LIGHT SOURCES FOR EYE-SHINE SURVEYS

OF ADULT CALIFORNIA RED-LEGGED FROGS

Most biologists do not have appropriate state and federal permits to carry out anything but night surveys for *Rana draytonii* using eye-shine (e.g., presence-absence surveys). For this reason, the choice of a light source becomes one of the most important aspects of successfully accomplishing an accurate survey. The following are a few comments and suggestions in choosing a light, which will help ensure a successful frog survey.

1. It is not recommended that "mega" spotlights, such as "Q-beams", be used. In most cases the light is so strong as to reflect many unwanted objects, in addition to frog eye-shine, thus making it difficult to carry out an accurate survey. This is especially the case when moisture on leaves and twigs is present and reflects light. For a discussion of light brightness, see Corben, C. and G.M. Fellers. 2001. A technique for detecting eyeshine of amphibians and reptiles. Herpetological Review 32(2): 89-91.
2. In nearly all cases LED (light-emitting diode) lights are NOT suitable for detecting frog eye-shine, especially the "low-end" models made for general camping use. Some of the 3-watt LED lights with special focusing lenses are marginal. For example, Brinkman, Brunton, and Princeton Tec all market 3-watt headlamps, which can be used, but they are not ideal. Those that are regulated (ensuring a constant light output for some designated time period - usually one hour) tend to be quite expensive – in the $70-$100 range, and for this amount of money a much more suitable headlamp can be purchased. Another problem with the high-watt LED headlamps is their relatively short battery life at maximum output (usually about an hour with their required AA batteries). This is not long enough for many surveys and does not compare well to the 4 to 5 hours of more suitable headlamps (see below). Lastly, the light color of LED bulbs often produces some rather odd coloring, which can be confusing if one is accustomed to incandescent light.
3. Hand-held light versus headlamp: The advantage of a headlamp is that the light is always relatively close to one's eyes – thus ensuring a consistent and good eye shine. It also frees hand for capture and maintaining balance. However, a hand-held light (or a headlamp held in the hand) can be held closer to one's eyes, resulting in significantly better eye shine and thus more frogs spotted.

4. The most suitable lights currently available, in terms of distance, focused beam, battery life, and cost are the classical miners or hunters headlamps that are usually powered by a 4 or 6 volt lead-acid battery (often gel-cells). Although a rechargeable lead-acid battery results in a greater initial expense and are heavy, these batteries can be recharged many dozens of times and thus probably result in a long-term savings over continually buying new batteries. There are numerous manufacturers of these units with a wide range of quality and extra features. The more economical units can be purchased for about $80, whereas the professional miners lights can be twice this amount. For moderate usage in frog surveys, we have found the more economical units quite suitable (e.g., Nite-Lite model Nite Sport II).
5. Most incandescent headlamps made for general camping use are not suitable because they often do not have a beam that can be narrowly focused, they often do not throw a powerful enough beam, and their battery life tends to be rather short.
6. Most normal hand-held "Mag Lights" are marginal because they are not bright enough. Those that use three or four D-cells are OK, but be prepared to run up a considerable cost in batteries and, unlike headlamps, they must be held in the hand. Also, some bulbs do not focus well, resulting in a dim hole in the middle of the beam. This can be remedied by replacing the bulb with a new one.

As to whether one uses binoculars in association with a spotlight is a decision that is closely tied to the survey site and objectives. If the survey requires using float-tubes, or entering the water with chest waders (because of obscuring vegetation or for capture), coordinating a light, binoculars, hands and feet in muddy, deep, cold water becomes troublesome, if not impossible. Binoculars work if the body of water can be easily surveyed from the bank with no need to enter the water, but often it is necessary to entering the water to complete an accurate survey. Most importantly, however, if positively identifying the source of the eye-shine to species is important, binoculars cannot be used successfully – one must be close enough to distinguish morphological features, which is often impossible from afar, even with binoculars.

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