

Dragonfly Distribution Changes May Indicate Climate Change in North Dakota



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Background:

- One of the main concerns about global climate change is its impact on the geographic distribution of species. It is predicted that southern species may expand northward and northern species may have their distributions greatly decreased by warming temperatures.
- North Dakota has seen the largest temperature rise in the last 100 years of all the lower 48 states. In ND, these changes may have the greatest effect on aquatic species (Yurkonis et al., 2015).
- There is a compelling argument that aquatic insects in particular would be excellent models to explore both distribution and ecosystem changes due to climate change. Aquatic insects have aquatic larvae which would be impacted by changes in temperature, precipitation, and hydrology. But most have a terrestrial adult stage which can fly and therefore travel from water body to water body.
- Drawback: the current distribution of most aquatic insect species is not well known in ND.
- We are using data from voucher collections of water quality studies as well as new collecting efforts to increase our knowledge of Dragonfly (Odonata - Anisoptera) distributions in ND.
- We hope to eventually model this data with climate data provided by colleagues in the CRCS research group of the ND EPSCoR program.

Methods:

- We used range maps from Paulson (2009, 2011), the species list from Bick et al. (1977), as well as data from Odonata Central to compare to the current published Dragonfly distributions for North Dakota.
- We examined specimens from the VCSU Macroinvertebrate Lab's collection of aquatic invertebrates. The specimens in this collection come from a variety of bioassessment projects from around the state.
 - The Dragonflies in these collections consist of larval stages that had only been identified to the genus level.
 - We pulled specimens from the voucher collection and identified them to species using a Leica MZ16 stereomicroscope with attached digital camera and Clemex software. We used the keys of Needham et al. (2014) for the larvae identifications.
- With funding from ND EPSCoR, we spent the summers of 2016 and 2017 traveling across ND collecting dragonflies (sites displayed in Figure 1).

Results:

- A total of 502 immature and adult specimens consisting of 31 species were collected in the summers of 2016 and 2017.
- An additional 320 immature specimens of 19 species have been identified from our voucher collection.
- We have documented a total of 36 species for the state of ND.
 - Of those 36 species, 8 are new records for ND.
- Overall, the 3 most common species collected were members of the family Aeshnidae (See Table 1).
- Among adults, 3 of the 4 most common species collected were all members of the family Libellulidae.

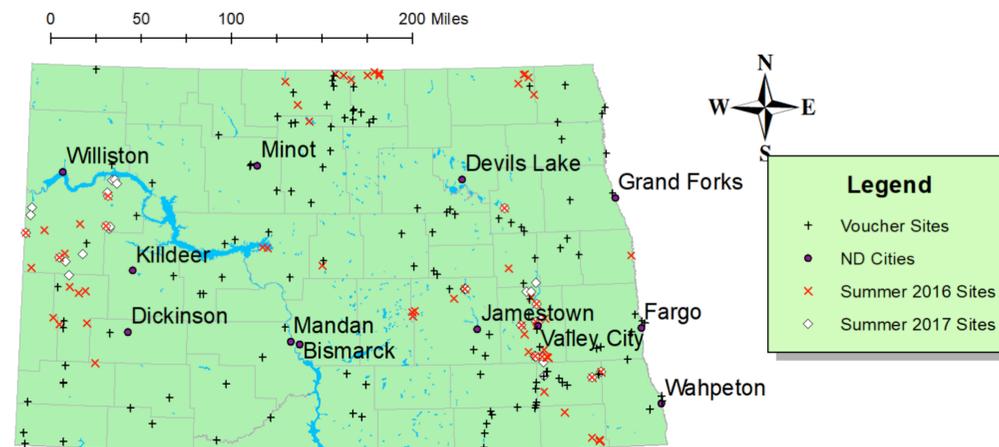


Figure 1. Collection site locations from the Summers of 2016 and 2017, as well as locations of older specimens from previous samples in the VCSU Macroinvertebrate Lab Voucher Collection.

Table 1. Total number of specimens of different life stages of the species identified in this study.

