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Abstract

Background

Approximately twenty-one years of historical mosquito abundance and species surveillance data, collected by the University of Notre Dame and the St. Joseph County (IN) Health Department, from 1976 to 1997 are made available. St. Joseph County is a county in Indiana, located on the Michigan-Indiana border, 35 miles from Lake Michigan.

New information

The collected data will allow for trends in species to be followed over a wide time range and facilitate further research regarding mosquito borne diseases, species distribution, and ecological changes over time.

Keywords

Mosquito Surveillance, West Nile Virus, Eastern Equine Encephalitis Virus

Introduction

Data collected in St. Joseph County, Indiana, represents species composition, relative abundance, and distribution of mosquitoes collected at a variety of locations throughout the county. Mosquitoes were collected in New Jersey light traps (NJLTs). Following collection, mosquitoes were identified by species/complex group. Data records were reconstructed, based on the year, from a combination of original paper records, re-digitized spreadsheet

printouts, and archival computer files (in various formats). The quantity of collections varied on a year-to-year basis, but collections continued throughout the entirety of the time between 1976 and 1997 and overall, we were able to reconstitute 12,944 different mosquito collections that occurred in the data collection time frame that we have high confidence of the location information. Because of recent reports of West Nile Virus (WNV) and Eastern Equine Encephalitis Virus (EEE) in the area surrounding St. Joseph County, this data, which contains abundance counts for a variety of mosquito species that are known vectors for these dangerous pathogens, will be especially powerful in the light of disease prevention and public health research.

General description

Purpose: In 2022, data was compiled from mosquito surveillance (years 1976 to 1997) in order to create a centralized location for the data. Previously, data had been stored in various locations, both physical and digital, and researchers worked to organize the data into one database file, for easy usage in further research projects and historical data reviews. Each data entry row is separated by mosquito species and sex and thus allows species abundance to be tracked over time. The trap locations were determined from accompanying notes, reports, and site names. Note, in some years, we could not determine the historical trap location of some traps, and those records are here excluded.

Sampling methods

Sampling description: Mosquito surveillance in St. Joseph County, Indiana was conducted from 1976 to 1997 using New Jersey light traps (NJLTs), using light as an attractant, by a team of researchers from the University of Notre Dame directed by Dr. George B. Craig and later Dr. Paul R. Grimstad (Young 2009). These trap placements, shown in Fig. 1, encompass a wide array of different environments in order to gain a representative sample of the mosquitoes present in St. Joseph County. Occasionally, due to various issues regarding trap placement and conditions outside of the researcher's control, the location of different traps, each marked with a different letter, was changed. Thus, the presence of multiple traps in the same general vicinity represents a change in trap location. In the data, each location is marked with a different letter. The slight location changes are marked by the assignment of a different number; thus all location changes can be tracked through the data collection period. Total mosquito count varied from year to year (*Fig. 2*). The count increased from 1976 to 1982, where it reached a peak, remaining relatively consistent from 1983 to 1995, and then peaked again in 1996 before reaching the more consistent level again in 1997. Once mosquitoes were collected, they were identified by species. Definite trends are seen in the yearly count of mosquitoes, when accounting for the different mosquito species that were found in the county each year (Suppl. material 2). Each year, the *Aedes* genera of mosquitoes consistently record the most number of mosquitoes collected. The *Culex* genera represents the next genera of mosquitoes with a high abundance throughout the year. And the *Psorophora* genera of mosquitoes have had consistently lower proportions of collected mosquitoes.

Suppl. material 2 presents the overall counts of mosquitoes, separated by species, for each of the collection years. The total number of mosquitoes collected per year is shown in Fig. 2.

Geographic coverage

Description: St. Joseph County, Indiana.

Temporal coverage

Data range: 1976-8-18 - 1997-9-27.

Usage licence

Usage licence: Open Data Commons Attribution License

Data resources

Data package title: Mosquito Surveillance from St. Joseph County, Indiana.

Number of data sets: 1

Data set name: Mosquito Surveillance from St. Joseph County, Indiana.

Description: Data can be found in Suppl. material 1. For these records, species identification method was morphological, developmental stage was adult, trap type was New Jersey Light Trap (NJLT), and attractant was light.

Column label	Column description
uniqueID	A unique record number
collection_end_date	The date the trap was collected
collection_start_date	The date the trap was set
sample_count	The number of mosquitoes
GPS_latitude	The GPS latitude
GPS_longitude	The GPS longitude
trapid	The name (code) of the trapping location
sample_count	The number of animals caught
sex	The sex of the animal
species	The species of the animal

