



**Species Action Plan**

**SMALL PEARL-BORDERED FRITILLARY**  
*Boloria selene*

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**Butterfly Conservation** (the British Butterfly Conservation Society) has an overriding objective to ensure a future for butterflies, moths and their habitats. In order to achieve this objective its aims are to:

- raise public awareness of the plight of our butterflies and moths and encourage public involvement in conservation.
- halt the decline of butterflies and moths and maintain or improve the present status of threatened species.
- improve the extent and suitability of key lepidoptera habitats and the environmental quality of the countryside as a whole for all lepidoptera species.
- work with and advise other conservation groups, local bodies and agencies on techniques of land management which favour butterflies and moths and related wildlife.
- acquire and manage habitats for butterflies and moths.
- encourage the research (both at amateur and professional levels) on butterflies and moths.
- support and encourage butterfly and moth conservation world-wide.

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## Summary

- The Small Pearl-bordered Fritillary, *Boloria selene* is a relatively widespread species in the UK but has declined severely in many areas since 1950. This decline has been most marked in central and eastern counties of England where the species is now almost absent, and it is becoming far more restricted in its remaining southern strongholds. The bulk of this decline in southern and eastern England occurred in woodland. The Small Pearl-bordered Fritillary has no statutory protection.
- The current rate of loss of colonies in southern England is estimated at 41% per decade (during the 1980s), although the species appears to be holding its own and is still very widespread in Wales, the north of England and Scotland. The national distribution map is now very much out of date and identification of core areas in each of its habitat types is urgently required to ensure appropriate conservation action for the species. A **medium** priority is afforded to the conservation action in this plan to protect and increase the number of Small Pearl-bordered Fritillary colonies in the UK. We will be reviewing this priority when more accurate distribution data is available.
- In lowland southern England, the Small Pearl-bordered Fritillary, occurs in damp, open deciduous woodlands that have a continuous history of coppice or underwood management producing continuous open spaces, or that have recently been cleared and replanted with conifers. In the West Country, Wales, the north of England and much of Scotland the species can generally be found breeding on moorland, marshland, damp grassland and open deciduous woodland. It is also found on Carboniferous limestone in the Mendips and around Morecambe Bay where it occurs in poorly grazed grassland habitats, sometimes amongst invading Bracken. It is widespread along cliff systems in much of western Britain.
- The Small Pearl-bordered Fritillary lives in a far wider variety of habitats than other Fritillaries, including the Pearl-bordered Fritillary. It is much more tolerant of damp vegetation and soils than the Pearl-bordered Fritillary, and in coppiced woodland habitats, populations of Small Pearl-bordered Fritillary peak in areas of two or more years coppice regrowth, as compared to the most open conditions created in the first year or two preferred by the Pearl-bordered Fritillary. Both species appear to be sedentary in coppice woodland habitats, but in some regions with more extensive habitats may be more mobile. This suggests both species may exist as metapopulations which breed over networks of habitats in the more unfragmented landscapes.
- The main threats to the butterfly are the continuing changes in woodland management, especially the decline in coppicing resulting in a loss of open clearings and reduction in the frequency of sizeable canopy gaps: Other threats are from the agricultural improvement and drainage of damp grassland habitat; abandonment of grassland/Bracken habitat (e.g. cessation of grazing) and abandonment of gorse burning in coastal valleys and other sites where gorse is dominant.
- The immediate major objectives of the plan are to halt the rapid decline of this butterfly in the UK; to maintain viable networks of populations throughout its current range; and to

conduct research on the distribution and ecology of the species to enable its effective conservation. A long term objective of the plan is to restore its 1950 range.

- The objectives of the plan will be achieved by determining current core areas of distribution of the butterfly; improving information on and dissemination of the habitat requirements of the species (especially in grassland, moorland, Bracken and open woodland habitats); maintenance or introduction of appropriate grazing regimes in grassland/Bracken habitats; prevention of further agricultural improvement of damp grasslands; maintenance/restoration of coppicing and active broad-leaved woodland management (including deer control where necessary) throughout the current and former range of the butterfly; limiting Bracken eradication measures in Bracken habitats; identifying potential reintroduction sites, giving advice on habitat restoration and conducting reintroductions if habitat restoration measures are successful.

- The Action Plan covers the next ten years, will be monitored annually and reviewed as the situation demands. The reviewing procedure is particularly important for this species, as our current knowledge about its distribution requires urgent updating. The priority and nature of any conservation action should be reviewed in the light of these results.

## **Part 1 Overview**

### **1.1 PRIORITY STATEMENT**

The Small Pearl-bordered Fritillary, *Boloria selene* was once widespread in woodlands, moorland, damp grassland/Bracken habitat throughout much of England, Scotland and Wales. It has declined severely in many areas since 1950 most noticeably in woodlands of central and eastern counties of England, where the species is now almost absent. It is also becoming far more restricted in southern England, except for the coastal valleys of Devon and Cornwall, where, it appears to be stable. In Scotland, northern England and Wales it is still widespread and locally abundant. It is listed as a species of conservation concern in Biodiversity: The UK Steering Group Report (DOE, 1995). Based on our current knowledge, **medium** priority should be afforded to conservation action to protect and increase the number of Small Pearl-bordered Fritillary colonies in the UK. This priority will be reviewed when we have more complete distribution data from Scotland, Wales and SW England.

### **1.2 BROAD OBJECTIVES**

1. Halt rapid decline.
2. Maintain viable networks of populations throughout its current range.
3. Conduct research on the ecology and distribution of the species to enable its effective conservation.
4. Long term objective to restore its 1950 range.

