Overton Biodiversity Society

Glow-worm survey

2011 update

In warm summer's nights, small spots of light can been seen scattered in the grass at St Mary's Churchyard. These are the glow of female glow-worms signalling their presence to males. Successive generations of glow-worm have been doing so on this site since at least the 1940s.

Nationally, glow-worms numbers seem to be in decline. OBS started monitoring this colony in 2009 in order to assess its strength and to help ensure the site is managed in such a way that the colony can thrive.

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Introduction

Glow-worms

Glow-worms, scientific name *Lampyris noctiluca*, are beetles. The common name refers to the 'worm-like' appearance of the wingless females and their ability to produce light. Adult females have a dark, segmented body, 15-25mm long (3/4-1"). The light-emitting organs are found on the underside, at the tip of the body. Males look quite different. They are shorter, 15-18mm (5/8") and bear on their backs a pair of membranous wings, folded at rest under a pair of leathery dark wing cases. They have only two small luminous spots at the tip of the abdomen. Both adult male and females emerge from their pupal case in June – July and live only for 2-3 weeks although warm weather often hasten this process.

Females hide during the day and come out when darkness falls. Then, they crawl up a blade of grass or up the stem of other plants and point their abdomen upwards, exposing the spots of bright greenish light which attracts males flying nearby. Mated females will soon lay eggs and die. Un-mated females will retreat after a few hours until another night.

Eggs hatch after about a month. The tiny larvae grow up to 25 mm over 2 years during which they feed on (a large number of) snails and slugs and moult multiple times as they grow bigger. Larvae are very similar to females in appearance but have a pale spot at the hind corners of each segment on the back. Like the males they only have two small luminous spots at the tip of the abdomen which can be seen glowing (and sometimes flashing) in dark summer's nights.

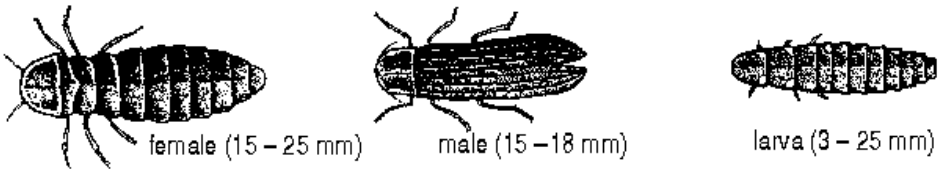

Figure 1: Glow-worm, *Lampyris noctiluca*.

The site

The site comprises St Mary's churchyard in Overton, Hampshire (grid reference SU 514500) and the adjacent parish cemetery on Kingsclere road. The total area covers approximately 1.2 ha (2.5 acres), including buildings, on calcareous soil.

The parish cemetery is bordered by a stone wall on the Western side. As it is an active cemetery the grass is kept short through regular mowing.

The churchyard is bordered by stone walls on 3 sides and by a steep verge on the Eastern side. The ground is sloped from West to East. The area South of the church is laid to grass which is mown frequently (approximately every 10 days in the summer months). The North side holds old grave stones surrounded by a variety of grasses and wild flowers strimmed at longer intervals. In 2010, this area was cut on the following dates: 23rd May, 6th June, 4th July, 1st August, 29th August, 12th September.

Flora

A botanical survey of the churchyard in June 2009 reported the following species:

Meadow Buttercup	Field Bindweed	Welted Thistle
Yellow Corydalis	Field forget-me-not	Dandelion
Stinging Nettle	Forget-me-not sp	Nipplewort
Curled Dock	Ground Ivy	Hawkbit sp
Common Sorrel	White Dead Nettle	Smooth Sow-thistle
Tutsan	Large Thyme	Hedge Garlic
Common Mallow	Lemon Balm	Lime
Musk Mallow	Common Clary	Cherry
Primrose	Foxglove	Whitebeam
Yellow Loosestrife	Dark Mullein	Cotonaster
Rock Stonecrop	Greater Plantain	Box
Dog Rose	Ribwort Plantain	Privet
Bramble	Lady's Bedstraw	Elderberry
Agrimony	Cleavers	Hawthorn
Garden Lady's Mantle	Honeysuckle	Sycamore
Birdsfoot Trefois	Field Scabious	Ivy
Black Medick	Wild Teasel	Grape Vine
Red Clover	Feverfew	Virginia Creeper
White Clover	Daisy	Yew
Broad-leaved Willowherb	Ox-eye Daisy	Barren Brome
Sun Spurge	Yarrow	Timothy
Herb Bennett	Common Ragwort	Cocksfoot
Bloody Cranesbill	Groundsel	Wall-rue
Cow Parsley	Common Knapweed	Grasses sp.

