# MONITORING GLOW-WORM *LAMPYRIS NOCTILUCA* L. (COL.: LAMPYRIDAE) POPULATIONS IN GRAZED AND MOWN GRASSLANDS

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## Abstract

Glow-worms *Lamyyris noctiluca* L. (Col.: Lampyridae) were studied in grasslands under varying management regimes. Meadows subjected to a single summer cut for hay supported smaller colonies than unmanaged sites although the reasons for this are unclear. Grasslands mown regularly throughout the summer showed an increase in numbers of females; it is theorised that this might be a consequence of favourable adjacent habitats and that the shorter sward provided advantage to females displaying to males in flight overhead. A mosaic of regularly mown and tall unmanaged grassland may provide the ideal habitat. Grasslands subjected to grazing by cattle or rabbits supported only small colonies.

## Introduction

Gardiner and Tyler (2002) and Gardiner *et al.* (2002) suggest that grassland management may be particularly important for the future survival of *Lampyris noctiluca* L. colonies. Populations of this species may have declined due to cessation of grassland management through the decline in sheep farming and the decimation of Rabbit *Oryctolagus cuniculus* populations due to myxomatosis which has led to scrub encroachment of grasslands and subsequent loss of suitable habitat (Gardiner and Tyler, *op. cit.*). Conversely, overgrazing may also be detrimental and some observers have reported reduced numbers of glowing females on grazed sites, perhaps due to the negative impact of grazing on snail (larval food) populations. However, many of these reports are purely anecdotal and there is an urgent need for scientific recording of populations to determine management techniques that may increase the remaining populations of *L. noctiluca* (Tyler, 2002). The aim of this paper is to compare the abundance of *L. noctiluca* in grazed, mown and unmown grasslands using a simple transect counting method, to elucidate the importance of grassland management in determining colony size in Essex.

## Sampling of *Lampyris noctiluca* populations

A transect was established at each of 16 Essex sites with a known *L. noctiluca* colony in 2001 to allow the abundance of glowing adult females to be ascertained. Two transects each were established in grazed grassland (rabbit grazed heathland / woodland (O. S. grid reference TL 7806) and cattle grazed unimproved pasture TL 5420 (breeds: Belted Galloway, Welsh Black and British White, stocking density: 1 cow per hectare), combined transect length = 4150 m, no of surveys = 24), and grassland regularly mown every two or three weeks throughout the summer

(TM 0019 and TL 5538, combined transect length = 510 m, no of surveys = 21). Six transects each were established in grassland mown once a year during the summer (May – September), often for hay (cuttings removed) or to keep a grassy verge from scrub encroachment (cuttings not removed) (site grid references: TL 7720, TL 7807, TQ 7885, TL 9526, TQ 6986, TQ 6888, combined transect length = 1660 m, no of surveys = 48) and unmanaged grassland (control) (site grid references: TQ 7086, TQ 9094, TL 8513, TQ 810860, TQ 835991, TQ 607792, combined transect length = 2250 m, no of surveys = 51).

Each transect at each site was at least 100 metres in length and was walked once in each of three two-week periods in 2001: 9-22 July, 23 July-5 August, and 6-19 August and many of the transects were walked in the same periods in 2002, 2003 and 2004 (some transects were discontinued in later years of the survey due to practical difficulties) to allow any changes in density in managed grasslands between years to be incorporated into the data. Any glowing adult females that were observed along the route were recorded. It was felt that these three periods adequately incorporated the peak glowing season in Essex when most adult females will be displaying. The main disadvantage to using transect counts of glowing females as an estimation of colony size is that females only mate once, after which they stop glowing (Tyler, 2002). Therefore, low numbers of glowing females at a site may indicate successful breeding on previous nights rather than a small colony.

The walks were standardised so that comparisons could be made between the densities of females per 100 m in grasslands with differing management. Survey participants were required to commence each walk between 2200 and 2300 hours, and to terminate by 0000 hours. A slow strolling pace was recommended for the walks to reduce the risk of overlooking glowing females along the route. Surveys were not conducted in unfavourable conditions, for example, when it was cold, wet or windy, because counts may be reduced under such climatic extremes (Alexander, 1992).

### Analysis of differences in abundance between grassland type

The authors used Kruskal Wallis multiple comparison test (Heath, 1995) to determine whether there was any statistical difference between the median density of adult females per 100 m in grassland that was grazed, mown regularly, mown once a year or unmanaged (control). Dunn's non-parametric procedure (Gardiner, 1997) was then performed to ascertain significant differences in female abundance between the four grassland types. As there were a large number of samples being compared, the authors accepted significant differences at $P<0.01$.

