

R&D leaflet W1-021/L



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Conservation of the southern damselfly in Britain

Biodiversity Technical Series – Number 1



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Published by:

Environment Agency
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Almondsbury, Bristol BS32 4UD
Tel: 01454 624400 Fax: 01454 624409

ISBN : 1857058755
© Environment Agency June 2002

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Conservation of the southern damselfly in Britain

The southern damselfly is one of Europe's most endangered insects. It is found mainly on small lowland heathland streams and on old water-meadow ditch systems next to chalk rivers. Changes in land use and management practices of these habitats over the last century have led to a substantial decline in the species. This damselfly has very specific habitat requirements and is identified in the UK Biodiversity Action Plan as being of top conservation priority. This short leaflet gives a brief summary of the key findings of a research project on this species.

Introduction

The southern damselfly is found in the southwest of both Europe and Britain. Britain is the most northerly country in which this species is found, but it has declined here by up to 30% in the last century. Britain currently contains about 60 southern damselfly sites (see Figure 1) and probably around 120 separate populations. Since dragonflies are predominantly a tropical insect group and generally require high temperatures, these northerly populations may be particularly vulnerable to extinction. The species has already disappeared or is on the edge of extinction in seven northern European countries (Belgium, the Netherlands, Luxembourg, Slovenia, Romania, Poland and Austria), but is widespread in France and Germany.

The southern damselfly is found in only three habitat types in Britain:

- **small streams on lowland heathland** – large populations in the New Forest (Hampshire) and the Preseli mountains (Pembrokeshire), and smaller populations in Dartmoor, East Devon, Dorset and the Gower (Glamorganshire);
- **water-meadow ditch systems** – a large population in the Itchen Valley and a smaller one in the Test Valley (chalk rivers in Hampshire);

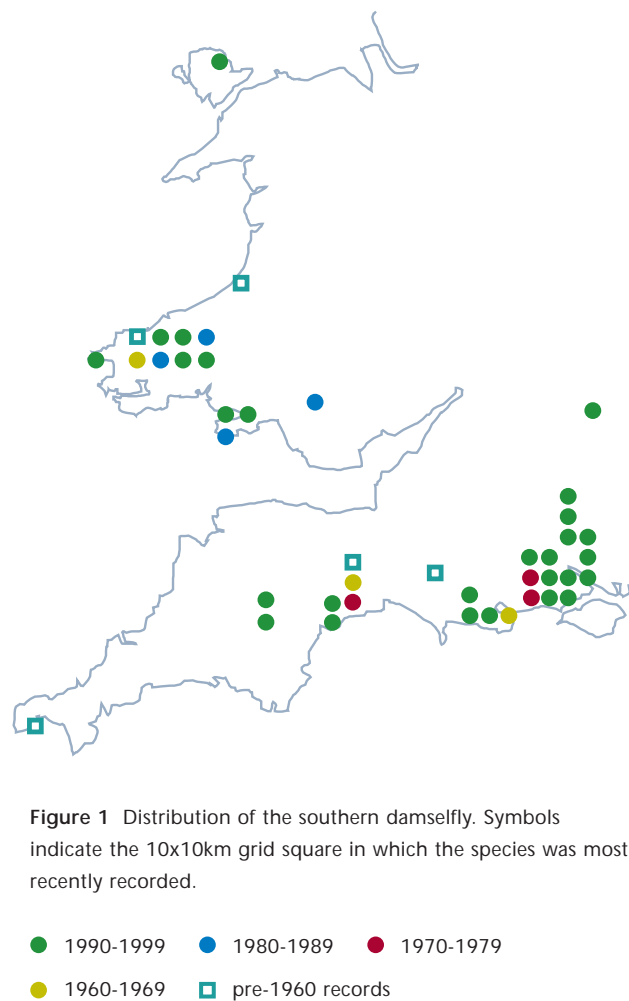


Figure 1 Distribution of the southern damselfly. Symbols indicate the 10x10km grid square in which the species was most recently recorded.