Fauna

A snails and slugs survey in the churchyard in May 2006 reported the following species:

Scientific name	Common name
*Arion ater**	Great Slug
Arion intermedius	Hedgehog Slug
Arion subfuscus(*)	Dusky Slug
*Candidula intersecta**	Wrinkled Snail
Cepaea hortensis(*)	White-lipped Snail
Cochlicopa lubrica(*)	Slippery Moss Snail
Deroceras reticulatum(*)	Common Grey Field Slug
Discus rotundatus(*)	Rounded Snail
*Helix aspersa**	Common Garden Snail
Lauria cylindracea	Chrysalis Snail
Limax flavus	Yellow Slug
*Monacha cantiana**	Kentish Snail
Oxychilus cellarius(*)	Cellar Glass Snail
*Trichia hispida**	Common Hairy Snail
Trichia striolata(*)	Strawberry Snail
Vallonia costata	Ribbed Grass Snail

Species marked with * are known to be eaten by glow-worm larvae in the wild. Those marked with (*) have been eaten in captivity (Tyler, 2002).

Survey Method

The purpose of the survey was to count the number of females glowing at night on the site. Two different approaches were used in 2009-2010 and in 2011.

- In the summer of 2009 and 2010, OBS volunteers walked a pre-defined route through the churchyard repeatedly at 3-4 days intervals throughout the glowing season. Volunteers plotted on a map (scale 1:375) every glowing female observed.
- In 2011 the surveying effort intensified and volunteers walked systematically throughout the entire site every over night, and plotted on a detailed map (scale1:375) every glowing female observed. Each recording night they started with a fresh map.

All visits started at about 11:00pm. The survey periods were:

- 2009: 4th July - 30th July; 8 visits
- 2010: 23th June - 8th August; 14 visits
- 2011: 1st June - 31 July; 31 visits

Figure 2 shows a map of the site and the survey routes for 2009 and 2010.

Figure 3 shows the detailed site map used in 2011 to survey the site in its entirety. The map includes headstones, graves and other features that allowed for a more precise recording of glow-worms' location.

