Quarterly Progress Reports To iDigBio Submitted By Active Thematic Collections Networks (TCNs)

May 2023

CONTENTS:

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TCN Quarterly Progress Report

1 January 2023 – 31 March 2023

TCN Name

Bringing Asia to digital life: mobilizing underrepresented Asian herbarium collections in the US to propel biodiversity discovery (All Asia)

Person Completing the Report

MICH: Brad Ruhfel (PI) & Kyle Lough (PM)
CINC: Eric Tepe (PI)
OSU: John Freudenstein

Share Progress in Digitization Efforts

MICH + CHIC:	
Specimens imaged:	16420 this period only 35875 total thru this period (26% of goal, 139,956)
Minimal records created:	-
Full/detailed records created:	5146 this period only 9716 total thru this period (7% of goal, 142,422)
Specimens georeferenced:	0 of projected total (65,000)
CINC + MU + CMNH:	
Specimens imaged:	1557 (0 CINC + 1557 MU + 0 CMNH)
Minimal records created:	-
Full/detailed records created:	1225 (0 CINC + 1225 MU + 0 CMNH)
Specimens georeferenced:	0
OSU:	
Specimens imaged:	700
Minimal records created:	0
Full/detailed records created:	0
Specimens georeferenced:	0

Share Best Practices, Standards, and Lessons Learned

MICH: nothing to report
CINC: nothing to report

OSU: nothing to report

Share Identified Gaps in Digitization Areas and Technology

MICH: nothing to report
CINC: nothing to report
OSU: nothing to report

Share Opportunities to Enhance Training Efforts

MICH: nothing to report
CINC: nothing to report
OSU: nothing to report

Share Collaborations with other TCNs, Institutions, and/or Organizations

MICH: MICH has two other ongoing TCN projects with which protocol, practices, and knowledge are shared: Global Lichen/Bryophyte and PCC (Pteridophytes).

CINC: CINC is also part of the GLOBAL bryophyte & lichen project, and efficiencies leaned in GLOBAL will be adopted in the All-Asia project (and vice-versa).

OSU: nothing to report

Share Opportunities and Strategies for Sustainability

MICH: nothing to report
CINC: nothing to report
OSU: nothing to report

Share Education, Outreach, Diversity, & Inclusion (EODI) Activities

MICH: Tours were given to the following groups, where they learned about our current digitization efforts as part of the All Asia project: 1) UM Society for Conservation Biology, 2) Ligaiya Romero - Purchase college.

CINC: The All-Asia project at CINC employs three student workers: two are women in STEM fields, one (male) is from an underprivileged Appalachian background. CINC also has a

collaboration with the University's Advancement and Transition Services in which students with developmental challenges image specimens with the supervision of a job coach. The repetitive nature of specimen imaging works well for helping the students develop skills, and the acute attention to detail of several of the students has resulted in excellent specimen images.
Two classes were hosted at CINC: Collecting the World" (11 students - an honors course on collections, conservation of collected things, ethics, etc.) and "Archaeootany and Ethnobotany" (~20 students). Each course spend around 1.5 hours in the herbarium, got info about the herbarium, collections in general, some history, saw a few highlights of the collection, and got to work hands-on with specimens. Two new volunteers joined from the Anthro class.

OSU: nothing to report

Share Information About Your Website and/or Portal Usage

MICH: nothing to report
CINC: nothing to report
OSU: nothing to report

Share Other Activities and/or Progress

MICH: nothing to report
CINC: The 422 Philippine specimens from CMNH have been imaged and fully transcribed; the CINC collection is nearing completion.
OSU: nothing to report

TCN Quarterly Progress Report

Prior to each Internal Advisory Committee (IAC) meeting, TCNs are asked to complete a quarterly progress report in the areas outlined below. The TCN Lead PI or Project Manager collects information from all collaborators and compiles them into one overall progress report for the TCN. The TCN Lead PI or Project Manager then submits the quarterly reports via an email to Cat Chapman. An archive of previously submitted reports is available on the Internal Advisory Committee wiki page.

Naming convention for files: YYYY-Q1-BigBee-TCN-CODEN

Individual PI reports due: *last Wednesday in Jan, Apr, Jul, and Oct*

Apr 26, 2023

TCN Name

Collaborative Research: Digitization TCN: Extending Anthophila research through image and trait digitization (Big-Bee)

Person Completing the Report

Crystal Maier, Pam Horsley & Katja C. Seltmann. This is the cumulative report for the Big Bee project. Individual institution reports can be found at: https://drive.google.com/drive/folders/1kLnxZIcTx9tb_kODWq4dKT-q8XMDuYav?usp=sharing

Share Progress in Digitization Efforts

ASUHIC

- A total of 13,219 specimen records of 7 families of Anthophila have been digitized with 100% georeferenced on the Bee Library portal (https://library.big-bee.net/portal/index.php).
- Produced 2D images of label-specimen or specimen: a total of 3,794 images representing 1,892 specimens that have been imported/uploaded on the Bee Library portal.
- Hired one undergraduate to photograph labels with the specimen or dorsal view of specimens.

CASC

- Worked with Michael Denslow at Notes from Nature to upload 2 new expeditions.
- Labels for 2,550 specimens photographed (16,200 running total)

- 2D focus-stacked images completed: 50 (1,010 running total)
- Recruited two new volunteers to help with the project

EMEC

- Two new part-time photography (focus-stacking) assistants trained for a total of 3
- Labels for 4,884 specimens photographed (32,522 running total)
- 2D focus-stacked images completed, 363 (2,503 running total)

FSCA

- FSCA uploaded 14,833 records to Ecdysis, some of which had been deposited previously in a different database.
- FSCA also uploaded 8,761 dorsal habitus images to the Big Bee Library.

LACM

- LACM photographed specimen labels with dorsal views for 2,835 specimens in the families Apidae and Colletidae
- Completed 2D imaging for the genus *Xylocopa* and are currently working on *Colletes*.

MCZC

- Captured photo-stacked image suites for 370 species of Andrenidae, Colletidae, Megachilidae, and Mellitidae constituting 1,614 images of dorsal, lateral and frontal views.
- Photographed the labels/low-resolution dorsal habitus images (running total) for 21,101 specimens of bees in the families Andrenidae, Colletidae, Megachilidae, and Mellitidae. Started transcription of labels and upload of transcribed data into MCZbase. The MCZ now implemented and put into production an effective workflow for transcription of labels into MCZbase. To date, the MCZ has transcribed and uploaded label data from 12,096 specimens to MCZbase.
- Workflows and scripts for renaming images, data quality control, and migration of taxon data into MCZbase are progressing smoothly, with no major issues.
- MCZ has captured 3-D image suites of four specimens on the Macropod system and are currently learning how to make photogrammetric reconstructions using Agisoft Metashape.

SEMC

- SEMC generated 5268 focus-staked exemplar images for 878 species and 1,756 specimens of the largest bee genera *Andrena* and *Colletes* and generated focus-stacked exemplar images for related, rare groups, such as *Alocandrena*, *Ancylandrena*, and *Mourecotelles*. They began working on the bumble bees.

UCMC

- To date we have captured 43,438 images of 21,453 individual specimens for ITD measurements and/or dorsal label imaging
- We have completed dorsal label and lateral images of *Bombus, Ashmeadiella, Atoposmia*, *Chelostoma*, *Heriades*, *Hoplitis*, *Noteriades*, *Megachile*, and *Osmia*
- We have captured 602 2D focused-stacked images of exemplar specimens, from 201 specimens of 64 species within 7 genera of Megachilidae: *Ashmeadiella*, *Atoposmia*, *Chelostoma*, *Heriades*, *Hoplitis*, *Noteriades*, and *Osmia*
- two *Agapostemon* type specimens were 2D focus-stack imaged (17 images total) for a collaborating research
- one Hoplitis albifrons collecting from the CU Mountain Research station was focus-stacked for the CU Alumni Magazine, the *Coloradoan*.
- one *Notes from Nature* transcription expedition had 1442 transcriptions and we are waiting for the ITD measurements on the same data set before uploading into Specify.
- A. Carper (PI) has continued developing 3D modeling protocols and has rendered 3 successful 3D models of *Hoplitis albifrons*, *Heriades cressoni*, and *Cemolobus ipomoeae*
- Carper (PI) and Scott (co-PI) continue to identify digitization priorities, including target species and individual exemplar specimens
- We have now hired and trained 14 undergraduate hourly assistants for dorsal specimen and label imaging and have trained three in 2D focus-stacked imaging
- Our imaging stations have also been used by other researchers within the museum, in other departments, and from around the world
- We trained two museum graduate assistants in 2D and 3D imaging as part of their research and for an *Emerging Museum Technologies* course
- We also trained a PhD student in the Dept of Ecology and Evolutionary Biology in 2D imaging, as part of her descriptions of three gynandromorphic bee specimens previously undocumented
- A collaborating Museum and Field Studies MS student has CT scanned the three gynandromorphs and is testing incorporation of 3D photo suites from our imaging station into higher resolution 3D renderings. These models will be compared to the photogrammetric models using AgiSoft 3D.
- Another PhD student in the Dept of Ecology and Evolutionary Biology, used our new tablet imaging station to calculate butterfly wing morphometrics and explore how secondary metabolite sequestration and temperature impacts wing morphology and flight performance
- We continue to occasionally host a visiting faculty from the Instituto Multidisciplinario de Biología Vegetal (CONICET-UNC, Argentina) who has been 2D imaging *Solanum* spp. seeds for comparative paleontological studies
- We continue to include lateral views along with dorsal view for label imaging as some characters can be important in this view (e.g. malar space in *Bombus*) and it has added only ~30 seconds to each specimen handling time

- A. Carper (PI) updated protocols for renaming images with tags using R coding and Windows command prompt.

UCSB

- UCSB produced bee images of label-specimen: total 1,004 images this quarter
- UCSB created high-resolution images for 3D models or exemplars: total 338 images this quarter
- 10 undergraduates worked on digitizing specimens, including images this quarter.

SDMC

- 289 dorsal label images taken (2822 of 10958 running total)
- 66 exemplar images taken (425 of 797 running total)
- 10 bees 3D imaged (15 out of rough estimate of 800 total)
    - with 1982 stacks produced for 3D models (3073 of 192,000 running total)
    - Volunteer 3D imaged 46 bees (number of stacks to be determined and uploaded, not included in metrics spreadsheet at this time)
- 1272 stacked 3D images uploaded to SCAN
- Focusing more towards 3D imaging than creation of 3D models

UNH

- Labels for 2,550 specimens photographed (16,200 running total)
- 2D focus-stacked images completed: 210
- CLSM micrographs of male genitalia: 35
- Hired three new undergraduate students (Griffin Dinardo, David Wilson and Audry Wilette) for focus stack imaging and one undergraduate student (Carly Hoag) for CLSM imaging of male genitalia

Share Best Practices, Standards, and Lessons Learned

- UCMC 3D imaging was put on hold after Canon 6D began experiencing intermittent issues. They replaced the camera as it was likely the result of damage incurred from flooring in Dec. 2022.
- UCMC continues to update imaging protocols and practices as they learn from partner institutions and are adapting to individual needs and workflows at UCMC
- UCMC has uploaded photos of our digitization setups and example images to a shared BigBee Google Drive folder
- UCMC has communicated progress, tips, and questions directly with M. Smith (Macroscopic Solutions) and through a dedicated Imaging Thread on the BigBee Slack Channel

- PI Oboyski presented “Cleaning NfN Data using OpenRefine” to BigBee team and affiliates to demonstrate the use of OpenRefine software to normalize collector names, localities, etc. before uploading to specimen database.
- PI Oboyski led data management discussion for 2 students in Gordon Frankie’s Urban Bee lab at EMEC
- SDMC began using Bulk Name Utility program to efficiently rename 3D image files to be uploaded to SCAN, and Photoshop to convert TIFF files to JPG

Share Identified Gaps in Digitization Areas and Technology

Accessing images and data as datasets, and updating taxonomic nomenclature/creating available taxonomic catalogs continues to be a challenge for the natural history collections and biodiversity data communities. Big-Bee is tackling these issues via streaming data from Darwin Core archives using preston, software created by Jorrit Poelen. In these examples, preston is used to access the information in available Darwin Core archives (found on the Web), including the links to large image files. This method creates the ability to build image datasets from lists of catalogNumbers or other identifiers.