● 1990-1999 ● 1980-1989 ● 1970-1979
● 1960-1969 ■ pre-1960 records



Small heathland stream habitat – Crockford stream, Hampshire.
© Environment Agency, 2001.



Water meadow ditch system habitat – Itchen Valley Country Park, Hampshire. © Environment Agency, 2001.

- **calcareous fenland** – small populations in Anglesey and Oxfordshire.

All three types of habitat have been fragmented by changes in management practices such as afforestation, reclamation for agriculture, water abstraction, dredging, canalisation, peat-cutting and reduced grazing pressure.

The damselfly's highly specific habitat requirements mean it is found only in small pockets of these three habitat types – where habitat conditions are exactly right (see the section on habitat requirements).

While most insects are conserved as a result of the conservation of their habitat types, the southern damselfly has been singled out for individual species protection in both Britain and Europe. As well as being listed as 'Rare' in the British Red Data Book, it is listed in the Berne and Bonn Conventions, the European Community Habitats Directive and Schedule 5 of the Wildlife and Countryside Act 1981 (as amended in 1995).


Because the southern damselfly is listed in the UK Biodiversity Action Plan (BAP), a species action plan (SAP) was devised. A steering group was set up in 1996 to co-ordinate the plan's implementation. This group comprises The Wildlife Trusts (lead partner), the Environment Agency (contact point), the British Dragonfly Society, the Countryside Council for Wales and English Nature. Academics from Liverpool University have been co-opted onto the group.

Although numerous small studies had been carried out on the southern damselfly, many aspects of the species' ecology remained to be determined. This made it difficult to formulate management strategies for this species and its habitat.

The SAP highlighted the need for further research into the ecological requirements of the southern damselfly in Britain and, in 1997, the steering group commissioned research in the form of a PhD study (1998–2001). The main aims were to:

- investigate aspects of the species' ecology including life cycle, development, reproduction, mortality and adult dispersal;
- investigate habitat features required by the southern damselfly across its British range (large-scale habitat use);
- investigate habitat features used within a site by different life stages (for example, for egg-laying, emergence, larval cover, adult roosting and mating);
- draw up monitoring and management guidelines based on this new information.

The project involved the collation of biological records, existing literature and anecdotal observations, and the collection and analysis of water samples. A number of mark–release–recapture and behavioural experiments on heathland sites were also implemented and analysed.

A pair of southern damselflies are shown in copulation on a thin, reddish-brown branch. The male is positioned above the female, with its abdomen curved around hers. Both insects have vibrant blue bodies and transparent wings. The background is a soft-focus natural setting.

Identifying the southern damselfly

The southern damselfly (*Coenagrion mercuriale*) is the smallest of several species of 'blue damselflies' found in Britain. It is approximately 29 mm long.

The adult male has a distinctive 'mercury mark' on its second abdominal segment and black 'spear' shapes along abdominal segments 3–5. There are two female colour forms:

- olive green 'gynomorph' (distinguished from other blue damselfly females by pale markings on abdominal segments 7–10 and on the head);
- blue 'andromorph' (has more extensive pale coloration and a blue body like the male).

Larval southern damselflies can be distinguished under a microscope from the shapes of their tails and head region (caudal lamellae and prothorax).



Distinctive mercury mark found on adult males.
© Environment Agency, 1999.

Main photo: a pair of southern damselflies in copulation.
© Environment Agency, 2001.

Ecology

The southern damselfly takes two years to complete its life cycle in Britain. Eggs are laid inside submerged plant stems and they hatch 4–6 weeks later. The larval stage makes up 90% of the life cycle and is spent in submerged stream vegetation. Larvae grow only from April to October each year, probably due to low winter temperatures. They feed on small invertebrate prey such as midges, blackfly and mayfly larvae, and freshwater shrimps.

Although the flight period lasts from early April to November in Mediterranean populations, the adult flight period in Britain lasts from late May to early August only. The peak emergence period is from mid-June to early July.

