

Dynamic Range Extensions of Seven Odonate Species into Arizona

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Abstract-- *Distributions of Arizona odonata are undergoing change. Seven key species are examined and their changes are discussed and related to climate change and anthropogenic versus natural causes.*

INTRODUCTION

The distributions and diversity of Odonata (dragonflies and damselflies) in Arizona have been rapidly changing (Figure 1). Most of the species that were present in the state 60 years ago are still resident. But many other species of these aquatic flying insects are newcomers to Arizona, flying in to exploit available niches and in doing so establishing new populations. In writing this paper, we are calling attention to seven species of odonata that seem to have become Arizona residents, to one degree or another. We are attempting to document their changes in distribution during the years 2008 through 2018. Those 10 years appear to be a decade of great biological flux in the American Southwest and it will be interesting to use the decade as a baseline for other 10-year periods and their resulting distributional changes. While other species have made inroads into Arizona's biota, perhaps to a lesser degree, these seven stand out for reasons as discussed below.



Figure 1. Examples of Odonata (dragonflies and damselflies) in Arizona.

***Aphylla protracta* (Narrow-striped Forceptail)**

Prior to 2008, the U.S. range for this species was shown (Paulson 2009) only as far as west central Texas. And in northern Mexico, records extended no farther north than east-central Sonora. The first documented occurrence of this

species in Arizona was in late July 2008 (Figure 2). That extended visit by a pair at San Bernardino NWR continued for more than two weeks. Subsequent reports, mostly of single individuals, occurred elsewhere in southeast Arizona in August 2012, August 2013, both July and August 2015, and in July 2017. Some of these sightings were documented from as far north as Roper Lake near Safford.

But most unusual during the past 10 years was the discovery in the summer of 2014 of a breeding population of this species south of Mammoth along the San Pedro River. As many as 18 individuals in a day, both males and females, were recorded at that location, and the population has proved to be viable through the summer of 2017. Since visits to that location had not been made in prior years, it is uncertain exactly how long *A. protracta* has been resident in this area. Yearly visits will be continued to document this unusual resident of central Arizona.

Narrow-striped Forceptail (*Aphylla protracta*) distribution before 2008 (left) and 2017 (right)

