

POND-BREEDING AMPHIBIAN HABITAT SUITABILITY NEAR
MUNICIPAL WELL FIELDS IN SOUTHERN RHODE ISLAND

BY

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ABSTRACT

Seasonal ponds are critically important breeding habitat for certain species of amphibians due to their periodic drying and resultant lack of predatory fish. Different species of pond-breeding amphibians have different minimum hydroperiod requirements for achieving reproductive success. In southern Rhode Island, the wood frog (*Lithobates sylvaticus* LeConte) requires approximately 17 weeks of inundation, beginning 1 March, for 50% of metamorphs to emigrate from their natal pond; spotted salamanders (*Ambystoma maculatum* Shaw) require approximately 24 weeks. The withdrawal of groundwater from high-volume wells could potentially shorten pond hydroperiods through induced recharge of surface water and adversely affect amphibian breeding success. The objective of this study was to determine whether seasonal ponds located near municipal wells provide less suitable habitat for pond-breeding amphibians than ponds located far from such wells. In 2007, we chose for study two municipal well fields in the Pawcatuck River watershed of southern Rhode Island: Tuckertown, pumping 11,495 m³/d (3.04 Mgal/d), and Bradford, pumping 1,757 m³/d (0.46 Mgal/d). Within 800 m of wells, we selected 11 ponds at Tuckertown and 13 at Bradford; 14 additional ponds located ≥ 2 km away from high-volume wells served as controls. All wells and ponds were located in stratified glacial deposits. Using control pond hydroperiod data (2001-2004) from a previous study and other measurements of these ponds, we created a multivariate regression model to estimate the hydroperiods to be expected at well-field ponds and control ponds in most years, in the absence of hydrologic manipulation. In 2008, we determined actual pond hydroperiods in the field and collected information on pond area, depth, vegetation, water chemistry, and soils. As another indicator of current or prevailing hydroperiod, we placed each pond into one of four hydroperiod classes based on the perennial

plants growing in the deepest zone. We conducted egg mass counts in 2008 as a measure of amphibian reproductive effort and estimated potential reproductive success as the percentage of ponds in each of the three pond groups that should have been able to support emigration of at least 50% of all wood frog and spotted salamander metamorphs prior to drying. At Tuckertown, 2008 hydroperiods were significantly shorter than in the control ponds; however, expected hydroperiods were not significantly different among pond groups. The majority of ponds at Tuckertown and at Bradford had hydroperiods at least four weeks shorter than expected; less than one-third of the control ponds met that criterion. Plants growing in the deepest zone also indicated that well-field ponds were drier than the controls. Wood frog egg mass counts were lower at Tuckertown than in the control ponds, but spotted salamander counts were similar among pond groups. Based on expected hydroperiods, more than 90% of the well-field ponds at Tuckertown and Bradford should have been capable of at least 50% wood frog metamorph emigration, and more than 75% of the ponds should have been capable of at least 50% spotted salamander metamorph emigration. Based on hydroperiods observed in 2008, this emigration rate would have been possible for wood frogs at only one-third of Tuckertown ponds and three-quarters of Bradford ponds. Less than 20% of Tuckertown ponds and less than 40% of Bradford ponds held water long enough in 2008 to permit 50% spotted salamander metamorph emigration. Our research has demonstrated lower pond-breeding amphibian habitat suitability in seasonal ponds near municipal wells and suggests that significant induced groundwater recharge may be occurring, particularly at well fields such as Tuckertown, where pumping rates are among the highest in the State. If ongoing hydrologic studies confirm such effects, regulatory agencies should consider adopting specific guidelines for minimizing the impact of groundwater withdrawal on seasonal pond habitats.