



Notes

Shifting status and distribution of range margin chorus frog (*Pseudacris*) populations in eastern Great Lakes watershedsJeffrey D. Corser^{a,*}, Kenneth J. Roblee^{b,1}, Glenn Johnson^{c,2}^a New York Natural Heritage Program, SUNY College of Environmental Science and Forestry, 625 Broadway 5th Floor, Albany, NY 12233, USA^b New York State Department of Environmental Conservation, Division of Fish, Wildlife and Marine Resources, 270 Michigan Avenue, Buffalo, NY 14203, USA^c State University of New York at Potsdam, Department of Biology, 44 Pierrepont Avenue, Potsdam, NY 13676, USA

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ABSTRACT

Contiguous with their range across major rivers into Canada, two different species of chorus frogs are now thought to inhabit the Great Lakes watersheds of New York. *Pseudacris triseriata* is found along the western Lake Ontario and Lake Erie plains while *P. maculata* (tentatively a new frog species in NY) inhabits the lowlands of eastern Lake Ontario and the St. Lawrence River. Both species are on their extreme range margins in NY. In 2010 we detected distributional declines of both putative chorus frog species based on a broad survey following standardized occupancy detection protocols. Causes are unclear but could relate to reforestation and urbanization of formerly more extensive agricultural lands, climate change, pathogenic fungal outbreaks and/or the contaminant effects of intensive agriculture. On the other hand, the prior overestimation of ranges because of misidentification may have inflated earlier perceived distributions (positive survey bias) because false positives are problematical for this cryptic frog. At broad geographical scales, chorus frog (meta) populations are highly dynamic and are likely shifting their ranges in response to rapidly changing overall environmental conditions in the northeastern U.S. and Canada.

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Introduction

Historical land use and biodiversity patterns in the large freshwater lake basins of the northeastern U.S. and Canada are currently experiencing unprecedented alterations (Wolter et al., 2006; Lake Ontario Biodiversity Strategy Working Group, 2009; Staiger and Thill, 2010) and many animals, including terrestrial species, are currently undergoing distributional shifts resulting from ongoing climate and habitat changes (Myers et al., 2009; Franci et al., 2010). Until recently it was understood that (meta)populations of the semi-aquatic trilling chorus frogs inhabiting New York (NY) were relatively stable and belonged to *Pseudacris triseriata*, the western chorus frog (Gibbs et al., 2007). Survey data from Gibbs et al. (2005) as well as the volunteer-based NY Amphibian and Reptile Atlas (NYSDEC, 2009) confirmed the notion that this species was widespread and common during the 1990s to early 2000s. Over 450 individual site records from NYSDEC (2009) were used to establish the range throughout the Lake plains from western and central NY, northward through the St. Lawrence Valley to Lake Champlain (Fig. 1; Gibbs et al., 2007).

Chorus frogs are very short-lived, most adults breed only in their first year of life, thus annual population turnover can be very high (97%) (Whiting, 2004). In the mixed forest/agricultural and suburban landscapes of the eastern Great Lakes chorus frogs are most often found breeding in open wet meadows, but they also form breeding aggregations in a broader array of small ephemeral fishless wetlands including vegetated swales, swamps, overgrown wet shrubby fields and ditches. They are one of the earliest frogs to breed in the spring (March/April) after emerging from nearby wooded terrestrial hibernation sites where they demonstrate freeze tolerance through the production of cryoprotectants (Jenkins and Swanson, 2005). Because of this, chorus frogs are known to be primary invaders of post-glacial terrain in the Great Lakes region (Bleakney, 1959; Holman, 1992), and the populations inhabiting the northeastern U.S. and Canada are thought to have colonized northeastward through the lower Great Lakes shortly after the glaciers retreated, about 12,000 years ago. Chorus frogs have similar contemporary distributions to many other amphibian species which have ring-like colonization patterns and zones of secondary contact around the Great Lakes (Demastes et al., 2007; Rissler and Smith, 2010).

Owing to perceived declines of chorus frogs in southwestern NY, Roblee (2001) compared data from NYSDEC (2009) with unpublished historical (1958–1987) frog survey data gathered by biologists from St. Bonaventure University. He noted that the range in western NY appeared to have retracted 100 km northward and the species apparently no longer inhabited upland valleys in the southwestern corner

