

Report under The Conservation of Habitats and  
Species Regulations 2017 (as amended),  
Regulation 9A

**2019-2024**

Conservation status assessment for the species:

**S6985 - Killarney fern**

***(Vandenboschia speciosa)***

**England**



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This report was produced by JNCC in collaboration with Natural England.

**This document should be cited as:**

Natural England and JNCC. (2026). Conservation status assessment for the species: S6985 Killarney fern (*Vandenboschia speciosa*).

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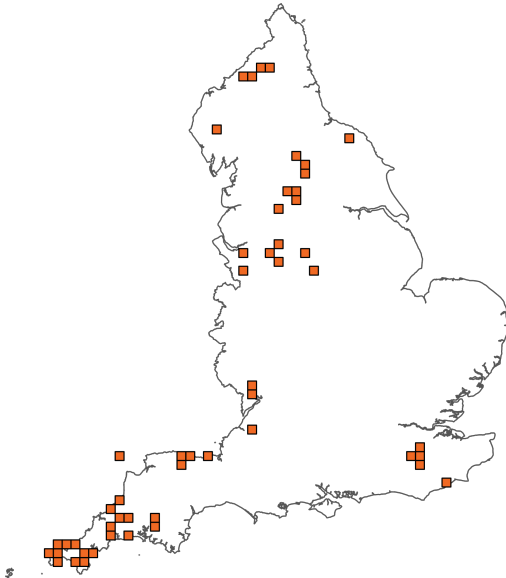
### **Important note - Please read**

- The information in this document represents the England Report under The Conservation of Habitats and Species Regulations 2017 (as amended), Regulation 9A, for the period 2019-2024.
- It is based on supporting information provided by Natural England, which is documented separately.
- The Habitats Regulations reporting 2019-2024 Approach Document provides details on how this supporting information contributed to the UK Report and the fields that were completed for each parameter.
- Maps showing the distribution and range of the species are included.
- Explanatory notes (where provided) are included at the end. These provide additional audit trail information to that included within the assessments. Further underpinning explanatory notes are available in the related country reports.
- Some of the reporting fields have been left blank because either: (i) there was insufficient information to complete the field; (ii) completion of the field was not obligatory; and/or (iii) the field was not relevant to this species (section 12 National Site Network coverage for Annex II species).

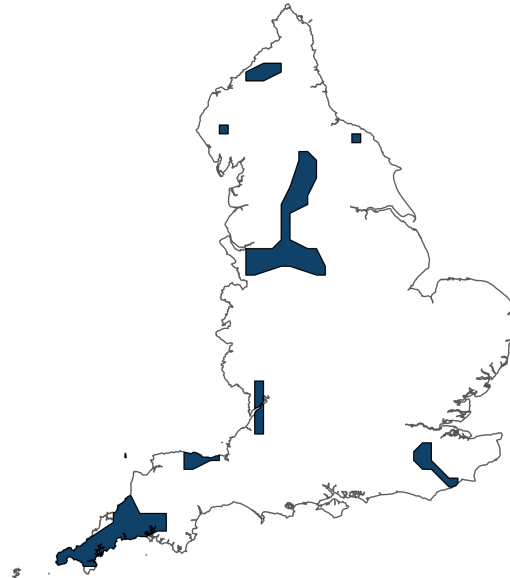
Further details on the approach to the Habitats Regulations Reporting 2019-2024 are available on the [JNCC website](#).

## Assessment Summary: Killarney fern

### Distribution Map



### Range Map



**Figure 1:** England distribution and range map for S6985 - Killarney fern (*Vandenboschia speciosa*). Coastline boundary derived from the Oil and Gas Authority's OGA and Lloyd's Register SNS Regional Geological Maps (Open Source). Open Government Licence v3 (OGL). Contains data © 2017 Oil and Gas Authority. The 10km grid square distribution map is based on available species records within the current reporting period.

**Table 1:** Table summarising the conservation status for S6985 - Killarney fern (*Vandenboschia speciosa*). Overall conservation status for species is based on assessments of range, population, habitat for the species, and future prospects.

