USING PLANTS AS INDICATORS OF HYDROPERIOD CLASS AND AMPHIBIAN HABITAT SUITABILITY IN RHODE ISLAND SEASONAL PONDS

BY

JONATHAN C. MITCHELL

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE

IN

ENVIRONMENTAL SCIENCES

UNIVERSITY OF RHODE ISLAND

2005

ABSTRACT

Hydroperiod, or duration of inundation, is one of the most important factors determining the habitat suitability of a seasonal pond for pond-breeding amphibians, but to date there has been no standard method for estimating hydroperiod without long-term monitoring. During a 3-year study of 65 seasonal ponds in the Pawcatuck River watershed of Rhode Island, I developed a hydroperiod classification for seasonal ponds and investigated the merits of using plants as indicators of pond hydroperiod class. From 2001 to 2003, surface water levels were monitored biweekly from March through December, and egg masses of wood frogs (*Rana sylvatica*) and spotted salamanders (*Ambystoma maculatum*) were counted each spring. Toward the end of each growing season I sampled the vegetation in each pond using a line-intercept approach and measured associated substrate elevations relative to the deepest point in the pond. Pond hydroperiod was defined as the number of weeks of continuous inundation from 1 March until the pond first dried; a pond flooded through December had a hydroperiod of 44 weeks, the maximum possible hydroperiod for this study. After close inspection of pond hydroperiod data, egg-mass counts, and published emigration dates for several species of amphibian metamorphs, I assigned each pond to one of four hydroperiod classes, according to the longest hydroperiod attained or exceeded in most (two of three) years: Class 1, < 20 weeks; Class 2, 20-27 weeks; Class 3, 28-36 weeks; and Class 4, 37-44 weeks. Thirty-four plant species and two genera, termed indicator plants, were assigned to the same classes based on average and 3rd quartile values calculated from frequency distributions of the number of ponds in which the plants occurred at each hydroperiod in each year. I used indicator plants growing in the deepest zone of each pond to estimate

the hydroperiod class of individual ponds in each year; the hydroperiod of ponds with no indicator plants growing in the deepest zone could not be estimated. Indicator plants were present in the deepest zone of 34 ponds in at least one year. Several ponds contained indicator plants in the deepest zone in more than one year; as a result, I was able to estimate hydroperiod class for 83 (of a possible 168) pond-years. I estimated the pond hydroperiod class for every pond-year using four different approaches and compared the estimates with the observed hydroperiod classes. The most accurate approach yielded a 72% correct classification rate for the ponds that supported indicator plants in the deepest zone. A comparison of estimated hydroperiod classes among three years showed that few ponds varied enough in plant species composition within the deepest zone to affect the hydroperiod class estimate. This suggests that plants are consistent indicators of pond hydroperiod, regardless of variations in species composition among years. Three-year maximum egg-mass counts varied among pond hydroperiod classes for both wood frogs and spotted salamanders. Generally, counts were lowest in Class 1, intermediate in Class 2, and highest in Class 3; counts in Class 4 tended to be similar to those in Class 1 or Class 2. This study shows that plants may serve as accurate and efficient indicators of seasonal pond hydroperiod and thereby facilitate assessments of suitability and potential productivity of these habitats for pond-breeding amphibians.