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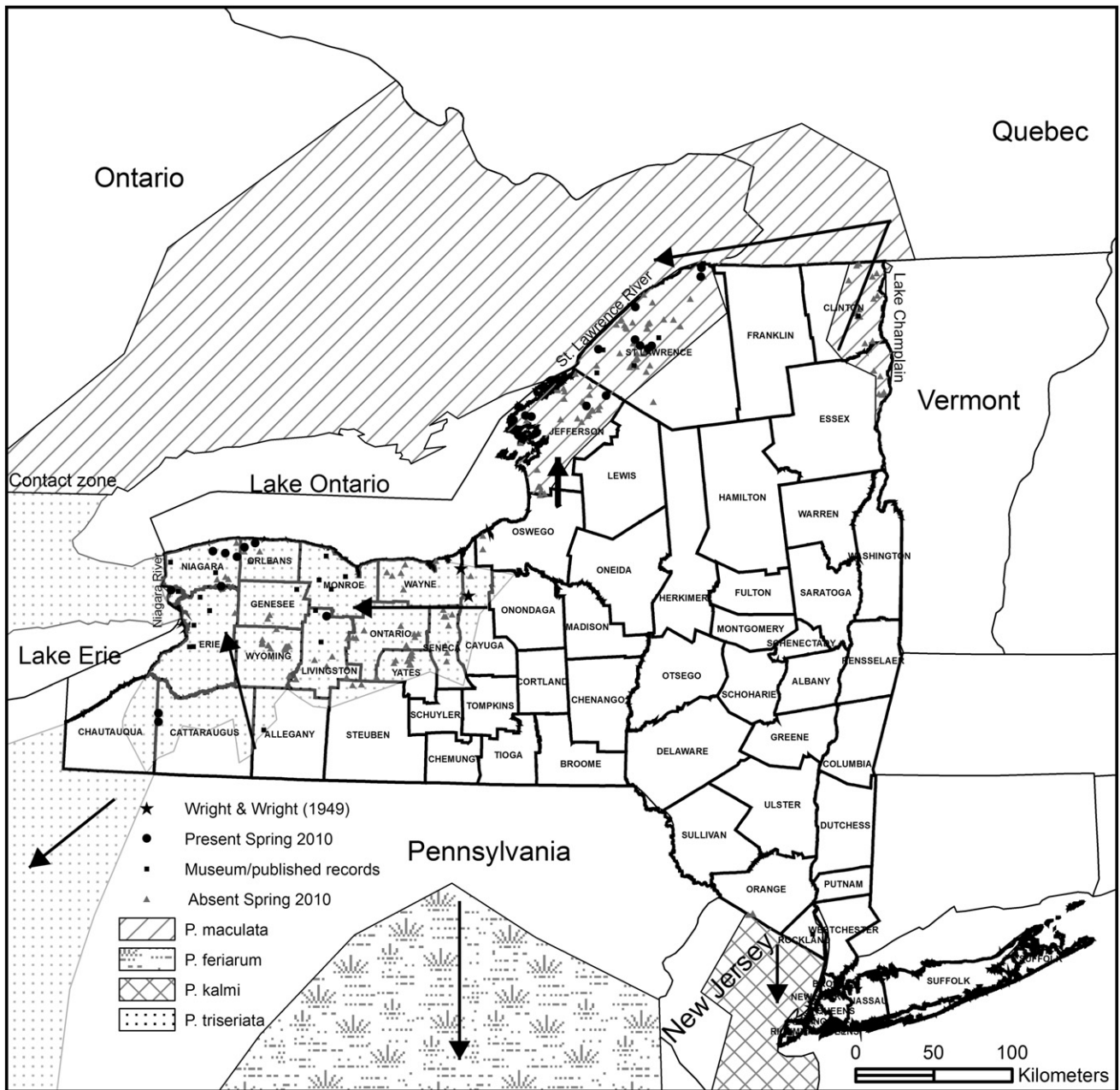


Fig. 1. Composite map of the known range and status of four species of trilling chorus frogs in the northeastern U.S. and Canada. New York (bold outline) lies on or near the overall range margins of four of the five species of trilling chorus frogs. A *P. kalmi* record on Staten Island is from Davis (1910) and a historical museum specimen in Rockland County was identified as *P. feriarum*. Arrows depict the direction of range retractions in NY based on our surveys and for congeners in neighboring states and provinces from the literature (see text).

of the state. Around the same time, Gibbs et al. (2005) resurveyed NY locales first visited in the 1970s by F. Schueler reporting that this species had also apparently declined in northern parts of the state, but populations in western and central NY had actually increased. Both Gibbs et al. (2005) and NYSDEC (2009) documented range expansions of chorus frogs into central NY, where they were previously only known from two historical (~1928) locales in northern Cayuga County (Fig. 1; Wright and Wright, 1949). Survey results from the Great Lakes Marsh Monitoring Program (Crewe et al., 2005) further muddled the picture by reporting that from 1995 to 2003 chorus frog populations in the Lake Erie basin had increased, while those in the Lake Ontario basin had declined. A discrepancy thus arose among these four contemporary sources of information regarding the status and distribution of chorus frogs in NY.

In the meantime, building on earlier work (Platz, 1989) on speciation within the widespread *P. triseriata* complex, Moriarty Lemmon et al. (2007b) compiled genetic, morphological, behavioral and acoustic evidence for the occurrence of two different species of chorus frogs in NY. They confirmed that populations in western NY were *P. triseriata*, but re-classified those in northern NY to *P. maculata* (boreal chorus frog). These closely related phenotypically similar forms are not sister taxa however, diverging about 9.5 million years ago (Moriarty Lemmon et al., 2007a) and boreal chorus frogs are known to occupy significantly colder climate envelopes than western chorus frogs (McKenney et al., 1998). Although specimens from northern NY were not included in the genetic analysis, this portion of the range was contiguous with sampled populations across the St. Lawrence River in Ontario, Canada that were designated as *P. maculata*. Based on this evidence, both NY (A. Breisch,

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