## Overall Conservation Status (see section 11)

Favourable (FV)

## Breakdown of Overall Conservation Status

Range (see section 5)	Favourable (FV)
Population (see section 6)	Favourable (FV)
Habitat for the species (see section 7)	Favourable (FV)
Future prospects (see section 10)	Favourable (FV)

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## National Level

### 1. General information

1.1 Country	England
1.2 Species code	S6985
1.3 Species scientific name	<i>Vandenboschia speciosa</i>
1.4 Alternative species scientific name	Trichomanes speciosum
1.5 Common name	Killarney fern
Annex(es)	II, IV

### 2. Maps

2.1 Sensitive species	Yes
2.2 Year or period	2010-2024
2.3 Distribution map	Yes
2.4 Distribution map; Method used	Complete survey or a statistically robust estimate

#### 2.5 Additional information

The distribution map in the report, includes both gametophyte and sporophyte life stages, undifferentiated to protect the locations of the more vulnerable sporophytes which have been collected in the past. The time period 2010-2024 has been used to provide a more representative current distribution for all plant species in this reporting round. This is because the national dataset of botanical records (BSBI) could show a dip in records post 2019 for many species, which is an artefact of the relaxation in recording effort post production of the Plant Atlas 2020.

### 3. Information related to Annex V Species

#### 3.1 Is the species taken in the wild / exploited?

#### 3.2 What measures have been taken?

##### a) Regulations regarding access to property

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**b) Temporary or local prohibition on the taking of specimens in the wild and exploitation**

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**c) Regulation of the periods and/or methods of taking specimens**

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**d) Application of hunting and fishing rules which take account of the conservation of such populations**

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**e) Establishment of a system of licences for taking specimens or of quotas**

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**f) Regulation of the purchase, sale, offering for sale, keeping for sale, or transport for sale of specimens**

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**g) Breeding in captivity of animal species as well as artificial propagation of plant species**

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**Other measures**

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**Other measures description**

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### **3.3: Hunting bag or quantity taken in the wild for Mammals and Acipenseridae (Fish)**

#### **a) Unit**

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**Table 2:** Quantity taken from the wild during the reporting period (see 3.3a for units). For species with defined hunting seasons, Season 1 refers to 2018/2019 (autumn 2018 to spring 2019), and Season 6 to 2023/2024. For species without hunting seasons, data are reported by calendar year: Year 1 is 2019, and Year 6 is 2024.

	Season/ year 1	Season/ year 2	Season/ year 3	Season/ year 4	Season/ year 5	Season/ year 6
<b>b) Minimum</b>	-	-	-	-	-	-
<b>c) Maximum</b>	-	-	-	-	-	-
<b>d) Unknown</b>	-	-	-	-	-	-

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### **3.4: Hunting bag or quantity taken in the wild; Method used**

### 3.5: Additional information

No additional information

## Biogeographical Level

### 4. Biogeographical and marine regions

4.1 Biogeographical or marine region where the species occurs ATL

#### 4.2 Sources of information

See section 14 References

### 5. Range

5.1 Surface area (km<sup>2</sup>) 10,209.27

5.2 Short-term trend; Period 2013-2024

5.3 Short-term trend; Direction Stable

5.4 Short-term trend;  
Magnitude

a) Estimated minimum

b) Estimated maximum

c) Pre-defined range

d) Unknown

e) Type of estimate

f) Rate of decrease

5.5 Short-term trend; Method used Based mainly on extrapolation from a limited amount of data

5.6 Long-term trend; Period 2000-2024

5.7 Long-term trend; Direction Stable

5.8 Long-term trend;  
Magnitude

a) Minimum

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**b) Maximum**

---

**c) Rate of decrease**

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**5.9 Long-term trend; Method used**      Based mainly on extrapolation from a limited amount of data

**5.10 Favourable Reference Range (FRR)****a) Area (km<sup>2</sup>)**

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**b) Pre-defined increment**      Current range is less than 2% smaller than the FRR

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**c) Unknown**      No

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**d) Method used**      Reference-based approach

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**e) Quality of information**      moderate

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**5.11 Change and reason for change in surface area of range**

**a) Change**      No

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**b) Genuine change**

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**c) Improved knowledge or more accurate data**

