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Efficiency of Sampling River Fishes with Rotenone

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Abstract—During 1987-92 we examined efficiency of rotenone sampling at 42 sites on 13 river systems in Michigan's lower peninsula. At each site, fish were collected by electrofishing, marked with a fin clip, and released into the treatment site shortly before the application of rotenone. Marked fish were then enumerated from the rotenone sample and recapture efficiency determined. Overall recapture efficiency was 0.43 and variability was large (±2 SD = 0.87). We grouped data by taxa, inch, discharge, and light transmittance; and developed models that predict recapture efficiency. At sites with low discharge and high transmittance, recapture efficiencies averaged from about 0.59 (sunfishes, suckers, and others) to 0.66 (minnows) for fish up to 9 in. For larger fish, efficiencies increased to about 0.89. At sites with high discharge or low transmittance, efficiencies for small fish (1 in) were only about 0.19-0.24 but increased asymptotically to about 0.84 for fish larger than 14 in. At all sites, efficiency was low (about 0.18) for benthic fishes (mudminnows, darters, and sculpins). Samples of fishes collected with rotenone provide fair estimates of total standing crop of a stream reach (about 75% of actual) but are not useful for describing numerical abundance (only about 33% of actual) unless corrected for biases. We recommend that additional data on recapture efficiencies be collected to improve precision and accuracy of efficiency models.

Rotenone, a fish toxicant, is used to sample fishes in rivers and streams, particularly when information on the entire fish community is desired (Davies and Shelton 1983; Hottell et al. 1983; Seelbach et al. 1988). Rotenone is more efficient and less biased with regard to fish taxon, fish size, and habitat type than alternative sampling methods. These variables cause significant biases to study community structure when electrofishing is used in small streams (Larimore 1961; Boccardy and Cooper 1963; Reynolds 1983), and these biases are magnified in larger rivers as overall efficiency decreases (Penczak and Zalewski 1973; Jacobs and Swink 1982; Towns 1984; Bayley and Dowling 1993). Compared to rotenone samples collected in large rivers, electrofishing produced only 1-29% of the number of individual fishes and 24-74% of the number of fish species (Nelson and Smith 1980; Jacobs and Swink 1982; Towns 1984). Netting techniques used in river sampling are also known to be very selective for particular fish taxa and size groups (Hubert 1983).

[1] Retired