### **1.3 LEGAL STATUS**

The Small Pearl-bordered Fritillary is not currently listed on Schedule 5 of the 1981 Wildlife and Countryside Act and therefore has no statutory protection.

<b>Population</b>	<b>-size</b>	<b>Not known except for a few sites covered by butterfly monitoring transects.</b>
	<b>-trend, numbers</b>	<b>Nationally total number of colonies is unknown.</b>
	<b>-trend, range</b>	<b>Formerly widespread, major decline in the south and east. Current strongholds in western and northern England, Wales and Scotland.</b>
<b>Knowledge of</b>	<b>-status</b>	<b>No up-to-date national data are available for this species. Location of large and medium colonies in each habitat type needs to be identified.</b>
	<b>-trends</b>	<b>Recent reviews of important sites in central-southern Britain (Warren 1993a) found the rate of extinction to be 41% during the decade 1980-1990. Clarke &amp; Robertson (1993) found loss rates of 36% since 1970 in Southern England. Local and regional studies have indicated serious declines (e.g. 100% in Bucks &amp; Oxon, 90% in Berks).</b>
	<b>-conservation requirements</b>	<b>Good ecological knowledge of its requirements in southern woodlands including practical management. Research is required for appropriate management regimes in other habitats, including open woodland.</b>

## Part 2 Biological Assessment

### 2.1 INTRODUCTION

Throughout much of lowland England the Small Pearl-bordered Fritillary, *Boloria selene* occurs in damp, open deciduous woodlands that have a continuous history of coppice or underwood management, or woods that have recently been cleared and replanted with conifers. In the West Country, Wales, the north of England and much of Scotland the species breeds on moorland, marshland, damp grassland and open deciduous woodland. Many populations breed on sites that receive a high rainfall (e.g. Western Highland Lochs and coastal valleys of Devon and Cornwall).

There is considerable variation in the morphology of the species and it is unclear if any of these forms represent true sub-species as suggested by Harrison (1937), with regard to specimens from parts of northern and western Scotland.

### 2.2 ECOLOGY

#### Life Cycle

The Small Pearl-bordered Fritillary is mainly univoltine, but often some of the larger southern colonies produce a small partial second brood in August. It begins to appear about the last week in May in the south but later in the north, occurring throughout June and into July.

#### Flight Period of Adult

Mean = late May to end of June

SW England = mid May to end of June, small second brood in August

NW England = early June to early July

Scotland = mid June to mid July

A variety of nectar sources are used by the adults. By the time they are on the wing, Bugle (*Ajuga reptans*), which is utilised by spring-flying woodland butterflies, is on the wane with few flowers left. The butterflies therefore turn mainly to yellow flowers, particularly Common Bird's-foot-Trefoil (*Lotus corniculatus*) and Buttercups (*Ranunculus* sp.). Ragged-Robin (*Lychnis flos-cuculi*), early Thistles (*Cirsium* sp.) and Marsh Thistle (*Cirsium palustre*) are also used.

The butterflies sexual strategy involves the male spending most of its time in a low 'patrolling' flight, constantly searching for the relatively inactive females, which spend their time basking and feeding (Emmet & Heath, 1990). The egg-laying females concentrate on locally warm areas within their site, where they lay in lush grassy vegetation with abundant violets growing in sunny situations. On many sites they co-exist with the Pearl-bordered Fritillary but select more overgrown grassy areas in slightly later stages of succession (Thomas, Snazell & Moy, in press). They lay their eggs singly often not depositing them directly on the food plants but on nearby plants or dead leaves, sometimes dropping them in

the vegetation whilst momentarily settled. In the south the most frequently used foodplant is Common Dog Violet (*Viola riviniana*), whilst in wetter locations and particularly in Scotland and Wales, Marsh Violet (*Viola palustris*) is commonly used (Emmet and Heath, 1990; Thomson, 1980).

The larvae hide beneath leaf litter and are extremely hard to find. Their habits are appreciably different from the larvae of the Pearl-bordered Fritillary. They shun direct sunlight, and after brief and hurried feeding immediately seek concealment amongst the leaf-litter and make no attempt to bask in the sun (Warren, 1992). Since the feeding requirements of the Small Pearl-bordered Fritillary and Pearl-bordered Fritillary overlap to some degree, larvae of both species may be found feeding on the same plant. The larvae overwinter in their fourth instar.

The degree of mortality of the Small Pearl-bordered Fritillary due to predation and parasitism is completely unknown. In colonies of high density, adults often fall prey to the crab spider *Misumena vatia*, a bright yellow species that lurks inside the flowers of various nectar plants and pounces when the butterfly alights to feed (Emmet & Heath, 1990). [The parasitoids can be studied quite easily by taking samples of larvae into captivity and then returning unparasitised ones to the site, as adults. Dr Shaw of Edinburgh Museum is willing to identify any parasites found].

## **Habitats**

The Small Pearl-bordered Fritillary lives in a far wider variety of habitats than other Fritillaries (Warren, 1992). These include woodland glades and clearings; damp grassland or moorland; acid grassland typically with Bracken and/or scrub and open deciduous woodland, even base-rich bogs.