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**d) Different method**

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**e) No information**

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**f) Other reason**

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**g) Main reason**

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**5.12 Additional information**

The range makes use of records for both the gametophyte and the sporophyte generations. The UK surface area of range was reported as 30630km<sup>2</sup> in 2019. There was, however, no surface area range value at the England level in the 2019 reporting round. Assessing England only change in range is therefore problematic. If JNCC's bespoke alpha hull model was run on the country (England and Wales) distribution data at that time, it would provide a baseline to more definitively compare the change in range between 2019 and 2024, other than comparing the maps. By a visual comparison of the maps for 2019 and 2024, it appears that there has been a slight decrease in range. However, this is not thought to be a genuine decrease (rather an artefact of recording

effort and range map calculation). New populations of sporophyte have been discovered, notably in the south west. This may be owing to increased survey or a genuine, climate-influenced change. However, taking both lifestages into account, it is judged that there has been no change in range during the reporting period. The range, taking both generations into account, is thought to be favourable (and so the operator of less than 2% smaller than the FRR as advised by JNCC is appropriate).

## 6. Population

**6.1 Year or period** 2010-2024

### 6.2 Population size (in reporting unit)

**a) Unit** number of individuals

**b) Minimum**

**c) Maximum**

**d) Best single value** 2,044

**6.3 Type of estimate** Best estimate

**6.4 Quality of extrapolation to reporting unit** moderate

### 6.5 Additional population size (using population unit other than reporting unit)

**a) Unit**

**b) Minimum**

**c) Maximum**

**d) Best single value**

**e) Type of estimate**

**6.6 Population size; Method used** Based mainly on extrapolation from a limited amount of data

**6.7 Short-term trend; Period** 2013-2024

**6.8 Short-term trend; Direction** Increasing

**6.9 Short-term trend; Magnitude**

a) Estimated minimum

b) Estimated maximum

c) Pre-defined range

d) Unknown Yes

e) Type of estimate Best estimate

f) Rate of decrease

**6.10 Short-term trend; Method used** Based mainly on extrapolation from a limited amount of data

**6.11 Long-term trend; Period** 2000-2024

**6.12 Long-term trend; Direction** Increasing

**6.13 Long-term trend; Magnitude**

a) Minimum

b) Maximum

c) Confidence interval

d) Rate of decrease

**6.14 Long-term trend; Method used** Based mainly on extrapolation from a limited amount of data

### **6.15 Favourable Reference Population (FRP)**

ai) Population size

aii) Unit number of individuals

b) Pre-defined increment Current population is less than 5% smaller than the FRP

c) Unknown No

d) Method used Reference-based approach

e) Quality of information moderate

### **6.16 Change and reason for change in population size**

a) Change	Yes
b) Genuine change	Yes
c) Improved knowledge or more accurate data	Yes
d) Different method	No
e) No information	No
f) Other reason	No
g) Main reason	Improved knowledge/more accurate data

### 6.17 Additional information

Population counts for this species usually focus on the sporophyte generation, and that has been the approach of previous reporting rounds. There appears to have been genuine increase in sporophyte numbers in both the short-term and long-term, with the gametophyte generation remaining (to the best of our knowledge) stable. Changing climate, notably milder winters, is thought to be the driver between this change.

**6.18 Age structure, mortality and reproduction deviation**      No deviation from normal

## 7. Habitat for the species

### 7.1 Sufficiency of area and quality of occupied habitat (for long-term survival)

a) Is area of occupied habitat sufficient?	Yes
b) Is quality of occupied habitat sufficient?	Yes
c) If No or Unknown, is there a sufficiently large area of unoccupied habitat of suitable quality?	

