

**Jennifer M. Zaspel**

**Associate Curator and Head of Zoology Milwaukee Public Museum**

**Stephen Cameron**

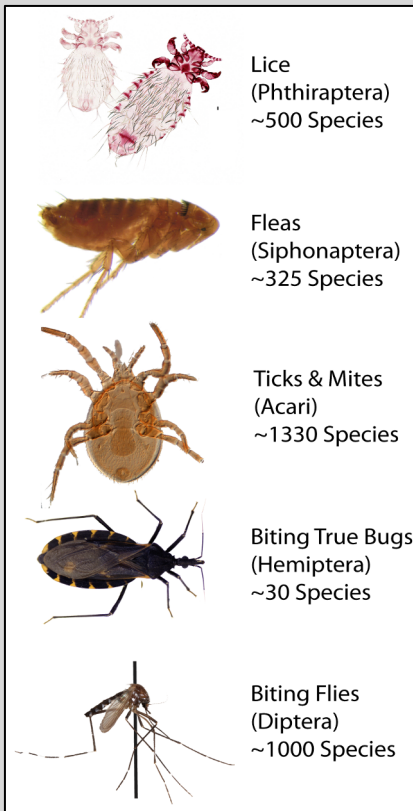
**Head and Professor of Entomology Purdue University**

- **Project Title:** Terrestrial Parasite Tracker: Digitizing collections to trace parasite-host associations and predict the spread of vector-borne disease
- **Project Start Date:** September 1<sup>st</sup> 2019
- **Project Period:** 3 years
- **Participating Institutions:** 28 + 1 New PEN 2021 (Carnegie)
- **Co-PIs/Leads on Subs:** 36
- **Participants:** 57+ (2019), 110+ (2020), 120+ (2021)



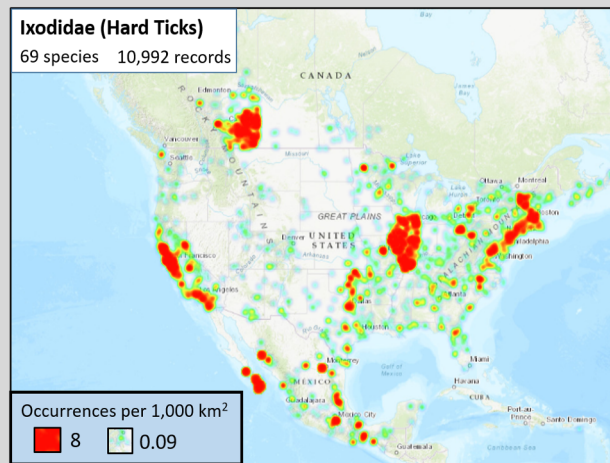
# PARASITE TRACKER

DOCUMENTING ARTHROPOD VERTEBRATE PARASITES



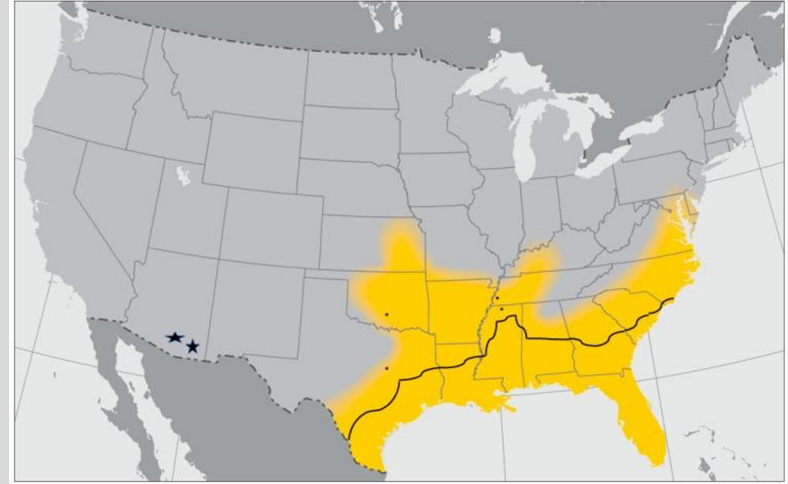
## Justification and Scope

- Parasitic arthropods inflict an enormous burden on the health of their hosts either directly, or through virulent pathogens that they vector
- Although parasites represent a substantial proportion of organismal diversity, their collections and associated data are not readily accessible
- Arthropod parasite data are underrepresented among digitized specimen data