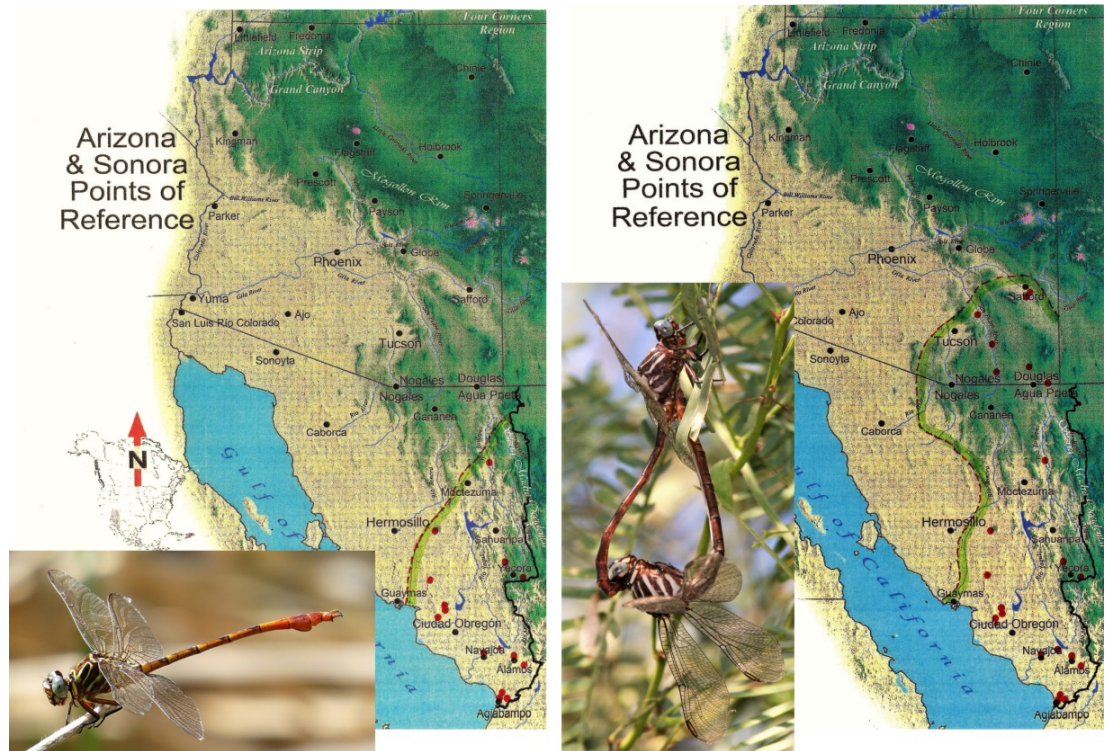


Figure 2. Narrow striped forceptail distribution in Arizona and northern Sonora before 2008 (left) and 2017 (right).

***Erpetogomphus elaps* (Straight-tipped Ringtail)**

This small, mostly West-Mexican, ringtail species is a common resident as far north as east-central Sonora. It occurs at middle elevations along small, permanent creeks and rivers. So, in September of 2008, it was quite a surprise to discover the first AZ record along Parker Canyon Creek, Santa Cruz County (Figure 3, Danforth and Bailowitz 2008). For four years, that lone individual remained the only known record of this species in the state despite further searching in the area. But, beginning in 2012, additional sightings were reported along other nearby drainages. Then, in 2017, multiple individuals were observed in four localities spread across the International Border. This has culminated in extension of that species' range to Sonoita Creek and into the Atascosa Mountains, more than 50 km to the west. Several questions come to mind. Since regional collection and photography of odonata were done prior to 2008, and this ringtail

had not been recorded, what has changed? And will *E. elaps* remain, now that it has a foothold on those canyons, which seem to be located at the proper altitudes and with appropriate amounts of water?

Straight-tipped Ringtail (*Erpetogomphus elaps*) distribution before 2008 (left) and 2017 (right)