### 7.2 Sufficiency of area and quality of occupied habitat; Method used

a) Sufficiency of area of occupied habitat; Method used      Complete survey or a statistically robust estimate

<b>b) Sufficiency of quality of occupied habitat; Method used</b>	Complete survey or a statistically robust estimate
<b>7.3 Short-term trend; Period</b>	2013-2024
<b>7.4 Short-term trend; Direction</b>	Stable
<b>7.5 Short-term trend; Method used</b>	Based mainly on extrapolation from a limited amount of data
<b>7.6 Long-term trend; Period</b>	2000-2024
<b>7.7 Long-term trend; Direction</b>	Stable
<b>7.8 Long-term trend; Method used</b>	Based mainly on extrapolation from a limited amount of data

### 7.9 Additional information

A stable trend has been concluded, based on repeated complete surveys of sites. However, it could be argued that, taking climate as an abiotic component of habitat, the area and quality of habitat is increasing as the climate becomes increasingly ammenable for the species.. Evidence has shown climatic conditions are important in the production of the sporophyte generation and the trend towards milder winters over the recent decades has increased the area of suitable habitat.

## 8. Main pressures

### 8.1 Characterisation of pressures

**Table 3:** Pressures affecting the species, including timing and importance/impact ranking. Pressures are defined as factors acting currently and/or during the reporting period (2019–2024). Rankings are: High (direct/immediate influence and/or large spatial extent) and Medium (moderate direct/immediate influence, mainly indirect and/or regional extent).

Pressure	Timing	Ranking
PB17: Use of plant protection chemicals in forestry	Ongoing and likely to be in the future	Medium (M)
PB05: Logging without replanting or natural regrowth	Ongoing and likely to be in the future	Medium (M)
PB09: Clear-cutting, removal of all trees	Ongoing and likely to be in the future	Medium (M)

PC01: Extraction of minerals (e.g. rock, metal ores, gravel, sand, shell)	Ongoing and likely to be in the future	Medium (M)
PB24: Drainage for forestry	Ongoing and likely to be in the future	Medium (M)
PD02: Hydropower (dams, weirs, run-off-the-river and respective infrastructure)	Ongoing and likely to be in the future	Medium (M)
PG12: Illegal harvesting, collecting and taking of plants and fungi	Ongoing and likely to be in the future	Medium (M)
PM05: Avalanches, landslides and collapse of terrain	Ongoing and likely to be in the future	Medium (M)
PA14: Use of plant protection chemicals in agriculture	Ongoing and likely to be in the future	Medium (M)
PK04: Atmospheric N-deposition	Ongoing and likely to be in the future	Medium (M)
PI01: Invasive alien species of Union concern	Ongoing and likely to be in the future	Medium (M)
PI03: Problematic native species	Ongoing and likely to be in the future	Medium (M)

## 8.2 Sources of information

See section 14 References

## 8.3 Additional information

No additional information

## 9. Conservation measures

### 9.1: Status of measures

a) Are measures needed?

Yes

b) Indicate the status of measures

Measures identified and taken

9.2 Main purpose of the measures taken

Maintain the current range, population and/or habitat for the species

9.3 Location of the measures taken

Both inside and outside National Site Network

## 9.4 Response to measures

Medium-term results (within the next two reporting periods, 2025–2036)

## 9.5 List of main conservation measures

**Table 4:** Key conservation measures addressing current pressures and/or anticipated threats during the next two reporting periods (2025–2036). Measures are ranked by importance/impact: High (direct/immediate influence and/or large spatial extent) and Medium (moderate direct/immediate influence, mainly indirect and/or regional extent).

Conservation measure	Ranking
MI02: Management, control or eradication of established invasive alien species of Union concern	Medium (M)
MK03: Restoration of habitats impacted by multi-purpose hydrological changes	High (H)
MS02: Reintroduce species from the directives	High (H)
MS03: Restoration of habitat of species from the directives	High (H)
MB09: Manage the use of natural and synthetic fertilisers, liming and pest control in forestry	Medium (M)
MB06: Stop forest management and exploitation practices	Medium (M)
MC01: Adapt/manage extraction of non-energy resources	Medium (M)
MC02: Adapt/manage exploitation of energy resources	Medium (M)
MI04: Restoration of habitats affected by invasive alien species (incl. of Union concern and others)	High (H)
MA09: Manage the use of natural and synthetic fertilisers as well as chemicals in agricultural for plant and animal production	Medium (M)
MB04: Adapt/manage reforestation and forest regeneration	Medium (M)
MB05: Adapt/change forest management and exploitation practices	Medium (M)
MB14: Manage drainage and water abstraction for forestry (inc. restoration of drained or hydrologically altered habitats)	Medium (M)
MC04: Reduce impact of hydropower operation and infrastructure (incl. the restoration of freshwater habitats)	Medium (M)