Additional information

Important Results

Because total mosquito count for each year is a partial reflection of the number of trapping sites and collections (i.e. collection effect), implications about species distribution can be better understood when looking at each collection year separately. Fig. 3 presents the mosquito species distribution in 1976, the first year of mosquito surveillance. Mosquito counts varied greatly for each species in 1976, but most prevalent species included *Aedes vexans, Culex* species, *Culex pipiens* (referred to as the common house mosquito), and *Culex salinarious*. The indication "*Culex* species" refers to mosquitoes that were unable to be taxonomically identified past the genera level, due to various issues, including missing body parts and missing identifying features. *Fig. 4* depicts the mosquito species distribution in 1997, the last year of mosquito surveillance. Again, mosquito species abundance varied greatly, but most prevalent species included *Aedes vexans,* and *Culex pipiens*. There is a wider distribution of the abundance of various mosquito species in 1997 than in 1976. Additionally, more species of mosquitoes were recorded in 1997 to 1976 which could indicate the appearance of new species in the area (but trap location changes may also affect this). The number of active traps remained relatively similar throughout the data collection period and ranged between 11 traps and 16 traps where the location could be determined. However, the number of unique collections did change greatly throughout the collection period which could account for differences in the abundance of various mosquito species. In 1976, 44 collections were reported and in 1997, 235 collections were reported. Neither of these years represent the year with the maximum number of collections, which occurred in 1996, when 672 collections were reported. The unique collection count for each year is depicted in Fig. 2B. The spike in abundance roughly corresponds to the spike in the number of collections, but there is still some variability in the total number of mosquitoes collected that does not seem to be a result of the number of unique collections, particularly the variations between 1981 and 1992.

In both 1976 and 1997, the *Aedes vexans* mosquito abundance was significantly higher than all other species. While the annual abundance of *Aedes vexans* mosquitoes has fluctuated, there have been peaks in 1981, 1982, and 1996 (Fig. 5). The *Aedes vexans* count peaks in 1982 and 1996 occur when total mosquito collections peak, indicating that these peaks in total mosquitoes collected in St. Joseph may be driven by an increase in *Aedes vexans* mosquitoes collected during those years.

West Nile Virus

The compiled dataset will be especially important for the consideration of various diseases that are most commonly spread by infected mosquitoes. One of these viruses, West Nile Virus (WNV), is spread by infected mosquitoes and was first detected in Indiana in 2001 (Indiana State Department of Health 2018). In 2018, the Indiana Annual Report of Infectious Diseases reported 35 cases of WNV with four deaths. Fig. 6 presents the yearly

abundance for four mosquito species known to be carriers of WNV. These mosquito species include *Culex pipiens, Culex restuans, Aedes triseriatus,* and *Aedes vexans* and are especially important to track as they represent some of the most abundant species in St. Joseph County throughout the entire data collection period.

Eastern Equine Encephalitis Virus

The Indiana Department of Health reports Eastern Equine Encephalitis Virus (EEE) to be "the most dangerous mosquito-borne virus that is naturally present in the state of Indiana" (Indiana Department of Health 2023). Thus, it is important to recognize three species found in St. Joseph County as known carriers of EEE (Fig. 7). These species include *Culiseta melanura, Coquillettidia pertubans,* and *Aedes canadensis*. While both *Culiseta melanura* and *Aedes canadensis* track relatively low counts throughout the collection period, they both have peaks in various years. It is important to recognize that *Coquillettidia pertubans* have had a trend of increased abundance throughout the entire collection, which may be important regarding the reports of EEE in Indiana.

Future Implications

Because general species abundance trends were relatively similar throughout the collection period, as emphasized by the species distributions from 1976 and 1997 (Figs 3, 4), comparisons between species abundances on a yearly basis may be considered to be representative of actual trends in the mosquito population in St. Joseph County, IN.

The newly created dataset will facilitate future research endeavors, which have the ability to be impactful in various fields of biological sciences, such as a number of studies (Arora et al. 2022, Campbell et al. 2022, van Klink et al. 2020) that performed novel analysis using historical mosquito surveillance records accessed on VectorBase (Giraldo-Calderón et al. 2022).

Data Availability

This reported dataset is included here as a MIReAD-compatible (Rund et al. 2019) supplemental file (Suppl. material 1). It will also be deposited in the VecDyn database at VectorByte.org.

Acknowledgements

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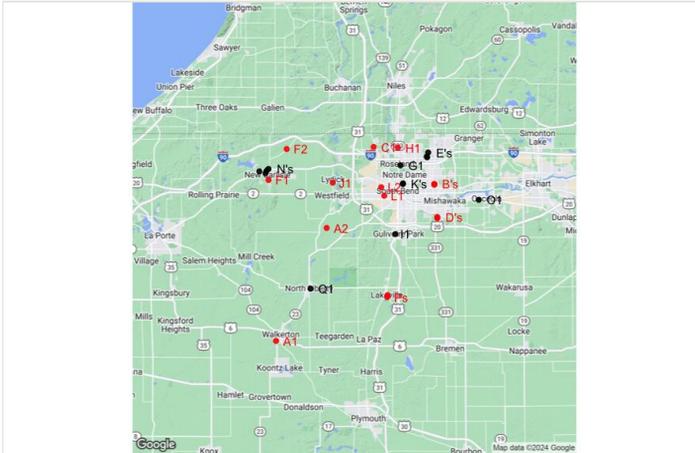
Figure 1.