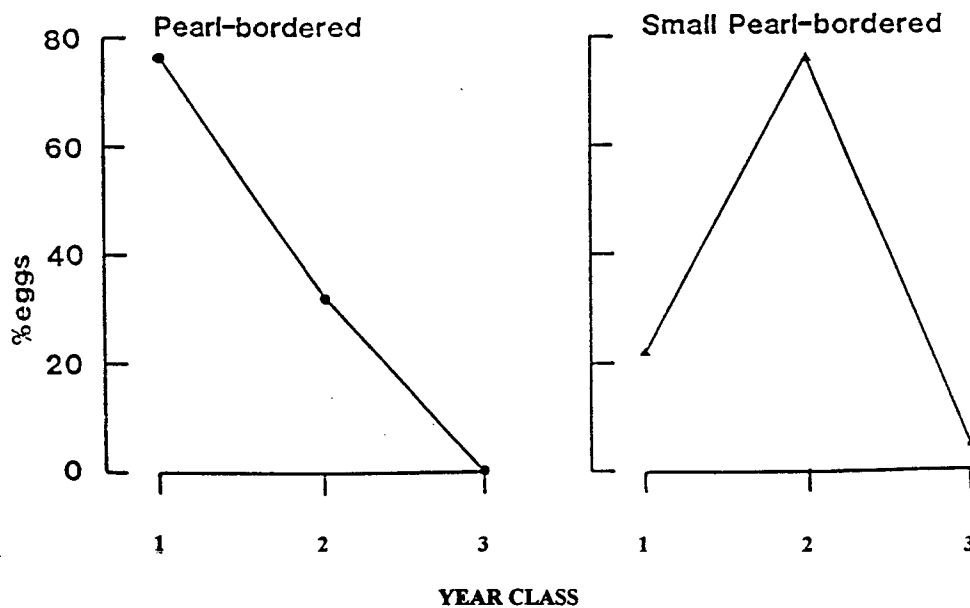
### **1) Woodland Glades And Clearings**

In lowland England, the Small Pearl-bordered Fritillary is found in open areas in woodland such as rides, glades or new clearings. It thrives, on a transitory basis, in many commercial woodlands, where forestry operations temporarily provide favourable conditions. Beneficial operations include those which encourage flushes of the larval food plant (e.g. clearances of Birch, Aspen and other scrub) or which delay succession (e.g. deer grazing, subsequent management or crop failure on plantations, and the regular cropping carried out on Christmas tree plantations).

Compared to its close relative, the Pearl-bordered Fritillary, the Small Pearl-bordered Fritillary prefers violets that are larger, growing in slightly denser or taller vegetation, and can occur on all aspects of land regardless of soil type. The Small Pearl-bordered is thus much more tolerant of damp vegetation than the Pearl-bordered Fritillary. Nonetheless the Small Pearl-bordered Fritillary also requires violets to be growing in open woodland or grassland, and avoids any that do not receive at least 50% of direct sunlight during the day (Thomas, Snazell & Moy, in press). However, such areas are usually replanted and only produce suitable conditions for a maximum of ten years after clearance. Colonies of the Small Pearl-bordered Fritillary can only persist for this length of time if the trees are slow growing or hindered by deer, or where weed control is practised by e.g. mowing or application of

herbicide. If the woodland is extensive enough, there may be other such clearing operations under way in other areas. If this is the case, and they are not too distant, the Small Pearl-bordered Fritillary can disperse along open sunny rides and tracks and establish new breeding areas. For these reasons, traditional coppice management where adjacent woodland plots are cut in succession produces ideal conditions for the butterfly. The response of the butterfly to coppicing is shown in Figure 1 below.

**Figure 1 Responses of the Small Pearl-bordered Fritillary and Pearl-bordered Fritillary in vigorous Hazel coppice (from Thomas *et al.*, in press).**



If there are no open clearings in a wood, the butterfly can maintain itself for a while at low density along the margins of broader woodland rides, provided they receive a high percentage of sunshine and have an adequate supply of violets. Under such conditions populations tend to be far smaller and there is a much higher chance of local extinctions. The maintenance of a continual supply of clearings is thus important for the long-term conservation of the species.

## 2) Grassland and Moorland Habitats

In Scotland, Wales, south west and northern England, the butterfly typically occurs in non-woodland habitats where there is an abundance of violets. Indeed, it is a characteristic butterfly of damp pastures, coastal cliffs, sand dunes and moorland in the west from Cornwall to Scotland (Heath *et al.*, 1984), where many breeding sites are around wet flushes. In mid-Wales, the Small Pearl-bordered Fritillary is a frequent resident of wet flushes and blanket mires, particularly on lower, sheltered slopes, where it breeds on Marsh Violet (Fowles 1994). It also occurs on calcicolous grassland, especially on Carboniferous limestone/scrub mosaics (Mendips and Morecambe Bay) and amongst mown or burnt gorse on other limestone.

Precise requirements and appropriate management regimes in non-woodland habitats are not well known (see appendix 4). Suitable conditions appear to be provided in damp or heathy vegetation where violets (often Marsh Violet) are abundant. Breeding colonies are probably best maintained by light grazing combined with periodic scrub clearance and /or small-scale burning. Colonies breeding in open grassland or moorland may also depend on a light cover of Bracken. The role of Bracken is unclear but the partial shade it casts may encourage a good growth of violet (and other “woodland” herbs), compared to more open grassland; in some more heavily grazed habitats, colonies may breed predominantly in Bracken areas which tend to be avoided by livestock (Warren and Oates, 1995). Such habitats are probably best maintained by cattle or pony grazing, though they may remain suitable for many years if abandoned, where succession is reduced and the Bracken is not too tall (e.g. cliff tops). A preliminary study was conducted in 1994 into the requirements of the Small Pearl-bordered Fritillary on the edge of Dartmoor, where it occurs in Bracken habitats which are used by the far more threatened High Brown Fritillary and Pearl-bordered Fritillary (M.S. Warren & N.R. Baker, unpublished). The results suggest that the Small Pearl-bordered Fritillary selects egg-laying sites where violets are abundant (5-30% ground cover), grass cover is patchy (0-60%) and there is a high percentage cover of dead Bracken (40-100%).

