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From rejection to collection! A new entomology collection at the University of California, Santa Barbara Museum of Natural History takes the university by swarm.

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Introduction

The University of California, Santa Barbara (UCSB) Natural History Museum at the Cheadle Center for Biodiversity and Ecological Restoration (CCBER) has formed an Invertebrate Zoology Collection from 10,000 specimens rediscovered in a basement on campus. Since its discovery, this collection has grown rapidly through coastal California arthropod survey efforts, donated student collections, and faculty research projects (Fig. 2). These surveys, conducted by CCBER for conservation and restoration monitoring, are hugely valuable as the coastal regions of Santa Barbara and Ventura County are critically endangered habitats, with over 95% of these areas lost to human disturbance, and online records about insects from these areas is presently uncommon.



Fig. 2: Specimens neglected for years have found new life through curation and digitization.

The creation of this collection has inspired new interest in entomology on campus. Undergraduate students, graduate students, and staff are learning basic entomology in newly formed classes and workshops, students are using the collection as a reference, and the inclusion of arthropods in faculty research is on the rise. The collection is providing space to voucher invertebrate research from UC Santa Barbara, and it has additional specimens and online data from our survey traps for researchers interested in California invertebrates.



Fig. 1: The UCSB Invertebrate Zoology Collection is located in Santa Barbara, California at the Cheadle Center.

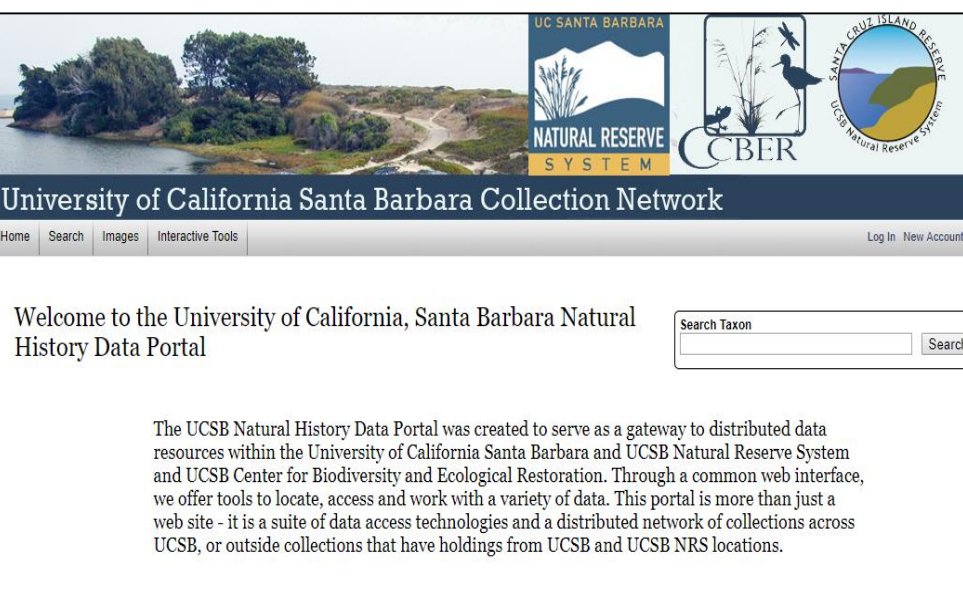


Fig. 3: Our database is open to the public and is accessible via www.symbiota.ccbcr.ucsb.edu.

Results

As of October 2017, the database has a total of 1,432 specimens. We are georeferencing the specimens, with almost 900 completed (Table 1). Databasing of the Diptera is complete and our entire Diptera collection of currently 715 specimens (35 families and 33 genera) has been transcribed and georeferenced. Determination to family for the Acalypratae is ongoing. Currently in the SCAN data portal there are 326 Diptera specimens (14 families and 24 genera) from coastal Santa Barbara and Ventura counties. The UCSB Diptera collection contains 226 additional specimens (24 families and 18 genera) from that same region. The addition of our specimens to the SCAN database will increase the occurrence records for Diptera in these areas by nearly 70%, and will be the first records for the families Bibionidae, Cecidomyiidae, Chironomidae, Coelopidae, Culicidae, Dolichopodidae, Empididae, Lauxaniidae, Mycetophilidae, Psychodidae, Pyrgotidae, Rhagionidae, Scatopsidae, Sciaridae, Therevidae, and Ulidiidae.

