# Online Resource 1

# Stratiomyidae Natural History Field Observations

#### Field Methods

Ten rock pools in Organ Pipe Cactus National Monument were surveyed for invertebrates during the year 2020. Each rock pool had a game camera monitoring the water level, so we knew the hydrology pattern for each pool and how recently the pools had filled due to monsoon precipitation. Sweep samples were taken (see methods in Chapter 2 of Washko 2023) and preserved, then later processed in the lab. The larvae of *Odontomyia* Meigen, 1803 were enumerated and measured in the lab to determine the population structure and density across differing hydroperiods.

#### Results

##### Larvae Density

Pools that were considered to have shorter hydroperiods, meaning they dried prior to summer monsoon rainfall, had higher densities of *Odontomyia* relative to longer hydroperiod pools that held water for >6 months from winter through the summer (K-W: n = 41, χ2 = 5.66, df = 1, p = 0.017). Shorter hydroperiod pools also had a higher proportion of *Odontomyia* in the community throughout the year 2020 (K-W: n = 41, χ2 = 5.09, df = 1, p = 0.024). As the number of days of inundation in a pool increased, the density of *Odontomyia* decreased (linear regression, F1, 39 = 3.55, R2 = 0.060, p = 0.067; Figure OR1.1a), and although this result is not significant, likely due to the large number of samples with a density of zero, the trend exists. The trend becomes significant when only samples with *Odontomyia* present are included (linear regression, F1, 13 = 5.41, R2 = 0.240, p = 0.037; Figure OR1.1b). There were no differences in *Odontomyia* densities or the proportion of the community they comprised across sampling dates.

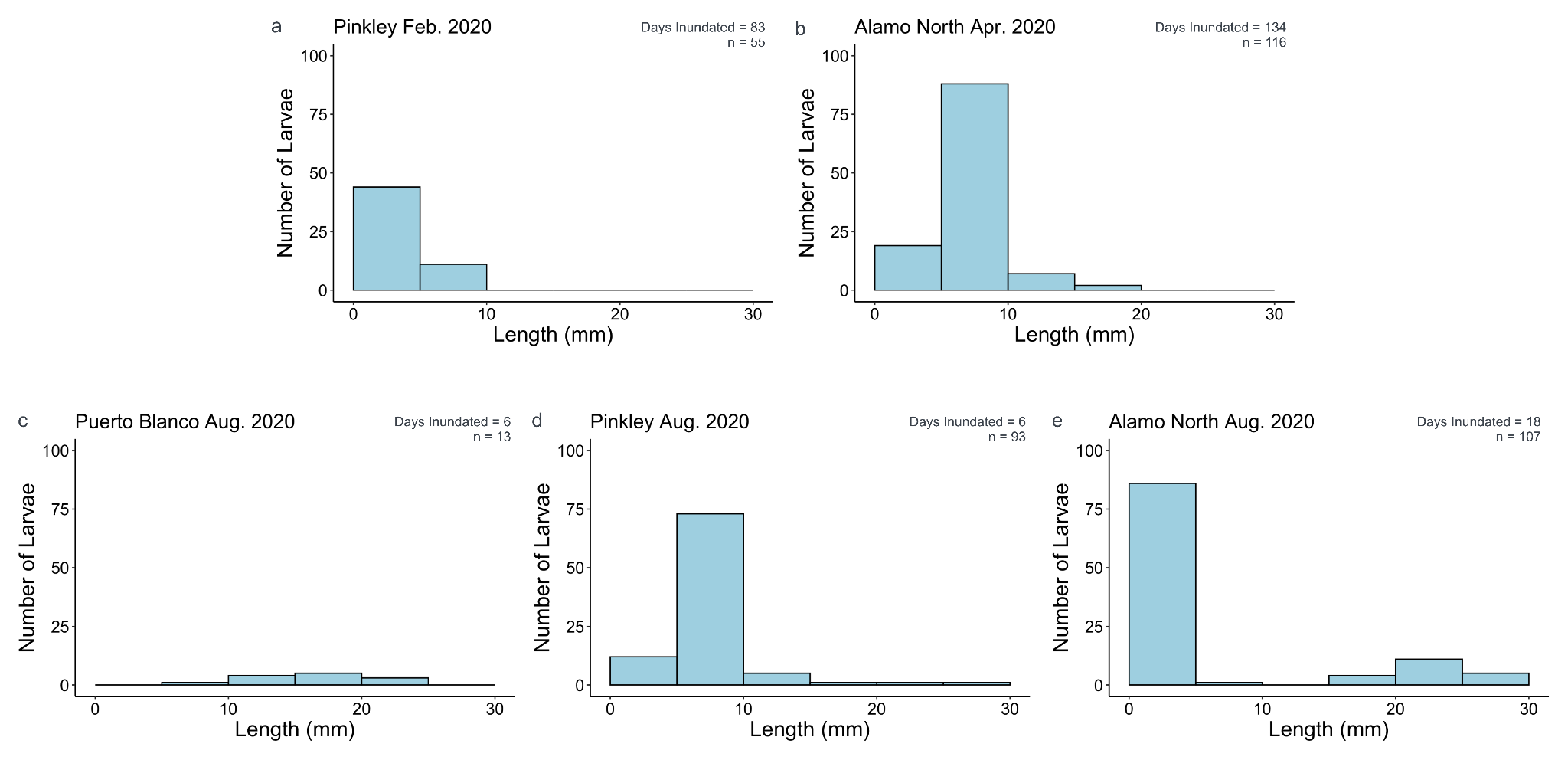
A graph of a number of days since filling

