Present  |
| 54   | Penarth                       | 318657  | 169887        | Surveys did not cover this area |                             | ●              | New, possibly a survivor of a once larger population ? |



**Figure 1.** Location of *A. capillus-veneris* along the Vale of Glamorgan Coastline, the largest populations are labelled. Contains Ordnance Survey map © Crown Copyright and database rights 2017.