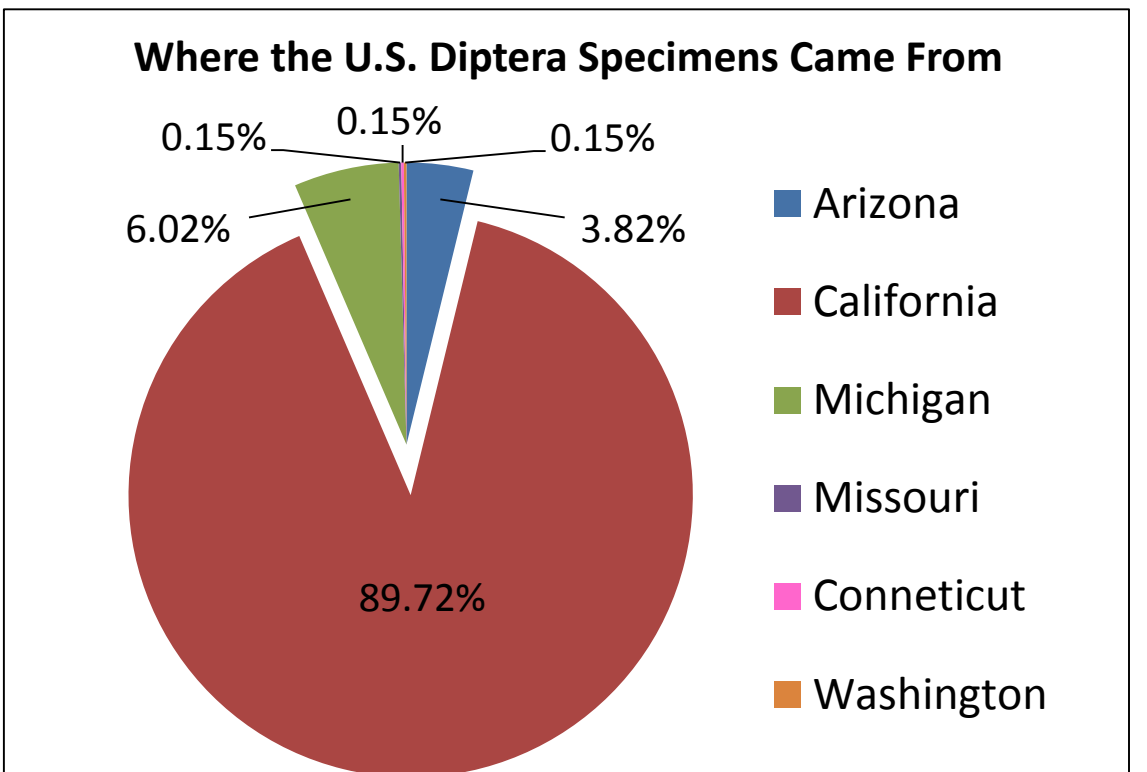


Fig. 9: The distribution of our Diptera specimens from the United States.

Total Database Stats as of Oct 2017	
Total records	1,432
# Georeferenced	863 (60%)
# of Families	66
# of Genera	43
# to Species	130 (9%)
# of Species	20

Table 1: Our progress with entering specimens and transcribing their data into the database so far.

Most of the Diptera specimens in the collection (~90%) are from California (Fig. 9). Specimens from Arizona and Michigan are the next most common, and those are probably from Dr. Wenner's personal collection. Most of the specimens are from the year 1975 (95), nearly 15% of our total Diptera specimens were collected from that year (Fig. 10). The other two peak years are 1989 (78) and 2016 (75), as these dates are correlated with student donations associated with on-campus classes. The influx of 2016 specimens is due to the acquisition of student collections from the recent UCSB invertebrate zoology and new entomology courses. The decrease in 2017 is misleading as the specimens from this year have not been incorporated into the collection.