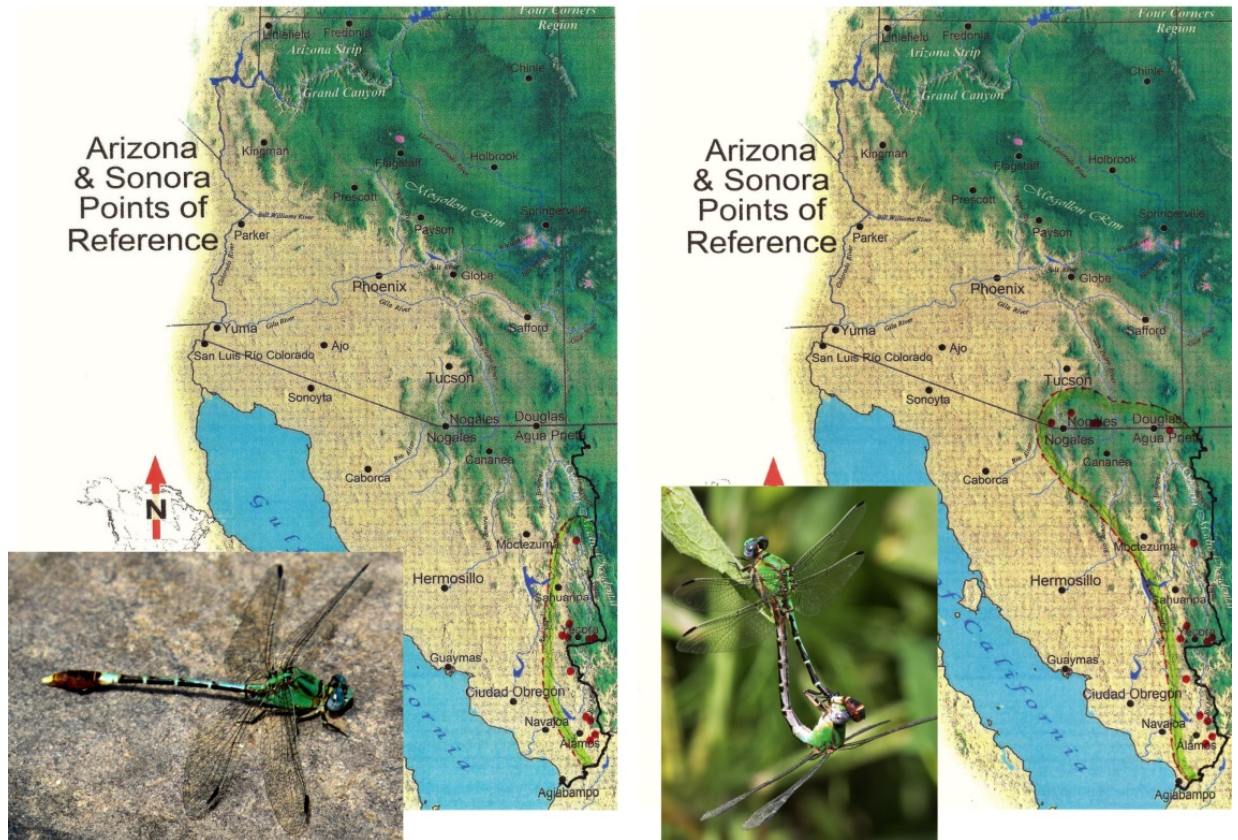


Figure 3. Straight-tipped ringtail (*Erpetogomphus elaps*) distribution in Arizona and northern Sonora before 2008 (left) and 2017 (right).

***Brachymesia gravida* (Four-spotted Pennant)**

While most of the recent range expansions of odonata into Arizona have come from the south, this species' origin has been from the east. Prior to 2008, it had been reported west to eastern New Mexico but with an additional population at Roper Lake State Park near Safford, Arizona. A resident population was known as far back as the summer of 2001. The isolation of that population, several hundred kilometers west of the species' continuous distribution, coupled with regular stocking of Roper and Dankworth Lakes for fishing (with fish stocks from eastern states where the species is common), suggested the possibility that the population had been accidentally introduced. However, beginning in 2013, populations of *B. gravida* were discovered at Arivaca Lake and Patagonia Lake, more than 160 km southwest of Roper Lake State Park. By 2015, additional populations were recorded at ponds near St. David and in 2017, numerous members of this species were recorded at Peña Blanca Lake. Those reports of multiple individuals were in addition to singletons at Menager's Lake in southwest Arizona in 2015 and at Sweetwater Wetlands in west Tucson in 2017 that indicate the

species is a strong flier. It appears *B. grandid* could eventually populate most cattail-lined lakes and ponds in the southern half of the state.

***Brechmorhoga pertinax* (Masked Clubskimmer)**

In June 1958, this predominantly Mexican and Central American species was documented in the United States for the first time, in the Chiricahua Mountains of southeast Arizona. A single specimen was then collected in 1992 in Madera Canyon in the Santa Rita Mountains but remained undiscovered in the University of Arizona insect collection for more than a decade. Then astoundingly, in the early 2000s, a breeding population was discovered along some of the permanent creeks below both Rims at Grand Canyon National Park! These northern populations continue to the present time. Prior to 2008, its only other appearance in the United States was of a few individuals during the summer of 2007 in the Chiricahua Mountains, nearly 50 years after its first discovery in the state. Then, during the early summer of 2015, the numbers of this clubskimmer exploded in Arizona's southeast corner with numerous reports from at least 5 drainages on both flanks of the Chiricahuas and from the east side of the Santa Rita Mountains as well. But, apparently none of the southeast Arizona populations have continued to flourish and, in fact, as of 2018, only the Grand Canyon populations persist. Perhaps the reliable water at the Grand Canyon allows those populations to thrive while the southeast Arizona colonies continually get wiped out, or nearly so, due to the ephemeral nature of the streams in those mountain ranges.