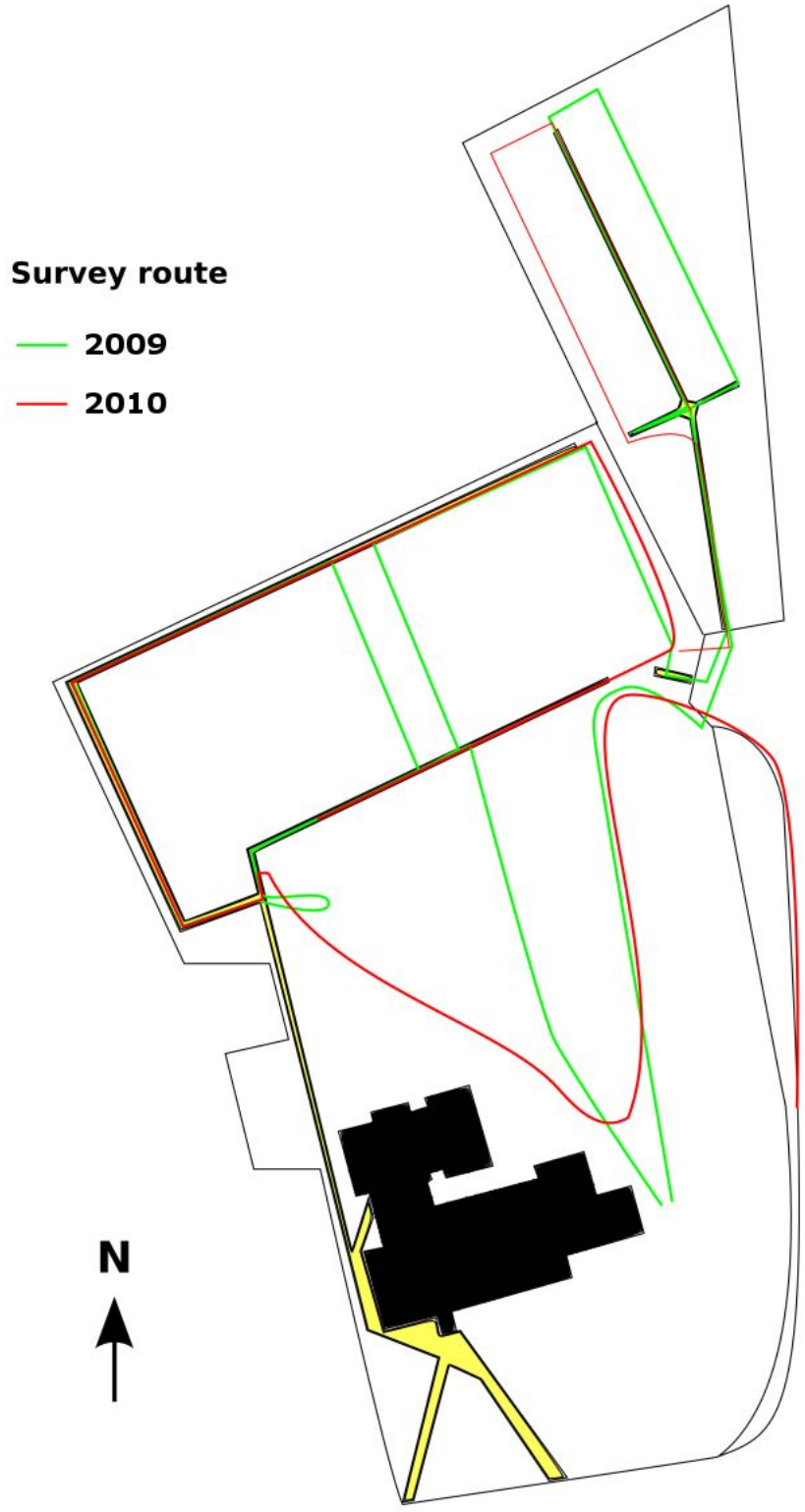

Figure 2: Map of the survey site including the survey route for each year. (Map reduced ca 3 times.)

Figure 3: Detailed, map of the survey site including headstones, graves, and other features. (Map reduced ca 3 times.)

Survey results

Nightly numbers

Numbers of glowing females counted each night can be seen on Figure 4. The graph shows variations in numbers at three levels: throughout the glowing season, from year to year and from night to nights.