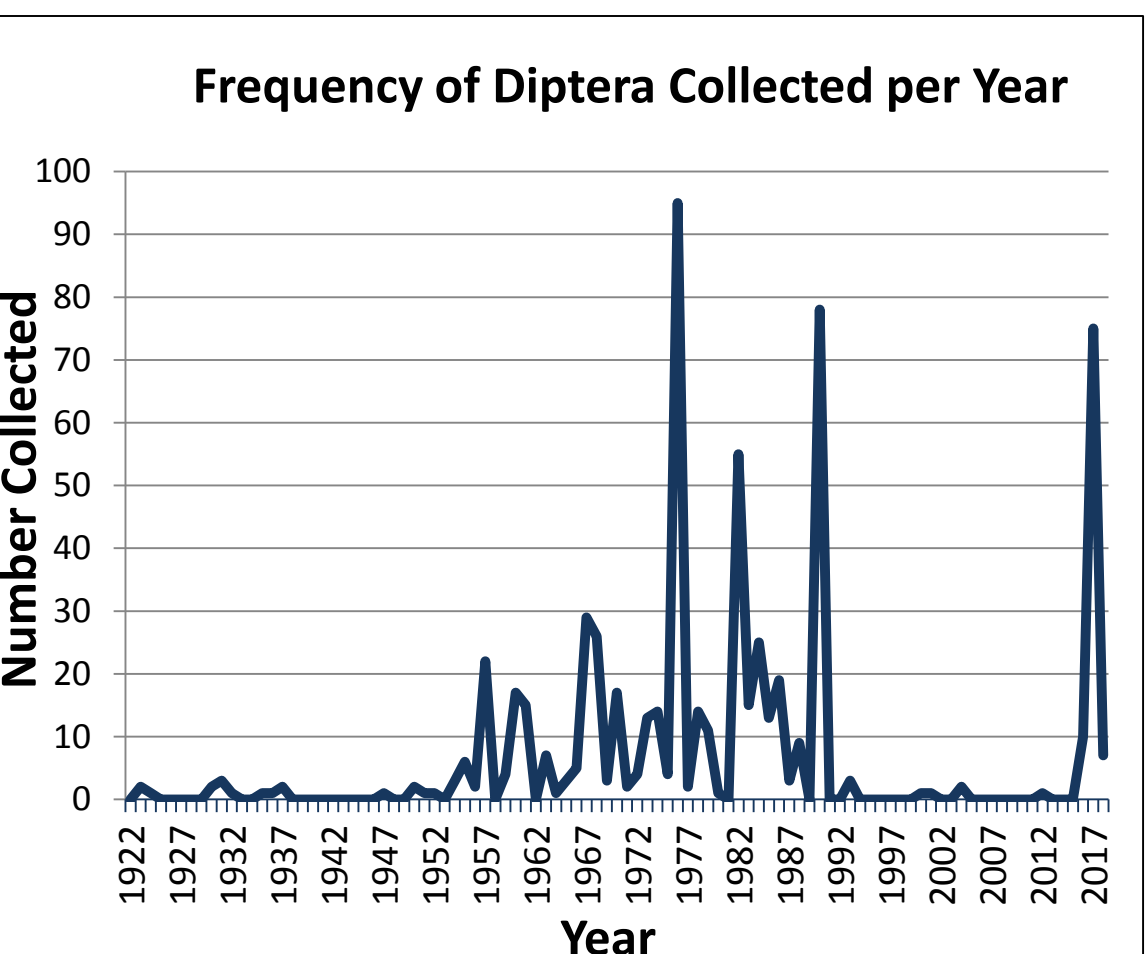


Fig. 10: An overview of Diptera specimen collecting events.