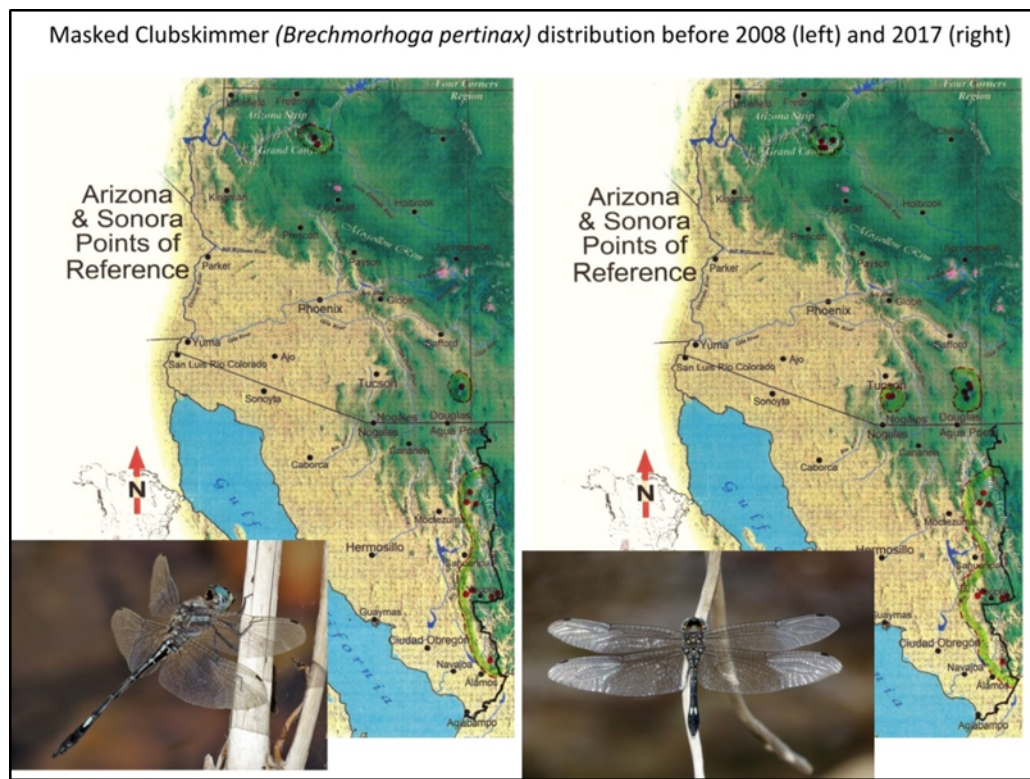


Figure 4. Masked club skimmer (*Brechmorhoga pertinax*) distribution in Arizona and northern Sonora before 2008 (left) and 2017 (right).

Orthemis discolor (Carmine Skimmer)

A close look-alike, *O. discolor* can be easily confused with its regionally common congener, *O. ferruginea* (Figure 5). The latter species occurs regularly in AZ, nearly statewide, and flies coast to coast across the southern United States. The more subtropical *O. discolor* occurs irregularly in south Texas but prior to 2008, it had only been known in Arizona from three reports. One of these reports, that of 2 males, was recorded in August of 1977 from Sycamore Creek northeast of Phoenix (Paulson 2004). After an absence of nearly 30 years, a single male was verified at Patagonia Lake in the fall of 2006 followed by another record at the southwest end of the Huachuca Mountains in the summer of 2007. Since 2008, an additional seven records of this species have been corroborated from Arizona, and all single individuals with the exception of a report of 2 males at Muleshoe Ranch north of Benson. It is certainly possible that a part of the reported increase in abundance for this skimmer is the recognition of the field marks necessary to separate it from the very similar *O. ferruginea* (see below). But it is also likely that the species may be responding to an altering climate, as it is becoming more common in southern Texas as well (Abbott 2016).