1. imageseq: An automated workflow to generate image sequence of specimen following Big Bee image sequence naming conventions and creates an archive of the image sequence. The images are downloaded, packaged in an archive and a animated gif of lower resolution images is created for viewing. https://github.com/Big-Bee-Network/imageseq
2. bee-image-finder: An automated workflow to Generate CC0 licensed images of specimens based on a series of catalogNumbers. https://github.com/Big-Bee-Network/bee-image-finder
3. Jorrit Poelen added an updated DiscoverLife Bee Name List to Nomer v0.4.10 and [1] This catalog was generated from a Webpage; related to https://github.com/globalbioticinteractions/nomer/issues/149 and https://github.com/globalbioticinteractions/nomer

- CAS is awaiting implementation of our image crawler tool to upload images to Monarch/GBIF. CAS scientific computing core team will install it this summer (not funded by this grant).

Share Opportunities to Enhance Training Efforts

- We continue to use weekly meetings and slack to keep in touch and help information disseminate between participants. Big Bee has spent a significant amount of work on the first quarters' image training as multifocal stack imaging using Macropod was new for

many of the participants. The Macropod system is an expert system that takes some understanding of lens, imaging and photography to execute well. Big Bee participants are trained using slack for communication and image sharing, online videos online at https://macroscopicsolutions.com/video-tutorial-big-bee-tcn/ and the Macroscopic Solutions YouTube channel, and one-on-one zoom training with Mark Smith (Macroscopic Solutions).

- Bee taxonomist, Jamie Pawelek, visited UCSB for two days of identification and discussion. During this time, she identified specimens in the collection for Big-Bee and aided 2 UCSB graduate students with their dissertation projects.
- Discussed opportunities for a Bee Library Portal Advancement Campaign with PI Seltmann.
- UCSB continues to support undergraduate research projects using Big-Bee images and data. Here are short descriptions of a few projects:
    - One project, led by Big-Bee postdoc Madeleine Ostwald is developing methods for quantifying bee hairs as a trait. Bee hairs are important for thermal regulation and pollen-collecting structures, yet they are difficult to describe in a repeatable way because they vary a lot across the body of a bee. In this project, we use machine learning to identify hairs and computer vision methods to create metrics for estimating this variation (i.e., surface area, texture recognition, entropy). Seven students (2 Data Science majors, 5 biology majors) are currently working on this project.
    - A second project involves improving the repeatable workflow of 3D modeling. This UCSB PSTAT capstone project is experimenting with the images created by Big Bee to create an optimized protocol for building 3D models. They are also developing methods for the measurement of bee body size and volume from the models.
    - Other projects led by Big-Bee postdoc Madeleine Ostwald aim to quantify bee responses to drought conditions. In collaboration with three undergraduate biology students, these projects rear adult and immature bees in the lab and in the field across a range of soil moisture treatments to examine the effects of dry soils on bee development and survival.
    - As part of a 10-species body size variation project led by Big-Bee postdoc Colleen Smith, two undergraduates are conducting independent research on how bee body size varies intraspecifically and responds to environmental variation. One student is examining the effects of elevation on the body size of the bee species *Lasioglossum sisymbrii*. A second student is investigating the relationships between bee dry mass, intertegular distance and thorax length also in *L. sisymbrii*.

Share Collaborations with other TCNs, Institutions, and/or Organizations

- Big-Bee Seltmann and Tucker (Big Bee/iDigBees), along with Hollis Woodard (UCR), Elizabeth Hill (USDA), and Brianne Du Clos (UCR) co-organized and led a 2-day biodiversity informatics/data management workshop for the bee community. This workshop was a collaboration with the USDA Native Bee RCN and will be held over Zoom. 150 participants attended the workshop that included speakers from many branches of the biodiversity informatics community, and a half-day Darwin Core/data standard introduction and exercise. Videos from the workshop are available online at: https://www.youtube.com/@nativebeemonitoringRCN/videos. During the meeting Seltmann presented two talks (Data lifecycle, Big Bee) and moderated the first day. Co-PI Maier (MCZC) presented at the Bee Monitoring RCN workshop, promoting BugFlow, a platform for sharing digitization workflows produced through Big Bee. One outcome of this workshop is an increased interest in data sharing among the participants and Big-Bee is planning a portal campaign with the Symbiota HUB tentatively scheduled for September. https://www.nativebeemonitoring.org/news/workshop-data-management with recording available via https://www.youtube.com/@nativebeemonitoringRCN
- Seltmann joined the Association of Fish and Wildlife Agencies Invertebrate and Pollinator Working Group, led by Ross Winton with the Texas Parks and Wildlife Department. This group is focused on increasing the inclusion of invertebrates, starting with bees, into regional and state wildlife action plans. During the first meeting, Seltmann presented on Big-Bee, collection data, and the Global Bee Interaction dataset and other trait datasets.
- Seltmann spoke with INHS, PSU about becoming Big-Bee partners by developing a PEN proposal. Seltmann & Michael Branstetter (USDA-ARS) wrote a one-page memo to NSF describing the importance of federal collections to the Big-Bee project. Presently, federal collections are not allowed to be funded under the NSF Capacity: Biological Collections solicitation. USDA-ARS collections are some of the largest bee collections in the US.
- PIs Bergersen and Grinter (CASC) joined efforts of the California Insect Barcoding Initiative (CIBI) to collect bee specimens in short day trips. Specimens will be DNA barcoded by the CIBI, and digitized by Bergersen. This work was not funded by this grant.
- SDMC Technician Deer visited LACM to discuss best practices regarding 3D imaging with Big Bee Technician Sylvia Reyes

Share Opportunities and Strategies for Sustainability

- Big-Bee plans to launch a portal campaign in September, bringing new partners to the network. Although not a new idea, this follows a recent workshop that engaged the greater bee community, including USDA and USGS.

Share Education, Outreach, Diversity, & Inclusion (EODI) Activities

- The name alignment workshop materials were published on Zenodo
    - Miller, JT, Poelen, Jorrit, & Seltmann, Katja. (2023, April 14). Big Bee Name Alignment Workshop. Zenodo. https://doi.org/10.5281/zenodo.7829969
- New Brunswick Museum CA, joined Big Bee as a partner collection. https://www.nbm-mnb.ca/natural-sciences/collections/zoology
- UCSB Seltmann led the UCSB Curation of Natural History Collections course. This experiential, hands-on course focused on curating and digitizing insect specimens for the UCSB Invertebrate Zoology Collections. 12 students learned about bee imaging, which involves taking high-quality photographs or videos of specimens for documentation and identification purposes. In addition to these technical skills, students participated in discussions and hands-on activities that will help them understand the importance of curating specimens and the role it plays in the fields of invertebrate zoology and ecology.
- Seltmann at UCSB mentored two PSTAT 197B Big-Bee Data Science Capstones. One to improve 3D photogrammetry and a second measuring visual acuity and body volume from 3D images. This is in collaboration with https://centralcoastdatascience.org an NSF-supported project.
- To date, the MCZ has trained 9 undergraduate student interns and one high school student on digitization and entomology collections procedures.
- Peter Oboyski was a lead organizer and/or presenter in the following outreach and education activities at the EMEC:
    - Hosted a museum tour and discussion with ~50 members of the Pest Control Operators of California as part of their continuing education credits.
    - Led an insect hike for 6 instructors at Sienna Ranch Nature Education Center
    - Led an insect hike for 20 members of the Santa Cruz Museum of Natural History
    - Presented “A natural history of insects” lecture and discussion for 20 students in American River Conservancy’s California Naturalist course.
    - Hosted a museum tour for 15 new graduate students in Environmental Science Dept.

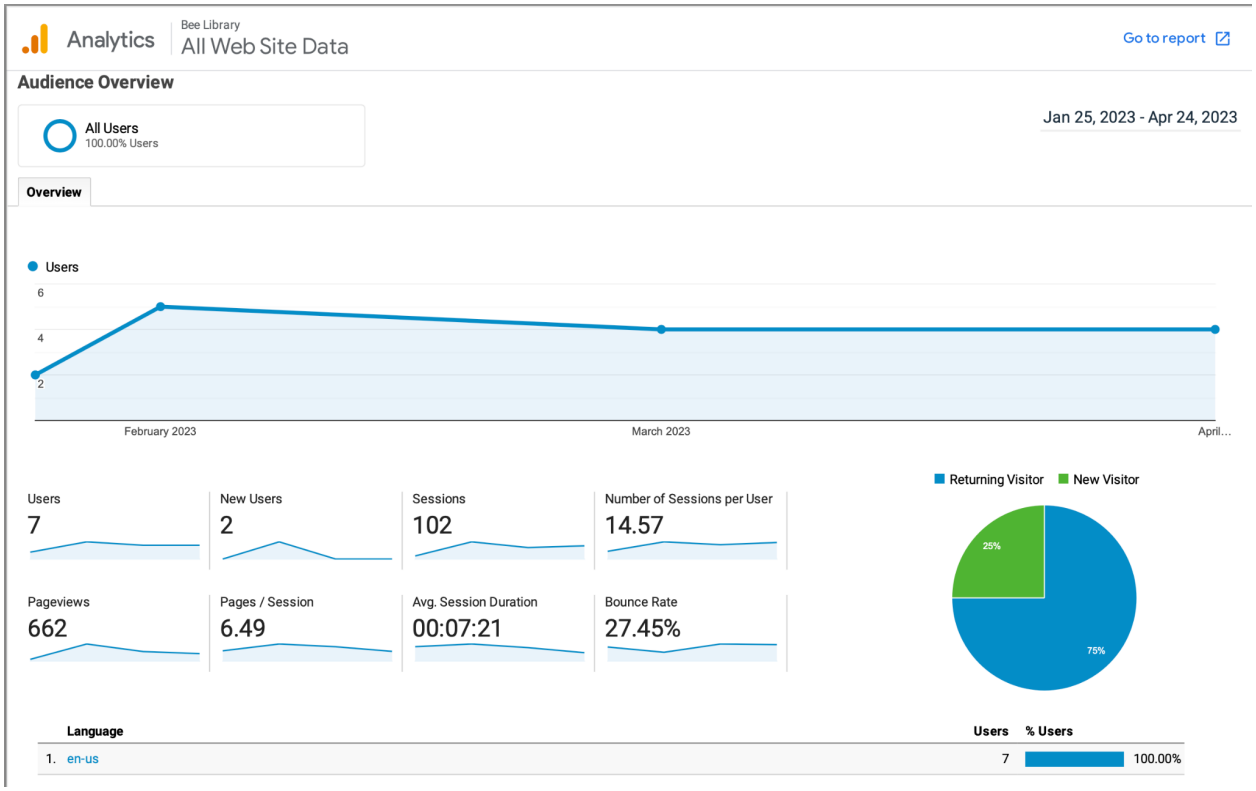
    - Led museum tours for Evolution Day - recognizing the contributions of Charles Darwin, Alfred Russell Wallace, and Henry Bates to the science of evolution (150 visitors).
    - Ongoing Pollinator Garden project as part of a Xerces Society “Bee Campus”. Students plant and manage native California plants in a demonstration garden designed to promote pollinators in cooperation with UC Berkeley campus landscapers.
- A. Carper and undergraduate fine arts student Jordan Longley, were awarded an Undergraduate Research Opportunity Program grant to create artistic exhibit materials from 2D imagery of bees
- A. Carper (PI) has included the project in 8 invited talks/outreach events to foster interest in current and future *Notes from Nature* expeditions. In this quarter:
    - University of Colorado Museum of Natural History (4/3/2023): *Pollinator Conservation and Management in CO and Beyond.* Organized a morning workshop for Front Range native bee researchers and three short outreach talks on pollinators in the afternoon followed by a Q/A panel.
- A. Carper has also included slides of the project in two guest lectures:
    - MUSM 6110: Advanced Seminar: *Emerging Technologies in Museum Studies*. University of Colorado-Boulder
    - GEOG 5500: *Beeography*, Geography and Environmental Sciences, University of Colorado-Denver.
- CASC Collaborated with Jewish Family and Children Services of San Francisco to recruit one person who is on the autism spectrum as a digitization assistant for BigBee transcribing labels and photographing bees.
- ASUHIC staff presented displays on the diversity of insects including pollinators at the Spring Bug Fest hosted by the Butterfly Wonderland Foundation (April 16, 2023).
- ASUHIC staff presented displays on Arizona insects, especially bee species at the Earth Day Celebration event hosted by the City of Chandler, Arizona (April 22, 2023).
- UNH - Santino Marchesano participated with a presentation at the Eastern Branch ESA meeting: “ Morphological differences in seta across *Andrena* bee species and sexes” using data based on high resolution stacked images from Bigbee project.
- UNH - Aaron Hoag participitaed the undergraduate research symposium with a poster: “From 2D to 3D: Confocal Laser Scanning Microscopy of Mitchel’s bee collection.

