Glowing, glowing, gone?

A history of Glow-worm recording in the UK

Dr Tim Gardiner FBNA © August 2009

The Glow-worm *Lampyris noctiluca* (Coleoptera: Lampyridae) has a widespread but distinctly local distribution in the UK (Tyler 2002), apparently being more abundant in southern England, especially on areas of chalk downland (Tyler 1994). However, in Essex, populations were recorded in similar abundance in disused chalk quarries (soil pH = 8.2) and remnant heathland on very acidic soils (soil pH = 4.3) (Gardiner *et al*. 2003b). This species is predominantly a grassland insect, although it occurs in other habitats such as hedgerows and open woodlands (British Naturalists' Association 1971). It seems that dense woodland with a sparse herbaceous understorey may be unfavourable for Glow-worms (Tyler 2002). Although Glow-worms can be found in a wide variety of habitats in the UK, they seem to prefer those that have a vegetation patchwork including bare earth and tall grass/scrub with a range of different sward heights (Tyler 2002).

Adult female Glow-worm © Mike Wright

Many naturalists consider Glow-worms to be a declining species, although much of this information is purely anecdotal (Scagell 2009). A major reason for the loss of Glow-worms from many sites is thought to be fragmentation of suitable habitats and isolation of colonies, which is compounded by the sedentary nature of this species. The adult glowing females (which glow to attract flying males) cannot fly to disperse and colonise new areas, whilst the larvae are not thought to move far in search of food (Tyler 2002). The larvae are reported to move approximately five metres an hour, but they may find roads or arable fields a significant barrier to dispersal. Isolated colonies may therefore lose genetic diversity through inbreeding and ultimately sustain insufficient individuals to remain viable (Tyler 1986).

The status of the Glow-worm in Britain is poorly documented, however, some efforts have been made to ascertain its national distribution. The earliest of these was a survey conducted by the British Naturalists' Association (BNA) in the 1960s and early 1970s. It was from this initial survey that a decline in the British Glow-worm population was first suspected; with many recorders noting an apparent fall in numbers (BNA 1971; 1974). The BNA survey was organised by Anthony Wootton and the data collected forms an invaluable record of how Glow-worm numbers have changed since the early 1900s. Analysis of a large number of reports from the BNA survey (BNA 1971; 1974) show that there has probably been a steady decline in the numbers of Glow-worms since the early 1900s (Fig. 1). For example, there were several reports mentioned in the BNA survey of 'thousands' of Glow-worms, most notably from Sussex in 1919, Skye in 1922, and Devon in 1957. Reports of 100 or more Glow-worms were also more numerous before the Second World War (WWII).

Fig. 1: Counts of Glow-worms from the BNA survey, the three reports of 1000 Glow-worms are from sightings reported as 'thousands', whereas, four reports of 100 refer to sightings of 'hundreds'

To understand why the Glow-worm may have declined, we need to consider what the countryside was like before the worst ravages of intensive agriculture. The pre-war countryside, with its intricate patchwork of small fields, hedgerows and unimproved flower-rich grasslands (all ideal Glow-worm habitat), was decimated after WWII as the agricultural policy of the time was to produce as much food as possible due to shortages. However, this agricultural production had a downside for Glow-worms, government policy coupled with increasing mechanisation of agriculture initiated large-scale removal of hedgerows and ploughing of unimproved grasslands (for conversion to arable cropping), these activities were particularly severe during the 1960s (Pollard *et al*. 1974). The result was a landscape of large, intensively managed (high nitrogen fertiliser input, pesticides commonly used) fields with few hedgerows and very limited availability of ancient grassland (Rackham 1986), unlikely to be favourable for Glow-worms.

Several records of Glow-worms from before WWII refer to them being seen whilst farmers harvested crops and from the edge of fields, suggesting they could be sighted in and around arable fields before the intensification of agriculture. However, these populations would have been susceptible to the insecticides commonly used since the 1950s and it is very rare in Essex to find them on farmland. Other reports of Glow-worms refer directly to their disappearance due to unimproved meadows being ploughed and cropped.

