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An Inexpensive, Floating, Insect-emergence Trap

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Emergence of aquatic insects has been used for a variety of research purposes, including (1) defining life histories (e.g., MASTELLER & FLINT 1980; BOERGER 1981; UTBERG & SUTHERLAND 1982), (2) studying pond colonization (e.g., STREET & TITMUS 1979), (3) monitoring water quality (MASON & SUBLETTE 1971), (4) quantifying the effect of environmental factors such as nutrients and macrophytes on insect populations (e.g., HALL et al. 1970; JOHNSON & MULLA 1982), and (5) providing an indirect measure of insect productivity (SPEIR & ANDERSON 1974). Emergence has also been used as an index of the effects of toxicants such as antimycin A and rotenone (HOUF & CAMPBELL 1977), crude oil (MILLER et al. 1977; MOZLEY 1978), and coal-derived liquids (DAUBLE et al. 1982).

The Environmental Sciences Division of Oak Ridge National Laboratory has been investigating the usefulness of aquarium microcosms and ponds for the quantification and prediction of toxicant effects on freshwater systems (GIDDINGS et al. 1981). Ideally, concepts and methods applicable to both 150-L microcosms and 15,000-L ponds would bridge the gap between the two. CUSHMAN & GOYERT (in press) documented the effects of a synthetic coal liquid on abundance, biomass, diversity, and number of taxa of benthic pond insects; samples for that study were taken with an Ekman grab. The effort of processing the benthic samples, as well as the destructiveness of the sampling in small ponds, limited the number of samples that could be taken. Therefore, I developed an inexpensive emergence trap appropriate for use in small outdoor ponds, as one method of increasing sampling efficiency and economy. Because the ponds fill with dense stands of macrophytes (CUSHMAN & GOYERT, in press), floating emergence traps were considered to be easier to use than nonfloating traps attached to the pond bottom; JOHNSON & MULLA (1982) also found that floating traps were preferable where dense stands of macrophytes occurred. To prevent the possibility of trapping adults from adjacent ponds, which would confound the results, the traps had to be designed such that they could only trap insects from the ponds upon which they were floating.

The emergence trap (Fig. 1) designed and built for this purpose is essentially a bottomless 28 x 19 x 9 cm rectangular box built of 2 x 9 cm pine lumber, assembled with waterproof carpenters' glue and finishing nails. Each side of the box has a 1-cm-diam hole drilled through, and covered on the inside with