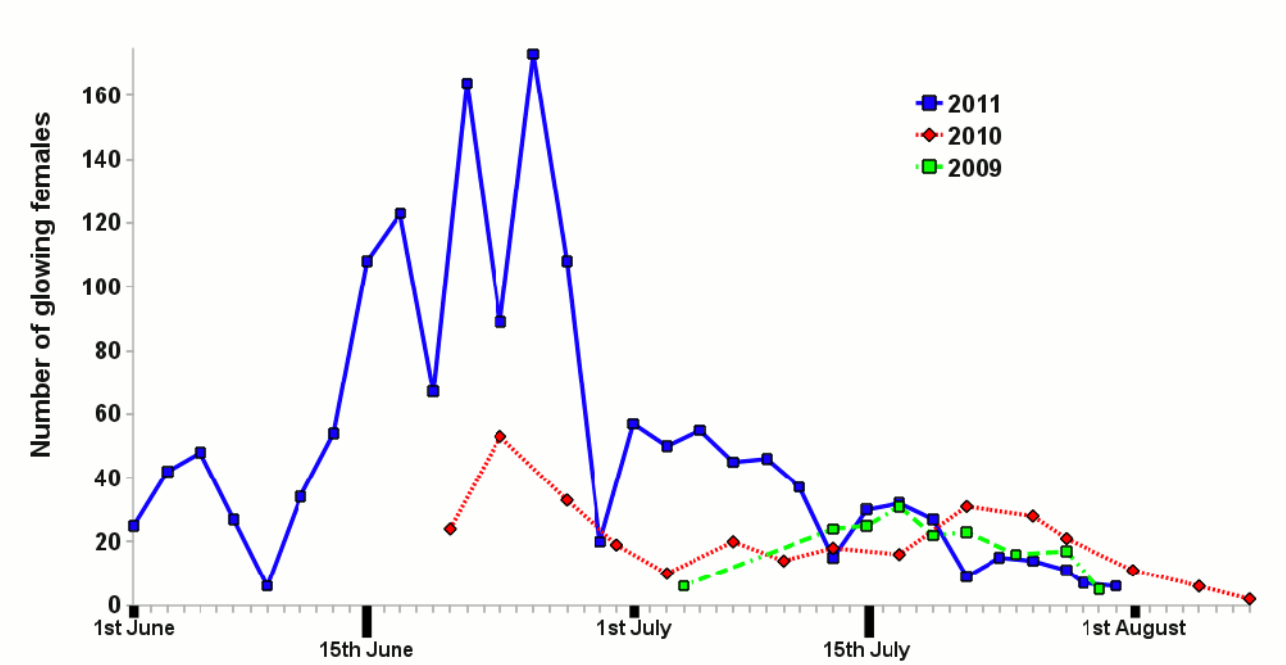

Figure 4: Number of glowing females counted on each survey night

Variations throughout the glowing season

In 2009 and 2010 we observed that the number of glowing females in one night increased progressively from the beginning of July to peak in mid-July and subsequently dropped back to single digit numbers by the end July or early August. In the same period in 2011 the trend was a more steady decline, starting from higher numbers at the start of the month: 50 glowing females on 3rd July 2011, compared to 10 on the same day in 2010 and 3 on 4th July 2009.

As we extended the duration of the counting period year after year, we observed that the height of the glowing season was in fact in June. In 2010 the highest count of the survey (53) was on the first night on 23rd June, but clearly we had missed the start of the season. Starting earlier still in 2011 we observed that the peak of the glowing season occurred in late June. Numbers increased rapidly, albeit somewhat erratically from 25 to 173 in 3 weeks to peak on 25th June. This pattern is very typical of glow-worm surveys throughout the country whereby numbers of glowing females build up strongly early in the glowing season and then drop rapidly with small numbers of females observed over a fairly long period after the peak. Incidentally, despite starting counting on 1st June in 2011 we missed the start of the season again!

Variations between years

Overall we counted many more glow-worms in 2011 than in the previous two years. The maximum number recorded on one night was 31 in 2009, 53 in 2010 and 173 in 2011. This may simply due to the fact that we have missed the true peak in the first two years when we surveyed for shorter periods.

In addition, this large difference in numbers may be related also to the difference in survey method. Although the survey paths in 2009-2010 covered a good proportion of the site, walking a restricted route did not allow to count all glow-worms present. The glow of female glow-worms is usually bright enough to be seen several meters away but the spot of light is very small and easily obscured by the surrounding vegetation and headstones so that one can reliably count females only within a short range. In contrast, in 2011 we searched the full site systematically and therefore were able to count all females glowing on the site at that time.

The difference in numbers is also likely to be caused by natural variations from year to year. Numbers recorded in this survey are comparable to numbers reported to the UK glow-worm survey in 1991 by Vivienne Brown (45) and in 2002 and 2005 by Simon Frogley (100+ and 47, respectively). Evidently significant annual fluctuations in numbers are to be expected and should be taken into account when assessing the strength of the colony based on punctual survey results.

Variations from night to night

The 2011 survey, where we had the most comprehensive data (with counts over a longer period and higher frequency) also illustrates how numbers of glowing females can vary widely from night to night. Between 1st and 25th June, although the trend was clearly a rapid increase in numbers, counts repeatedly dropped and increased again. For example in the period 17-27 June, we counted 123, 67, 164, 89 and 173 females. It is not clear why numbers should vary so much. The most likely explanation is that numbers vary in response to weather conditions. Figure 5 shows the temperature recorded in a nearby garden at 11:00pm over the 2011 survey period, together with the female counts for the same dates. This figure shows a correlation between drop of temperature and female counts. It seems that below 12ºC females were less likely to glow. In addition. volunteers counting glowing females noticed that on cooler days glowing females tended to display closer to the ground rather than climb up to the top of the vegetation. This made them more difficult to spot so that glowing females may have been slightly under-recorded on those cooler nights.

