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Impacts of Mosquito Control Agents on Amphibians and an Aquatic Food Web in South China

Mosquito control agents are applied in many developed areas in Southeast Asia to control infectious diseases such as malaria and dengue fever. In South China, these agents include petroleum oil, the insecticide temephos, and the bacteria *Bacillus thuringiensis*. Mosquito control efforts most often target larval stages, potentially impacting other aquatic species occupying the same habitats. Using mesocosm experiments, we evaluated the effects of these three measures on embryonic and larval survival in four wetland-breeding amphibian species. Embryonic survival exceeded 90% for the ornate pigmy frog (*Microhyla ornata*), paddy frog (*Fejervarya limnocharis*), and Asian common toad (*Bufo melanostictus*) in controls, temephos, and the bacteria treatment, but no embryos survived in the oil treatment. For the brown tree frog (*Polypedates megacephalus*), survival ranged from 65-75% for all treatments. For the larvae of all species, survival was ≤5% in oil. Survival of larval *M. ornata*, *F. limnocharis*, and *B. melanostictus* was 56-66% in bacteria and 59-76% in temephos, but for *P. megacephalus* was 6% in bacteria. Survival in controls was <15% for the three benthic feeders *F. limnocharis*, *B. melanostictus*, and *P. megacephalus*, and significantly lower than that (38%) of the mid-water column feeder, *M. ornata*. Presence of the odonate predator, *Pantala flavescens*, was associated with reduced survival in controls for the benthic-feeding amphibians. Temephos appeared to limit odonate populations thereby benefitting larval amphibians. Our study indicates that where conservation of amphibians is a priority, the use of petroleum oil for mosquito control should be avoided.