Occurrence records for Ixodidae available on *Symbiota Collections of Arthropods Network (SCAN)*. Numbers are representative of all arthropod parasite groups in North America: low numbers, large gaps, and few collections that have contributed data to date. Heat maps are depicting areas with a maximum number of occurrences of 8 (red) and a minimum of 0.09 per 1,000 km<sup>2</sup>.

- *Biological Associations*- index parasite-host associations
- *Disease Ecology*- create digital records for organisms that spread disease to better understand their ecological interactions
- *Changing Species Distributions*- use precise georeferenced specimen data to create distribution maps and identify areas of threatened parasite diversity
- *Systematics, Taxonomy, and Species Trait Analyses*- facilitate comprehensive systematic approaches and alpha-taxonomic studies



Map showing the current versus the historic geographic distribution of the Gulf Coast Tick, *Amblyomma maculatum*. Dark black line and the four isolated black dots indicate the historic distribution based on Bishop and Trembley. Asterisks in southeastern Arizona indicate new established populations as reported by Allerdice et al. Photo credit Dr. R. Ryan Lash, Traveler's Health Branch, DGMQ, Centers for Disease Control and Prevention, Atlanta, GA.

**Fig. from Sonenshine, D.E. 2018.** Range expansion of tick disease vectors in North America: implications for spread of tick-borne disease. *International Journal of Environmental Research and Public Health* 15: 478 doi: 10.3390/ijerph15030478.

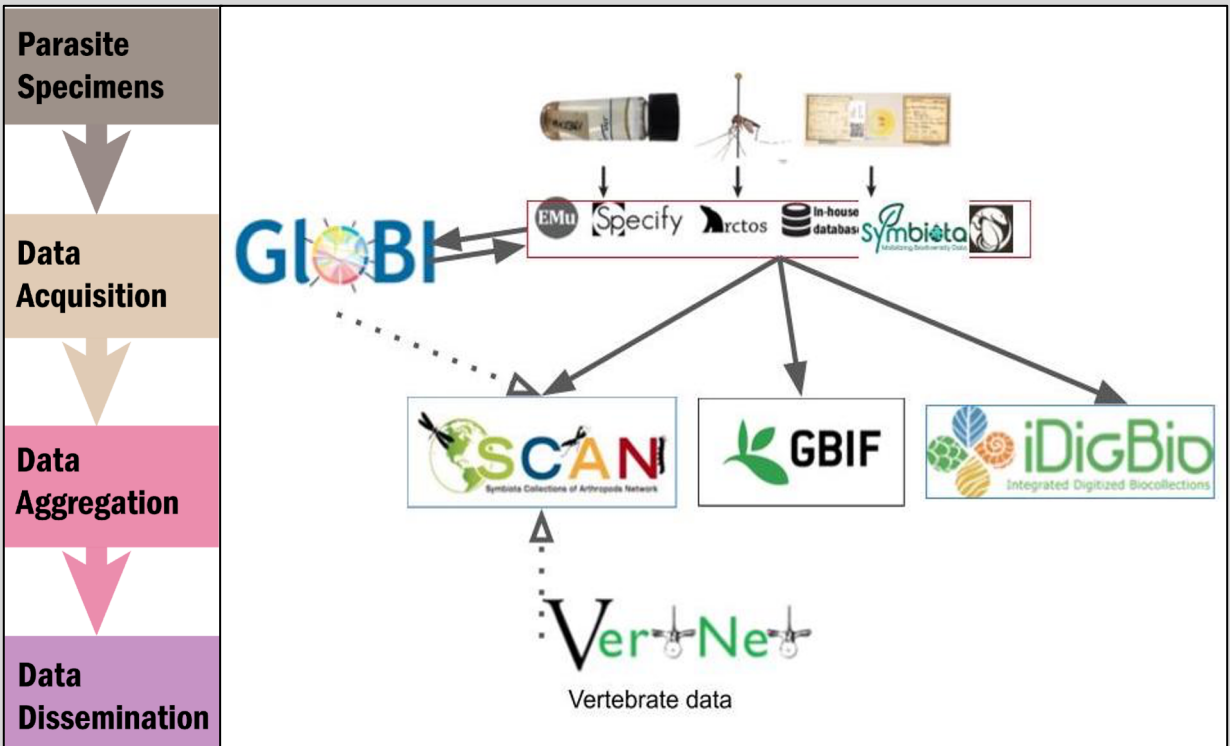
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## Digitization Objectives