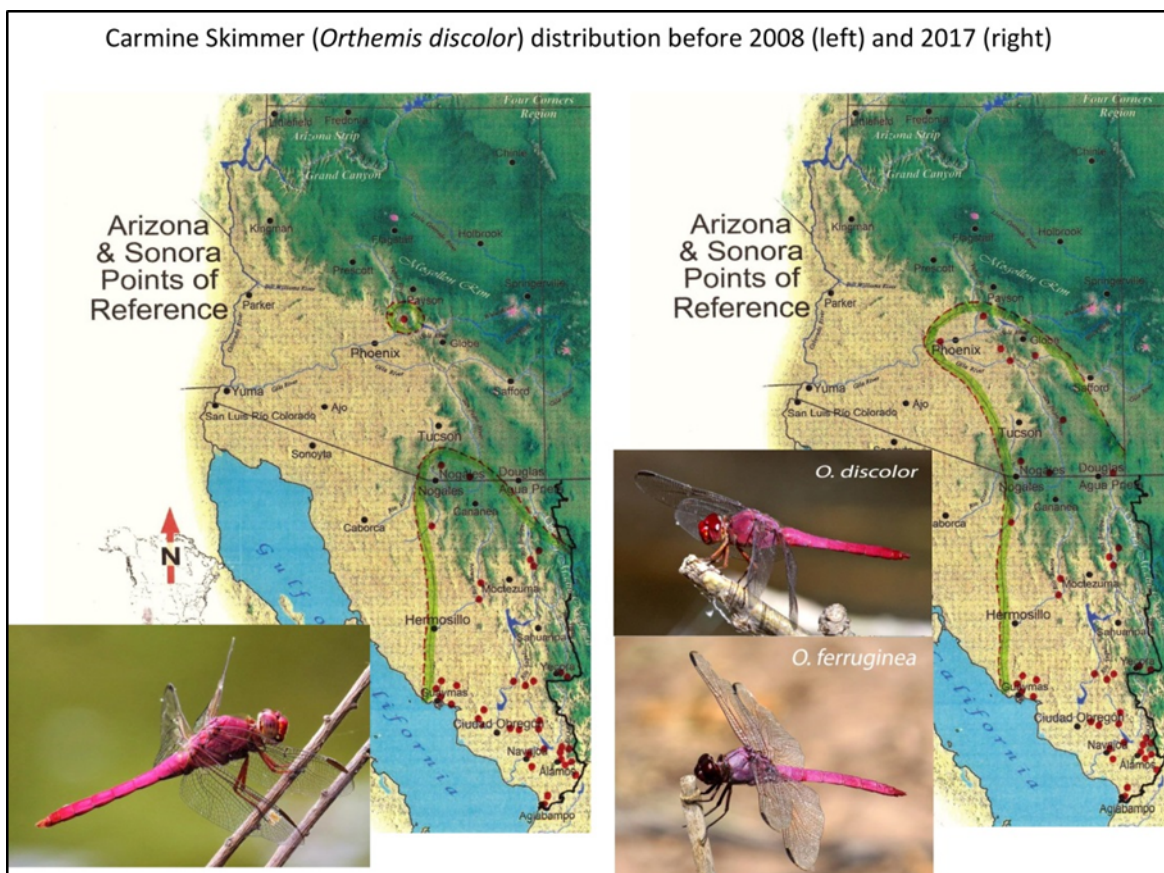


Figure 5. Carmine Skimmer (*Orthemis discolor*) distribution in Arizona and northern Sonora before 2008 (left) and 2017 (right).

Argia anceps (Cerulean Dancer)

This damselfly is a species that was unknown and even unanticipated in the United States prior to 2008 (Danforth et al. 2013, Figure 6). It was a regular species in northwestern Mexico and had been known as far north as central Sonora

(Bailowitz et al. 2015). In 2012, two Arizona specimens were photographed, one in Sycamore Canyon and another at Muleshoe Ranch, but both were misidentified as a similar species more typically found in Arizona. Early in 2013, after another specimen of this dancer was photographed and verified, the two records from the preceding year were re-examined and their true identities were confirmed. The range of this species has increased greatly over the last 5 or 6 years so that it has been now been recorded at close to 20 locations. In addition, ovipositing pairs have been observed on more than one occasion and as many as 24 individuals have been reported from a single location in a single day! The range now extends north at least to Aravaipa Creek, more than 160 km north of the United States border. The biggest question for *A. anceps* is whether this species' range will continue to expand or whether it will eventually succumb to a morphing climate scheme in AZ and disappear.