If the Glow-worm data shown in Fig. 1 is analysed using a simple Spearman's Rank Correlation, then there is a highly significant negative relationship between year and the counts of Glow-worms ($r^s = -0.33$, $P<0.01$, number of counts in analysis = 80). For those of you that are not statistically minded this means that numbers of Glow-worms have reduced significantly since the early 1900s based on the reports submitted as part of the BNA survey. The number of reports of single Glow-worms has also increased (0% of total number of reports for 1900-1940, 22% for 1941-1960 and 42% for 1961-1980), suggesting a reduction in numbers. This means we should be very worried indeed about the Glow-worm, as a large proportion of counts since 1961 are of single glowing females.

However, the decline may not be entirely due to intensive agriculture, as the crash in rabbit numbers due to myxomatosis in the 1950s led to the scrubbing over of many chalk downlands in Sussex for example, a prime Glow-worm area. There are several reports from the BNA survey of hillsides swarming with Glow-worms, we can only imagine what this looked like nowadays.

There is anecdotal evidence to suggest that the Glow-worm may have been declining as early as the 1880s in Epping Forest in Essex. The earliest mention of the Glow-worm in Epping Forest is in a paper by William Cole in the 1899 Essex Naturalist with the rather charming title 'Glow-worm and frog' (Cole 1899). In this paper Cole described his discovery of a glowing female on Epping New Road verge, which he assumed, upon greater investigation, to have been swallowed by a frog when the light suddenly went out! Cole goes on to describe the general abundance of Glow-worms in the Buckhurst Hill area in 1879-82 and subsequent decline that he attributes to the increasing scarcity of snails (the larval food of the species) due to the high number of snail devouring birds. I would suggest that the high levels of pollution from the industrial revolution (particularly of sulphur dioxide), which led to the destruction of sensitive lichen populations in the south of the Forest (James & Davies 2003), may have been responsible for the decline of Glow-worms at such an early stage of the post Epping Forest Act (1878) era, when the neglect of pollarding and reversion of open areas to scrubland had not really been felt by grassland species such as the Glow-worm. Glow-worms are a snail feeder and may have received lethal doses of pollutants passed on from their prey that assimilated the chemicals from feeding on contaminated vegetation, the process being known as 'bio-accumulation' (Gardiner 2007b).


Adult male Glow-worm
© Mike Wright

The decline of the Glow-worm in the late 1800s was probably not too severe as the species was noted as being present in the open spaces near Woodford from 1935-39 (BNA 1974). Alfred Leutscher (1974) fondly recalls his camping days in the early

1900s when Glow-worms were common enough in the Forest to be collected and hung in jam-jars inside tents, the glow apparently producing enough light to read by! Such a nostalgic account from a past chairman of the BNA suggests that Glow-worms were still in abundance in the early 1900s (Gardiner 2007b). In 1991/92, a survey was launched by Robin Scagell, with the aim of both revisiting the sites identified by the BNA survey and investigating previously unrecorded ones. The survey suggested that the Glow-worm was still widespread, although reports of over 100 females were comparatively rare.

I first became interested in Glow-worms as a teenager when I read about them in Chris Packham's (newly appointed Vice Chairman of the BNA) entertaining Collins guide to grasslands and scrub (Packham 1989). I had obtained it from a second hand book shop in Great Yarmouth and was enthralled by the promise of these 'living lanterns', if only I could find them. Surely there wouldn't be many in the intensively farmed landscape of eastern England. Suitably inspired by what I had read, I initiated the Essex Glow-worm Survey in 2001, which had two main aims: to ascertain the distribution of the insect, and to implement a robust transect monitoring method to ascertain if Glow-worms really are declining across a number of sites. Counts of Glow-worms (adult females) have been repeated since 2001 at several sites and the survey shows that overall numbers of adult females in the county (all sites combined) have not declined (Fig. 2). However, 35% of the 275 counts undertaken in the county since the survey started are of < 2 females (e.g. counts of 1 or 0 females) which was similar to the low Glow-worm numbers noted by the BNA in the 1970s and before.