Emergence occurs in the morning, and depends on sunlight and temperature. Final instar larvae find open, shallow, slow-flowing areas of stream. They crawl up emergent vegetation, where they moult into immature adults. Tall plants with rigid, upright stems are favoured as emergence perches (for example, rushes). Within a few hours, newly emerged adults called 'teneral' have hardened. Typically, they fly into tussocks surrounding the stream to feed, roost and mature over a period of 5–8 days.



Females lay their eggs into submerged plant stems – shown here in a dissected Marsh St John's Wort stem.



A late (penultimate) instar larva. © Environment Agency, 2000.



A blue damselfly final instar exuvia on its emergence perch (Spike Rush). © Environment Agency, 2000.

Mature adults live for about a further week; investigations at Aylesbeare Common found that, on average, males lived for 10 days and females for 8 days. They reproduce several times during this period. Depending on weather conditions (especially sunlight), they are present at the stream between 9.30 am and 4 pm; reproductive activity peaks at midday.

Once adults have formed a tandem pair at the stream, they copulate in surrounding tussocks for around 20 minutes. Staying in tandem, they fly directly to the stream for oviposition (egg-laying). The female 'tests' plant stems for up to 50 seconds before laying, and submerges herself in the water up to her wings (sometimes completely) during laying. This behaviour may serve to place eggs deeper in the stream and prevent desiccation of eggs if the water level drops. Between 50 and 350 eggs are laid at a time by a female (the average is 150 eggs). Eggs are usually laid into mats of soft-stemmed, submerged and semi-emergent herbs (for example, Marsh St John's Wort and Bog Pondweed on heathland sites) in open, shallow areas of slow-flowing water.

Most mature adults are relatively sedentary, moving less than 25 metres in their lifetime. However, movements of up to 1.8 km have been recorded across unsuitable habitat in mark–release–recapture experiments and adults can probably move further than these field-observed distances. Dispersal and recolonisation may occur frequently in large clusters of population. Dispersal also depends on landscape features. It is more likely to occur between sites that are closer together, or those connected by a suitable stream with no intervening scrub patches.

Table 1 | Features important to the southern damselfly in Britain

Type	Description
Physical and topographical	<ul style="list-style-type: none"> • <i>Low altitude</i> (<90m above sea level) and <i>gentle slopes</i> (<10% slope) • <i>Small watercourses</i> with <i>slow to moderate flow</i> that heat up rapidly when exposed to the sun: <ul style="list-style-type: none"> – shallow, narrow streams on heathlands (<0.4m deep and <5 m wide) – small ditches on chalk stream sites (0.75–10m wide) • Watercourses <i>fed by springs or groundwater</i> (thus ensuring <i>permanent flow</i> and <i>high minimum winter water temperatures</i>) • Water sources arising from <i>soft deposits</i> of sandstone, limestone and clay (those that are easily weathered and increase the buffering capacity of the stream water to changes in pH) • Watercourses with an <i>inorganic substrate</i> overlaid with shallow organic peat or silt
Vegetation/structural	<ul style="list-style-type: none"> • <i>Open</i> and <i>exposed</i> watercourses without rank vegetation or shading • <i>Medium to high cover</i> of submerged and emergent stream vegetation of <i>low to medium height</i> (0.2–0.6m) • <i>Herbaceous, perennial stream vegetation</i> (including soft-stemmed submerged and rigid-stemmed emergents) • Some degree of <i>shelter</i> on the bankside or in parts of the stream (for example, bog myrtle)
Chemical	<ul style="list-style-type: none"> • <i>Low levels of plant nutrients</i> such as nitrates (<0.2mg/litre) and phosphates (<0.025 mg/litre) that prevent eutrophication and the invasion of algae or tall emergents • <i>High oxygen concentrations</i> • <i>Unpolluted water</i>

Habitat requirements

A wide range of habitat features is important to the southern damselfly in Britain. These are summarised in Table 1.

Habitat features to ensure a successful larval stage include:

- an unpolluted aquatic environment;
- submerged vegetation cover (for feeding and refuge from predation);
- sufficient warmth and oxygen for development.

Since small, exposed streams warm up quickly, oviposition and emergence will proceed quickly in summer and can be carried out in open, shallow areas. The bankside vegetation structure described in Table 1 provides areas for adults to roost, shelter, mature, feed, display, mate and bask.

