-NOTE-

A Simple and Inexpensive Light Trap for Lake Zooplankton

ABSTRACT

Various types of light traps have been used in aquatic ecosystems to attract fish larvae, zooplankton, and benthic invertebrates. However, most of these devices have been cumbersome and expensive. I devised a simple and inexpensive light trap using a modified Ruttner water sampler and green Cyalume® light sticks. Repeated trials in Kastraki Lake (Greece) demonstrated that the light trap was efficient in attracting zooplankton, notably the cladoceran *Bosmina longirostris*.

A great number and variety of light traps have been employed to attract and trap phototactic aquatic organisms. However, most of these devices have been cumbersome and expensive, and the light is usually produced from fluorescent lamps powered by batteries. Cyalume® light sticks (LSTs) have been used as light sources in aquatic light traps for the attraction of fishes (Gehrke 1994, Burke 1995) and benthic crustaceans (Hovda and Fosshagen 2003). Such light sources offer the advantages of low cost, light weight and ease of handling (e.g., no need for a power supply). I modified a standard 2L Ruttner water sampler and employed LSTs as the light source to create a device for the attraction and capture of lake zooplankters.

The 75 cm X 10 cm (diameter) Ruttner bottle was modified as follows. The upper opening of the armed bottle was reduced from 6.5 cm to 1 cm by using two 5.5 cm plastic tubes as spacers on the inside arms (Fig.1). This modification consequently extended the lower opening of the bottle to 12 cm. The thermometer, which was attached to an arm inside the bottle, was removed. At the lower end of this arm a 4 cm long wire was placed, from which the two 15 cm long light sticks were hung by two 10 cm cotton strings. The outer transparent face of the bottle was covered with a black plastic sticker so that no light could pass from inside or outside the bottle. The two LSTs were held together by a thin cotton string tied around their lower ends.

To test the utility of the light trap, replicate samples were collected from a bridge over Kastraki Lake in western Greece. Separate collections occurred on two dates in June. During the sampling procedure, the bottle was lowered into the water and was held stationary for 30 seconds at a depth of 1.5 m under the surface. The bottle was then closed with the messenger, and the water was retrieved. This procedure was repeated five times and comprised a single composite sample. "Dark" samples (the LSTs were not producing light) were collected in triplicate, and then "bright" samples (the LSTs were activated) were also taken in triplicate. Each water sample was washed through a 50 μm net to retain the zooplankton. There was no light moon on either sampling occasion. All planktonic organisms were counted from the entire samples. Comparisons between dark and bright samples for each zooplanktonic species were made using the Mann-Whitney test (U-test) after pooling the samples of the two days.

The most abundant species in the zooplankton community was *Bosmina longirostris*. For this species, the average number of specimens recovered from the bright samples was nearly three times greater than that of the dark ones on both sampling dates (197.8 vs 63.3 specimens per sample), and these differences were statistically significant ($p=0.004$). However, there were no statistically significant differences ($p > 0.05$) between dark and bright samples for the less abundant crustaceans such as *Macrocyclops albidus* (copepodites and nauplii) or *Daphnia cucullata*. This was also true for larvae of the mollusk *Dreissena polymorpha* and the rotifers *Ploesoma truncatum*, *Keratella cochlearis*, *Trichocerca similis* and *Synchaeta* sp.

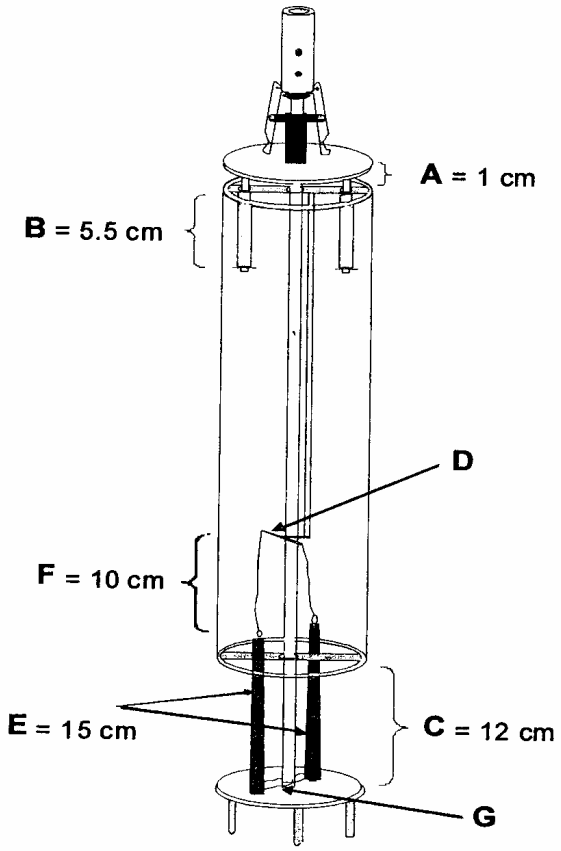

Figure 1. Ruttner water sampler modified as a light trap. A, reduced opening of 1 cm; B, 5.5 cm long plastic spacer tubes in the inside arms; C, new lower opening of 12 cm; D, 4 cm long wire; E, light sticks; F, 10 cm long cotton strings; G, cotton string to hold the lower ends of the light sticks together.

These results show that the combination of a simple water sampler and LSTs was efficient in attracting and capturing at least one zooplanktonic species, although adequate randomization of the sampling locations and a higher number of samples would enhance these observations. The estimated abundance of *B. longirostris* from the dark samples (6.33 ind. L^{-1}) was in accordance to the average abundance of this species in the Kastraki Lake (5.3 – 7.1 ind. L^{-1}), as it was recorded during day and night using a 5 L plastic water sampler. In contrast, the estimated abundance of this species as derived from the bright samples differed significantly, as a result of an intense aggregation of *B. longirostris* specimens into the light trap. This means that the use of this light trap is not appropriate for quantitative studies of zooplankton. Indeed, this is a theoretical disadvantage of all light traps, because of the possible variability in the phototactic response of the different species, and that is why these devices are used only for qualitative studies.

However, the advantages of this light trap in comparison to other devices lie with its simplicity, low cost and ease of handling. The small size and the light weight of the apparatus make it useful for various aquatic ecosystems, especially shallow lakes and marshes. In addition, this light trap can be used for capture of positively phototactic benthic species, or species which are in close association with the bottom of the lake and normally are inaccessible by alternative methods. In the present study only one

color of light was used, and the sampling duration was only 30 seconds. Different exposure times would probably affect the total number of *B. longirostris* specimens captured in the light trap, and different colors of Cyalume® light sticks may attract other species as well.

LITERATURE CITED

Burke, N. C. 1995. Nocturnal foraging habitats of french and bluestriped grunts, *Haemulon flavolineatum* and *H. sciurus*, at Tobacco Caye, Belize. Environmental Biology of Fishes 42: 365-374.

Gehrke, P. C. 1994. Influence of light intensity and wavelength on phototactic behaviour of larval silver perch *Bidyanus bidyanus* and golden perch *Macquaria ambigua* and the effectiveness of light traps. Journal of Fish Biology 44: 741-751.

Hovda, J. I. and A. Fosshagen, 2003. Hyperbenthic calanoids and *Thespesiopsyllus paradoxus* (Sars) collected with a light trap in western Norway. Sarsia 88: 89–94.

George Kehayias

Department of Environmental and Natural Resources Management
University of Ioannina, Seferi 2, 30 100 Agrinio, Greece
E-mail: gkechagi@cc.uoi.gr

Received: 23 February 2006 Accepted: 18 May 2006