- Transcribe and georeference label data from **1.2+** million arthropod parasite specimens from 22 collections across North America (U.S. and territories) including ~55,000 specimens from biotic-association collections



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## Data Integration

- TPT is providing baseline information for research and management of ecological interactions among parasites, pathogens, and their hosts in North America through Global Biotic Interactions (GloBI) data integration and review services.

<https://www.globalbioticinteractions.org/>

- Global Biotic Interactions (GloBI) is an open data integration platform that continually indexes existing openly available species interaction datasets, literature, and specimen records using open source software.

- Specimen data transcribed for the TPT project will generate 500,000 new parasite-host association records in GloBI.



GloBI

about blog browse contribute data search references status 日本語 Español

Example query: [What do sea otters \(\*Enhydra lutris\*\) eat?](#) or [What do honey bees \(\*Apis\*\) pollinate?](#)

What kind of  do  interacts with  ?

organisms  
Interacts with... plenty of things!



Eider  
(Somateria)

...

has parasite



flea  
(Siphonaptera)

...

Supported by:

<http://invertebrates.si.edu/parasites.htm>. Accessed at <cleaned\_up.tsv> on 16 Nov 2019. [show](#) Provider: <http://invertebrates.si.edu/parasites.htm>. Accessed at <cleaned\_up.tsv> on 16 Nov 2019.

Benesh, D. P., Lafferty, K. D. and Kuris, A. (2017), [A life cycle database for parasitic acanthocephalans, cestodes, and nematodes](#). *Ecology*, 98: 882. doi:10.1002/ecy.1680 [link](#) [show](#) Provider: Sarah E Miller. 9/19/2017. Species associations manually extracted from Benesh, D. P., Lafferty, K. D. and Kuris, A. (2017), [A life cycle database for parasitic acanthocephalans, cestodes, and nematodes](#). *Ecology*, 98: 882. doi:10.1002/ecy.1680. Accessed at <<https://github.com/millirse/Benesh-et-al-2017/archive/9ddc91ac0c04b7b06761d30032d2b93369855fcd.zip>> on 16 Nov 2019.

<http://arctos.database.museum/guid/MSB:Para:16981> [link](#) [show](#) Provider: MSB Parasite Collection (Arctos) - Version 32.32

<http://arctos.database.museum/guid/MSB:Para:2861> [link](#) [show](#) Provider: MSB Parasite Collection (Arctos) - Version 32.32

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<http://arctos.database.museum/guid/MSB:Para:3177> [link](#) [show](#) Provider: MSB Parasite Collection (Arctos) - Version 32.32

<http://arctos.database.museum/guid/MSB:Para:5341> [link](#) [show](#) Provider: MSB Parasite Collection (Arctos) - Version 32.32

## Highlights from Year 2

- Almost 400,000 digitized records (1/3 of total goal)
  - 190,000 label transcriptions
  - >190,000 scanned slides and vials
  - >3,400 high resolution images
- NfN expeditions have exceeded goal for crowdsourcing
  - 19 expeditions, ~65,000 transcriptions
- Two more GloBI review reports: ~420,000 interactions/500,000 goal
- Second PEN at CMNH has been funded
- TPT taxonomy has names lists for lice and fleas
- Presentations at Digital Data and SPNHC, planning for Taxonomy Symposium Working Session at TDWG next month!