Management implications

Active management regimes are required to maintain habitat condition for the southern damselfly on wet heathland or on water-meadow ditch systems. The primary threat to its habitat is inadequate management of vegetation due to insufficient grazing or clearance. This leads to rank stream and bankside vegetation and to vegetation dominated by only a few species (for example, bog myrtle, purple moor grass and rushes). This is a problem at over 34 British sites and has led to extinctions in Pembrokeshire (St David's Head and Waun Isaf) and Devon (Venn Ottery).

At least 22 sites are threatened by reductions in water availability due to factors such as canalisation, artificial drainage, siltation, headward erosion, and excessive scrub and tree growth. This has resulted in extinction in Pembrokeshire (Afon Brynberian) and



Above: Streams are fed by springs or groundwater maintaining high winter water temperatures and preventing freezing – Crockford Stream, Hampshire in winter. © Environment Agency, 2001.

Above left: Heathland stream in the Preseli Mountains, Pembrokeshire. © Environment Agency, 2000.

Left: Heavier grazing animals poach water margins producing a diverse tussock structures favourable to the southern damselfly. © Environment Agency, 2001.

has reduced populations in Hampshire (Blackwell Common, Horsebush Bottom and Millersford Bottom East) and Dorset (Outflow Mire, Povington Heath). At a few sites, water quality has been threatened by nutrient run-off.

In light of these threats and the habitat needs listed in Table 1, the following management measures are suggested for southern damselfly habitat:

- Use moderate grazing regimes with cattle, horses or ponies to produce poaching of the watercourse margin and a diversity of tussock structures.
- Graze cattle between April and October and horses or ponies all year round (this is generally successful).
- Make sure the watercourse is accessible to grazing animals.
 - Alter the profile of high stream banks to suit.
 - Do not fence off watercourses from animals. Fences can, however, be used to concentrate livestock at the stream.
- Vegetation clearance may be required to supplement grazing at some sites.
- Bankside clearance:
 - On heathland sites, clear bog myrtle, scrub and trees by hand from areas of stream or mire, but preserve a degree of shelter nearby.
 - On chalk stream sites, hand-cut short sections of bankside herbs and rushes on a rotational basis.
- Channel clearance:
 - Hand-cut channel vegetation, but only in short sections and on a rotational basis (3–5 year rotation).
 - Do not use mechanical methods of channel clearance.
 - On chalk stream ditches, cut the central ditch area but retain a broad fringe of emergent vegetation.
- If cut vegetation cannot be removed from the site, deposit it on one bank or in one area only.
- Burning can be detrimental to aquatic flora and

fauna, and to shelter-belt vegetation. Only carry out burning on sites where it is an integral or historic management practice for the southern damselfly. Burn only small sections of the stream and remove burnt vegetation from the site.

- Avoid canalisation, drainage, abstraction, peat-cutting and dredging near watercourses.
- On chalk streams, use drop-board weirs to maintain water levels in ditches in spring and summer. Semi-permanent wooden weirs are not effective at sites grazed by cattle since poaching prevents adequate control of water flow.
- Shallow berms (60–90 cm wide) could be constructed on large water-meadow ditches to provide areas of shallower water.
- At some heathland sites, weirs could be installed to recreate runnel systems from large channels. At some sites, new ponds and runnels in stream sections adjacent to existing populations could be excavated with care.
- Do not dispose of sheep dip into watercourses.
- Minimise nutrient run-off from agricultural land near watercourses. Where possible, manage agricultural land adjacent to watercourses without inputs. At the very least, farm a 20 m strip extensively on either side of the watercourse.
- Actively manage unoccupied stream habitat within 1–3 km of southern damselfly populations.
 - On heathlands, encourage the development of habitat between existing sites and unoccupied sites as valley mire or wet heath (these habitats are more conducive to dispersal).
 - Remove scrub boundaries between sites and between roosting and breeding areas within a site, but leave some shelter.
- Grants may be available from English Nature (only for sites of special scientific interest – SSSIs), the Department for Environment, Food and Rural Affairs (for England) and the Countryside Council for Wales to aid the sympathetic management of existing and potential adjacent sites. Such action may encourage the southern damselfly to extend its range. Contact the individual organisations for further information.