Share Information About Your Website and/or Portal Usage

Big Bee shares information via our Bee Library Symbiota portal and published datasets on Zenodo. We presently have our first trait dataset, the *Global Bee Interaction dataset*, that includes all indexed interactions for bees. This dataset is facilitated by Global Biotic Interactions. The *Big Bee indexed biotic interactions and review summary* is a project dataset that tracks all

bee data from the project. These datasets have an ever-increasing number of downloads, which contrasts with our portal usage which remains low.

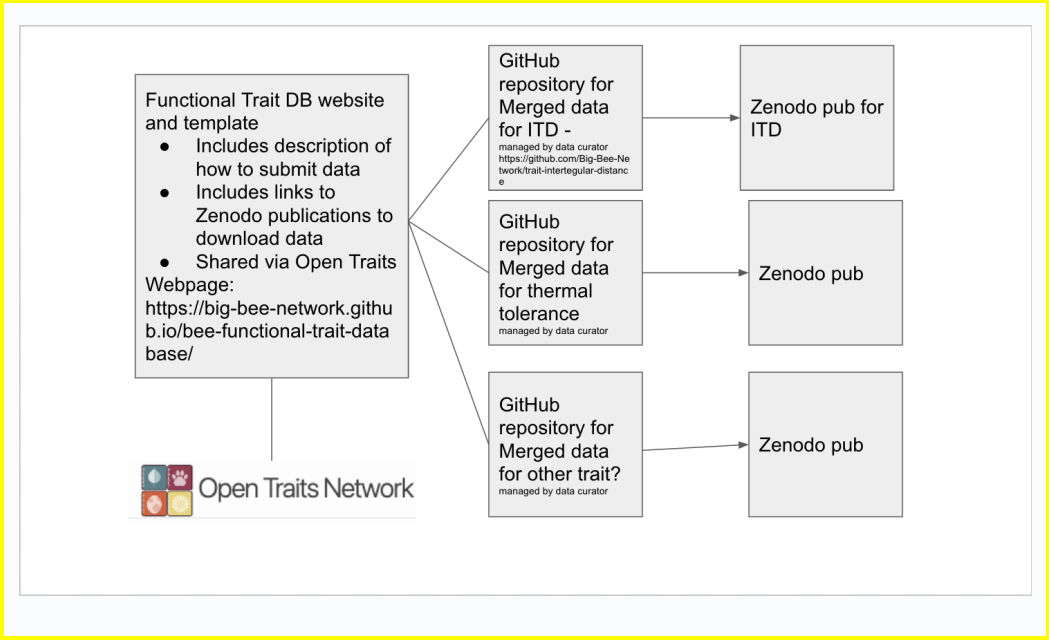
- Our Notes from Nature project, Big-Bee Bonanza has 32,128 completed subjects with 1,498 volunteers. This project is transcribing label data and measuring bee body size.
- Based on Google Analytics, The Bee library usage remains low with only 7 users and 102 sessions between January 25, 2023 - April 24, 2023. It is expected for this to increase as one collection, FSCA, is starting to manage data live on the portal. They are our first live managed collection.
- Global Bee Interactions Zenodo publication had 136 downloads and 382 views. This is up from 88 downloads and 294 views last quarter.
- Big Bee indexed biotic interactions and review summary had 171 downloads and 294 views. This is up from 128 downloads and 259 views last quarter.



Share Other Activities and/or Progress

- UCSB implemented the first version of a Bee Functional Trait database. Although in its infancy, this part of the Big Bee project is concerned with how to effectively share trait

data according to community best practices. The project is early in its development but will use GitHub as a means of versioning datasets of bee traits. The traits will then be curated into datasets for publication on Zenodo (see workflow below). We plan to submit the datasets for review and sharing via the Open Traits Network. The GitHub-produced website for this project is here: https://big-bee-network.github.io/bee-functional-trait-database



- SEMC made major progress linking all generated images to specimen records in the database. They developed a workflow to upload images to specimen records followed by a batch upload of the metadata. This is the first time their insect collection links multiple files in extension with collection object and collecting event attachments. Without a doubt, this opens the door for significant progress in this aspect for other groups of insects housed in the collection.
- SEMC experienced several problems with the Macropod Pro imaging system that delayed work for a couple of weeks. The camera failed and the lenses were dusted. The camera had to be sent back to Cannon for repairs while the lenses to Macroscopic Solutions for cleaning.
- EMEC Museum staff (not funded by TCN) sorted and integrated into the museum collection several hundred bee specimens from UC Berkeley research projects, loans, and new identifications.
- ASUHIC added a new storage procedure in the Bee Library to add image tags based on image file names. This added 19,400 annotations to images within the portal.
- FSCA learned how to transfer specimen records from a different database, which was essential for getting the data into the appropriate repositories.
- LACM continues to practice and troubleshoot 3D imaging with the Macropod camera

- Kate and Sylvia (LACM) have shared and continue to update LACM 3D imaging workflow in the shared drive.
- LACM has started to compile 3D image suites for specimens and plans to begin imaging types as soon as they complete maintenance on the Macropod.
- SDMC Deer aiming to improve personal bee identification skills and has applied multiple workshops to help identify undetermined bees in museum collection, learned how to create GIFs of rotating bees from 3D images, implementing photoshop editing to stacked images as part of workflow, Big Bee project page draft to museum website nearly complete, SDMN Science Communication Manager is working on pitch for Big Bee to national news reporters, recruited volunteer to start image transcription on SCAN for Big Bee Project.

Presentations/Posters

1. Seltmann K.C., Paul D. Title:Lets Talk About Data. March 2023. Native Bee Monitoring RCN Data Management Workshop. Zoom. Talk.
2. Seltmann K.C. Title: Big-Bee: Sharing Bee Interactions & Traits. March 2023. Native Bee Monitoring RCN Data Management Workshop. Zoom. Talk.
3. Poelen, J. Title: Bee Species Interactions. March 2023. Native Bee Monitoring RCN Data Management Workshop. Zoom. Talk.
4. Poelen was presented virtually at NanoSessions #1 #2 on 2023-02-28/2023-03-28 titled "How Big is That Bee" to help facilitate the publication of Big Bee specimens and traits in semantically Nanopublications. Organized by KnowledgePixel (https://knowledgepixels.com/) and attended by Pensoft Publishers (https://pensoft.net) among others. See https://github.com/Big-Bee-Network/UCSB-IZC00012194/blob/main/nanosessions-presentation-2023-02-28.md and https://github.com/Big-Bee-Network/UCSB-IZC00012194/blob/main/nanosessions-presentation-2023-03-28.md for text based slides
5. C. Palmrose-Krieger, S. Lee and N.M. Franz. Presented a poster at the 30th Annual School of Life Sciences Undergraduate Research Symposium [Hybrid] on Memorial Union, Ventana Ballroom, Arizona State University, Tempe, Arizona. *Big-Bee: Trait Digitization to Advance Buzz Ecology and Taxonomy Research*. April 2023.

Datasets and other products

1. Miller, JT, Poelen, Jorrit, & Seltmann, Katja. (2023, April 14). Big Bee Name Alignment Workshop. Zenodo. https://doi.org/10.5281/zenodo.7829969
2. Katja C. Seltmann. (2022). Global Bee Interaction Data (v2.02) [Data set]. Zenodo. https://doi.org/10.5281/zenodo.7315159

3. Seltmann, Katja C., Poelen, Jorrit H., Allen, Julie, Eldredge, K. Taro, Engel, Michael, Gonzalez, Victor, Knowles, L. Lacey, & Horsley, Pam. (2023). Big Bee indexed biotic interactions and review summary (0.7.0) [Data set]. Zenodo. https://doi.org/10.5281/zenodo.7865367
4. Engel, M.S. 2023. A new species of *Callomegachile* from Larat, Indonesia (Hymenoptera: Megachilidae). *Entomologist's Monthly Magazine* 159(1): 13–18.
5. Engel, M.S. 2022. New species of the stingless bee genus *Plebeia* (Hymenoptera: Apidae). *Journal of Melittology* 114: 1–28.

CALIFORNIA PHENOLOGY TCN – QUARTERLY REPORT – MAY 2023

Assembled by Katie Pearson on April 25, 2023

PROGRESS IN DIGITIZATION EFFORTS

We have officially achieved all of our digitization goals. The CAP TCN has surpassed our imaging goal by 12% (over 1 million specimens imaged), our transcription goal by 32%, and we have completed 100% of our georeferencing goal (Figure 1).