### Results and discussion

The total number of glowing females counted in this survey was 1259 from 144 surveys over the four year monitoring period (2001-2004). There were significantly lower densities (at $P<0.001$) of adult females recorded from grazed pasture (sward height < 10 cm) than from sites which were mown or unmanaged (Table 1),

suggesting that grazed pasture supported only small colonies of *L. noctiluca* in this study. It may be that grazing (by rabbits and cattle) has a negative impact on snail populations that provide food for the larvae of this species and larger populations in Essex may be found in habitats which are unmanaged and have taller and ranker vegetation (> 30 cm in height) that support large snail populations (Tyler, 2002). It seems that this study adds quantitative data to the anecdotal argument that grazing can lead to reduced *L. noctiluca* populations. Indeed at the site heavily grazed by rabbits (sward height < 10 cm), recorded numbers fell from 40 glowing females in 2001 to only three females in 2004.

**Table 1.** *Lampyris noctiluca* abundance in managed grasslands in Essex (data for all four years was pooled).

| Grassland management | Median no. of females per 100 m (range)* | Total no. of females counted | Max count |
|---|---|---|---|
| Grazed (cattle/rabbits) | 0.04 (2)[a] | 76 | 29 |
| Mown frequently | 2.33 (9)[b] | 149 | 27 |
| Mown once a year | 1.00 (8)[c] | 163 | 20 |
| Unmanaged (control) | 2.71 (21)[b] | 871 | 101 |

* Median values in this column followed by a different superscript letter are significantly different at P<0.001 (Kruskal Wallis multiple comparison test)

It would seem that meadows cut once a year for hay in the summer support smaller colonies than unmanaged sites (Table 1), suggesting that mowing at this time of year may lead to reduced colony size although the precise reasons behind the low abundance in these Essex meadows are unclear and further research is needed. However, grasslands under hay management did display increases in female abundance, for example, in one unimproved hay meadow, nine glowing females were recorded in 2001, 35 females in 2003 and 20 females in 2004.

Grasslands mown frequently throughout the summer (< 10 cm sward height) tended to have densities of glowing females that were comparable to unmanaged grassland (> 2 females per 100 m; Table 1). The authors suggest that the relatively high abundance of *L. noctiluca* at these sites was due to the favourability of the surrounding habitats which were hedgerows and tall grassland / scrub which may have offered abundant larval food and shelter. It may be that females preferred to display on the short grassland habitats because it is easier for them to be spotted by flying males in these open areas (Tyler, 2002). A mosaic of regularly mown and tall unmanaged grassland may therefore be the ideal management for *L. noctiluca* providing adequate female display areas and larval habitat. Tyler (2002) suggests that random mowing of sites (mower meandering across site and route varied each year) to create a fine-scale mosaic of short and tall vegetation may be beneficial to

*L. noctiluca* populations and this study of Essex colonies seems to provide some evidence to promote the use of this management technique to enhance abundance of this species in grasslands.

## Conclusion

This study of Essex *L. noctiluca* colonies showed that populations of this species were particularly large in unmanaged and frequently mown habitats suggesting that a combination of these two management techniques at a site may well have a favourable impact upon populations of this species. Pastures grazed by cattle and rabbits had particularly small colonies perhaps due to the adverse effect of grazing on snail populations.

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### *Dasineura thomasiana* (Kieffer) (Dip.: Cecidomyiidae), new to the Isle of Man

From research work in Ireland, the author has become familiar with the galls of the cecidomyiid *Dasineura thomasiana* (Kieffer). Young terminal leaves of lime *Tilia* are rolled or crinkled and distorted with thickened veins. As a result, while recently incorporating his galls into the collections of the National Museum of Ireland, he recognised unnamed Manx specimens of *D. thomasiana*. The galls was collected by him on a lime tree at the Onchan Pleasure Park (O.S. grid reference SC 3978) on 5 July 1998 but were not determined at the time. White larvae were noted as being present. The identification has been confirmed using M. Redfern, P. Shirley & M. Bloxham (2002. *Field Studies* **10**: 207-531). The species is not included in the comprehensive list of Manx Cecidomyiidae by K. M. Harris & F. D. Bennett (2003. *Entomologist's Record* **115**: 109-115).— J. P. O'Connor, National Museum of Ireland, Kildare Street, Dublin 2, Ireland.