MG04: Control/eradication of illegal killing, fishing and harvesting of wild plants, fungi and animals	High (H)
MM02: Minimise/prevent impacts of geological and natural catastrophes	Medium (M)
MK01: Reduce impact of mixed source pollution	High (H)
MK02: Reduce impact of multi-purpose hydrological changes	High (H)
MI05: Management of problematic native species	Medium (M)

## 9.6 Additional information

Measures are needed to protect sporophyte localities from both gross modification (e.g. quarrying, clear-felling if wooded, alteration or watercourses), from collection (see comments re: sensitivity), and influence of water and airborne pollution. Measures addressing pollution are identified but less established and taken.

## 10. Future prospects

### 10.1a Future trends of parameters

<b>ai) Range</b>	Overall stable
<b>bi) Population</b>	Positive - increasing $\leq 1\%$ (one percent or less) per year on average
<b>ci) Habitat for the species</b>	Overall stable

### 10.1b Future prospects of parameters

<b>aii) Range</b>	Good
<b>bii) Population</b>	Good
<b>cii) Habitat for the species</b>	Good

## 10.2 Additional information

Whilst there is uncertainty around the conclusions around Future Prospects, there are some indications from recent surveys and published research. Britain and Ireland are at the northern end of the global distribution of *Vandenboschia speciosa*, with Macronesia providing the current and historic heartlands for the species and the Laurisilva the classic habitat. The shifting climate of our northern islands, particularly warmer winters,

is becoming increasingly favourable for sporophyte growth. Recent research suggests that under current climate projections, populations at the south of Killarney Fern’s global range will be at risk, whilst the UK and Ireland are the ‘only areas that are maintained with steady potential’ (Ben-Menni Schuler et al. 2022). This has significant implications concerning our international responsibility for the species as we must ensure that where climate suitability is predicted to be maintained or even improved, this is not compromised by adding other, more avoidable pressures (such as invasive species which cast a degree of shade detrimental to *V. speciosa*). Further, the climate may not be wholly more amenable for *V. speciosa* to increase its population: the potential trend towards a greater risk of drought could prove detrimental for a species reliant on the balance between water availability and evaporation. The stable, hard-rock environment of the gametophytes combined with their widespread distribution and the protected nature of the sporophyte colonies should ensure stability in terms of overall range for both gametophyte and sporophyte. On the balance of evidence, the prospects appear to be good.

## 11. Conclusions

<b>11.1 Range</b>	Favourable (FV)
<b>11.2 Population</b>	Favourable (FV)
<b>11.3 Habitat for the species</b>	Favourable (FV)
<b>11.4 Future prospects</b>	Favourable (FV)
<b>11.5 Overall assessment of Conservation Status</b>	Favourable (FV)
<b>11.6 Overall trend in Conservation Status</b>	Stable

### 11.7 Change and reason for change in conservation status

This field is not reported as the period 2019-2024 marks the first instance in which conservation status has been assessed at the national level, meaning no comparisons to previous reports can be drawn.

### 11.7 Change and reason for change in conservation status trend

This field is not reported as the period 2019-2024 marks the first instance in which conservation status has been assessed at the national level, meaning no comparisons to previous reports can be drawn.

## 11.8 Additional information

No additional information

## 12. UK National Site Network (pSCIs, SCIs, SACs) coverage for Annex II species

### 12.1 Population size inside the pSCIs, SCIs and SACs network

<b>a) Unit</b>	number of individuals
<b>b) Minimum</b>	
<b>c) Maximum</b>	
<b>d) Best single value</b>	1,933
<b>12.2 Type of estimate</b>	Best estimate
<b>12.3 Population size inside the network; Method used</b>	Complete survey or a statistically robust estimate
<b>12.4 Short-term trend of population size within the network; Direction</b>	Stable
<b>12.5 Short-term trend of population size within the network; Method used</b>	Complete survey or a statistically robust estimate
<b>12.6 Short-term trend of habitat for the species inside the pSCIs, SCIs and SACs network; Direction</b>	Stable
<b>12.7 Short-term trend of habitat for the species inside the pSCIs, SCIs and SACs network; Method used</b>	Based mainly on extrapolation from a limited amount of data