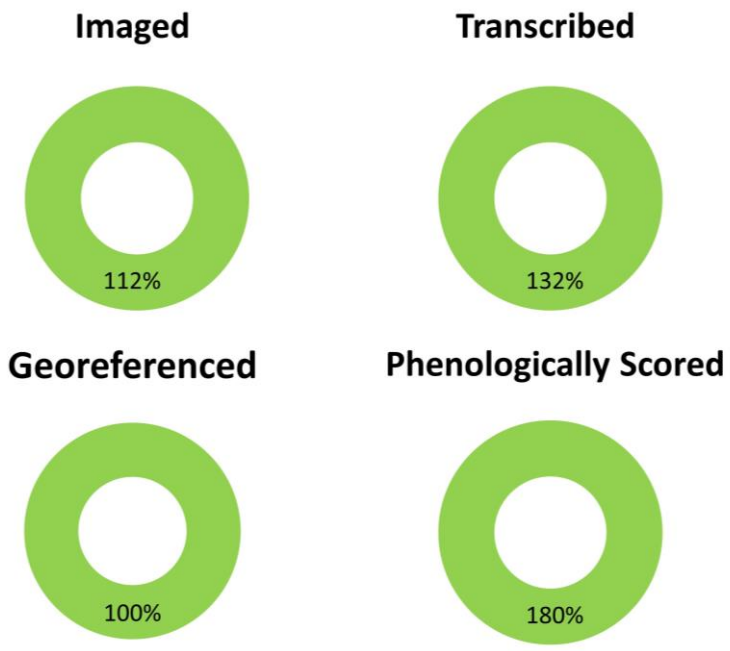


Figure 1. Progress in each of our four major digitization goals. Totals represent the original goals of the CAP grant: 902,400 specimens imaged and phenologically scored, and 300,000 transcribed and georeferenced. Additional specimens to be digitized by the PEN grant are tabulated in the PEN section below. This progress reflects completely new digitization activities to the CCH community, rather than total data liberated by the grant. In the latter terms, we have far exceeded our goals in all four areas listed here.

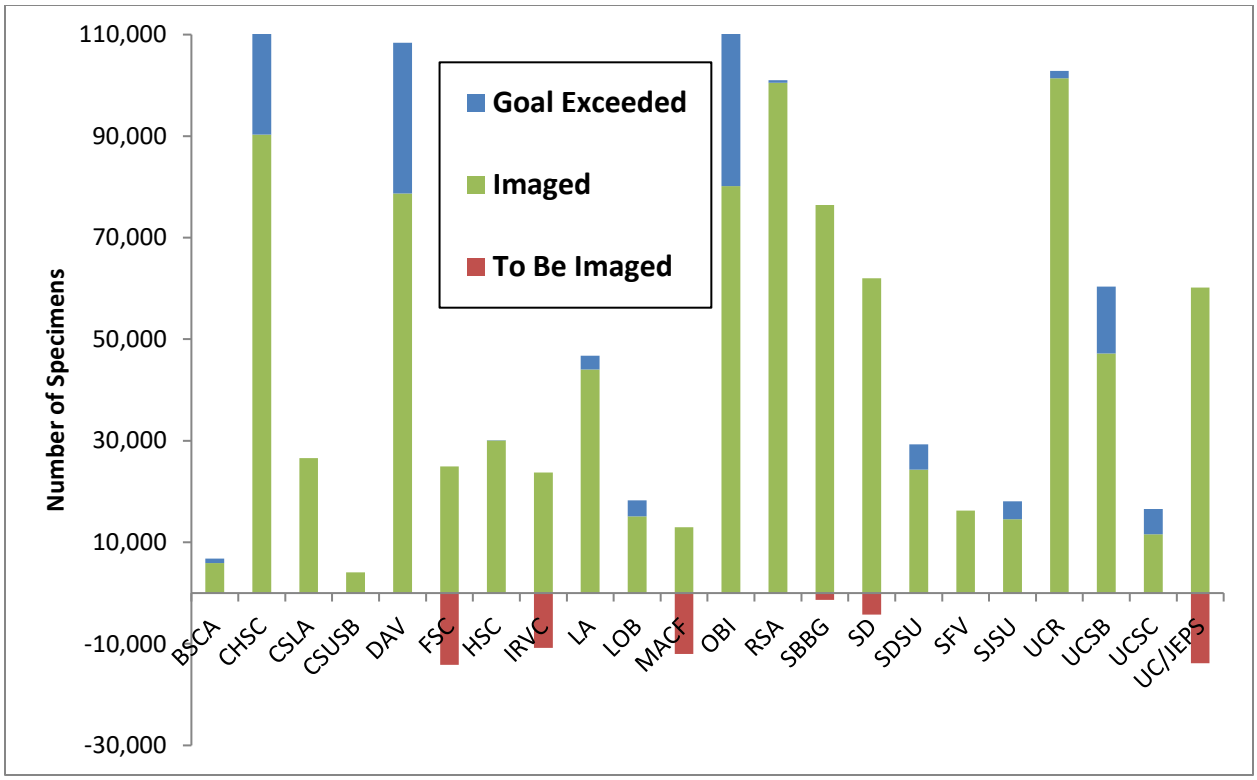


Figure 2. Herbarium specimen imaging progress. Blue portions represent the number of specimens that have been imaged, while green portions represent the number of specimens that have been imaged beyond the expected target specimens. Red bars below the zero line indicate the number of target specimens that have not yet been imaged. Note that SD's total includes the 15,000 additional Baja California specimens added as part of the PEN.

PEN PROGRESS

OSC, SHTC, and UNLV have completed their imaging goals, and OSC continues to digitize. Imaging is ongoing at PUA, SFSU, and SD. CDA has continued to experience delays in procuring their equipment. Figure 3 shows the current imaging progress at PEN institutions.

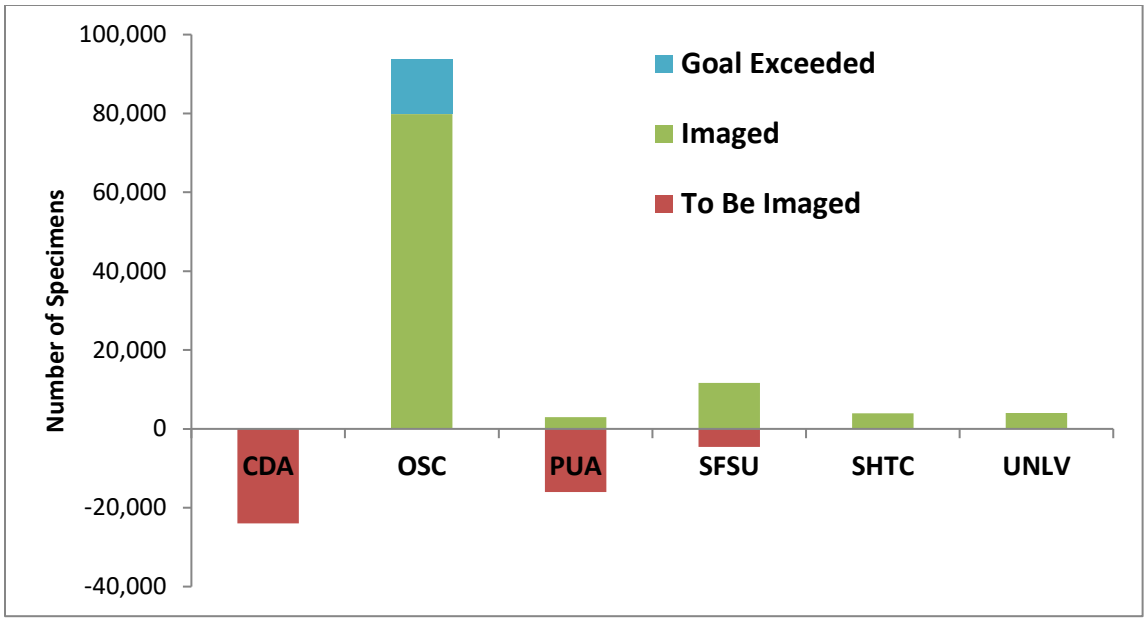


Figure 3. Herbarium specimen imaging progress for the seven PEN institutions. Green portions represent the number of specimens that have been imaged, while red bars below the zero line indicate the number of target specimens that have not yet been imaged. For SD, the total number of specimens to be imaged, including those added as part of the PEN grant, is indicated in Figure 2; therefore, SD is not included in this figure.

SHARE AND IDENTIFY BEST PRACTICES AND STANDARDS (INCLUDING LESSONS LEARNED)

Nothing to report

IDENTIFY GAPS IN DIGITIZATION AREAS AND TECHNOLOGY

We are working with the Symbiota Support Hub to migrate all of our images currently stored with CyVerse to ASU servers. Several CAP TCN participants have beta-tested the new workflow, and the transfer is scheduled for the month of May.

SHARE AND IDENTIFY OPPORTUNITIES TO ENHANCE TRAINING EFFORTS

We continue to support the work of our “100 Club” of naturalist georeferencers. We hold Zoom co-working sessions on the first Tuesday of every month in which we socialize, answer questions, and georeference together. Their involvement has precipitated two particular successes: one georeferencer realized that a large number of specimens that he was transcribing were typed, and so he reached out to the collector to see if he had the data in tabular format. The data had in fact been submitted to the California Academy of Sciences, and upon request from the PM, CAS provided these data to be integrated into CCH2 portal. This saved us from having to transcribe 587 specimen records.

Another 100 Club member noticed that many labels she was georeferencing had a plot number from a vegetation survey that had been conducted. She reached out to the state botanist to see if the coordinates of these survey plots could be found. They were elusive initially, but after consulting with a

more senior staff member, the plot data were found stuffed into a corner. These field notes remain to be digitized, but once they are, they will provide much more precise coordinate data to these indispensable specimens from the Inyo National Forest.

We held one Consortium of California Herbaria meeting in April to discuss—among other topics of community importance—future funding for California herbaria given a recent, new funding opportunity.

SHARE AND IDENTIFY COLLABORATIONS WITH OTHER TCNS, INSTITUTIONS, AND ORGANIZATIONS

CAP collaborators have been in contact with the San Diego Mesa College Herbarium (SDM), Pinnacles National Park Herbarium (PINN), and the Ventura County Agricultural Office (CDFA) collections to bring existing herbarium specimen data into the CCH2 portal and collaboratively digitize specimens. We facilitated the transfer of 4000 images of the PINN collection into CCH2, where they will be transcribed by PINN personnel and volunteers, and 30 images have been uploaded for SDM.

The RSA collection has been collaborating with the Botanical Research Institute of Texas and George Mason University to digitize microscope slides and the RSA xylarium. The RSA xylarium now has 720 specimens and 469 images in the CCH2 portal, which are being connected to other specimens via Symbiota's linked resources tools.

We have continued to encourage members of the CCH to publish their data to iDigBio and GBIF. This month, the CSU Stanislaus Herbarium newly started to publish their data to GBIF.

SHARE AND IDENTIFY OPPORTUNITIES AND STRATEGIES FOR SUSTAINABILITY:

CAP PIs continue to provide leadership for the Consortium of California Herbaria, including facilitating quarterly CCH meetings. These meetings have focused largely on potential avenues of funding for California's herbaria.

SHARE AND IDENTIFY EDUCATION AND OUTREACH (E&O) ACTIVITIES:

We completed two Notes from Nature expeditions of 793 and 2,278 specimens from CSU Fresno and Inyo National Forest, respectively, and imported these data to the CCH2 portal. These expeditions engaged 137 and 663 unique transcribers, respectively. We launched another CSU Fresno expedition of 1,962 specimen records, and a new expedition of CSU Fullerton records for 1,373 specimens.

