

Analysis of Online Naturalist Sources for Creation of a Bay Area Mosquito, Dragonfly, and Damselfly Database

Zack LaGrange, Allison Stegner, Elizabeth Hadly
Stanford University

Introduction

Background: This project was inspired by a pressing conservation issue that has recently gained a large amount of attention, informally known as the “Insect Apocalypse.” Insect biomass worldwide has been declining and scientists are struggling to figure out why. One obstacle they have run into is the lack of data on insects throughout the world. Stanford’s own Jasper Ridge Biological Preserve is an exception because it maintains a manmade lake (Searsville Lake) which gives access to sediment cores containing aquatic insect remains.

This project consisted of creating a database with maps of sightings and information on more than a hundred species of mosquitoes (Family: Culicidae), and dragonflies and damselflies (both Order: Odonata) native to the Bay Area. Because these species spend most of their lives either in or around water, they are perfect candidates for measuring insect biomass using the Searsville Lake cores.



Figure 1: A shot of Searsville Lake at JRBP in the Santa Cruz Mountains outside of Stanford University. Picture is from Stanford News 2015.

Method of Online Research

The sightings of species were taken from the online naturalist site Global Biodiversity Information Facility (GBIF). Sightings for all Culicidae and Odonata species were downloaded and transformed into a file type readable by R v. 3.6.3. This gave access to all sightings within San Mateo, Alameda, Solano, San Francisco, Sonoma, Santa Clara, and Contra Costa County. For Culicidae, additional contact with Bay Area vector control departments was necessary to build a complete list. A variety of online sources were used including peer-reviewed articles, county vector control websites, and wildlife databases to build trait tables in Google Docs with descriptions and information on each species.

Maps and Trait Tables

There are a total of 29 species from the family Culicidae present in the Bay Area. Only 16 were present in the original GBIF data, but 11 additional species were included after the data was reviewed by a member of the San Mateo County Mosquito & Vector Control District. Two invasive species, *Aedes aegypti* and *Aedes albopictus*, which spread Zika and yellow fever, were added because there have been some populations, all now eradicated. There are a total of 119 species from the order Odonata present in the Bay Area. Maps were not available for all species because some species’ sightings did not have corresponding longitude and latitude coordinates.

Species Present in GBIF Data					
Genus	Species	Diseases Carried	Preferred Habitat	Life Cycle	Notable Traits
<i>Aedes</i>	<i>A. dorsalis</i>	California encephalitis virus	Variety of fresh and brackish water sources including coastal marshes, springs, streams, etc.	Multiple generations in a season (multivoltine); Adults emerge in late spring to mate, females will move inland to feed but return to the coast (when possible) to lay their eggs; females lay eggs more than 100 eggs singly on top of the water; when temperature lowers, eggs will diapause through fall and winter and emerge in spring, aquatic stage can last 12 days, including larval and pupa stages; adults can survive for up to 2 months	A very aggressive biter; able to migrate long distances (~30 miles)
	<i>A. nigromaculis</i>	Western equine encephalitis	Near any sort of standing water, but very common near riparian	Multivoltine; Adults emerge in late spring with near populations	A very aggressive biter; able to migrate distance (~30 miles)

Figure 2: An example from the Culicidae table showing the categories of information given for each species.

Odonata Species in the Bay Area GBIF Data

- **Dragonflies (Suborder Anisoptera)**
- Family: Aeshnidae

Genus	Species	Description	Distribution/Habitat	Life Cycle
<i>Aeshna</i>	<i>A. canadensis</i> N	Adults have an underlying brown body, males have brightly colored blue stripes on the thorax and abdomen. Females have either blue, green or yellow (most common) varieties, all females have green thoracic stripes and green and blue abdominal dots. Size: 2.75in, males are larger.	Found all across Canada and the Northern United States; preferred habitat is forested areas near sources of clean freshwater; often seen in areas with vegetated water sources like marshes and ponds	Eggs are laid inside the stems of aquatic plants, either under or at water level; larvae hatch within one to three weeks; the length of the larval stage is highly variable and depends on climatic conditions and food availability; multiple moltings occur as a nymph underwater; the nymph eventually emerges and molts one last time over about 24hrs to harden its wings and exoskeleton; life as an adult is usually only a few months from June-October
	<i>A. interrupta</i> Y	Males are black and brown with a	Common across most of southern	<i>A. interrupta</i> , like most Damers

Figure 3: An example from the Odonata table showing the categories of information given for each species.



Figure 4: Each blue dot represents a sighting for a particular species. This is the map for the mosquito *Culex tarsalis*. The same format was applied to all maps.

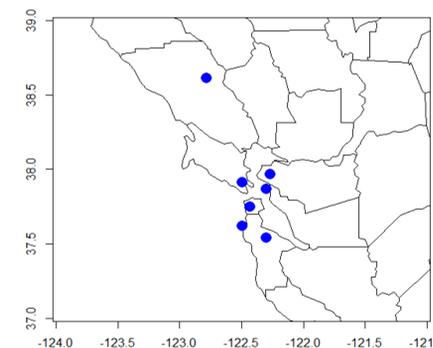


Figure 5: An enhanced map of *Culex tarsalis* sightings in the respective counties.

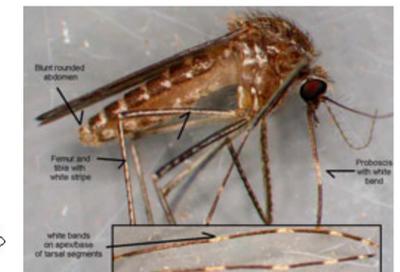


Figure 6: Image of *Culex tarsalis* from the University of Wyoming Museum of Entomology

Future Directions

While the Culicidae table is finished, the Odonata table contains 119 different species and is not yet complete. All species have been identified and mapped through R v. 3.6.3, but this project will continue into the fall. Once complete, it will assist researchers in identifying species within the Searsville Lake cores, giving important insight into population changes at JRBP.

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