

**European Community Directive
on the Conservation of Natural Habitats
and of Wild Fauna and Flora
(92/43/EEC)**

**Second Report by the United Kingdom under
Article 17
on the implementation of the Directive
from January 2001 to December 2006**

**Conservation status assessment for :
S1065: *Euphydryas aurinia* -
Marsh fritillary butterfly**

Please note that this is a section of the report. For the complete report visit <http://www.jncc.gov.uk/article17>

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S1065 *Eurodryas aurinia* Marsh fritillary butterfly

Audit trail compiled and edited by JNCC and the Invertebrate Inter-Agency Working Group

This document is an audit of the data and judgements on conservation status in the UK's report on the implementation of the Habitats Directive (January 2001 to December 2006) for this species. Superscript numbers accompanying the headings below, cross-reference to headings in the corresponding Annex B reporting form. This supporting information should be read in conjunction with the UK approach for species (see 'Assessing Conservation Status: UK Approach').

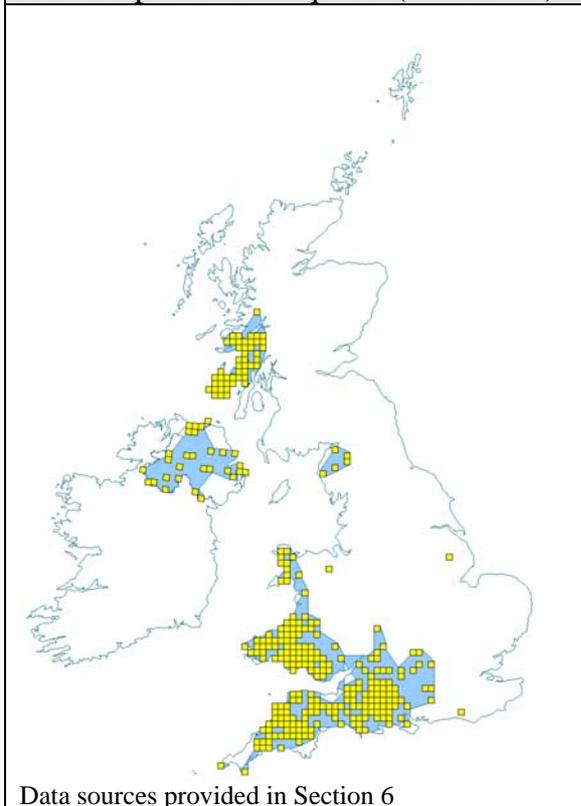
1. Range Information^{2,3}

1.1 Surface area of range^{2,3,1}

55,219 km²

The above estimate was calculated within Alpha Hull software, using extent of occupancy as a proxy measure for range (see Map 1.1), at a 10km resolution. The value of alpha was set at 20km to reflect the dispersal capacity of this species.

Map 1.1. Current extent of occurrence and occupied 10 km-squares (1990-2006)



1.2 Date of range determination^{2,3,2}

1990 – 2006

Extent of occurrence was mapped using records from 1990 onward. Most UK records were sourced via the NBN Gateway; the most recent of these were 2004. Additional 2006 Northern Ireland records were provided by the Environmental Heritage Service.