We presented an informational overview of the CCH2 portal for the Ventura County Weed Management group on March 23, 2023 upon invitation from the Deputy Agricultural Commissioner.

Five CAP herbaria collaborated to coordinate an event for WeDigBio titled "A Whirlwind Tour of California Herbaria". The PM provided an overview of the Consortium of California Herbaria, and each of five institutions (UC/JEPS, CAS, OBI, SBBG, and RSA) provided tours of their collections, each focusing on a different part or specialty of their collection. Following each tour, curators and collections managers

were available for Q&A. This event was quite successful and engaged 140 non-presenting participants. A recording of the event was posted here: https://youtu.be/tQLkqvx6rjM and has received 120 views in the 2 short weeks since being posted.

WEBSITE AND PORTAL USAGE

Our project website (capturingcaliforniasflowers.org) has received 1,726 visits and 2,234 pageviews from February 1, 2023 – April 25, 2023, both metrics approximately equal to those from last quarter. The data portal (cch2.org) has supported 5,569 sessions, 91,801 pageviews, and 999 users over the same time period.

TCN Quarterly Progress Report

Prior to each IAC meeting, TCNs are asked to complete a quarterly progress report in the areas outlined below. The TCN Lead PI or Project Manager collects information from all collaborators and compiles them into one overall progress report for the TCN. The TCN Lead PI or Project Manager then submits the quarterly reports via an email to Cat Chapman. An archive of previously submitted reports is available on the Internal Advisory Committee wiki page.

Digitization TCN – Collaborative Research: Documenting Marine Biodiversity through Digitization of Invertebrate Collections (DigIn)

Person Completing the Report: Regina Wetzer (Lead PI)

Progress in Digitization Efforts

AMNH: Chris Johnson, Estefanía Rodríguez, Lily Berniker: To date we have added 13,936 new catalog records and modified 9,720 existing records with grant efforts. This represents approximately 134,920 specimens in 23,712 lots. 21,931 of these 23,656 catalog records are attached to a locality record, of which 7,587 are unique; 14,654 of these catalog records are attached to a locality record with geographical coordinates. 5,244 project catalog records have an image of the specimens and/or labels attached and 18,249 have a scan of the card catalog record attached. 4,713 catalog records are attached to an expedition record. These represent 128 unique expeditions or expeditions with varying dates. We also have 381 high resolution images of Crustacea from the Barnwell collection ready to be uploaded into the database. We have modified our light boxes to minimize shadows in images and created multiple sizes to accommodate specimen size.

ANSP: Paul Callomon: Some.

BPBM: Holly Bolick: This quarter our digitization efforts focused on incoming specimens of a variety of deep sea invertebrates from Hawaii and the Pacific collected on expeditions between 2009-2012 that were being stored at the University of Hawaii. Due to time constraints, we had to shift focus from our planned digitization specimens to these incoming specimens. We also received in situ and lab images of these specimens which increased our total number of specimen images significantly. We added 369 new specimen records. We updated and cleaned an additional 3,496 specimen records. We mobilized 192 more specimen images and acquired 6 new specimen images. Our specimen image total (mobilized and new images) is now 3,754.

CAS: Christina Piotrowski: A total of 5,056 CASIZ specimen records were fully digitized (except for bulk georeferencing) this quarter. Data records were digitized by implementing a combination of direct data entry and data entry by scanning and transcribing specimen labels. All records were cleaned, edited, and uploaded directly to our Specify database, and are now accessible via GBIF and iDigBio portals. Until last quarter, CASIZ databased records were not reported as “uploaded to iDigBio”, since they are technically not georeferenced. A total of 27,458 (of 59,616) Cumulative databased (uploaded) DigIn records are reported.

CAS volunteers scanned 1,707 specimen labels, which will be hand-transcribed soon. Staff and volunteers transcribed 5,069 specimen records in total, and approximately 1,600 specimen jars were pre-curated by volunteers. Existing photo slide scanning has progressed, however no slides have been directly associated with specimens yet, as this

phase has not been initiated. We initiated a primary types imaging project and have to date created 347 image files in total (including multiple views per lot). We also processed researcher requests for type specimen images (3 images).

We've updated outward facing CASIZ website links to our new database portal (http://specify-portal.calacademy.org/iz/), which now serves up to date cataloged CASIZ specimen records. Data is also pushed out via IPT to aggregators, including iDigBio and GBIF, among other aggregators. We are working hard towards capacity for linking and attaching specimen and label images and have made significant progress this quarter. Pending continued internal technical assistance, we aim to have a portion of CASIZ specimen images shared online soon.

FMNH: Rosana Cunha : Primary goals of the DigIn project at the Field Museum include to (1) newly digitize the about 1,140 remaining lots of marine non-molluscan invertebrates on EMu, and (2) newly generate and upload photos of about 50 type species of these groups to the museum's database. 85% of these lots (or roughly 984) have now been cataloged, and 34 photos of the types are already accessible online. Although small in number, imaging of these diverse (e.g., wet preserved or slide-mounted) types has been challenging and provided opportunities to develop and improve internal workflows (see below). In total, FMNH currently houses over 14,300 lots of digitized non-molluscan invertebrates on its database.

FWRI: Paul Larson: 1,727 specimens were digitized this quarter. For several weeks Tracy was out on field work for her other job, and she has additionally been put on other funding temporarily through the end of this fiscal year, and has thus been working on other activities (namely the SEAMAP identification workshop (see outreach section).

HBOM: M. Dennis Hanisak: This quarter we continued photography of our invertebrate samples, imaging 474 samples – the number to date is 1,147.

MCZ: Adam Baldinger: This quarter, 731 uncataloged lots, equaling about 4,813 specimens, were digitized from spreadsheet data and specimens in hand. As of 24 April 2023, 23,153 records in MCZbase are flagged as a DigIn record. Of these, 21,772 lots have georeferenced coordinate data, but only 16,355 records have data that have been vetted or otherwise verified by MCZ staff. Digital images of nearly all of the echinoderm types have been generated and uploaded to MCZbase. [N.B. If more than one Syntype lot exists for a given species, specimen(s) in only one of the respective Syntype lots is/are imaged.] This quarter, 787 images for 360 primary types have been uploaded to MCZbase.

NCSM-NMI: Megan McCuller: Progress has slowed due to no longer having a technician (our budgeted 1.5 year FTE is up) and we have only digitized 220 lots. However, the work that the technician did – specifically the label imaging – has provided a backlog of over 1,500 known undigitized lots that can be digitized using Specify directly from the images. Additionally, data from the Southeastern Regional Taxonomic Center (SERTC) voucher collection that we acquired is nearly done being wrangled for import into Specify and that will account for over 3,000 records, not counting an uncertain amount of undigitized SERTC lots. The SERTC collecting events data has already been wrangled and imported. Thankfully, SERTC staff had already digitized all collecting event information whether or not any lots are connected to them and so no georeferencing is needed. This will greatly reduce the amount of time spent entering data for lots not previously digitized by SERTC.

NHMLA: Dean Pentcheff: We continue to employ undergraduate students from the University of Southern California (USC), partly funded by the federal work-study program, as our main digitization workforce. Through this past quarter, we had approximately 30 students working part-time on the project. Thanks to the extraordinary organizational efforts of staff

members Victoria Westover and Caroline Haymaker, they have been well-trained and are working largely autonomously.

To manage the complexity inherent in digitizing our highly heterogeneous collection data, we rely on three main sources of information for the digitizers: 1. Meticulously reviewed and revised documentation on how to interpret and classify data labels; 2. A software-driven "Training Environment" which allows us to create synthetic label-digitizing experiences, along with (semi-)automated "grading" of the exercises; and 3. Real-time use of specific Slack channels for posting questions (often with illustrative snapshots) about labels and how they should be digitized. Those questions are answered by knowledgeable staff (either on-site or remote, as appropriate).

We have experimented with volunteers as a supplementary workforce. Because their hours tend to be unpredictable and often quite short, we are training them on very focused subsets of the tasks we expect from the work-study digitizers. At this time, we are unsure how or whether it will be worthwhile to continue the volunteer program.

It is worth noting that our cumulative raw digitization rate has improved to better than one minute per specimen (this rate includes all specimens digitized to date). Though part of that improvement is doubtless due to increasing experience and better training, we suspect that a large part of it is a function of heterogeneous "digitizability" through the collection. As we march through the taxonomically-arranged collection, the curatorial patterns and history of each taxon tend to make digitization more or less quick, and those areas come in coherent chunks of the digitization effort.

RSMAS: Maria Criales: A total of 7,905 new records were digitized and. We completed transcribing data from cataloged cards and books and uploaded them into Symbiota/InvertEbase, capturing a total of 35,126 lots. We continue updating the database, verifying the specimens' existence and condition as well as making new labels. During this quarter 1,175 data were georeferenced making a total of 5,278.

SBNHM: Daniel Geiger: 42,135 lots iDigBio cataloged = 42.1% complete.

SIO-BIC: Charlotte Seid: Digitized 224 lots and 273 locality records this quarter as incidental work by the collection manager. No DigIn funds were expended this quarter. We anticipate hiring DigIn students in the summer or fall.

SIO-PIC: Linsey Sala: We have completed the QC of data entry errors made in the 2nd half of Y2 (n=3,542 records) and continued to improve our SOP for data capture. Due to the complexity of label types this has required digitizers to develop deeper understanding of SIO-PIC expeditionary details and internal database queries to get data from the labels. Additionally, we have completed data capture for 1,146 copepod slides and 1,445 vial/jar based lots (e.g. euphausiids, chaetognaths).

UCM: Kelly Martin: A total of 1,000 specimen lots have been imaged by student workers. Graduate student, Cameron Pittman, has also been responsible for finishing off the imaging of specimens that were missed in our first pass. We have met our imaging goal and will turn our efforts toward georeferencing. We are currently compiling records to be georeferenced.

UF: John Slapcinsky: 2,925 new records were added to our Specify database which is harvested weekly by iDigBio. 4,841 images were uploaded and 2,727 images were edited and are prepared for upload.

VIMS: Jennifer Dreyer: 552 new records have been entered into Excel this quarter. No additional records have been uploaded into Specify this quarter due to continued issues with my Specify taxon tree. I am working with Vijay to get this resolved. He is helping me take the full WoRMS taxon tree and filter it so that major taxonomic groups that I don't

need are removed but all the remaining marine invertebrate taxa are present in the tree. I previously had Specify filter the tree but given all the problems with missing taxa, I decided I needed to start over and import a clean tree or get a taxon tree from another collection. We are going to see if this works so I can get back on track. 198 historic/old specimen labels were photographed for an archive to attach to specimen records in Specify. 315 specimen records were precurated and are in the workflow to be added into the database.