### 12.8 Additional information

No additional information

## **13. Complementary information**

### **13.1 Justification of percentage thresholds for trends**

No justification information

### **13.2 Trans-boundary assessment**

No trans-boundary assessment information

### **13.2 Other relevant information**

No other relevant information

## 14. References

### Biogeographical and marine regions

#### 4.2 Sources of information

Ben-Menni Schuler S, Hamza H, Blanca G, Romero-García AT, Suárez-Santiago VN. 2022. Phylogeographical Analyses of a Relict Fern of Palaeotropical Flora (*Vandenboschia speciosa*): Distribution and Diversity Model in Relation to the Geological and Climate Events of the Late Miocene and Early Pliocene. *Plants*.11(7):839. <https://doi.org/10.3390/plants11070839>

BSBI Distribution database (Accessed January 2025)

Prendergast, A. & Mills, A., In prep. 'Killarney Fern *Trichomanes speciosum* Willd. in England A confidential record of extant populations 2023 with kind assistance by Fred Rumsey', unpublished, Natural England

Stroh, P.A., Humphrey, T.A., Burkmar, R.J., Pescott, O.L., Roy, D.B., & Walker, K.J., 2023 *Trichomanes speciosum* (gametophyte) Willd. in BSBI Online Plant Atlas 2020, <https://plantatlas2020.org/atlas/2cd4p9h.885> (Accessed January 2025)

Stroh, P.A., Humphrey, T.A., Burkmar, R.J., Pescott, O.L., Roy, D.B., & Walker, K.J., 2023 *Trichomanes speciosum* (sporophyte) Willd. in BSBI Online Plant Atlas 2020, <https://plantatlas2020.org/atlas/2cd4p9h.c3> (Accessed January 2025)

Rumsey, F.R. 2018 *Trichomanes speciosum* Willd. (syn. *Vandenboschia speciosa* (Willd.)Kunkel) Sporophyte, St. Nectan's Kieve, nr. Tintagel, E. Cornwall, VC.2 - a CONFIDENTIAL report to Natural England (April 2018).

Rumsey, F.J., Jermy, A.C. & Sheffield, E 1998 The independent gametophytic stage of *Trichomanes speciosum* Willd. (Hymenophyllaceae), the Killarney Fern and its distribution in the British Isles *Watsonia* 22, 1-19

Trewen, K., 2003. Report on Surveys of the Killarney Fern (*Trichomanes speciosum*) in East Arncliffe Wood and West Arncliffe Wood, North York Moors - November 2002 to February 2003. English Nature unpublished report - IN STRICT CONFIDENCE

Trewen, K., 2004. Report on the Status of the Killarney Fern (*Trichomanes speciosum*) in West Arncliffe Wood, North York Moors (Third Annual Recording) - February 2004. English Nature unpublished report - IN STRICT CONFIDENCE

Trewen, K., 2005. Survey to Determine the Status of the Killarney Fern (*Trichomanes speciosum*) in Northern Cumbria - February to April 2005. English Nature unpublished report - IN STRICT CONFIDENCE

Trewen, K., 2005. Report on the Status of the Killarney Fern (*Trichomanes speciosum*) in Park Hole Wood, North York Moors, in 2005. English Nature unpublished report - IN STRICT CONFIDENCE

Trewen, K., 2005. Report on the Status of the Killarney Fern (*Trichomanes speciosum*) in West Arncliffe Wood, North York Moors (Fourth Annual Recording) - February to April 2005. English Nature unpublished report - IN STRICT CONFIDENCE

Trewen, K., 2006. Report on the Status of the Killarney Fern (*Trichomanes speciosum*) in West Arncliffe Wood, North York Moors (Fifth Annual Recording) - February 2006. English Nature unpublished report - IN STRICT CONFIDENCE

Trewen, K., 2006. Report on the Status of the Killarney Fern (*Trichomanes speciosum*) in Park Hole Wood, North York Moors, in March 2006. English Nature unpublished report - IN STRICT CONFIDENCE