### **3) Open Wood Pasture**

In Scotland, the Small Pearl-bordered Fritillary is also associated with open and lightly grazed deciduous wood pasture. Very little is known about this type of habitat and the regimes needed to manage it. However, in the few sites that have been studied in Scotland, favoured habitats tend to have a sparse canopy, are well drained and contain Bracken/Grass mosaics. The Small Pearl-bordered Fritillary occurs throughout such woodland including wetter areas (D. Barbour, pers.comm.)

The Small Pearl-bordered Fritillary thus generally occurs in a much greater range of habitats than the Pearl-bordered Fritillary, including sand dune slacks and cliff habitats of coastal areas (in Scotland) and the wetter areas of open woodland (throughout its range).

## **2.3 DISTRIBUTION AND POPULATION**

### **Distribution**

The Small Pearl-bordered Fritillary has a Holarctic distribution occurring in central and northern Europe through Asia to Korea; it has its southernmost limit in northern and western Spain and is absent from Ireland, peninsular Italy and the Mediterranean islands. It is widespread in North America.

In Britain, the Small Pearl-bordered Fritillary is now extinct in most of the midlands and eastern England. In SW England, Wales and Scotland, the species is locally common but there have probably been substantial losses due to drainage and improvement of its grassland habitat. The national distribution map (see Appendix 1) is now very much out of date. Recent county atlases show that the Small Pearl-bordered Fritillary is still declining in the south (e.g. Thomas & Webb, 1984; Shreeve, 1990; Asher, 1994; Collins 1995). A review of important butterfly sites in central-southern Britain found that the rate of population extinction was

extremely high at 41% per decade. Moreover the extinction rate was as high on protected sites as on unprotected sites and had increased rapidly over the last few decades (Warren, 1992). In contrast, Thomson (1980) considers that the species is more widespread than previously thought throughout Scotland, and several county atlases from Wales show that it is still widespread (e.g. Fowles, 1984; Morgan, 1989). A summary of recent distribution data for the butterfly in Scotland is given in Appendix 2.

### **Population**

The mobility of the Small Pearl-bordered Fritillary has been studied in Bracketts Coppice, Dorset, after coppicing was resumed in 1986 (Thomas & Snazell, 1989). Four coppice panels were cut at varying distances from the surviving colony, which had become restricted to a small field within the wood, and 20 adults were transferred to each new panel. Subsequent mark-recapture experiments showed that the transferred adults stayed (and bred) within the new panels, but movement from the original population of about 1000 adults was very small, except to the panel that was cut alongside.

Although it is possible that greater dispersal occurs from sites where the habitat is deteriorating, the main conclusion of this study is that the Small Pearl-bordered Fritillary is extremely sedentary in coppiced woodland in southern England. In such habitat it not only needs a continual supply of new clearings in which to breed, but it is also essential that clearings are created close together so that colonies can move easily from one to another. If there is even a short break in the supply of new clearings, or if the distance between them is too great, then extinction is likely to be rapid.

There are no published studies for the mobility of the Small Pearl-bordered Fritillary in its more extensive habitats of, for example grassland, moorland and open deciduous woodland, where successional changes are naturally slower or where they have been arrested by grazing. Anecdotal evidence suggests that, especially in northern Britain, the Small Pearl-bordered Fritillary is much more mobile. If this is the case, where the species occurs in more open and unfragmented habitat it may exist as metapopulations\* which breed over a network of habitats.

## **2.4 LIMITING FACTORS**

### **Historical**

Changes in woodland management (especially the decline in coppicing) which has led to fewer open habitats within woods and to the increasing distance of new, suitable clearings from occupied ones (thus reducing colonisation rates) than was previously the case.

Loss, abandonment and “improvement” of unimproved grassland and Bracken/gorse habitats.

### **Current and Future Limiting Factors**

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\* A metapopulation is a collection of local populations, connected by occasional dispersal, in which there are local extinctions and colonisations (Gilpin & Hanski, 1991).

Continuing changes in woodland management, especially loss of open clearings and a reduction in the frequency of sizeable canopy gaps within modern high forest systems, resulting in an increased distance between new clearings and old ones.

Continuing decline in the market for coppice produce (although this may have recently been reversed in some areas).

Abandonment and “improvement” of unimproved grassland / Bracken habitat (e.g. cessation of grazing).

Abandonment of gorse burning in coastal valleys and other sites where gorse is dominant.

Further loss of improved grassland through drainage, agricultural improvement and afforestation.

## **2.5 RESUME OF CONSERVATION TO DATE**

### **Ecology and Conservation Requirements**

Dr Jeremy Thomas and co-workers have studied the ecology of the Small Pearl-bordered Fritillary in Dorset and its conservation requirements in open, damp woodland have been defined (Thomas, Snazell & Moy, in press; Fuller & Warren, 1994; Appendix 3). The ecology and habitat requirements of the butterfly in areas outside coppiced woodland in southern England is poorly known and remains an important topic for future research. Preliminary studies have been carried out on the edge of Dartmoor in conjunction with research on the far more threatened High Brown Fritillary. Furthermore, a ten fold increase in Small Pearl-bordered Fritillary occurred on two sites managed for the Large Blue by rotational gorse burning, and heavy winter and light summer grazing. This management resulted in Dog Violet and Pale Dog Violet populations increasing by approximately one hundred fold (J. A. Thomas pers. comm.).