Our quantitative table can be accessed here: [2023 Q2 – Production counts]

Institution	Grant proposal commitments		Commitments completed		Records ready to upload	Georeferencing			Curation	Specimen photography		Label or catalog data capture				Direct capture from specimens			Capture seconds-per-specimen		Transcription seconds-per-specimen		Processing seconds-per-specimen		Logs captured	Comments
	DigIn lots to digitize for upload	DigIn images to create or mobilize for upload	Specimen records uploaded to iDigBio	Images uploaded to iDigBio	Specimen records fully prepared for upload to iDigBio	Records prepared for georeferencing	Records uploaded to CoGeo	Records QCed and repatriated after georeferencing	Specimens precurated for digitization	Specimen images taken	Specimen images QCed and databased	Records imaged from ledgers, cards, or labels	Records OCRed or transcribed	Records QCed	Records databased	Records directly captured from specimen labels	Specimen records QCed and databased	(Add columns if there's something else to report)	Seconds	Phrase describing capture	Seconds	Phrase describing transcription	Seconds	Phrase describing processing	Field Notes and Station Files digitized	Qualifications or explications. Or just say, "Hi!".
NJMNH	5,250	0	0	0	0	0	0	0	0	0	0	0	0	0	302	0	0	0								
NMNH	56,708	7,000	15,285	0	0	~5000	2,682	2,375	0	4,818	4,035	22,738	20,668	18,447	22738*	20	20	0	905	removing labels an	303	transcribing specimen label data into database	0		0	* includes existing records modified for the project such as
NNSP	22,060	1,600	0	0	0	0	0	0	21,600	0	0	0	0	0	0	0	0	0								Concentration has been on cleaning, regularizing and linking data from analog sources into a main database of presence records from a full collection inventory.
NJMNH	10,000	5,000	4,361	0	0	0	0	0	0	0	0	0	0	0	0	702	0	0	0	0	0	0	0	0	0	
SPBM	6,238	3,900			3,517					161	3,395															
CAS	59,616	3,500	22,402	0	0	0	0	0	8,989	1,471	0	41,457	34,915	16,699	6,139	16,263	16,234	0								
FMNH	1,140	50			471	188				6						471										
FWRI	33,582	150	11,809	0	11,809	0	0	0		0	0	0	0	0	0											
FBOM	10,000	0							671	671	671															Hi!
MCZ	31,564	4,631	13,450	638	15,447	15,259	0	0	0	327	327	0	0	0	15,447	15,447	0	0					420	data entry of new r	0	Hi!
NZSM-NMI	31,283	675			7,162					0	0	9,642	0	0	0	7,162			150	imaging labels (each label separately - previously taking images of all labels at once)						The number reported in records imaged is how many images we've taken, but there many be more than one image per record
NHMLA	320,000	2,572	0	0	0	0	0	0	200	0	0	57,182	0	0	0	104,921	0	0	89	label photos and di	0		0		0	Hi!
SBMAS	55,000	0		14,122	0		0	4,133	0	0	0	0	0	0	28,593	0	0	0	0	0	Transcribing spe		900		0	Hi!
SBMNH	100,000	4,500	36,817	0	0	0	0	0	0	0	7,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Time estimates impossible to break down, because we do everything at the time of cataloging specimen: update taxonomy as needed, georef... type-status assessment, etc. Non-grant funded staff time also includes ID [not part of grant, vvalue added] besides data entry.
SIO-BIC	29,300	30,000			8,541					793	11					8,541	8,541		181	data entry from lab	0	NA	16	QA/QC, running sc	0	Time estimates are a vast underestimate because they represent work only on a repetitive and uniform set of specimens, used as a test case and low-hanging fruit.
SIO-PIC	34,371	0														95	3,311	QCed for data capture errors and additional data additions, but will require additional round of QC for database							Hi!
JCM	3,285	1,000	0	0	0	53	0	0	0	1,000	0	3,554	0	0	0	0	0	0	0		0		0		0	
JF	20,000	400,000																								
JWS	6,000	125							550			208				135	310		180	imaging labels	120	direct label capture into Excel				No additional records have been uploaded into Specify this quarter due to continued issues with my Specify taxon tree. I discovered that my taxon tree was missing more random taxa groups (some gastropods, bivalves and polychaetes) and the tree needed to be fixed again. I did continue to QA/QC 310 specimen records so that I would have those ready when the taxon tree was fixed. The tree was fixed right before Christmas but since returning from our institutes holiday break, I have not been able to get back to the database yet.

Best Practices, Standards, and Lessons Learned

AMNH: Chris Johnson, Estefanía Rodríguez, Lily Berniker: Best Practice: 1) transcribing verbatim data with a specific format single | to indicate a separate lines on a label & || to indicate a new label; 2) making use of volunteers to do the verbatim transcriptions & allowing digitizers & staff to make the interpretation for shared or standardized fields. Lesson Learned: standardizing date format within database to facilitate sharing with aggregators. Making sure your institution's firewall is not blocking your ability to share data via the IPT.

ANSP: Paul Callomon: Created a new digital imaging setup for non-mollusk invertebrate type lots, using a light table and glass/lucite stands.

CAS: Christina Piotrowski: Preparations continue for our joint DigIn/ESB Conference Symposium. We are presenting work by our two TCNs at the Society for the Preservation of Natural History Collections meeting 28 May thru 2 June, to be hosted at CAS. CAS is contributing with two collaborators from ESB case studies for digitization problem solving during our respective projects.

FMNH: Rosana Cunha: We continue to use WoRMS to attach currently accepted nomenclature to newly digitized records. We have trained a volunteer in researching and adding currently accepted names to the database. This volunteer moves through the collection material in advance of the cataloging digitizer adding taxa, which greatly enhances the efficiency of data entry. Moreover, we have contracted a part-time intern for georeferencing the locality data in our system.

MCZ: Adam Baldinger: MCZ staff continue to be involved in the Steering Committee and in working group discussions. Information obtained is then shared with curatorial staff in other MCZ departments, including those working on other TCN's (e.g., ESB). Various staff members working on the project participated (via Zoom) in monthly DigIn meetings.

RSMAS: Maria Criales: The Symbiota cleaning tool linked to WoRMS, as well as, the printing labels tool have been a great help saving a lot of time and effort. A new undergraduate student started working with data and samples – great progress.

SBNHM: Daniel Geiger: With environmental survey material and anything on histological slides, avoid duplicate entries from sub-samples or scattered slides. Before cataloging new specimens, search db for possible material already cataloged and in collection and combined lots. Adds a lot of labor without adding numbers of cataloged lots, but is better in the long term.

SIO-PIC: Linsey Sala: Our DigIn group at SIO PIC started a Slack channel, where all team members can pose questions and resolutions to complicated tag types, sorting out expeditionary detail formatting, and updates to data capture and QC protocols.

UCM: Kelly Martin: Our biggest lesson this quarter was the importance of data backup and SOPs. This helped us recover relatively quickly after the flooding event, and we did not lose any data or institutional knowledge.

VIMS: Jennifer Dreyer: I continue to attend All Hands meetings and participate in the consolidated monthly meetings for any agendized topics and office hours for unagendized topics as often as I can. I continue to actively participate with the general group via Slack to provide content and feedback on publicity content.

Identified Gaps in Digitization Areas and Technology

AMNH: Chris Johnson, Estefanía Rodríguez, Lily Berniker: Still have not been able to find a reasonable work around to have multiple catalog records associated with a single, shared image record/image.

ANSP: Paul Callomon: The Academy's digital infrastructure is still undergoing rebuilding.

CAS: Christina Piotrowski: CAS is currently working hard to associate existing digital images with CASIZ specimen records, with the aim of enabling attachment of archived and future images to Specify records. One roadblock has been the heterogeneous source and copyright ownership for older images, and that many files were not previously labeled or named in a standardized manner. We are exploring an electronic solution for attaching files that does not require the significant staff time necessary to clean and standardize file naming and file structure. Once images are linked in Specify, staff will have a means for locating each image, so repairing the inherited non-standardization will not be as crucial. Even when these issues are solved, we will still have much work to do before we've categorized copyright status and terms of use for tens of thousands of externally produced images, and before all Creative Commons licensed images are ready for sharing.
We also still have no means to re-import bulk georeferenced coordinate data into Specify (the Specify team is apparently working towards a solution).

NCSM-NMI: Megan McCuller: We are still struggling to get our data online, but are working with Vijay to identify the best way forward.

SIO-BIC: Charlotte Seid: Working to align internal database fields with DwC terms. Restructuring locality fields to express multi-point localities as a single point + uncertainty, per DigIn training materials.

UCM: Kelly Martin: With our recent flood event, we had some issues this quarter with the camera and software that slowed us down. We have been able to get all the equipment back up and running. I think our major slow down right now is that we are trying to migrate our database from excel to specify. The data cleaning required has, in some ways, helped us identify specimens we need to image/georeference.

VIMS: Jennifer Dreyer: I am still on hold with georeferencing given all the problems with my taxon tree.

Opportunities to Enhance Training Efforts

CAS: Christina Piotrowski: Piotrowski participated in a research expedition to the Maldives this quarter and alongside building the collections she trained new in-country partners in specimen collection and curation, mentoring Fisheries staff in collection building, presenting a talk on Collection Building for Maldivian government scientists, and advising them on treatment of their deteriorated existing collections. This partnership will likely continue into the future, possibly resulting in our new partners visiting CAS for more training, as has occurred with Filipino colleagues.

MCZ: Adam Baldinger: Staff members attend regularly scheduled MCZbase and imaging training sessions to enhance workflows and imaging techniques.

RSMAS: Maria Criales: Vijay Barvy started georeferencing data from our UM expeditions. The general expressions workshop taught by Dean Pentcheff was very instructive.

VIMS: Jennifer Dreyer: I continue to work with one volunteer who is working up to 6 hrs/wk in the Collection imaging specimen labels with our document camera and then transferring specimens into new vials, if needed.

Collaborations with other TCNs, Institutions, and/or Organizations

AMNH: Chris Johnson, Estefanía Rodríguez, Lily Berniker: AMNH met with the New York Botanical Garden to share with them our digitization practices.

CAS: Christina Piotrowski: Piotrowski serves on Cordell Bank NMS Advisory Council and meets at least quarterly with the Council and that of our neighboring Gulf of the Farallones NMS Advisory Council, serving in the Research Seat. Piotrowski is working towards rekindling a collaborative contracted project with NOAA/NMFS to voucher invertebrate lots from Alaskan office cruises and specimen images annually, similar to our collaborations that were curtailed 10 years ago due to lack of funding. Piotrowski advises as a member of the SDNHM Advisory Committee as the SDNHM team works to determine which specimens they will retain and which to deaccession from their (chiefly marine Mollusca) collections. We continue to collaborate with the ESB TCN, especially in planning for our SPNHC2023 symposium. CAS will soon be collaborating with local sister museums Oakland Museum and the Legion of Honor art museum to loan specimens for their respective exhibit galleries, the former to educate community members on local NMS species, and the latter to bring together historical paintings and related natural history specimens.

FMNH: Rosana Cunha: FMNH PI Rüdiger Bieler (who also serves as lead PI on the ESB-TCN) is coordinating efforts with ESB, the shared Symbiota portal InvertEBase, and the World Register of Marine Species (WoRMS), for which he serves as a member of the Steering Committee.

MCZ: Adam Baldinger: Information continues to be shared among permanent MCZ curatorial staff working on other TCN's (e.g., ESB) and on an NSF-CSBR cryogenic collections-improvement grant.

NHMLA: Vijay Barve: Vijay connects DigIn to the larger biodiversity/collections community with his participation and periodic involvement in events like GBIF's "Data Use" seminars, "Symbiota Office Hours", and through workshops like the "Native Bee Monitoring RCN

Data Management Workshop", and "Biodiversity Data: Preparing and publishing data to the GBIF and OBIS networks."