Glowing female
© Mike Wright

Locally however, Glow-worms appear to be declining at more sites than they are increasing at (Fig. 3). At Langdon Hills Nature Reserve near Basildon (Marks Hill), the Glow-worm seems to have disappeared over the course of the monitoring period and was last seen in 2001 (Gardiner 2007a). The number of females seen per night in the mid 1980s at this site was in excess of 50 (Mandy Greig pers.comm.) so there may have been a long-term decline. The habitat at Langdon Hills has remained superficially similar (e.g. hedgerow and mown verge habitat) for many years, therefore reasons for the decline and possible extinction remain unclear, but may be linked to installation of street lighting near the colony (Gardiner 2009).

It is likely that climate change may affect Glow-worms, with low spring rainfall (March-May) leading to reduced abundance of females in the summer (Gardiner 2007a). The results from the first five years of the survey suggest that mature larvae in the 'walkabout' phase in the spring months may be unable to find sufficient snail prey to sustain themselves as adults (which don't feed) later in the summer. Therefore, drought conditions in spring may lead to a scarcity of larval food (snails being more prevalent in wet weather) and even desiccation of larvae in the walkabout phase in very dry and hot years such as 2003.

There will of course be cumulative effects from drought conditions, for example, low numbers of females in 2003 will lead to fewer occurrences of mating and a low number of eggs being laid, therefore there may be lower female numbers in future years (Gardiner 2007a).

Mating Glow-worms, female (top) being ambushed by two males © Mike Wright

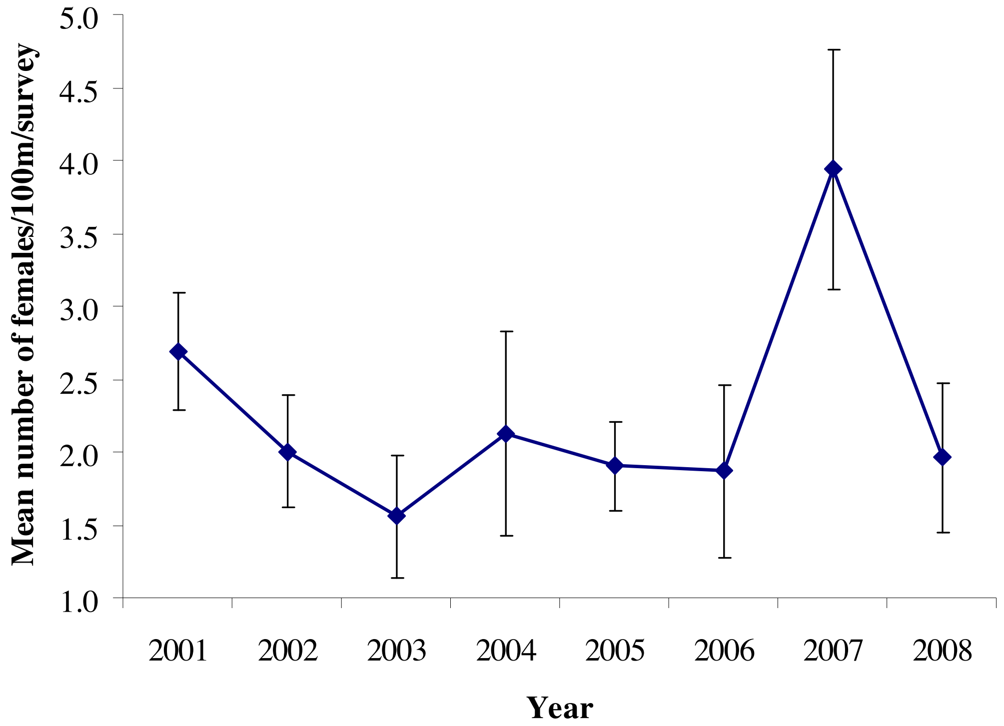

Fig. 2: Mean numbers of adult female Glow-worms counted each year on standard transects as part of the Essex Glow-worm Survey (standard error bars shown)

Soil conditions may compound the scarcity of snails in dry years. The soil at Manwood Chase is well drained (82% sand, unpublished data), whereas, at One Tree Hill, the transect was located on a south facing ridge where the well drained silt soil (74% silt, unpublished data) may increase larval scarcity in dry weather and be the main cause behind declines in abundance at both sites (Fig. 3). Indeed, anecdotal evidence suggests that females have become increasingly restricted to damp hollows at One Tree Hill as the survey has progressed and may have a preference for the wetter north facing side of the ridge (Nick Stanley pers.comm.).