### **Current Studies**

The Small Pearl-bordered Fritillary is being monitored on two transects in the Butterfly Monitoring Scheme (Pollard & Yates, 1994). In addition a variety of conservation organisations (e.g. ITE, EN, RSPB, Lancashire Wildlife Trust, National Trust, Cumbria Wildlife Trust and Forest Enterprise) are monitoring the species in different areas on the Morecambe Bay limestone and in south Lakeland by butterfly transects. Several colonies are being monitored by local branches of Butterfly Conservation.

### Part 3 Actions and Work Programme

*This section has been divided into the standard headings Policy and Legislative; Site Safeguard and Acquisition; Land Management; Species Protection and Licensing; Advisory; International; Future Research and Monitoring; Communications and Publicity; Review. Actions are given a low, medium or high priority. The lead organisation(s) concerned for each action is/are named.*

Definition of Colony Size: Large = >1,000 adults; medium = 100-1,000 adults.

Area of search is defined in NCC (1989, figure 2, page 18).

For key to abbreviations see page 21.

#### 3.1 POLICY AND LEGISLATIVE

**Lead  
organisation(s)  
concerned**

##### **Action 1 PRIORITY: HIGH**

Improve financial incentives for coppice restoration and active woodland management throughout range (especially measures that will increase the size and frequency of canopy gaps and clearings).

**FA (+ LAs)**

##### **Action 2 PRIORITY: LOW**

Prevent the destruction of coppice woodland by extending coverage of felling licences to include small diameter timber.

**FA**

##### **Action 3 PRIORITY: HIGH**

Include habitat requirements of the Small Pearl-bordered Fritillary when drawing up or revising management prescriptions in ESAs and other agri-environment schemes. (e.g. to promote appropriate Bracken and grazing management in regions where the species occurs).

**MAFF, CoCo,  
EN, CCW,  
SOAFD,  
WOAD.**

##### **Action 4 PRIORITY: MEDIUM**

Review grant applications for Bracken control in regions where the Small Pearl-bordered Fritillary occurs in bracken habitat and refuse or amend control programmes on existing and potential sites.

**NPs, EN,  
CCW,  
SNH, FA**

### 3.2 SITE SAFEGUARD AND ACQUISITION

#### Action 5 PRIORITY: MEDIUM

Designate as SSSI three large or medium colonies per area of search (or as many as exist if less than three) in areas of rapid decline if this will help ensure favourable habitat management. **EN, CCW, SNH**

#### Action 6 PRIORITY: HIGH

Encourage protection of all large/medium colonies through management agreements and/or reserve acquisition *etc.* **All**

### 3.3 LAND MANAGEMENT

#### Action 7 PRIORITY: HIGH

Incorporate needs of the Small Pearl-bordered Fritillary in all management plans on SSSIs with colonies. **EN, CCW, SNH**

#### Action 8 PRIORITY: HIGH

Maintain/restore coppicing and active broad-leaved management throughout range (especially measures that will increase the frequency of large canopy gaps near existing populations). **All**

#### Action 9 PRIORITY: HIGH

Encourage appropriate grazing and scrub management regimes on grassland/Bracken/Gorse mosaics, and appropriate management for open woodland habitats in regions where the Small Pearl-bordered Fritillary survives. **All**

#### Action 10 PRIORITY: HIGH

Encourage management that will maintain some large populations or networks of populations across the butterfly's range. **All**

#### Action 11 PRIORITY: MEDIUM

Encourage restoration of suitable breeding habitat within former range , where there is potential for re-establishing viable networks of populations. **BC, EN, CCW**

### **3.4 SPECIES PROTECTION AND LICENSING**

#### **Action 12 PRIORITY: MEDIUM**

Conduct strategic re-introductions of Small Pearl-bordered Fritillary (and parasitoids that may be identified) into networks of suitably restored habitat. **BC etc.**

### **3.5 ADVISORY**

#### **Action 13 PRIORITY: HIGH**

Advise conservation agencies and site owner/managers on practical habitat management for the Small Pearl-bordered Fritillary and how to incorporate this with other management priorities and interests. **BC, ITE, EN, CCW, SNH**

#### **Action 14 PRIORITY: MEDIUM**

Advise on habitat restoration techniques on potential and former sites. **BC, ITE etc.**

#### **Action 15 PRIORITY: MEDIUM**

Produce a brief, practical guide on habitat management for the Small Pearl-bordered Fritillary, incorporating this with management for other wildlife. **BC, EN, SNH, CCW**

### **3.6 INTERNATIONAL**

#### **Action 16 PRIORITY: MEDIUM**

Make information about the Small Pearl-bordered Fritillary, its decline and conservation measures available to other countries especially in northern Europe. **JNCC, BC**

### **3.7 FUTURE RESEARCH, SURVEY AND MONITORING**

#### **Action 17 PRIORITY: HIGH (URGENT)**

Collate all recent records, update national distribution map and determine core regions of distribution by habitat type. **BC, ITE, JNCC**

**Action 18 PRIORITY: HIGH**

Identify location of all large and medium colonies in areas of rapid decline.

**BC, SNH, EN,  
CCW, NT *etc.***

**Action 19 PRIORITY: MEDIUM**

Identify location of all large and medium colonies in all other areas.

**BC, SNH, EN,  
CCW, NT *etc.***

**Action 20 PRIORITY: LOW**

Investigate the genetic variation and existence of different sub species in the UK.

**SNH, BC, Us**

**Action 21 PRIORITY: HIGH**

Conduct further research on habitat requirements, ecology and management techniques in habitats other than lowland woodland.

**All**

**Action 22 PRIORITY: HIGH**

Establish monitoring on a range of sites representing each habitat type throughout the UK.

**BC, ITE,  
SNH, EN,  
CCW, NT**

**Action 23 PRIORITY: HIGH**

Collate transect data annually and calculate annual index to compare trends on individual sites.