Trewen, K., 2006. Report on the Status of the Killarney Fern (*Trichomanes speciosum*) in East Arncliffe Wood, North York Moors - November 2005 to April 2006. Volume 1. English Nature unpublished report - IN STRICT CONFIDENCE

Trewen K., 2006. Report on the Status of the Killarney Fern (*Trichomanes speciosum*) in East Arncliffe Wood, North York Moors - November 2005 to April 2006. Volume 2. English Nature unpublished report - IN STRICT CONFIDENCE

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Rumsey, F.R. 2013 *Trichomanes speciosum* Willd., Killarney Fern, Sporophyte generation in England - A CONFIDENTIAL record of extant populations. NHM, London

## **Main pressures**

### **8.2 Sources of information**

No sources of information

## 15. Explanatory Notes

Field label	Note
1.4: Alternative species scientific name	Most records (and recorders) continue to regard <i>Trichomanes speciosum</i> Willd. as the accepted name for this taxon - and it remains the name in use in the standard British flora (Stace, C.A. 2019).
2.1: Sensitive species	Sporophytes of <i>Vandenboschiaspeciosa</i> have been collected from the wild for private horticultural collections and herbarium specimens for c.200 years. Whilst there are no recent reports of this, the pteridological community remains concerned and the locations of two sporophyte sites are still kept secret (even from the statutory nature conservation agencies). This concern does not, however, extend to the gametophyte localities. However, with increasing sporophyte development, previously gametophyte-only sites may become sporophyte sites, and have a higher sensitivity.
2.3: Distribution map	Showing undifferentiated sporophyte and gametophyte records. Data from BSBI Database (Accessed January 2025) and Prendergast and Mills (in prep) report.
2.4: Distribution map; Method used	Data from BSBI Database (Accessed January 2025) and Prendergast and Mills (in prep) report. The surveys for the Prendergast and Mills (in prep) report revealed increases in sporophyte numbers and recruitment.
5.3: Short-term trend; Direction	It remains the case that gametophytes are likely to be under-recorded (difficulties in identification and also access to sites (deep recesses within rock - either solid geology or boulders)) but indications are that they are very long-lived and persistent in these situations. The sporophyte sites are generally well-recorded and whilst the increases in sporophyte numbers noted in the previous reporting round has increased the range is thought to be stable.
5.11: Change and reason for change in surface area of range	No recorded or reported significant changes. The sporophyte sites are generally well-recorded and whilst the increases in sporophyte numbers noted in the previous reporting round has increased the range is felt to be stable.

	No change in the overall range when sporophyte and gametophyte taken together.
6.2: Population size	As in previous reporting rounds and general monitoring for this species, the population counts are of the sporophytes. Assessed here as plants. 'Colonies' are sometimes used in surveys but usually in addition to plant counts and the latter are preferred as they are less equivocal. Occasionally counts are of 'fronds' which may equate to plants on some sites, particularly where plants are small/immature, but the largest plants can have 100's of fronds. A large proportion of the plants are from a single Yorkshire locality (which has not been comprehensively surveyed since 2006, but surveys in 2023 (for the Prendergast and Mills (in prep) report) confirmed an increase in sporophyte numbers at the site, as seen elsewhere in the country).
6.3: Type of estimate	Following previous reporting rounds, this is an estimate of the sporophyte plant numbers. It is based upon previous estimates from the previous reporting round and more recent surveys (2023). However, the length of time covered by the assessment must reduce its reliability to some extent.
6.6: Population size; Method used	The population size was reached using counts from the previous reporting round (JNCC, 2019) combined with samples taken during surveys in 2023 to provide insight into changes (Prendergast and Mills (in prep)s, although it was not possible to include the Cumbrian sites at that time). The 2023 survey was able to make comparisons with previous surveys, assisted by the author of a previous assessment of the status of Killarney Fern commissioned by Natural England (Dr Fred Rumsey). The 2023 survey also established permanent quadrats to facilitate the collection of easily repeatable and comparable data over time to gain a measure of population change.
6.8: Short-term trend; Direction	The 2023 surveys found abundant evidence of fresh/young/new sporophytes forming from gametophytes at almost all sites, from Cornwall to Yorkshire, confirming that the recent observations represent a widespread phenomenon. In addition to new sporophytes, existing patches and fronds