The importance of soil type seems to be confirmed by the lack of substantial female declines at sites (Hatfield Forest, Finches Nature Area, Iron Latch and Shut Heath Wood; Fig. 3) located on clay soils where water retention may be higher in dry years (Gardiner 2007a).

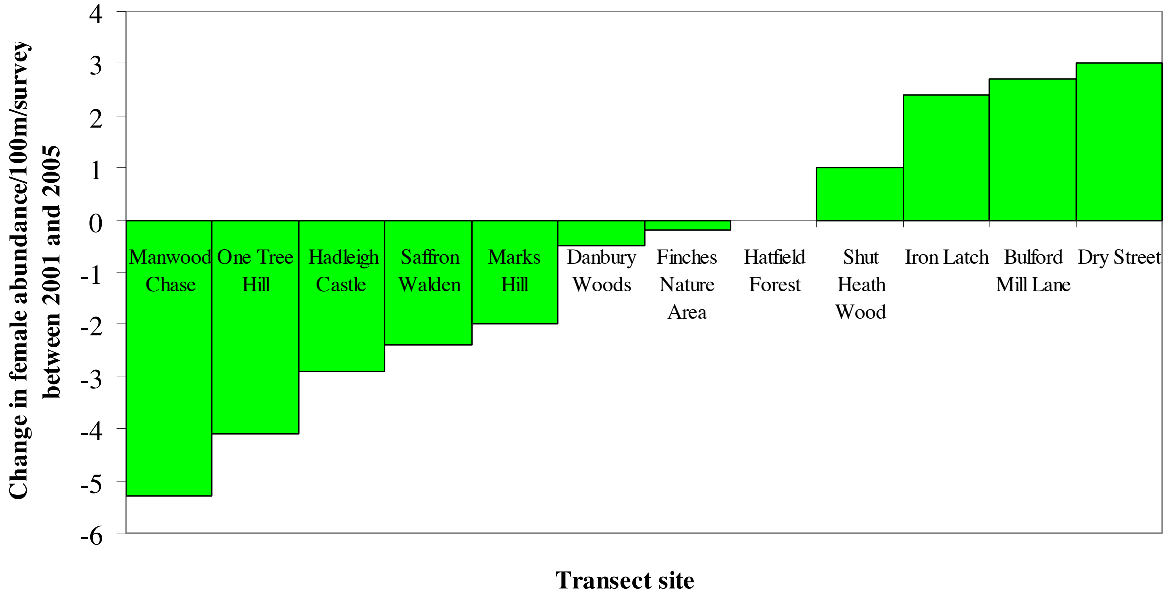

Fig. 3: Changes in the abundance of Glow-worms at 12 sites in Essex over the first five years of transect counting

Despite the problems faced by Glow-worms in the modern countryside, they still have a widespread distribution, even if colonies do not have the large numbers of individuals that they used to have in the early 1900s. In Essex, there are approximately 70 recorded locations for Glow-worms since 1992 (Fig. 4), which is a surprising number given that they were thought to be very rare in the county. However, the low abundance of Glow-worms on nature reserves in the county is a worry, particularly as most of the high density populations exist in the wider countryside on unprotected sites (Gardiner 2008). Nature reserves could be considered 'habitat islands' isolated from each other by unfavourable agricultural areas which are an effective barrier to female or larval dispersal. The preference for habitats in the wider countryside may explain the decline of the beetle since WWII, when populations not on nature reserves would have been vulnerable to destruction due to the intensification of agriculture and urban development. On a positive note, I believe that there is a substantial chance of increasing population abundance and distribution on Essex nature reserves because there are large areas of available habitat (which is not all currently suitable) and plenty of opportunities to link populations with corridors such as new hedgerows.