Species	Adults	Larvae	Exuvia	Total	%
<i>Anax junius</i>	15	91	-	106	13.6%
<i>Aeshna interrupta</i>	35	49	1	85	10.9%
<i>Aeshna umbrosa</i>	3	75	2	80	10.2%
<i>Libellula pulchella</i>	40	22	-	62	7.9%
<i>Gomphus graslinellus</i>	-	43	17	60	7.7%
<i>Leucorrhinia intacta</i>	17	27	-	44	5.6%
<i>Gomphus externus</i>	2	33	-	35	4.5%
<i>Sympetrum corruptum</i>	20	11	-	31	4.0%
<i>Sympetrum internum</i>	23	8	-	31	4.0%
<i>Sympetrum costiferum</i>	24	5	-	29	3.7%
<i>Epitheca cynosura</i>	6	19	-	25	3.2%
<i>Aeshna constricta</i>	1	23	-	24	3.1%
<i>Libellula luctuosa</i>	9	7	-	16	2.0%
<i>Sympetrum obtrusum</i>	14	2	-	16	2.0%
<i>Sympetrum danae</i>	-	15	-	15	1.9%
<i>Argomphus cornutus</i>	2	12	-	14	1.8%
<i>Sympetrum vicinum</i>	4	9	-	13	1.7%
<i>Epitheca spinigera</i>	0	12	-	12	1.5%
<i>Sympetrum semicinctum</i>	10	-	-	10	1.3%
<i>Somatochlora ensigera</i>	2	7	-	9	1.2%
<i>Pachydiplax longipennis</i>	8	-	-	8	1.0%
<i>Stylurus notatus</i>	-	8	-	8	1.0%
<i>Ophiogomphus severus</i>	-	7	-	7	0.9%
<i>Stylurus intricatus</i>	-	7	-	7	0.9%
<i>Dromogomphus spinosus</i>	-	6	-	6	0.8%
<i>Aeshna eremita</i>	3	2	-	5	0.6%
<i>Rhionaeschna multicolor</i>	4	-	-	4	0.5%
<i>Dromogomphus spoliatus</i>	-	3	-	3	0.4%
<i>Epitheca princeps</i>	-	2	1	3	0.4%
<i>Erythemis simplicicollis</i>	1	2	-	3	0.4%
<i>Leucorrhinia proxima</i>	-	3	-	3	0.4%
<i>Plathemis lydia</i>	1	2	-	3	0.4%
<i>Libellula quadrimaculata</i>	2	-	-	2	0.3%
<i>Gomphus lividus</i>	-	1	-	1	0.1%
<i>Pantala hymenaea</i>	1	-	-	1	0.1%
<i>Sympetrum madidum</i>	1	-	-	1	0.1%
Total	248	513	21	782	



Figure 2. Photos of some common North Dakota dragonflies: Common Green Darner (*Anax junius*) (left), Shadow Darner (*Aeshna umbrosa*) larva (middle), Twelve-spotted Skimmer (*Libellula pulchella*) (right).



Figure 3. Blue-eyed Darner (*Rhionaeschna multicolor*) adult

Discussion:

- The 6 dragonfly species we found in 2016 and 2017 that were not previously documented in ND are as follows: Blue-eyed Darner (*Rhionaeschna multicolor*) (pictured in Figure 4), Spot-winged Glider (*Pantala hymenaea*), Black-shouldered Spinyleg (*Dromogomphus spinosus*), Common Baskettail (*Epitheca cynosura*), Prince Baskettail (*Epitheca princeps*), and Ashy Clubtail (*Gomphus lividus*).
- The 2 new records from the voucher collection are the Flag-tailed Spinyleg (*Dromogomphus spoliatus*) and the Elusive Clubtail (*Stylurus notatus*).
- The newly identified species records could be due to either insufficient sampling in the past or their recent migration into the state.
- We hope to correlate our data with climate data to determine if they are recent migrants.
 - We may be able to look at past weather data and see if changes in climate correlate with the appearance of species in the state.
 - In the future, correlating distribution changes to climate data and may enable the prediction of range changes based on climate models.

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