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## Decline in Relative Abundance of *Hippodamia convergens* (Coleoptera: Coccinellidae) in Fall Shoreline Aggregations on Western Lake Superior

Wayne P. Steffens<sup>1</sup> and Ryan P. Lumen<sup>2</sup>

### Abstract

In the 1970s, migratory coccinellid aggregations on western Lake Superior shorelines consisted of over 90% *Hippodamia convergens* Guérin-Méneville. In 2014, the alien *Harmonia axyridis* (Pallas) accounted for over 80% of shoreline coccinellid aggregations and *H. convergens* declined to less than 10% of the total. Additional work is needed to elucidate the extent and cause of the decline of *H. convergens* in western Lake Superior shoreline aggregations.

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In recent years, several native North American coccinellids (Coleoptera: Coccinellidae) including *Adalia bipunctata* (L.), *Coccinella novemnotata* Herbst, and *C. transversoguttata richardsoni* Brown have declined across eastern North America, while over this same period alien species have spread over the same area (Wheeler and Hoebke 1995, Turnock et al. 2003, Harmon et al. 2007, Losey et al. 2007, Bahali et al. 2015). Less widely reported are declines of the native coccinellid *Hippodamia convergens* Guérin-Méneville. Turnock et al. (2003) reported an 80% decline in relative abundance of *H. convergens* in Manitoba after invasion by the alien *Coccinella septempunctata* L. Gardiner et al. (2009) failed to find any *H. convergens* in Michigan soybean fields in 2005-2006, although the species was previously found there and in soybeans in Iowa, Wisconsin and Minnesota. The species has also declined in Ohio (Gardiner et al. 2012). We report a decline in relative abundance of *H. convergens* in western Lake Superior coccinellid shoreline aggregations since the 1970s.

Lee (1980) sampled late summer and fall migratory coccinellid shoreline aggregations at Duluth, Minnesota's Park Point six times and the Brule River beach in northwest Wisconsin twice, as well as other sites in northwest Wisconsin from 1975 through 1977. *Hippodamia convergens* often accounted for more than 90% of the coccinellids he collected on Lake Superior sites, and never numbered fewer than 113 per site (Table 1). The second most abundant species over all surveys at those locations was *H. tredecimpunctata tibialis* (Say). Other native species made up the remainder. Based on the near absence of coccinellids at Park Point in November and early spring, and the fact that none of nearly 1000 marked beetles were recovered, Lee (1980) concluded that the coccinellids had merely washed up and were not overwintering there. Most of the migratory aggregations had moved on within 2-3 weeks.

In five surveys at the Park Point Pine Forest Scientific and Natural Area (SNA) and two visits to the mouth of the Brule River in October of 2014, we found 610 coccinellids in shoreline aggregations. The two most abundant species were *Harmonia axyridis* (Pallas) and *H. convergens* (Table 2). The alien *Harmonia axyridis* accounted for over 80% of all specimens while the formerly dominant *H. convergens* accounted for less than 10%. We found only 39 *H. convergens*

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and a single specimen of *H. t. tibialis*. Native species and aliens including *C. septempunctata* and *Hippodamia variegata* (Goeze) made up the remainder of specimens. Minnesota voucher specimens have been deposited in the University of Minnesota Duluth Insect Collection, Duluth, MN; Wisconsin specimens were counted and left *in situ*

All of the sample sites are sandy beaches, and the shoreline habitats that migratory coccinellid aggregations encountered in the 1970s and in 2014 were probably not significantly different. Shorelines on western Lake Superior are constantly being reworked by storms and wave action, but review of aerial photography spanning 1980-2014 indicate few permanent changes in shoreline habitats during that period.

Gardiner et al. (2009) found that *H. convergens* was still the most common native coccinellid in Minnesota soybean fields at 19.5% of the total, but also found that *H. axyridis* was more than twice as abundant. Gardiner et al. (2009) also reported that heterogeneous landscapes with an abundance of forested habitat favor *H. axyridis* over native species such as *H. convergens*. The western Lake Superior Region is largely forested, which may explain why *H. axyridis* is now even more abundant relative to *H. convergens* in Lake Superior shoreline aggregations than in Minnesota agricultural settings.

*Harmonia axyridis* became established in Minnesota by the late 1990s (Hesler et al. 2001) and may have been first collected in Wisconsin in 1994 (University of Wisconsin-Madison Insect Research Collection Specimens # 1926 A-B), but it now appears to dominate autumn shoreline aggregations on western Lake Superior while *H. convergens* has declined dramatically. Invasive coccinellid populations will eventually stabilize their rapid population growth and expansion into new areas (Turnock et al. 2003, Bahlai et al. 2015), and evidence from Michigan suggests some native coccinellids might also stabilize and recover somewhat after invasion-related declines (Bahlai et al. 2015). Turnock et al. (2003) reported occasional years of high *H. convergens* abundance in shoreline aggregations even after the species had declined 80% in Manitoba. Additional surveys of western Lake Superior migratory aggregations and resident populations are needed to better understand trends in relative and absolute abundance of *H. convergens* and other native and exotic coccinellids.

Table 1. The two most abundant coccinellids in western Lake Superior shoreline aggregations 1975-1977.

Location	Date	<i>H. convergens</i>	<i>H. tredecimpunctata</i>
Park Point MN	9/21/75	365	3
Park Point MN	10/26/75	1630	217
Park Point MN	10/26/76	148	
Park Point MN	8/30/77	474	10
Park Point MN	9/12/77	211	
Park Point MN	10/21/77	222	
Brule R. WI	10/25/76	283	1
Brule R. WI	9/12/77	192	2
Cornucopia WI	10/25/76	167	1
Cornucopia WI	9/12/77	260	
Herbster WI	10/25/76	217	1
Port Wing WI	10/25/76	113	1
<b>Total</b>		<b>4282</b>	<b>236</b>

Table 2. The two most abundant coccinellids in fall shoreline aggregations on western Lake Superior in 2014.

Location	Date	<i>H. convergens</i>	<i>H. axyridis</i>
Park Point	10/14/14	16	48
Park Point	10/15/14	13	31
Park Point	10/18/14	1	196
Park Point	10/23/14	1	54
Park Point	10/30/14	7	80
Brule R.	10/6/14	1	1
Brule R.	10/12/14		100
<b>Total</b>		<b>39</b>	<b>510</b>

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