Permission is required from the Environment Agency (especially near watercourses and wetlands) before undertaking some of these activities. Prior consent of the Countryside Council for Wales or English Nature may be required within or close to statutory conservation sites – SSSIs and candidate Special Areas of Conservation (SACs).



Heathland stream on Aylesbeare Common, RSPB Reserve, Devon. The southern damselfly prefers soft-stemmed submerged vegetation, such as the Bog Pondweed shown here, for egg laying. © Environment Agency, 2000.

Case study

Aylesbeare Common, Devon*

Many of the management practices recommended above have been employed with success on an isolated southern damselfly site at Aylesbeare Common, Devon. Before 1990, streams on this heathland site were overgrown with dense tussocks of purple moor grass and black bog rush. When grazing was reinstated in 1986, the maximum count of southern damselflies was 12. A single heavy season of winter grazing in 1990 was followed by annual light summer grazing between May and October. The bankside vegetation became shorter, with fewer tussocks and less overgrowth of purple moor grass. Streams were opened up and the cover of submerged aquatic herbs increased. Shallow pools and runnels, which were dug in 1993 next to populated areas of stream, were colonised by the southern damselfly within a couple of years. Populations expanded still further following the clearance of woodland in 1997. By 2001, this management regime had increased the population to a maximum daily count of 326.

* Information from Lesley Kerry, Royal Society for the Protection of Birds (RSPB)



Heathland streams at Waun Fawr, Pembrokeshire.
© Environment Agency, 2000.



Steering Group members visit a southern damselfly site in Devon.
© Environment Agency, 1999.

Monitoring of the southern damselfly – how you can help

In addition to the monitoring programmes carried out every six years by statutory bodies, the UK southern damselfly SAP steering group recommends annual surveillance of this species at as many British sites as possible.

The British Dragonfly Society would like to hear from anyone carrying out annual counts at sites or who would like to become involved in southern damselfly conservation. Further information can be found at <http://www.dragonflysoc.org.uk>

The following suggestions are made for anyone carrying out surveillance of the southern damselfly:

- Adults are the easiest stage to count. Larvae and exuviae are difficult to find and identify.
- The largest counts are obtained from mid-June to mid-July (peak emergence is within this period in Britain).
- Count adults at the stream between 11am and 1pm on sunny days (preferably 17°C or warmer) with little or no cloud cover or strong winds (less than Force 3 on the Beaufort scale).
- Counts will underestimate populations since, depending on weather conditions, 25–75% of individuals will not be present at the stream but will be roosting in tussocks.
- The habitat in British southern damselfly sites is often difficult to define or move through. When comparing counts between years at a site, it is recommended that fixed transects along water bodies (or mire) are used rather than rigid, timed counts. Ideally, the transect should include areas

of high and low population. The transect should be walked for roughly the same amount of time on approximately the same date(s) each year.

- For SSSIs and SACs where the southern damselfly is identified as an 'interest feature', Environment Agency R&D Technical Report W1-021/TR describes habitat attributes likely to indicate favourable condition for the species.

Other/future research

The UK SAP steering group has initiated a variety of research to find out more about the ecological requirements of the southern damselfly in Britain.

In 2000, it commissioned a second PhD study to investigate the ecology of the southern damselfly in chalk stream, water-meadow and fen habitats. One of the objectives of this study is to aid the development of further management guidelines for these habitats. The steering group plans to update the guidelines given in R&D Technical Report W1-066/TR and this leaflet in 2005 in light of the research findings.

A UK site assessment project was carried out between spring and autumn 2001. Standardised information on habitat, management and adjacent land use was gathered at British sites to provide baseline data for monitoring purposes.

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For further information about dragonfly and damselfly conservation, including the southern damselfly, visit the British Dragonfly Society website at www.dragonflysoc.org.uk



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