## Development of TPT Taxonomy

- Determine nomenclature needs across institutions and platforms
- **Identify available resources**
- **Assess congruence**
- **Build consensus**
- Implementation
- Refinement



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## Development of TPT Taxonomy

Compile Available Resources


Clean, Prepare, Reconcile

Community Access

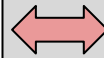






Terrestrial Parasite Tracker

**Taxonomic Lists**



ITIS Integrated Taxonomic Information System



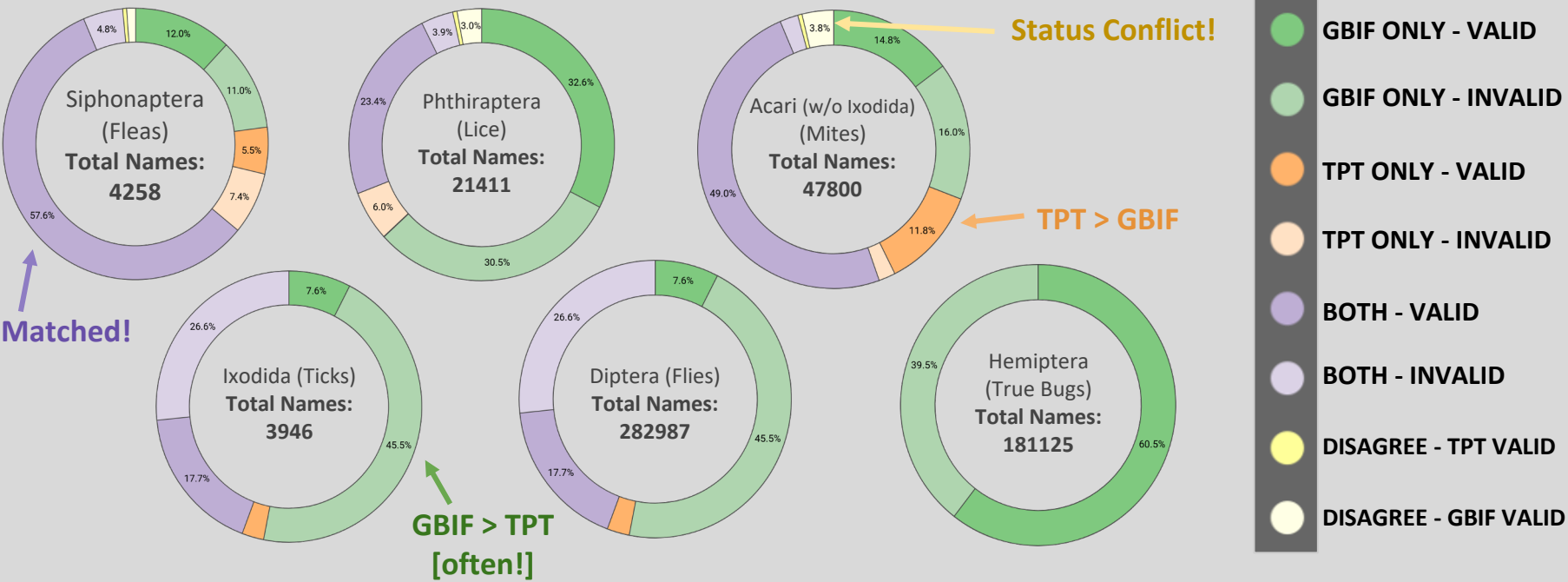


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## TPT Taxonomy Reconciliation



Derived from GBIF backbone snapshot taken on April 13, 2021



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## Thank You!

**MacroscopicSolutions** 

Portable, High Performance Imaging and Microscopy Systems

**SCAN**  
Symbiota Collections of Arthropods Network



**LepNet**  
Lepidoptera of North America Network



**BIODIVERSITY  
COLLECTIONS  
NETWORK**



**InvertNet**  
Advancing Digitization of Biological Collections

**WRBU**  
WALTER REED BIOSYSTEMATICS UNIT  
Know the vector, know the threat




**iDigBio**  
Integrated Digitized Biocollections



**NSC  
ALLIANCE**

**VerNe** 



**VectorBase**  
Bioinformatics Resource for  
Invertebrate Vectors of Human Pathogens

***In Memoriam: James (Jim) Boone (1962-2021)***  
**Entomology Collections Manager at Bernice Pauahi Bishop Museum**