Background / Methods

The Invertebrate Zoology Collection originated as a teaching collection from an entomology class taught by Dr. Adrian Wenner in the 1950's. The collection was expanded to include specimens collected by Dr. Wenner in the 1960's. After he retired during the 1980's, the collection was abandoned. In 2015, it was rediscovered and incorporated into the museum at the CCBER (Fig. 1). The collection began to grow again from student-donated specimens from the present day UCSB entomology and invertebrate zoology courses, accessions from the UCSB Natural Reserve System, and regional arthropod survey projects (Fig. 17-22).



Fig. 5: February 2017, new drawers arrived ready to house specimens.

The historic collection had out-of-date identifications, if any, and were coarsely organized by family. Thanks to funding from the Institute of Museum and Library Services (IMLS) and the UCSB Coastal Fund, new drawers and unit trays were purchased, nomenclature was coarsely updated, and specimen determinations re-examined (Figs. 4 & 5). The specimens are presently being organized in new unit trays based on the general protocol for the Invertebrate Zoology Collection at the American Museum of Natural History. Specimens are determined to the lowest rank possible with a focus on bees, ants, tiger beetles, and dune insects.

Starting in April 2017, databasing the specimens began according to the CalBug protocol of transcribing specimen information from imaged specimen labels (Figs. 6&8). Specimens given a barcode printed by a Datamax Thermal Label Printer. Once imaged, the photo is color corrected, cropped, and renamed using a custom Gimp python plugin called BugFlipper, and bulk-uploaded into our Symbiota data portal (Fig. 3). This process is ongoing as specimens are being continuously added thanks to donations by students and from local research projects. To date, we have completed 10% of the imaging and databasing.

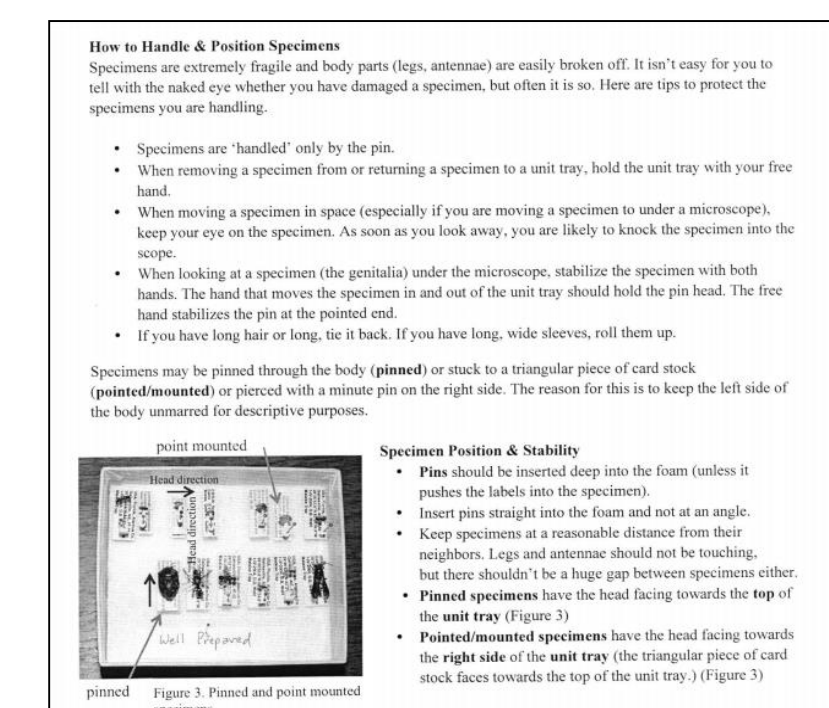


Fig. 7: One section of the American Museum of Natural History protocol.

Through the curation and databasing of this collection, a new suite of opportunities are now available to students and researchers around the university, and interest in entomology is at an all-time high (Figs. 12-14). Workshops and teaching materials have been created to train staff and students from all around campus to identify arthropods to order (Fig. 11&15) and family. The specimen data from our efforts will be shared with the Symbiota Collections of Arthropods Network (SCAN) and Integrated Digitized Biocollections (iDigBio) projects.



Fig. 4: Student undergraduate student Kristi Liu organizing a drawer of Coleoptera.