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**Figure OR1.1** Fewer *Odontomyia* Meigen, 1803 larvae were found in rock pools that held water for longer periods of time. This trend was nonsignificant when **a)** all samples were included, but significant when **b)** only samples with *Odontomyia* present were considered.

##### Larvae Sizes

*Odontomyia* larvae collected ranged in size from 1–30mm long. In pools filled by winter precipitation, most larvae were small (Figure OR1.2a-b). During the summer, we collected larvae shortly after the first monsoon rainfall. In these refilled pools, a variety of larval sizes were encountered ranging from small, recently hatched individuals to larger, mature larvae (Figure OR1.2c-e).



**Figure OR1.2** Histograms of larval lengths for three different pools on spring dates versus monsoon dates. These dates are separated by a drying event. First, **a)** Pinkley pool in February, and **b)** Alamo North pool in April. Then, **c)** Puerto Blanco pool in August, **d)** Pinkley pool in August, and **e)** Alamo North pool in August. Larvae lengths during monsoon season indicate hatchlings as well as large larvae remaining after the previous hydroperiod. In the top right corner of each graph, note the number of days of inundation when larval lengths were measured and the number of larvae.

#### Discussion

*Odontomyia* larvae were more prominent in shorter-lasting pools of Organ Pipe Cactus National Monument by overall density and the proportion of the community they comprised. In analyses for related work in the monument, we found that *Odontomyia* were an indicator species for pools of shorter hydroperiods (Washko 2023). Aquatic Stratiomyidae larvae have been observed surviving in ephemeral waterbodies across the globe (De Jong et al. 2015; Hay et al. 2018; Lytle et al. 2008; Miller 1968; Wiggins et al. 1980; Wissinger and Gallagher 1999), so there is a strong foundation for their potential as ephemeral habitat specialists.

A variety of *Odontomyia* larvae sizes were present. In winter and spring, when pools had been inundated for 80 days or longer, the population was composed of small individuals that likely hatched after a recent filling or refilling event and were incrementally developing to reach larger sizes. These pools dried during the spring/summer dry season and were inundated again when monsoon precipitation fell in August 2020. Upon refilling, again there were small larvae that had recently hatched, but there were also much larger larvae that had likely aestivated during the dry spell, survived, and were completing their larval development. A similar phenomenon has been seen in a genus of Chironomidae in California; larvae aestivate during the dry summer (there is no monsoon in northern California) and continue development when the winter rains allow flow in the floodplain channels (Cranston and Dominguez 2007). Aestivation is common in many Chironomidae (Cañedo-Argüelles et al. 2016) as well as in some Ceratopogonidae (Cantrell and McLachlan 1982), but has not been widely studied in Stratiomyidae.

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