1.3 Quality of range data^{2.3.3}

Good

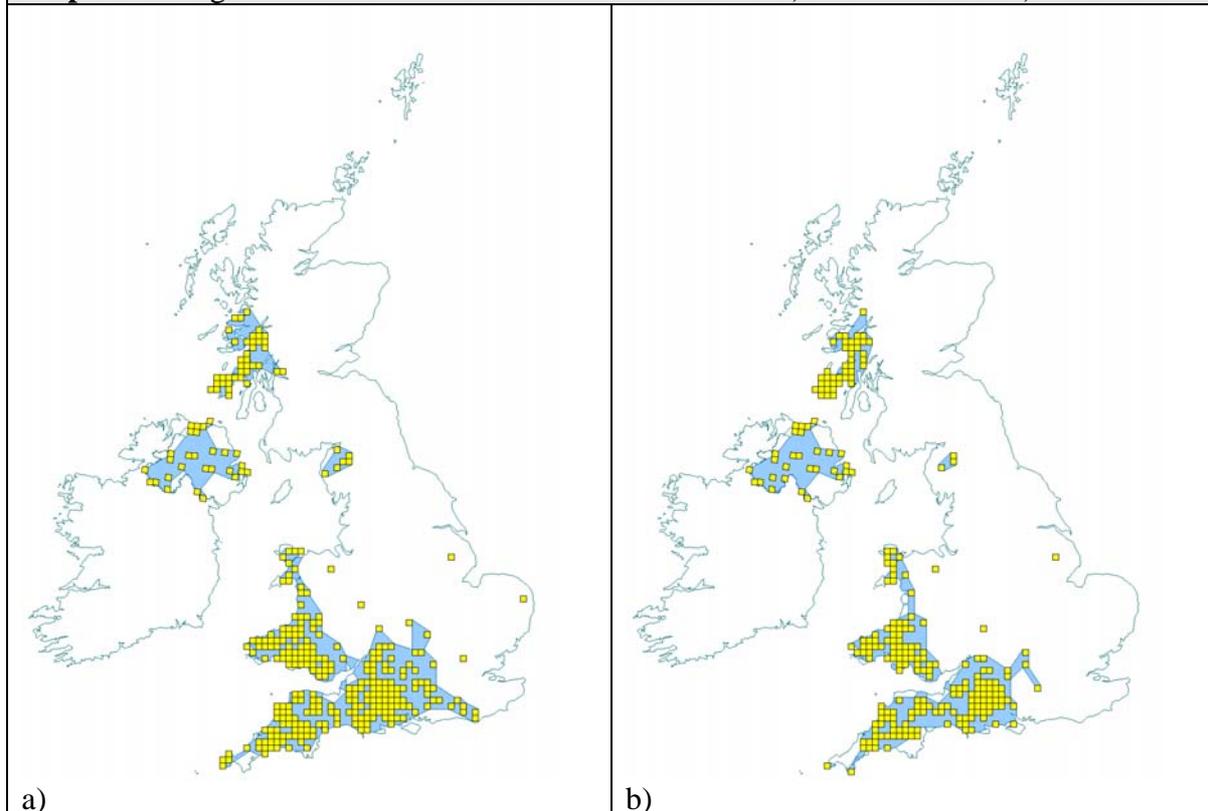
There has been 'blanket-wide' survey in England and Wales over the last decade and the NI populations are all well-known. A few new populations are discovered each year, but this is a very small percentage of the c. 300 UK populations. The range in Scotland, though less well known is nonetheless sufficient report quality of data used to determine range as Good.

1.4 Range trend^{2.3.4} & Range trend magnitude^{2.3.5}

Decreasing

Although formerly widespread in central and eastern England, *Eurodryas aurinia* is now mainly confined to western and northern parts of the UK. Based on the information available, it is not possible to comment on post-1994 trends in range with any certainty. However, there is evidence to suggest that range is continuing to decline, in particular along the eastern edge of its distribution (see Maps 1.2 a & b). (Extent of occurrence cannot be calculated for the more recent date class because post-1995 data for Northern Ireland is not currently available. Hence, similarly, rate of decline cannot be reported).

Map 1.2 Change in distribution between two date classes: a) 1985 - 1994 & b) 1995-2006.



1.5 Range trend period^{2.3.6}

1994 – 2006

1.6 Reasons for reported trend in range^{2.3.7}

3. Direct human influence (restoration, deterioration, destruction);

4. Indirect anthropo(zoo)genic influence

Declines have been attributed to agricultural improvement of marshy and chalk/limestone grassland; afforestation and development of habitats; changes in grazing stock and practice; and increasing fragmentation and isolation of habitats (www.ukbap.org.uk/UKPlans.aspx?ID=300).

1.7 Favourable reference range^{2.7.1}

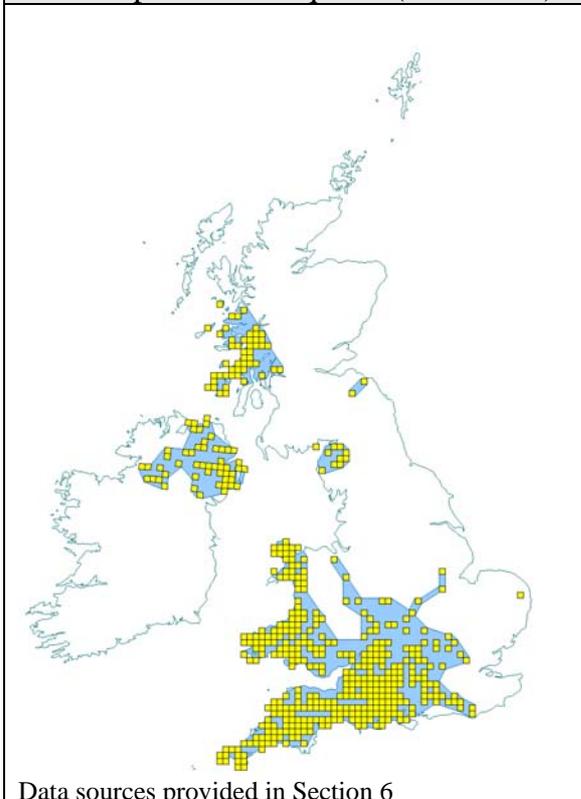
60,883 km² (Current is 10% below the favourable reference range)

The decision tree in Note 1 has been used as a guide in determining the favourable reference range estimate (see 'Assessing Conservation Status: UK Approach').