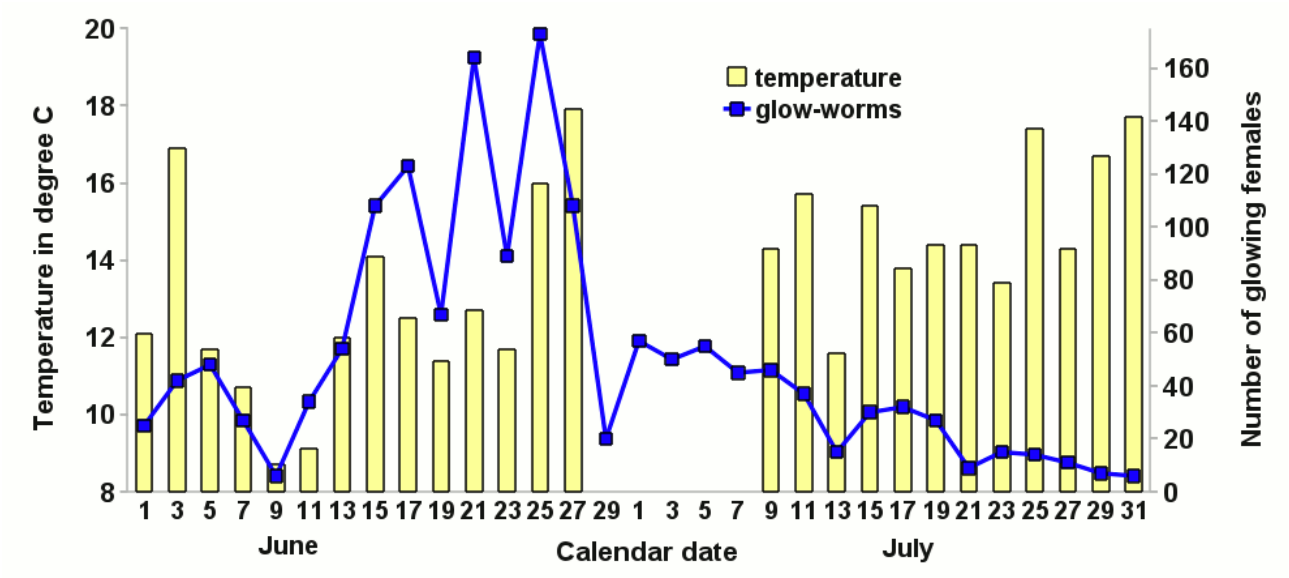

Figure 5: Temperature and female glow-worms counted on each survey night in 2011

Distribution

Female glow-worm are very sedentary and are likely to display from the same spot on successive nights. With this in mind, in our survey we assumed that a sighting plotted at the same spot on the map on several nights indicated the presence of the same female. Naturally, when analysing the results it was difficult to tell with certainty whether a dot on the map was recording the same spot as one from the previous night or whether it is was another spot very close. Usually we chose to interpret nearby records on consecutive nights as a record from the same female on both nights. This uncertainty was greatly reduced in 2011 when we increased the precision of the map with more landmarks to help plotting glowing females accurately.

Figure 6 and 7 show the spatial distribution of all glow-worms identified in 2009 - 2010 and in 2011, respectively. We identified 59 glowing females in 2009, 160 in 2010 and 687 in 2011. Taking into account the imprecision of the recording method true numbers were probably higher.

These maps show that glow-worms were scattered over most of the site, in the churchyard and also in the parish cemetery (in small numbers). However, no glow-worms were found on the more open South side of the church where the grass is mown short. This illustrates the glow-worm known preference for medium high grass and habitats made of mixture of open grassland and some cover in the form of woodland or scrub.

Another, non-documented element that may make this site (like other cemeteries) favourable to glow-worms is the presence of head stones and other masonry work, particularly old one. Careful examination of these stones shows that through the effect of time and weather they have slowly become looser at the base. This creates a lot of nooks and crannies that glow-worms can use to hide as adults but also as larvae and pupae and also for laying eggs. Presumably these spaces are also useful to snails and slugs, the food source of glow-worms.

A somewhat surprising observation is that glow-worms were seen in large numbers on the steep verge along the main road, since this area is very well lit by several (orange)street lights. Light pollution is often cited as potentially detrimental to glow-worms as artificial lights attracts males potentially keeping them away from females. Maybe this is not the case or maybe although females were glowing on the verge, they had less success mating than females in darker areas on the site. A finer spatial analysis of data would be required to clarify this point.

Note that during the survey in 2011, two larvae were observed in the northern area of the churchyard (on 25th & 31st July).

Figure 6: Spatial distribution of glowing females in 2009 – 2010. Each dot represents the location of one female.

Figure 7: Spatial distribution of glowing females in 2011. Each dot represents the location of one female.