Cerulean Dancer (*Argia anceps*) distribution prior to 2008 (left) and by 2017 (right)

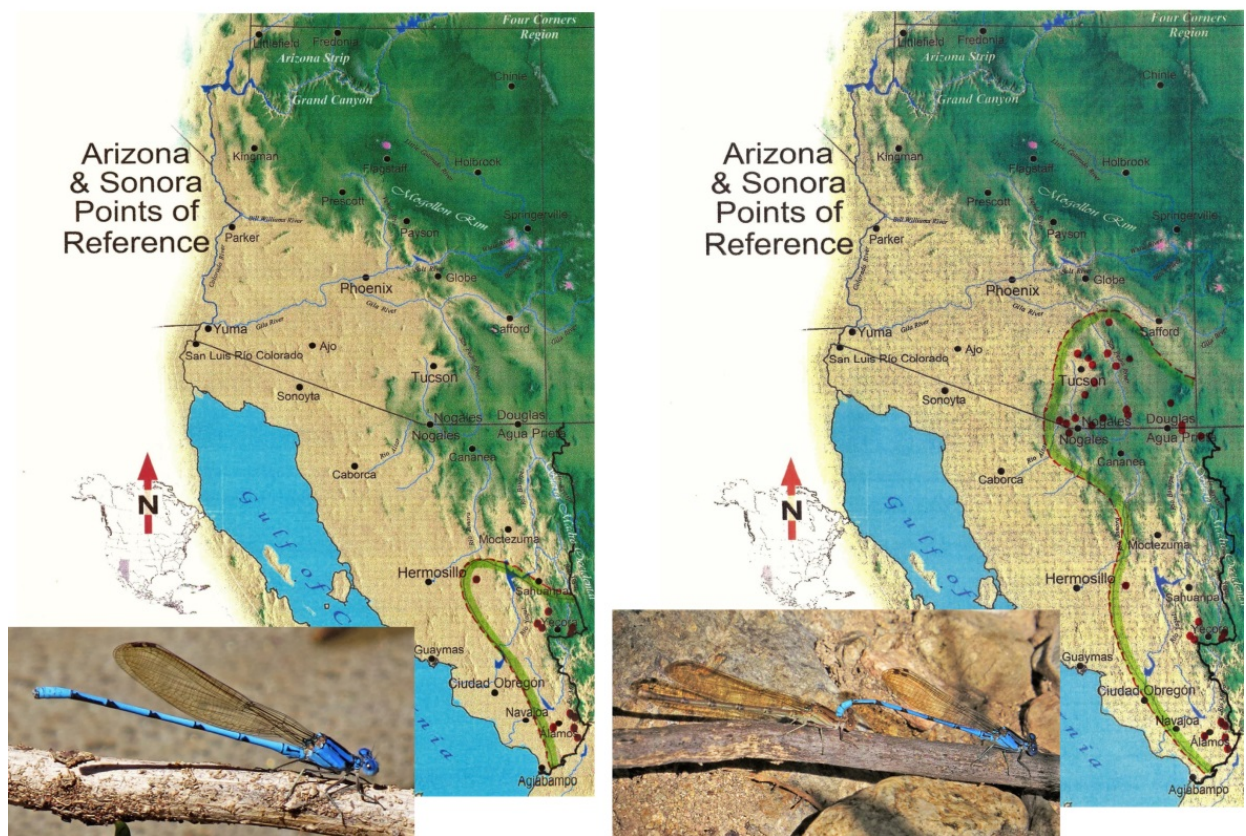


Figure 6. Cerulean dancer (*Argia anceps*) distribution in Arizona and northern Sonora prior to 2008 (left) and 2017 (right).

***Enallagma novaehispaniae* (Neotropical Bluet)**

This lowland, tropical species occurs widely as far south as Argentina (Paulson 2002). But to the north, in the United States, it appeared to be confined to south and central Texas prior to 2008 (Abbott 2011, 2015). Sonora records approached the Arizona border within 100 km near Oquitoa, but Arizona reports were lacking. Then in the fall of 2010, two individuals were verified west of Gila Bend (Bailowitz 2010), a first for the state (Figure 7). Nearly five years later, in

2015, a few solitary individuals were recorded along the southern border of the state in several places to the east and west of Nogales. But it wasn't until late in 2016 that the cornerstone of this species' distribution was discovered. Huge numbers of *E. novaehispaniae* were found downstream from the sewage plants near Phoenix. In 2017, a large population was also discovered along the Santa Cruz River downstream from Tucson's water treatment plant. The combination of rapid flow, warmed water, and considerable growth of floating and emergent vegetation makes those habitats ideal for this bluet. We consider the species to be secure in Arizona, at least at the above locations, for the foreseeable future.