Map of trap locations. Various traps were established during the duration of mosquito collection in St. Joseph County, IN.
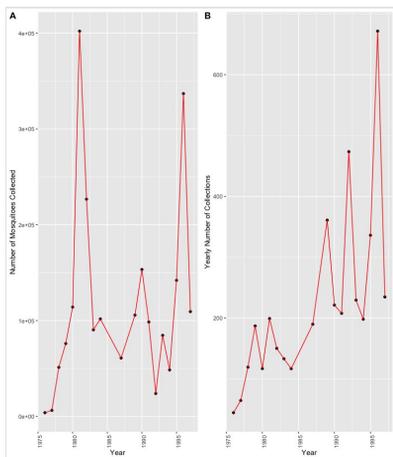
Figure 2.

Total number of mosquitoes collected each year, from 1976 to 1997 (A) and total number of collections each year, from 1976 to 1997 (B). Mosquito abundance totaled for all species collected each year during the collection period shows large variation in the number of mosquitoes collected each year. Note some variation is due to differences in trapping effort as well as collections removed becuase we could not determine their histroical placement location. The side-by-side comparison of these graphs allows some observations to be made and evaluated regarding the explanation behind trends that were found in the data.

Figure 3.

The yearly total of mosquitoes for each species in 1976. Mosquito count varied for each species, but most prevalent species included *Aedes vexans*, *Culex species*, *Culex pipiens* (referred to as the common house mosquito), and *Culex salinarious*.

Figure 4.

The yearly total of mosquitoes for each species in 1997. Mosquito counts varied for each species, but most prevalent species included *Aedes vexans,* and *Culex pipiens*.
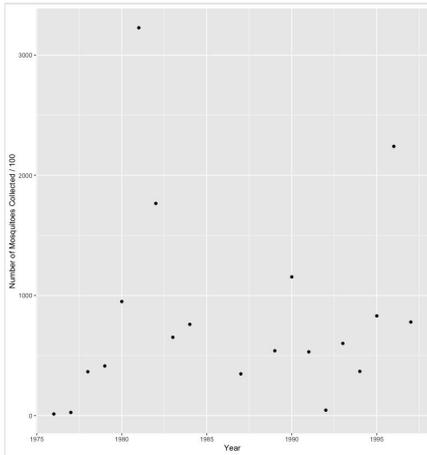
Figure 5.

Annual mosquito abundance for *Aedes vexans*. *Aedes vexans* are consistently the most abundant species collected as a part of this data collection and their abundance fluctuates briefly, but stays relatively consistent throughout the twenty-one year collection period.
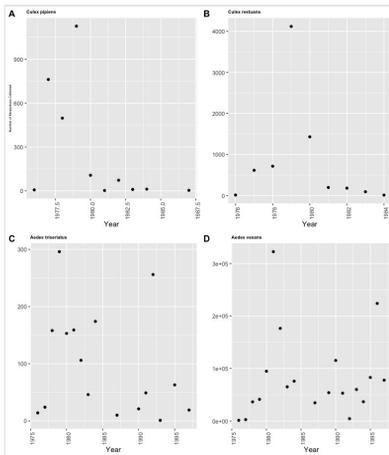
Figure 6.

Yearly abundance for four WNV vector species. All four species are known to be carriers of West Nile Virus: **A** *Culex pipiens*, **B** *Culex restuans*; **C** *Aedes triseriatus*; **D** *Aedes vexans*. These species represent some of the most abundant species in St. Joseph County, IN throughout the data collection period (1976 to 1997).
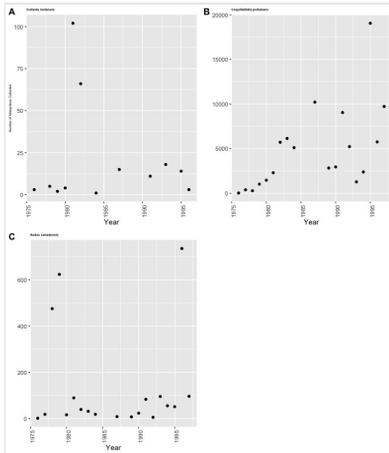
Figure 7.

Yearly abundance for three EEE vector species. All three species are known to be carriers of Eastern Equine Encephalitis Virus (EEE): **A** *Culiseta melanura*; **B** *Coquillettidia pertubans*; **C** *Aedes canadensis*. The number of collections of *Cq. pertubans* had a noticeable increase from 1976 to 1997.

Supplementary materials

Suppl. material 1: St. Joseph County mosquito surveillance data

Authors: Carmela Marie D'Antuono, Kayla Anderson, Joseph Afuso, Jennifer Robichaud, Samuel S. C. Rund
Data type: occurrences
Brief description: For these records, species identification method was morphological, developmental stage was adult, trap type was New Jersey Light Trap (NJLT), and attractant was light.
Download file (7.32 MB)

Suppl. material 2: Total mosquito count, by species, for each year of mosquito surveillance in St. Joseph County, IN.

Authors: Carmela D'Antuono
Data type: Species Abundance
Download file (3.60 kb)