	<p>had grown substantially. This recruitment and increased growth of sporophytes appears to be increasing and climate-driven. Relatively few gametophyte sites have been assessed on multiple occasions but expert opinion suggests that they are generally long-lived colonies in stable habitats.</p>
6.16: Change and reason for change in population size	<p>Population counts for this species usually focus on the sporophyte generation, and that has been the approach of previous reporting rounds. There appears to have been genuine increase in sporophyte numbers in both the short-term and long-term, with the gametophyte generation remaining (to the best of our knowledge) stable. Changing climate, notably milder winters, is thought to be the driver between this change.</p>
7.1: Sufficiency of area and quality of occupied habitat	<p>Gametophyte sites continue to be discovered and these do not seem to be confined to site with a narrow range of characteristics.. Some gametophyte sites have also produced sporophytes from time-to-time (increasingly so in recent years) and it seems likely that climatic conditions are primarily responsible for this transition rather than habitat quality or extent (although there is clearly a relationship between the two given the climatically marginal nature of England with respect to the survivorship potential of sporophytes in cold winter weather).</p>
7.2: Sufficiency of area and quality of occupied habitat; Methods used	<p>Most suitable habitat for the species is likely to be occupied only by gametophytes due to climatic constraints on sporophyte production and survival (namely sufficient humidity and lack of extreme winter cold). Gametophytes have only been recognised in England in relatively recent times (since the late 1980s) and few sites discovered have been resurveyed whilst more new sites continue to be found. However, gametophyte distribution data are now relatively abundant and the distribution of apparently suitable (and occupied) habitat seems to be widespread.</p>
9.1: Status of measures	<p>Measures are needed to protect sporophyte localities from both gross modification (e.g. quarrying, clear-felling if wooded, alteration of watercourses), from collection (see comments re: sensitivity), and influence of water and</p>

	airborne pollution. Measures addressing pollution are identified but less established and taken.
8.1: Characterisation of pressures	Whilst there are a number of threats in theory with respect to sporophyte colonies the majority are addressed through existing designations. Only illegal collection remains a widespread concern (but with little recent evidence that this is a major pressure). Of more widespread concern is the vulnerability of gametophyte localities to herbicide applications to control bracken ( <i>Pteridium aquilinum</i> ), to modification of tree cover or forest canopies (resulting in increased risk of dehydration, direct insolation and frost penetration) and to quarrying.
9.3: Location of the measures taken	Very nearly all of the sporophyte population lies within Natura 2000. Of the remaining sites, only one is not within Sites of Special Scientific Interest (offering protection from gross modification and interference). All measures are currently directed at sporophyte sites.
9.4: Response to the measures	The measures are in place and have immediate and ongoing effect.
9.5: List of main conservation measures	Beyond site designation and maximum confidentiality of records for sporophytes there are few measures which can mitigate against the existing pressures and threats. Monitoring of gametophyte sites is, for example, very difficult given both their wide distribution, difficulty in determination and physical access to the colonies. The measures listed here apply mainly to sporophyte localities but also as general principles to apply wherever gametophytes are known to occur.
12.1: Population size inside the pSCIs, SCIs and SACs network	This figure, as with other population figures above, is of sporophytes only. It represents c.99% of the known English sporophyte population. Whilst some gametophytes occur alongside sporophytes within Natura 2000 sites, neither the population size nor an accurate percentage of

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	the English gametophyte population represented within Natura 2000 sites can be determined.
7.9: Additional information	A stable trend has been concluded, based on repeated complete surveys of sites. However, it could be argued that, taking climate as an abiotic component of habitat, the area and quality of habitat is increasing as the climate becomes increasingly ammenable for the species. Evidence has shown climatic conditions are important in the production of the sporophyte generation and the trend towards milder winters over the recent decades has increased the area of suitable habitat.
5.1: Surface area	The area calculation makes use of both sporophyte and gametophyte records/locations.

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