Neotropical Bluet (*Enallagma novaehispaniae*) distribution prior to 2008 (left) and 2017 (right)

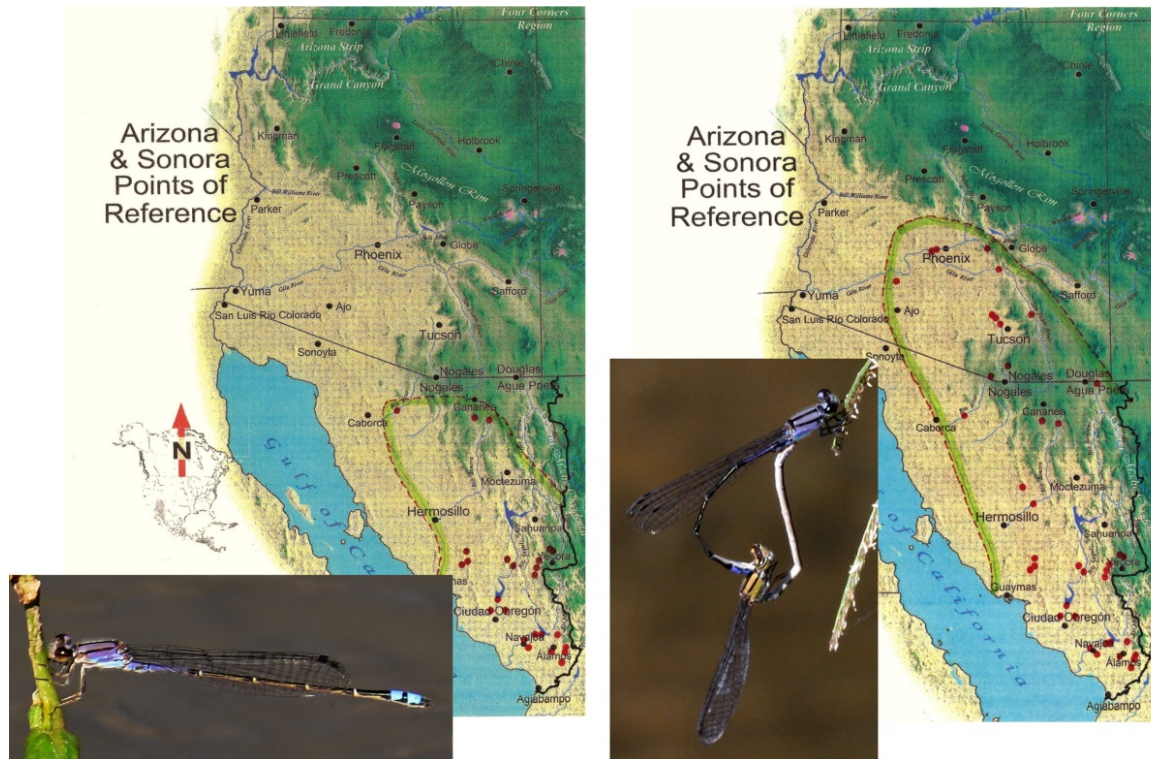


Figure 7. Neotropical Bluet (*Enallagma novaehispaniae*) distribution in Arizona and northern Sonora prior to 2008 (left) and 2017 (right).

SUMMARY

The above observations suggest that the seven species we discuss here may have already become permanent fixtures in Arizona. However, numerous other species that have made appearances into Arizona in the past, even in numbers, have not become established. Overall, the long-term successes of Arizona's odonate populations remain, for the most part, unpredictable. It is generally agreed that a "climate change" of some significance is predicted for the American Southwest. With those predicted warmer climes, other subtropical odonate species known from Sonora may also attempt colonization within Arizona. While there may be some upcoming failures, some additional species, like these current seven, may also become resident in Arizona in the not too distant future.

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