Fig. 6: Example of an imaged specimen.

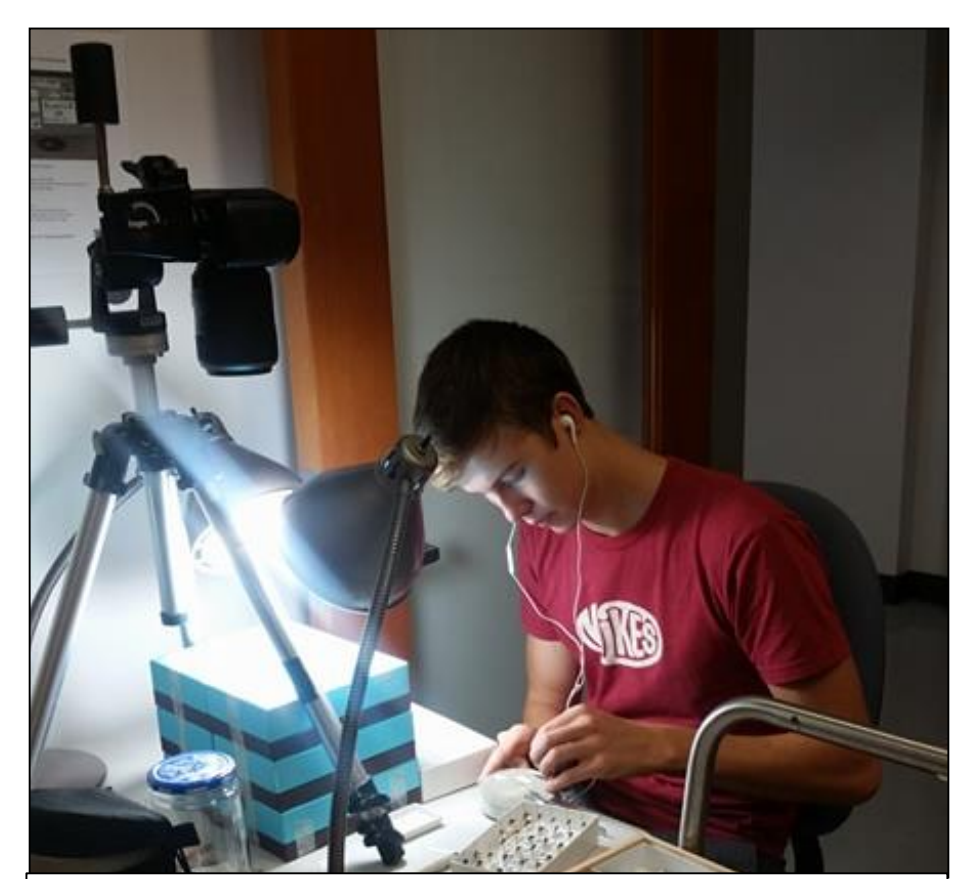


Fig. 8: Student undergraduate student Mike Martin imaging specimens for the database.

A Small Collection with Huge Impacts



Fig. 11: Identification and curation workshop hosted by CCBER for staff and students.



Fig. 12: Increased collaborations with classes such as UCSB's Natural History Collections Curation course.



Fig. 13: Outreach to student groups, such as UCSB's Natural History Collections Club.



Fig. 14: Increased undergraduate internship opportunities and field experiences.



Fig. 15: Teaching collection, voucher specimens, identification guides, and educational resources made available.



Fig. 16: Updated organization makes it easy to find specimens.



Fig. 17: Acquisition of Santa Cruz Island collection to incorporate into CCBER.



Fig. 18: New research projects and surveys.

Ongoing Projects



Fig. 19: Master's thesis project on California Ophioninae by Rachel Behm.



Fig. 20: UCSB North Campus Open Space wetland restoration arthropod monitoring project.



Fig. 21: Pollinator surveys of the Nipomo lupine (*Lupinus nipomensis*) by UCSB PhD student Justin Luong.



Fig. 22: Spatial survey of ladybugs in restored and unrestored areas by Justin Luong.