Duration of displays

Female glow-worm glow until they have attracted a male and mated. Records in the literature indicate that 73% of female glow-worms display for 1 to 3 nights; most females glow for only one night (43%) (Tyler, 2002). To determine whether Overton's glow-worm population was similar in that respect we tried to estimate the duration of display of each female identified earlier. The duration of display for a female was calculated by counting the number of nights from the first to the last night that female was recorded as glowing. However, if in that time window gaps appeared when the female was not glowing for more than 2 recording nights these records were dropped as it was unclear these truly were records of a single female.

Figure 8 shows the frequency distribution of duration of glow for all 3 years of the survey. Even with the inherent imprecision of our method, our results reported that most females displayed for one night only: 34% in 2009, 57% in 2010 and 53% in 2011, although a small number seemed to display for over 3 weeks. Considering that females stop glowing once they have mated this suggests that there were plenty of males nearby to ensure another generation will follow. However, it is interesting to note that no males were ever seen while surveying the site. Evidently they do not come out at the same time as surveyors! Locating male glow-worms could be the focus of future survey.

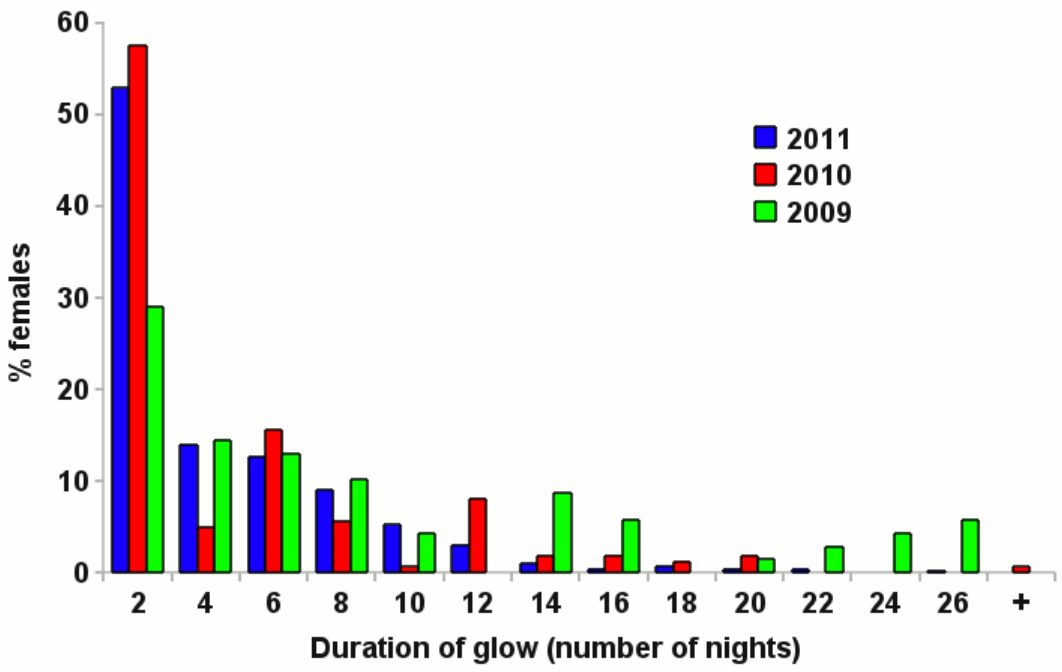

Figure 8: Frequency distribution of duration of glow for all females observed each year.

Conclusion

Although glow-worm numbers may be in decline nationally, the colony in Overton seems sound. The churchyard provides a favourable habitat with snails for larvae to feed on and a suitable environment for females to display and find mates. OBS will continue to monitor the colony and to communicate with the church warden to help maintain a healthy population there.

It is important to note though that in order to draw an accurate picture of the strength of the colony it is essential to take counts frequently as numbers vary widely and isolated counts could be very misleading.

Credits

St Mary's church: Moira Hilton (church warden) and Rev. Ian Smale (rector)

Liaison with church warden: Jane Beckman, Valda Stevens

Botanical survey: Peter Hutchins

Mollusc survey: June Chatfield

Glow-worm counts: Tanya Ashton, Ken & Jane MacKenzie, Véronique Kerguelen, Adam Trickett, Alan & Valda Stevens.

Historical records: Vivienne Brown, Simon Frogley

Weather data: John Macmillan

Glow-worm information: Robin Scagell, John Tyler *The Glow-worm*, 2002. ISBN 0 9523526 1 3

Pictures: Robin Scagell (http://www.glowworms.org.uk/), John Tyler

Report: Véronique Kerguelen