Current trend is decreasing, but the rate of this trend is Unknown. Map 1.3 shows historical extent of occurrence (1960-1989), calculated at 82,698km² (using Alpha Hull software, with alpha set at 20km). When compared with the current extent of occupancy (54,795km²; shown in Map 1.1), this suggests a decline of 33% since the 1960s.

Data used to compile these maps include some introduced populations and this will affect the percentage decline. However, even accepting this, decline is unlikely to have exceeded 1% per annum. Therefore, in accordance with Note 1, the current range is reported as 10% below the favourable reference range, i.e. the favourable reference range is 60,883 km².

Map 1.3. Historic extent of occurrence and occupied 10 km-squares (1960-1989)



1.8 Range conclusion^{2.8}

Unfavourable - Inadequate

Current range is less than the favourable reference range, but not by more than 10%.

2. Population of the Species^{2.4}

2.1 Population estimate^{2.4.1}

315 Occupied 1-km squares

Information from Butterflies for the New Millennium plus 5 as reported to BAP in 2005 gives 315 occupied 1km squares. This figure corresponds approximately to the number of colonies of *E.aurinia* throughout the UK (www.ukbap-reporting.org.uk National Biodiversity Action Plan - Targets).

Populations of marsh fritillary vary greatly in size from year to year, and, at least in part, this is related to cycles of attack from parasitic wasps. Adults tend to be sedentary and remain in a series of linked metapopulations, forming numerous temporary sub-populations, which frequently die out and re-colonise. Where unable to do this, populations do not seem to be able to persist in habitat fragments. It is therefore essential to conserve a cluster of sites in close proximity.

2.2 Date of population estimate^{2.4.2}

2005

2.3 Method of population estimate^{2.4.3}

2 = Extrapolation from surveys of part of the population, sampling

Survey work undertaken as part of the BAP process and records from Butterfly Recording as reported in Butterflies for the New Millennium plus 5.

2.4 Quality of population data^{2.4.4}

Good

More or less comprehensive surveys have been undertaken in England, Wales & NI in the past decade and partial surveys have taken place in Scotland. Data quality is therefore good.

2.5 Population trend^{2.4.5} and population trend magnitude^{2.4.6}

Decreasing

Population trend is not easy to estimate. Using 10km square data from the Butterflies for the New Millennium dataset a 37% decline has been calculated over 30 years (between two sampling periods: 1970-82 to 1995-99). The methodology used is described in Thomas *et al.* 2004 and compensates for differential recorder effort between the two recording periods. A simple model can be used to calculate the annual rate of decline from this data. If the annual rate of decline is p , then after a period of n years, the proportion of the original that will remain is $(1 - p)^n$. Putting in the figures we have for marsh fritillary:

$$(1 - p)^{30} = 0.63$$

then the annual rate of decline must be:

$$p = 0.015283$$

i.e. a decline rate of circa 1.5% per annum.

Losses at a 10km square level have been shown to underestimate population declines by an average of 35% (Thomas & Abery 1995). Therefore actual loss figures are likely to be higher than the calculated figure of 37%.

Comprehensive surveys in Wales show that the species has declined by 52.2% of its historical range at 10km square level and, despite recent conservation efforts, this rate of loss is continuing. For example, 23.5% of tetrads (4x4km squares) occupied during the 1980s were found to be unoccupied during surveys undertaken during the 1990s. Twelve of the 200 Welsh populations recorded since 1990 are known to have definitely become extinct, whilst repeat visits to 88 populations found no evidence of marsh fritillaries at a further 42 (Fowles & Smith 2006).

2.6 Population trend period^{2.4.7}

1990 – 2006

2.7 Reasons for reported trend in range^{2.3.7}

3. Direct human influence (restoration, deterioration, destruction);

4. Indirect anthropo(zoo)genic influence

Declines have been attributed to agricultural improvement of marshy and chalk/limestone grassland; afforestation and development of habitats; changes in grazing stock and practice; and increasing fragmentation and isolation of habitats (www.ukbap.org.uk).