**BC, ITE *etc.***

**Action 24 PRIORITY: MEDIUM**

Identify potentially suitable, unoccupied habitats within 10-20km of existing populations.

**BC**

**Action 25 PRIORITY: LOW**

Identify potentially suitable, unoccupied habitats in former range greater than 20km from existing populations.

**BC**

**Action 26 PRIORITY: HIGH**

Investigate dispersal ability of the Small Pearl-bordered Fritillary, the effect of habitat loss and isolation of colonies on population viability.

**BC, EN,  
CCW, SNH**

### **Action 27 PRIORITY: MEDIUM**

Conduct research on parasitoids and other species associated with Small Pearl-bordered Fritillary habitats. **BC, ITE *etc.***

## **3.8 COMMUNICATIONS AND PUBLICITY**

### **Action 28 PRIORITY: HIGH**

Publicise this Action Plan, the decline of the Small Pearl-bordered Fritillary and measures needed to conserve it. **All**

## **3.9 REVIEW**

### **Action 29 PRIORITY: HIGH**

Review this action plan annually and update in five years if necessary. It is particularly important to review the plan when we have more knowledge of the Small Pearl-bordered Fritillary's current distribution and status. **EN, CCW, SNH, BC**

### **Key to abbreviations**

All = All organisations listed  
BC = Butterfly Conservation  
CCW = Countryside Council for Wales  
CoCo = Countryside Commission  
EN = English Nature  
FA = Forestry Authority  
FE = Forestry Enterprise  
ITE= Institute of Terrestrial Ecology  
JNCC = Joint Nature Conservation Committee  
LAs = Local Authorities  
MAFF = Ministry of Food and Fisheries  
NT = National Trust  
SNH = Scottish Natural Heritage  
SOAFD = Scottish Office Agriculture & Forestry Department  
Us = Universities  
WOAD = Welsh Office Agricultural Department  
WT = Woodland Trust  
Wts = Wildlife Trusts

## References

- Asher, J.** (1994). The butterflies of Berkshire, Buckinghamshire and Oxfordshire. Information Press. Oxford.
- Clarke, S.A. & Robertson, P.A.** (1993). The relative effects of woodland management and Pheasant predation on the survival of Pearl-bordered and Small Pearl-bordered Fritillaries in the south of England. *Biological Conservation*. **65**, 199-203.
- Collins, G.A.** (1995). Butterflies of Surrey. Surrey Wildlife Trust.
- Emmet, A.M. and Heath, J.** (Eds) (1990). The moths and butterflies of Great Britain and Ireland, Vol 7, part 1, Harley Books, Colchester.
- Fowles, A.P.** (1984). The butterflies of Ceredigion. *Nature in Wales*. **3**, 31-43.
- Fowles, A.P.** (1994). Invertebrates of Wales. A review of important sites and species. JNCC, Peterborough.
- Fuller, R.J. & Warren, M.S.** (1994). Coppiced woodlands: Their management for wildlife. (2nd edition). Joint Nature Conservation Committee, Peterborough.
- Gilpin, M & Hanski, I.** (Eds) (1991). Metapopulation dynamics: Empirical and theoretical investigations. Academic Press, London
- Heath, J.** (1981). Threatened Rhopalocera (Butterflies) in Europe. Nature And Environment Series, **23**, Council Of Europe. Strasberg.
- Heath, J, Pollard, E. and Thomas, J.A.** (1984). Atlas of butterflies in Britain and Ireland. Viking, London.
- Harrison, J.W.H.** (1937). Rhopalocera on the Island of Scalpay, with an account of the occurrence of *Nymphalis io* on Raasay. *Entomologist* **70**,1-4.
- Higgins, L.G.** (1975).The classification of European Butterflies. Collins, London.
- Morgan, I.K.** (1989). A provisional review of the butterflies of Carmarthenshire. Unpublished report for Nature Conservancy Council, Aberystwyth.
- Nature Conservancy Council** (1989). Guidelines for the selection of SSSIs. Nature Conservancy Council, Peterborough.
- Shreeve, T.G.** (1990). The Small-Pearl-bordered and Pearl-bordered Fritillary in the counties of Berkshire, Buckinghamshire and Oxfordshire. Upper Thames Branch, Butterfly Conservation.

**Thomas, J.A.** (1984). The conservation of butterflies in temperate countries: Past efforts and lessons for the future. In: Ackery, P. R. & Vane-Wright, R. (eds). *The biology of butterflies*. 337-65, Academic Press, London.

**Thomas, J.A.** (1991). Rare species conservation: Case studies of European butterflies. In: Spellerberg, I.F., Goldsmith, F.B. and Morris, M.G. (eds). *The scientific management of temperate communities for conservation*. 149-198. Blackwell Scientific Publications, Oxford.

**Thomas, J.A. & Snazell, R.** (1989). Declining Fritillaries: The next challenge in the conservation of Britain's butterflies. *Annual report of the Institute of Terrestrial Ecology*, 54-56.

**Thomas, J.A. Snazell, R.G and Moy, I.L.** (in press). The conservation of violet-feeding Fritillaries in southern Britain. *English Nature*, Peterborough.

**Thomas, C.D., Thomas, J.A. & Warren, M.S.** (1992). Distributions of occupied and vacant butterfly habitats in fragmented landscapes. *Oecologia*, **92**, 563-567.

**Thomas, J.A. & Webb, N.** (1984). *Butterflies of Dorset*. Dorset Natural History & Archaeological Society. Friary Press, Dorchester.