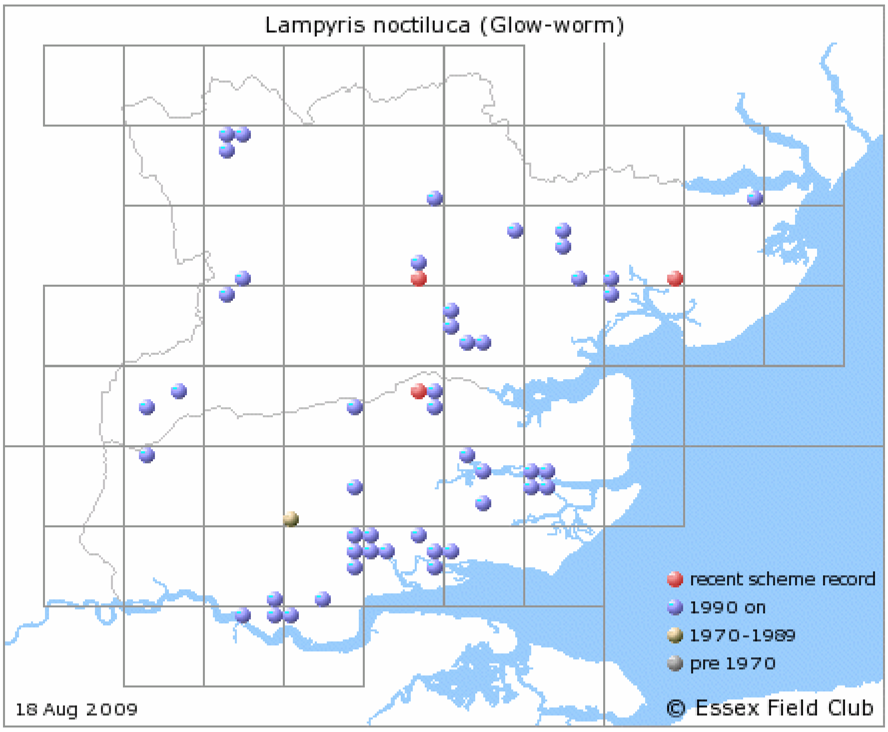

Fig. 4: Distribution of Glow-worm records in Essex

It may also be possible to create stepping stone habitats between large nature reserves as effective 'rest stops' for females or larvae that chance upon them. These stepping stones are particularly applicable for many Essex sites, where linear corridors would be interrupted by barriers such as roads, although their effectiveness would depend on whether larvae or females could traverse the habitats between stepping stone patches. Stepping stone habitats that could benefit Glow-worms include newly created wildflower meadows managed with an appropriate rotational hay cutting regime (Gardiner 2008). Therefore, a landscape scale approach needs to be taken to effectively link nature reserve and non-nature reserve sites with favourable corridor or stepping stone habitats to create a patchwork of interconnected colonies where exchange of genetic material is possible.

A focus for future Glow-worm studies should be to monitor population abundance over time, as in the ongoing Essex Glow-worm Survey. The easiest possible method (though not necessarily the best) is to count glowing adult females on several nights on a set transect route during June and July. It is crucial that the same route is walked each year on every survey to allow a comparison of numbers between years, therefore highlighting any increase or decline in a population. Generally, it is best to follow these criteria when selecting an appropriate night to walk your transect on:

- Avoid surveying on cloudless nights (< 33% cloud cover) with a full moon due to difficulty in detecting glowing females
- Only undertake counts in dry weather as female numbers appear to be affected by heavy rain or drizzle
- Start surveys at approximately 10 pm as counts are very low after 10.30 pm in late summer, it must be dark enough for it to be difficult to make out colours though

With careful monitoring, appropriate habitat management, and protection of sites it may be possible to halt the long-term decline of Glow-worms in the UK. It is my favourite insect, a view I share with Chris Packham and countless others. We owe it to the naturalists of the past who were similarly inspired, to Gilbert White of Selborne, Alfred Leutscher, and Anthony Wootton, to make sure the Glow-worm continues to fascinate in the centuries that follow.

Further information

For more information on Glow-worms in the UK see www.glowworms.org.uk or visit the Essex Glow-worm Survey homepage on the Essex Field Club website (www.essexfieldclub.org.uk).

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