2.8 Justification of % thresholds for trends^{2.4.9}

Not applicable

2.9 Main pressures^{2.4.10}

100 Cultivation

102 Mowing, cutting

110 Use of pesticides

120 Fertilisation

140 Grazing

141 Abandonment of pastoral systems

161 Planting

180 Burning

590 Other forms of transportation and communication

620 Outdoor sports and leisure activities

629 Other outdoor sports and leisure activities

703 Soil pollution (nutrient enrichment)

810 Drainage

950 Biocenotic evolution (scrub development)

2.10 Threats^{2.4.11}

102 Mowing, cutting

140 Grazing

141 Abandonment of pastoral systems

180 Burning

620 Outdoor sports and leisure activities

629 Other outdoor sports and leisure activities

703 Soil pollution (nutrient enrichment)

950 Biocenotic evolution (scrub development)

2.11 Favourable reference population^{2.7.2}

At least 410 occupied 1-km squares

The decision tree in Note 1 has been used as a guide in determining the favourable reference population estimate (see 'Assessing Conservation Status: UK Approach').

Population is currently declining at a rate of circa 1.5% per annum (see section 2.5). Using the 2005 population figure of 315 occupied 1 km squares, an averaged population estimate for 1994 of 373 occupied 1 km squares can be derived. Knowing that the population in 1994 was not in Favourable condition, a minimum value for the favourable reference population might be assumed to be at least 10% higher than the calculated value i.e. 410 occupied 1 km squares.

2.12 Population Conclusion^{2.8}

Unfavourable – Bad

The current population is more than 25% below the favourable reference population. It is also subject to complicating factors of metapopulation dynamics. For these reasons, a conclusion of Unfavourable – Bad has been given.

3. Habitat for the Species in the Biogeographic Region or Sea^{2.5}

The marsh fritillary butterfly *E. aurinia* is found in a range of habitats in which its larval food plant, devil's-bit scabious *Succisa pratensis*, occurs. Marsh fritillaries are essentially grassland butterflies in the UK, and although populations may occur occasionally on wet heath, bog margins and woodland clearings, most colonies are found in damp acidic or dry calcareous grasslands (including 6410 *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) and 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*)). In Northern Ireland it occurs in fens and on sand dunes and there are two dune populations in Wales. Management in both wet and dry situations is predominantly by low-intensity cattle or pony grazing. Sheep selectively graze devil's-bit scabious and are therefore detrimental to marsh fritillary populations, except at very low stocking rates. Burning and mowing are also known to have caused the extinction of populations.

3.1 Surface area of habitat^{2.5.2}

50km²

Cowley *et al* (1999) investigated the relationship between distribution data and known flight area requirements for a number of species including *E. aurinia*. The mean area of *E. aurinia* colonies was estimated to be 0.06 km². Extrapolation from this figure gives an estimate of 22km² in 1999 (based on 374 sites). This figure represents the area of habitat occupied during a particular season and does not include areas used as part of the metapopulation matrix. Surface area of habitat has therefore been estimated as at least 50 km². Survey work in Wales has found 18.2sqkm of habitat associated with 55% of the Welsh colonies which leads to an estimate of between 25 & 30sqkm of habitat in Wales. England has a similar number of populations and might well have 20-25sqkm of habitat if landscapes are similar. Scotland has large areas thinly populated with fewer populations but might have 10-15sqkm, NI has no more than 1-2sqkm. Based on this an upper estimate can be derived of about 70sqkm.

3.2 Date of estimation^{2.5.3} **2000**

3.3 Quality of data on habitat area^{2.5.4} **Poor**

3.4 Habitat trend^{2.5.5} **Decreasing**

3.5 Habitat trend period^{2.5.6} **1994 – 2006**

3.6 Reasons for reported trend in habitat^{2.5.7}

3. Direct human influence (restoration, deterioration, destruction);

4. Indirect anthropo(zoo)genic influence

There is a history of inappropriate habitat management, either agricultural abandonment or intensification. In Wales, only 11.85% of breeding habitat was assessed as being in good condition. Of the suitable habitat that was not managed sympathetically, 33% was over-grazed and 67% was suffering from agricultural neglect (Fowles & Smith 2006). Similar conclusions were derived from a study in England (Hobson et al 2001). Several new projects in England and Wales are beginning to address this, but declines have not yet been halted.

3.7 Suitable habitat for the species (in km²)^{2.7.3}

Unknown

No comprehensive survey of habitat suitable for *E. aurinia* has been undertaken. There has been some intensive research at a more local level (e.g. Cowley *et al* 1999). In Wales there has been considerable effort in recent years to determine the extent of suitable habitat. Since 2000, surveys of habitat extent and quality have been carried out on 116,373 hectares of grassland surrounding 111 populations (55% of the total number of surviving populations). Of the grassland that was surveyed, 1822 ha (15.9%) were mapped as being capable of supporting marsh fritillary populations on the basis of the presence of the foodplant. However, only 216ha (11.85%) of the grassland that was suitable for marsh fritillaries was classified as being in good condition. The remainder was regarded as having sub-optimal vegetation structure and/or the foodplant was at low density; 33% of the habitat resource that was not in Good condition was regarded as inappropriately or excessively managed and 67% was suffering from neglect (Fowles & Smith 2006).