**Thomson, G.** (1980). *The Butterflies of Scotland*. Croom Helm, London

**van Swaay, C.A.M.** (1990). An Assessment of changes in butterfly abundance in the Netherlands in the 20th Century. *Biological Conservation*, **52**, 287-302.

**Warren, M.S.** (1992). Britain's vanishing Fritillaries. *British Wildlife Magazine*, **3**, 282-96.

**Warren, M.S.** (1993a). A review of butterfly conservation in central southern Britain. I. Protection, evaluation and extinction in prime sites. *Biological Conservation*. **64**, 25-35.

**Warren, M.S.** (1993b). A review of butterfly conservation in central southern Britain. II. Site management and habitat selection by key species. *Biological Conservation*. **64**, 37-49.

**Warren, M.S.** (1994). Autecology and conservation needs of the High Brown Fritillary. Annual report 1993/1994. Unpublished Report for English Nature. Butterfly Conservation. Wareham, Dorset.

**Warren, M.S & Fuller, R.J.** (1994). *Woodland rides and glades: Their management for wildlife*. (2nd edition). Joint Nature Conservation Committee, Peterborough.

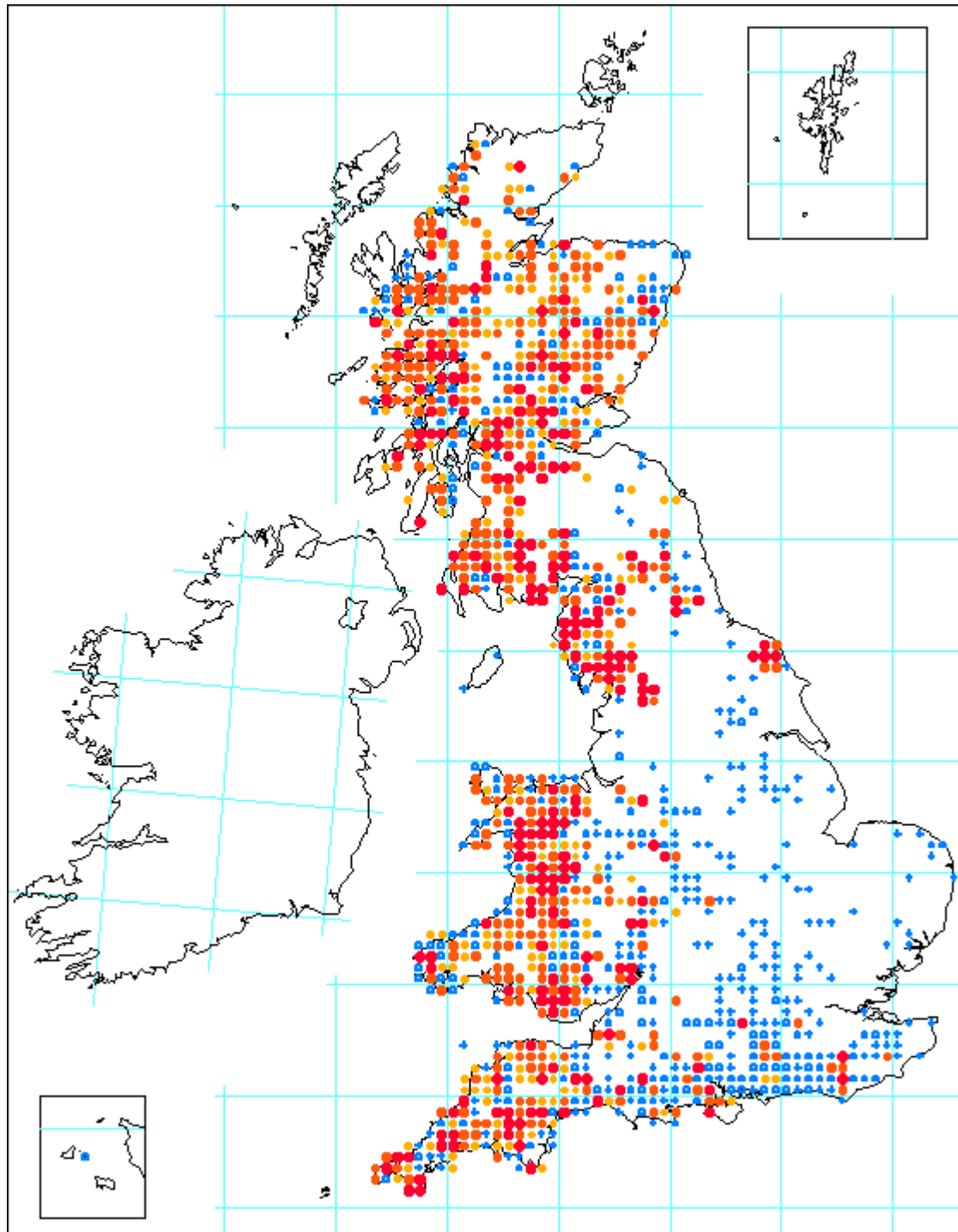
**Warren, M.S. & Oates, M.R.** (1995). The importance of Bracken habitats for butterfly populations. In: R.T. Smith & J.A. Taylor (Eds) *Bracken: An environmental issue*, 178-181. International Bracken Group Special Publication No.2, Aberystwyth (available from School of Geography, Leeds University).

**Appendix 1 The distribution of the Small Pearl-bordered Fritillary**

Butterflies for the New Millennium project (2001).

Copyright of Butterfly Conservation/Biological Records Centre.

(Dark full spot all records from 1995-1999; open circles all records between 1970-1982; cross all pre 1970 records).