RSMAS: Maria Criales: We continue collaboration with ECOSUR, Quintana Roa, Mexico. This month we provided ~100 lots of polychaete material from our previous expeditions for a PhD thesis student. We also started a new cooperation Florida Atlantic University. M. Criales has been attending the DigIn All Hands, Symbiota, and nomenclature working group meetings.

SIO-BIC: Charlotte Seid: SIO-BIC and the City of San Diego Public Utilities Department co-hosted the Southern California Unified Malacologists 27th annual meeting (Feb 4), emphasizing interdisciplinary uses of marine invertebrate specimens.

Opportunities and Strategies for Sustainability

ANSP: Paul Callomon: We are transitioning to all-LED setups across our imaging facilities.

BPBM: Holly Bolick: Since the beginning of the DigIn project, we were able to satisfy the needs of three specimen loan requests without sending physical specimens through the mail, dramatically cutting down on cost, damage to physical material, and carbon footprint.

CAS: Christina Piotrowski: We continue to brainstorm a means to ensure that future incoming non-Mollusca collections added to the CAS Research Collection will be digitized ahead of incorporating them into the physical collections. This will be a financial hardship for our institution at current staffing levels unless we can secure funding from specimen donors, but these resources do not typically exist when important biodiversity collections are submitted for donation. We have secured temporary resources internally for a portion of the necessary work on the recently received unfunded EPA dredge disposal survey donation, however this funding will not permit us to complete this very large curation project. We are making our best effort to digitize all material that is acquired, but this will not likely be a sustainable effort unless additional staff is made available, or unless all specimen donors provide funding for curation.

NHMLA: Dean Pentcheff: Word of the taxonomic work of the DigIn program has percolated out to some of the younger taxonomists involved with West Coast POTWs ("privately owned treatment works" — regional wastewater facilities), and we have begun integrating them into our discussions. Because biologists working for regulated facilities all along the coast try to coordinate their monitoring, they have a direct interest in maintaining and revising marine taxonomic information. Therefore, their efforts to harmonize taxonomy, between agencies and relative to international nomenclators (such as WoRMS [marinespecies.org]), are analogous to the efforts of the DigIn participants. Integrating their participation into the DigIn program is a significant contribution to building a sustainable community of West Coast marine taxonomists.

RSMAS: Maria Criales: We continue developing an educational MPS track program around the collection, which in the future should generate great opportunities of funding.

SIO-PIC: Linsey Sala: We've put together data capture and QC protocols for digitizing slides versus vials/jars and different taxa to assist with training a new generation of digitizers when this turnover occurs. Additionally, we've started glossaries of collection equipment, expeditions, and common abbreviations to assist with future digitizer training.

VIMS: Jennifer Dreyer: We continue to archive historic/old specimen labels that will be attached to specimen records in Specify.

Education, Outreach, Diversity, & Inclusion (EODI) Activities

AMNH: Chris Johnson, Estefanía Rodríguez, Lily Berniker: Fani participated in Career at Benjamin Franklin Middle School, sharing career paths in collections based scientific research using the marine invertebrate collections.

ANSP: Paul Callomon: We continue to train Drexel Co-op students in digitization, taxonomy and nomenclature. We also give tours and talks to high school students in the WINS (Women In Natural Sciences) program.

BPBM: Holly Bolick: We completed two additional social media posts in February and April. We highlighted the DigIn project at this year's annual science festival at the museum held on Earth Day (22nd) which had over 2,000 people in attendance.

CAS: Christina Piotrowski: We provided 9 Collection tours of the IZ Collection to undergraduate students from San Francisco State University, students from SF City College, Careers in Science high school interns, and several internal Academy stakeholders. CAS Teaching Collections were also used more directly for education, both on the Academy's public floor and at local elementary schools. Piotrowski was interviewed by the SF Chronicle about recent California *Velella velella* stranding.

We continue to work with local graduate students who assisted DigIn directly by either scanning or transcribing specimen labels during digitization work. Piotrowski reached out to the CAS Education team who work with our local educators in an attempt to engage both their staff and local educators to attend the planned DigIn summer 2023 Educators' Workshop, however the date selected this year in July does not work out well for the SF Public school system educators or our staff. Our digitization technician will attend alone for professional development purposes provided there is sufficient space for her in the workshop.

FMNH: Rosana Cunha: We are coordinating with the Museum's Learning Center regarding potential programming involving non-molluscan marine invertebrates. The school partnership coordinator Eleanor Sweeney from the Museum's Learning Center will attend the Educator Workshop "Scientific Discovery & Natural History Collections" hosted by the Natural History Museum of Los Angeles County this Summer, together with the echinoderm expert and FMNH collections technician Rosana Cunha.

FWRI: Paul Larson: This period FWRI staff are putting on a week-long invertebrate identification workshop focusing on the species frequently collected by collectors involved with the federally funded SEAMAP project. Guests from various gulf state partners are attending, and we are using hundreds of specimens during lab-times to supplement the presentations and discussions.

MCZ: Adam Baldinger: Two student interns from Cambridge Rindge and Latin High School are assisting with the inventory of several coral families.

NCSM-NMI: Megan McCuller: We have a new volunteer in our lab who is knowledgeable about photography and learning how to photograph specimens as well as rehouse them.

NHMLA: Dean Pentcheff: This quarter we continued significant planning and recruitment activities for the upcoming summer museum/educator workshop to be held in Los Angeles in July.

RSMAS: Maria Criales: We conducted presentations for elementary school students, and for an UM invertebrate zoology class, highlighting the value of invertebrate collections and digitization of museum collections.

SIO-BIC: Charlotte Seid: Conducted 14 E&O presentations (8.25 hrs) for 163 visitors (elementary school through adult learners), highlighting invertebrate biology and the value of digitized museum collections. Provided themed specimens and short presentations to a

weekly student-led wellness/creativity program, "Art in the Archives," which promotes interdisciplinary engagement with SIO-BIC specimens.

SIO-PIC: Linsey Sala: 11 E&O tours of SIO-PIC, expressing value and importance of collections and digital discoverability. Assisted with teaching a lab course in Marine Zooplankton this quarter, where many specimens are being utilized and promoting the utility of data aggregators to conduct biodiversity research.

UF: John Slapcinsky: Taught a group of elementary students from the Boys & Girls Club about local mollusks and other invertebrates in our Museum in the Parks program.

VIMS: Jennifer Dreyer: I did 2 public outreach events: one for 100 3rd grade students at a local elementary school and one at a local nature center for 100 people. I did 1 tour of our Invertebrate Collection to the general public. 81 specimens were used from the Collection for outreach or taxonomic comparisons for research projects and reached over 329 people total. I was asked to provide taxonomic identifications for organisms through 9 public requests to our institute, as well as to VIMS researchers. I contribute to the Instagram social media posts based on the publicity assignment and repost them on my personal Instagram to increase distribution. The education outreach working group moves forward with the planning of the summer workshop but unfortunately given the dates in July, no one from the VIMS marine educators group or a local high school partner is able to attend. We are planning on participating next year and hope the dates are more conducive for our participation.

Other Activities and/or Progress

AMNH: Chris Johnson, Estefanía Rodríguez, Lily Berniker: We've completed fully digitizing the wet Bryozoa collection.

FMNH: Rosana Cunha: The DigIn grant fueled the first attempts at digitizing glass-slide-mounted material. Two staff and a volunteer were trained in procedures and best practices for slide imaging. In addition to producing images of type material that will be published online, the division is now equipped to produce and publish slide images of types beyond the DigIn grant. FMNH is also working to identify a museum-wide standard for composite images that combine multiple slides in a single series.

MCZ: Adam Baldinger: Brachiopods cataloged originally in MCZ's Malacology or Invertebrate Paleontology collections are being recataloged into the Invertebrate Zoology collection.

NCSM-NMI: Megan McCuller: Our former technician plans to continue working with us on a volunteer basis.

NHMLA: Victoria Westover: DigIn has published 158 Instagram posts, 64 Instagram stories, and 42 Twitter posts to date. Our 158 Instagram posts include 33 *Invertebrates of the Week*, 33 *Scientist Spotlights*, 28 *Friday Fun Facts*, 62 *General Content* posts, and two Instagram Reels, which are short-form vertical videos about the digitization workflow at NHMLA. The general content on our Instagram page includes two introductions to DigIn, eight posts that relate to trending hashtags in the scientific community, 18 posts about invertebrate specimens, 12 posts about specimen collection, specimen observation, or outreach events, seven posts about relevant international holidays, two project updates, and 13 other posts that highlight various topics, such as the purpose of ethanol in museum collections. The 64 Instagram stories include one introduction to the project, 37 invertebrates that link to resources on InvertEBase, four inside looks of collection spaces, ten stories about relevant international holidays, six stories about outreach events, as well as six stories about publications that include DigIn digitized specimens. Our 42 Twitter posts consist of two introductions to the project, seven posts about relevant international

holidays, three posts on trending hashtags in the scientific community, seven posts about specimen collection, specimen observation, or outreach events, nine posts about invertebrates, one project update, and 13 other posts about various topics, such as NCSM-NMI's efforts to create 3D models of specimens using photogrammetry.

NHMLA: Dean Pentcheff, Vijay Barve: The **Nomenclature Working Group** is meeting regularly and is making progress resolving names with WoRMS. We are utilizing WoRMS, ITIS, and BHL resources for this process. Names resolution will be most helpful when we submit data to iDigBio and GBIF, ensuring that the names are resolved to the correct entities. The workflow is currently being developed and tested.

Data Publishing is an important component that all DigIn teams either already have in place or will need in place soon. To that end, we have created, revised, and shared Darwin Core terms and data worksheets to help with standardization and workflow.

On the specimen **geolocation** front, we have created guidelines and a template for data submission. 100 record sample datasets have been requested from everyone needing geolocation assistance from Q-Quatics. Sample geolocation datasets are trickling in and most groups have received their geolocated data back. DigIn teams are in the process of repatriating the geolocated data into their own collection management systems.

SIO-BIC: Charlotte Seid: Coordinated the triage and acquisition of additional specimens donated to SIO-BIC by SIO emeritus professor Lisa Levin. These scientifically valuable collections will require further work for physical curation and digitization.

UCM: Kelly Martin: Over the winter, our museum experienced a major flood during an unprecedented cold spell in Colorado (frozen pipes). The museum was shut down for several weeks as the building was fixed (insulation, dry wall, carpets, electrical, etc.). During that time, the collections were closed and students/staff were not able to work – this has contributed to a delay in our progress. In addition, many computers and imaging stations were destroyed. Fortunately, no specimens within our Invertebrate Zoology section were damaged.

TCN Quarterly Progress Report

Prior to each IAC meeting, TCNs are asked to complete a quarterly progress report in the areas outlined below. The TCN Lead PI or Project Manager collects information from all collaborators and compiles them into one overall progress report for the TCN. The TCN Lead PI or Project Manager then submits the quarterly reports via an email to Cat Chapman. An archive of previously submitted reports is available on the Internal Advisory Committee wiki page.

TCN Name

Eastern Seaboard: Mobilizing millions of marine mollusks

Person Completing the Report

Rüdiger Bieler, FMNH, Lead PI

Share Progress in Digitization Efforts

Share information here. You can also embed graphics if desired.