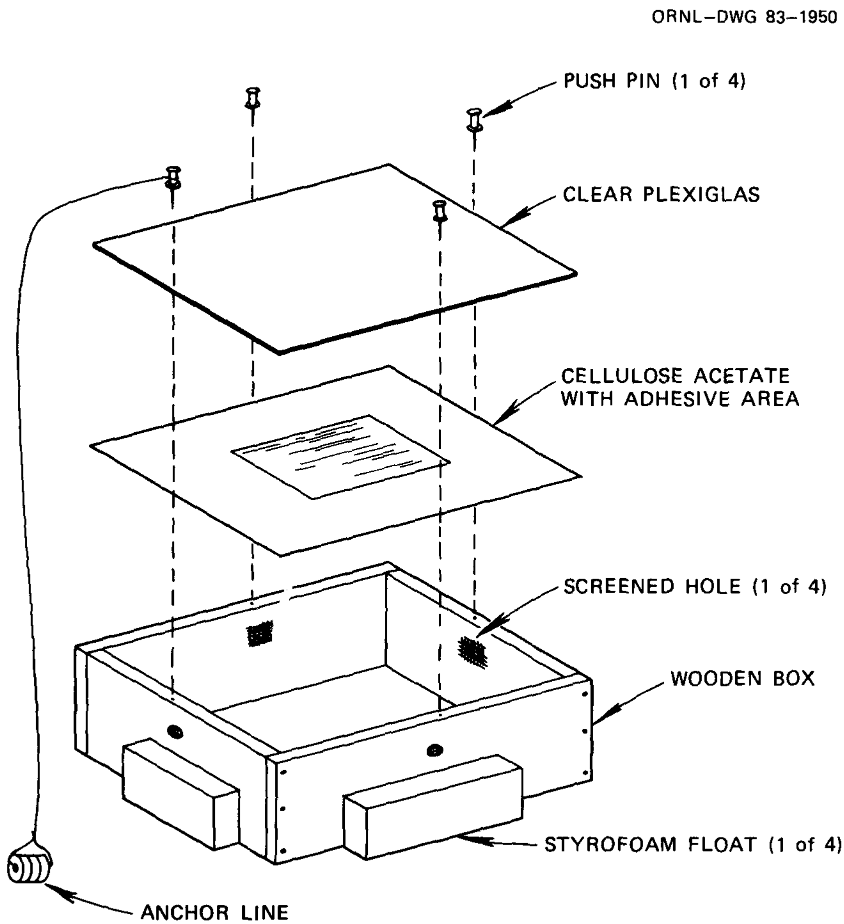

Figure 1. Schematic diagram of floating insect emergence trap.

0.5-mm-mesh-opening stainless-steel screen stapled in place, to minimize the accumulation of organic vapors within the trap. Flotation of the traps is increased by attaching styrofoam blocks to each side of the box, using epoxy adhesive. A 9 x 19 cm area in the center of a 16.5 x 26 cm piece of 0.2-mm-thick clear cellulose acetate film (defined by the use of a stencil) is lightly sprayed with Tree Tanglefoot (Tanglefoot Company, Grand Rapids, Michigan), a material found useful by MASON & SUBLETTE (1971) for floating emergence traps. This sheet is placed sticky-side-down on top of the box, then held down by a matching sheet of 1.6-mm-thick clear Plexiglas. Both sheets are then secured to the wooden box with four push-pins, one in the center along each margin. A thin nylon cord, knotted around one of the push-pin heads and with brass weights tied to the free end, is used to anchor the floating trap in place on the pond surface in predetermined, randomly located positions. Traps can be left on the ponds for one week and then removed to the laboratory. The sticky area on each trap is cut from the cellulose acetate sheet, formed into a cylinder (sticky-side-in), placed in a 400-mL beaker, and flooded with paint thinner (Amercoat No. 10, Ameron Company, Brea, California). After one day, any insects still attached to the sheet are prodded loose, and the insects in each beaker are concentrated on a screen and then preserved in a 70% ethanol-5% glycerine solution for identification, weighing, measuring, or counting. The total material cost of each trap is approximately US $1.50 (plus a slight additional material cost for the cellulose acetate film, Tree Tanglefoot, paint thinner, and preservative). The traps described here differ from those used by the authors cited earlier on the basis of a combination of small size, simplicity of construction and use, floating design, and prevention of accidental sampling of insects from nearby water bodies.

An initial application of the traps on experimental ponds to which various doses of a coal-derived liquid were added resulted in up to 182 individuals captured per trap after a one-week exposure period (unpublished data). Diptera, comprising primarily Chironomidae and Ceratopogonidae, dominated the samples. There were lesser contributions from Ephemeroptera (Caenidae and Baetidae), Trichoptera (Hydroptilidae and Leptoceridae), and Odonata (Coenagrionidae). These taxa had all been found previously in benthic samples from the same set of ponds (CUSHMAN & GOYERT, in press).

The construction and use of these emergence traps is inexpensive, so they would be appropriate for use in pond toxicity studies requiring large numbers of samples. If necessary, the traps could be considered expendable. The traps may be more useful for quantifying emergence of those insects that emerge directly from the water surface (e.g., chironomids) than those insects that crawl onto emergent objects (e.g., Odonata), and thus may not be appropriate for some community measurements (e.g., total emergence biomass or predator-prey ratio). Nevertheless, the traps provide a quantitative measure of pond insect emergence at a fairly minor cost. These emergence traps are also potentially useful in short-term aquarium microcosm studies, if illumination is maintained at a level sufficient to allow adequate photosynthesis despite the traps on the surface. Even if aquaria representing different treatments were near each other, migration from one aquarium to traps in another could not confound the results because each trap provides a virtually complete seal to the water surface. Because of the relatively limited potential for recruitment of many aquatic insect species in a laboratory setting (e.g., environmental chambers), emergence results would best reflect short-term (< one generation) responses.

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