**Appendix 2 Summary of distribution data for the Small Pearl-bordered Fritillary in Scotland (D. Barbour pers. comm.).**

<b>Source*</b>	<b>Area</b>	<b>No. of 10 km squares with records from 1970 onwards **.</b>
Highland Biological Recording Group	Highland region plus Isle of Mull	<b>121</b>
D Barbour - provisional maps	Grampian region	<b>54</b>
Dundee Museum	Dundee and Angus	<b>20</b>
Perth Museum	Perthshire including Kinross and part of Central region	<b>50</b>
Fife Nature	Fife	<b>12</b>
Lothians Biological Records Centre	Lothian region	<b>6</b>
MBGBI (1989)***	Strathclyde, excluding Mull, but includes part of the Central region	<b>53</b>
MBGBI	Dumfries & Galloway	<b>32</b>
MBGBI	Borders region	<b>5</b>
<b>Total</b>		<b>353</b>

\* plus MBGBI (see \*\*\*) in each case

\*\* Each 10-km square has been uniquely assigned to one area - that is , no duplication occurs at area borders.

\*\*\* MBGBI (1989) records for areas that are not covered by active schemes are taken direct from maps in Vol 7 (1) of Moths and butterflies of Great Britain and Ireland (Emmet and Heath, 1990).

### **Appendix 3 Regional surveys of the Small Pearl-bordered Fritillary**

**Anon** (1994). Butterflies in Cumbria. Provisional distribution maps. Tvlle House Museum and Art Gallery. Carlisle City Council.

**Asher, J.** (1994). The Butterflies of Berkshire, Buckinghamshire and Oxfordshire. Pisces Press. Oxford.

**Bristow, C.R., Mitchell, S.H. and Bolton, D.E.** (1993). Devon butterflies. Devon Books, Tiverton.

**Chalmers-Hunt, J.M.** (1980). The butterflies and moths of Kent. Vol 3 *Entomologists Record and Journal of Variation*. **92**: Supplement.

**Collins, G.A.** (1995). Butterflies of Surrey. Surrey Wildlife Trust.

**Fowles, A.P.** (1984). The Butterflies of Ceredigion. *Nature In Wales*. **3**, 31-43.

**Morgan, I.K.** (1989). A provisional review of the butterflies of Carmarthenshire. Unpublished report for the Nature Conservancy Council.

**Shreeve, T.G.** (1990). The Small-Pearl-bordered And Pearl-bordered Fritillary in the counties of Berkshire, Buckinghamshire and Oxfordshire. Upper Thames Branch, Butterfly Conservation.

**Thomas, J.A. & Webb, N.** (1984). Butterflies of Dorset. Dorset Natural History & Archaeological Society. Friary Press, Dorchester.

## **Appendix 4 Conservation requirements of the Small Pearl-bordered Fritillary**

### **Habitat**

- 1) Clearings in deciduous woodlands with lush vegetation, abundant violets and nectar sources
- 2) Unimproved grassland, flushes and moorland.
- 3) Acid grassland with Bracken and/or scrub.
- 4) Open and lightly grazed deciduous wood pasture.
- 5) Ungrazed or lightly grazed grassland and Bracken on carboniferous limestone (Mendips & Morecambe Bay).

### **1) Woodland Clearings**

Ensure a constant supply of flower-rich, sunny, open rides and clearings where the soil is damp and vegetation lush. Traditional rotational coppicing is particularly suitable. The species requires wide corridors to enable the butterfly to move from established breeding sites to new, freshly cleared areas. Ideal conditions are provided in woodland re-growth a few years after clearance. Colonies can be maintained in conifer plantations in ancient woodland if there are wide sunny rides and extensive glades between cleared areas (see Fuller & Warren, 1994; Warren & Fuller, 1994).

### **Deer Control**

When considering the maintenance and re-establishment of coppicing, deer control should aim at reducing deer populations to levels where habitat damage is only very light. Too often deer control is seen as a way of managing the deer as a resource, and inevitably such a deer population will threaten butterfly habitat.

**2) Damp Grassland, Flushes and Moorland**

Precise requirements and most appropriate management regimes are not well known. Suitable conditions appear to be provided in damp grassy or heathy vegetation where violets (often the Marsh Violet) are abundant. Colonies are probably best maintained by light grazing, especially by cattle, combined with periodic scrub clearance where needed. Some poaching by livestock in flushes is probably highly beneficial.

**3) Grassland with Bracken and/or Scrub**

Precise requirement and ideal management poorly known. Violets probably need to be quite abundant in medium height swards (e.g. 5-15cm) either in open grassland or alongside scrub edges, usually Gorse. The role of Bracken is unclear but the partial shade it casts may encourage good growth of violets (and other “woodland” herbs) compared to more open grassland. It may also protect violets from heavy grazing if livestock are present (Oates & Warren, 1995). Habitats are probably best maintained by cattle or pony grazing, though they may remain suitable for many years if abandoned if Bracken is low and sparse (e.g. on cliff tops).

**4) Open Wood Pasture**

Suitable breeding conditions are not known in this habitat which is found predominately in Scotland. Further research is needed into the butterfly’s precise requirements and appropriate management regimes.

**5) Ungrazed or lightly grazed grassland and Bracken on carboniferous limestone (Mendips & Morecambe Bay).**

Most sites on carboniferous limestone are ungrazed (often recently abandoned) or ineffectively grazed (e.g. light extensive sheep grazing). Many colonies appear to be based on violet clumps growing between poorly grazed tussocks of grass (Blue Moor Grass *Sesleria albicans* and Upright Brome Grass *Bromus erectus*). In some sites the butterfly is also breeding along bracken edges (e.g. the Mendips) or in areas of slow scrub regrowth or where incipient scrub is invading violet-rich sparse grassland (e.g. Morecambe Bay).