3.8 Habitat conclusion^{2.8} **Unfavourable – Bad**

4. Future Prospects^{2.6}

Poor prospects

Species is likely to struggle unless conditions change.

E. aurinia is the subject of considerable conservation effort. Landscape scale projects to address management issues and to restore metapopulation networks have begun in several areas and there is now widespread recognition of the plight of the marsh fritillary and the actions required to conserve metapopulations. However, the scale of the problems facing this species are immense and many areas now consist of heavily fragmented patches of breeding habitat that are inadequate to support viable metapopulations in the medium-long term.

Research has indicated that about 100ha of habitat are required to support viable metapopulations (Bulman 2001) and relatively few areas currently contain this amount of habitat. Without a substantial input of resources the majority of marsh fritillary metapopulations in Britain will continue to decline and many are expected to become extinct in the next few decades. Future prospects for *E. aurinia* are thus judged to be Poor.

E. aurinia is listed on Annex II of the EC Habitats Directive and Appendix II of the Bern Convention and is fully protected under Schedule 5 of the WCA 1981, and under Schedules 5 and 7 of the Wildlife Order (Northern Ireland) 1985. It is the subject of a Species Action Plan under the UK Biodiversity Action Plan (and included on the revised UKBAP list.)

4.1 Future prospects conclusion^{2,8}

Unfavourable – Inadequate

A few metapopulations are improving as we impose better management regimes, but overall the UK population is declining faster than we can act. So, it's improving in the sense that things are better than if we did nothing, but not improving if we judge it on the basis that each year there are fewer and fewer populations in the UK.

5. Overall Conclusion^{2,8}

Unfavourable – Bad

Population and Habitat were assessed as Unfavourable – Bad. Range and future prospects were assessed as Unfavourable – Inadequate. Hence, in accordance with Annex C the overall conclusion is Unfavourable – Bad.

Table 5.1. Summary of conclusions

Parameter	Judgement	Grounds for Judgement (in accordance with Annex C)	Reliability*
Range	Unfavourable – Inadequate	Any other combination Range is below the favourable reference range, but not by more than 10%.	1
Population	Unfavourable – Bad	Current population is more than 25% below favourable reference population	1
Habitat	Unfavourable – Bad	Area of habitat(s) is clearly not sufficiently large to ensure the long term survival of the species	3
Future Prospects	Unfavourable – Inadequate	Any other combination A few metapopulations are improving as we impose better management regimes, but overall the UK population is declining faster than we can act.	2
Overall Assessment	Unfavourable – Bad	One or more red	2

*1=High, 2=Moderate, 3=Low

High – Expert opinion is that the concluding judgement accurately reflects the current situation based on a professional understanding of the species. For range, population, and habitat, quality of data used to establish the current estimate has been identified as Good; data used to inform trends is comprehensive and up to date.

Moderate – A greater understanding of the feature, or the factors affecting it, is required before a confident concluding judgement can be made by experts. For range, population, and habitat, the current estimate and/or

trend are based on recent, but incomplete or limited survey data; or alternately, a comprehensive, but outdated (pre-1994) review.

Low – Judgements, and comprising estimates, are based predominately on expert opinion.

N/A – Assessment conclusion is Unknown, on the basis of insufficient reliable information

6. References

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FOWLES, A.P. & SMITH, R.G. 2006. Mapping the habitat quality of patch networks for the marsh fritillary *Euphydryas aurinia* (Rottemburg, 1775) (Lepidoptera, Nymphalidae) in Wales. *Journal of Insect Conservation*, **10**: 161-177.

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Map Data Sources

UK records (1990-2004):

Butterfly Conservation; Tullie House Museum; HBRG Lepidoptera dataset; Invertebrate Site Register – England; Invertebrate Site Register – Scotland; EHS Species Datasets; SW Pilot Project BAP Species Inventory 2002; Devon Biodiversity Records Centre; UK Biodiversity Action Plan - Invertebrate data for Ceredigion; Dorset SW Pilot species dataset; Wiltshire & Swindon Biological Records Centre (via the NBN Gateway)

Additional Northern Ireland records (2006):

B. Hamill (pers. comm), Environmental Heritage Service.