FMNH ESB: Digitization of ESB material in the gastropod collection is well underway. Digitized 1,306 de novo lots including vitality status, representing an estimated total of 15,400 specimens; 8,686 records were cleaned/enhanced/improved; georeferenced 111 de novo localities, and georeferenced 55 existing records. Created 1,168 multimedia records (labels) and attached them to their associated catalog records.
ANSP ESB: 407 lots totaling 1,935 specimens were newly catalogued and digitized during this period and 1,239 lots had their data upgraded.
BMSM ESB: During this period, 329 ESB records were cataloged, containing 780 specimens. Staff cleaned and standardized 443 ESB records. BMSM georeferenced 557 localities encompassing 1,305 records (1,120 from Florida), all including error radius. The total number of georeferenced ESB records so far is 22,724. Entire BMSM dataset consists of 134,176 records, of which 24,316 are from ESB, including a total of about 152,435* ESB specimens. New composite images were created for 15 ESB lots.

*This number is an estimate. We know of 130,929 specimens. To get the other 21,506 specimens, we multiplied the average number of specimens across all of the ESB lots (6.27) by the number of records without a listed number of specimens (3,430).

CM ESB: 6,359 total ESB records data cleaned; 3,277 total ESB records georeferenced. In 1st quarter 2023, 143 additional localities georeferenced representing 1,126 records of marine mollusks from the Eastern Seaboard.
DelMNS ESB: New specimens were digitized (n=167) and over 500 specimen lots were improved. DelMNS has spent considerable time exploring whether it is useful to take photographs of entire lots of specimens instead of just selecting a single representative for photographing. In this approach, specimens are dumped onto the background and quickly aligned into the same orientation (apex up, aperture facing the camera) and centered in the camera view.. The goal is to maximize the number of specimens that are available for measure while minimizing handling time. We have tested several camera and photograph setups and concluded that it is possible to greatly increase the number of specimens imaged without compromising image quality or measurement accuracy.
FWRI ESB: 797 new records were cataloged this quarter, bringing our total cataloged/finalized lots under the project up to 5589, 90% of our target goal. Digitizing has continued as usual but data uploading has slowed down this quarter as collections staff are focusing on preparing a week-long invertebrate identification workshop for partners on another grant. There are currently 1917 records waiting for upload, which will put us over our target for the grant once complete and uploaded. Additionally, our database connection to ESB was repaired so that new lots are being automatically ingested to ESB.
HBOM ESB: This quarter we focused on the photography of HBOM mollusks and successfully photographed 1,387 specimens.
HMNS ESB: 3,252 catalog records, representing 48,008 specimens, have had their collection localities cleaned. The first group of 2,000 records, representing 17,428 specimens have been uploaded to InvertEBase.
LACM ESB: Between January 1st and March 31st, 842 lots were digitized, representing 18,308 specimens. To date, LACM has digitized 62.1% of its ESB lots, which is 61% of its ESB specimens. Digitization and georeferencing was completed by our ESB-funded assistant collections manager, Cathy Groves, and the Malacology department's Collections Manager, Lindsey Groves.
MCZ ESB: 239 lots/records were databased this quarter. To date, 31075 records were assessed as being relevant to ESB,, and of these, 25,995 with verified georeferences. 24,588 records are available on iDigBio. 8,000 records were moved into the named group on MCZbase this quarter, so that they can be collaboratively geolocated. Those still need to be cleaned/vetted for accuracy.
NCSM ESB: Between January 1 and March 31, 2023 we have digitized 101 lots and 100 lots in progress. This quarter 75 localities have been georeferenced.
PRI ESB PEN: Between January 1 and March 31, 2023, we have digitized 209 lots totaling 13,057 specimens. Cumulatively, 2,885 lots (44% of goal) containing 87,002 specimens (55% of goal) have been digitized. An additional 209 lots have been coded with live-dead status (3,070 lots in total have been coded so far. We have not taken any more specimen photos. Cumulatively we have taken 277 photographs of 106 specimens (23% of goal). We have uploaded 3,054 records to Invert E Base through Symbiota. Volunteers and interns have helped with associating labels with cataloged material.

RSMAS ESB: During this quarter 1,950 lots representing 9,200 specimens have been captured to a total of 16,739 lots and 61,373 specimens. New 5,800 new lots were uploaded into InvertEbase via Symbiota and 1,165 data were georeferenced. We completed the digitalization of data from cataloged cards and books into excel spreadsheets. We continue uploading data into InvertEbase and verifying the existing and conditions of samples on shelves.
UF ESB: We moved our entire fluid preserved collections and offices late last year into early this year. This move is now entirely completed but as a result we had a slowdown in digitization activities this quarter and last quarter. We digitized 39 lots containing 139 specimens that are available in our online Specify Portal and InvertEBase. Georeferenced and estimated error radii for 39 specimen lots.
UMMZ ESB: 720 lots representing 4762 specimens have been newly digitized, 720 images generated and 3 lots georeferenced; 1,023 specimens records and >200,000 specimen/catalog images were newly uploaded to GBIF. As a result, 193,626 out of 201,847 specimen records have at least one image.
YPM ESB: During this quarter we continued to maintain georeferencing infrastructure and provide day-to-day support and training. In addition, 1) Added 2022 Gebco bathymetry layer to available Geolocate map overlays, 2) Added min./max. depth and elevation from specimen records to user interface, and 3) Enabled extraction of depth and elevation from linked Symbiota datasets.

Share Best Practices, Standards, and Lessons Learned

Share information here. You can also embed graphics if desired.

FMNH ESB: Our team of volunteers continue to implement the geographic workflows developed in preparation for digitization in the gastropod collection. This same group of volunteers is continuing to verify taxonomy of the gastropod collection using the authoritative taxonomic database MolluscaBase. Incorporated label imaging into the daily digitization workflow to create a digital record of the collecting data for each lot. This additional step increased data entry rates by 13%. Creating label history in the database enables easy access to label data for future reference. This eliminates the need to return to the collection to physically examine labels which is both time-consuming and poses additional risk to the specimens.
ANSP ESB: Nothing to report.
BMSM ESB: After an almost inactive period of three months that followed the local impact by Hurricane Ian, operation of BMSM collection on Sanibel Island is back to about 90% normalcy. The collection is available for in-house maintenance and checks. Having in mind the potential for damage to the collection posed by storms, staff and board at BMNSM are considering moving the collection to a new research + collection facility on the mainland, away from Sanibel Island.
CM ESB: Nothing to report.
DelMNS ESB: We are establishing new workflows for that enable us to quickly increase the number of mollusk specimens that are imaged and made available through iDigBio, Symbiota/InvertEBase and other portals for use in digital natural history collection CUREs.

FWRI ESB: Nothing to report.
HBOM ESB: Nothing to report.
HMNS ESB: Nothing to report.
LACM ESB: Nothing to report.
MCZ ESB: Permanent staff involved in the project continue to participate in committees/work groups. Information is then shared with others in MCZ's Malacology and Invertebrate Zoology departments, including those working on other TCNs (DigIn). Various staff members working on the project participate (via zoom) in ESB monthly ESB general meetings and monitor communications shared on various Slack channels. MCZ is now hosting museum-wide, monthly imaging workshops to set standards for photography of specimens.
NCSM ESB: Nothing to report.
PRI ESB PEN: Katie Pearson of Symbiota helped us in uploading two datasets to Invert E Base. She was a great help in figuring out where certain pieces of information should be mapped to.
RSMAS ESB: We continue cleaning taxonomic names using the Symbiota cleaning tool incorporated into WoRMS and Catalogue of Life. This is taken a lot of effort because these scientific names of most mollusks from our collection are very old
UF ESB**:** Nothing to report.
UMMZ ESB**:** Nothing to report.
YPM ESB: Nothing to report.

Share Identified Gaps in Digitization Areas and Technology

Share information here. You can also embed graphics if desired.

FMNH ESB: Nothing to report.
ANSP ESB: Nothing to report.
BMSM ESB: Nothing to report.
CM ESB: Nothing to report.
DelMNS ESB: Nothing to report.
FWRI ESB: Nothing to report.
HBOM ESB: Nothing to report.
HMNS ESB: Because of the sheer volume of information and its being in multiple modules in EMu, exporting the data from EMu as a CSV file did not work. The resolution came from the Field Museum when one of their IT staff wrote a Crystal Report that would allow us to cleanly export our data.
LACM ESB: Nothing to report.
MCZ ESB: Nothing to report.
NCSM ESB: Nothing to report.
PRI ESB PEN: Nothing to report.
RSMAS ESB: Our initial estimated number of 20,000 was overestimated because some cataloged numbers entered originally in books do not exist in our collections.
UF ESB: Nothing to report.
UMMZ ESB: Nothing to report.

YPM ESB: Nothing to report.

Share Opportunities to Enhance Training Efforts

Share information here. You can also embed graphics if desired.

FMNH ESB: Nothing to report.
ANSP ESB: A co-op student and Computer Sciences major from Drexel University (Juwhan Jung) has been learning about nomenclature as he applies his programming skills to improve our database.
BMSM ESB: Staff at BMNSM published a short note on the egg-capsule deposition process in *Melongena corona*, one of the ESB taxa, and the PI co-authored a research note on the first record of an introduced species, *Naria turdus*, to the US, on the east coast of Florida.
CM ESB: Nothing to report.
DelMNS ESB: DelMNS and Widener University completed a senior research project on shell morphology and predation in *Neoterebra dislocata*, one of the ESB taxa.
FWRI ESB: Nothing to report
HBOM ESB: Nothing to report.
HMNS ESB: Our Collections Manager has recruited an unpaid intern (Tiffany Bridges) to begin cleaning collection localities and assigning the marine subdivision to catalog records in our database. Tiffany is an undergraduate from Arizona State University pursuing a degree in Ecology and Evolutionary Biology. Her goal is to eventually find a paid position in a museum collections department.
LACM ESB: Nothing to report.
MCZ ESB: Staff have begun using lightroom to quickly edit images before bulkloading them to MCZbase, which has decreased the time needed for photo edits. During a three week period in January 2023, two students from Harvard Extension School's Museum studies program worked in the department for a total of 35 hours each. They assisted with data entry of ~400 records into a spreadsheet and rehoused specimens for ESB into the collection.
NCSM ESB: Nothing to report.
PRI ESB PEN: Nothing to report.
RSMAS ESB: We conducted presentations for an elementary school, and for UM Invertebrate zoology class, highlighting the value of the mollusk collection.
UF ESB**:** One ESB student has expressed interest in independent research projects and is being trained in systematics research and is currently generating sequence data for columbellids.
UMMZ ESB: Nothing to report.
YPM ESB: Nothing to report.

Share Collaborations with other TCNs, Institutions, and/or Organizations

Share information here. You can also embed graphics if desired.

FMNH ESB: Continued coordination with DigIn and PILSBRy TCNs, as well as WoRMS/MolluscaBase.
ANSP ESB: Juwhan Jung has built an interface that finds the basis of record for names in ANSP malacology database that are not in WoRMS. Those that have been published will be uploaded to MolluscaBase. This interface is ready to make available on GitHub.
BMSM ESB: Nothing to report.
CM ESB: Nothing to report.
DelMNS ESB: Ongoing collaboration with BCEENET (RCN-UBE) to understand the types of information that undergraduate faculty and students need to incorporate specimen data into CUREs.
FWRI ESB: Nothing to report.
HBOM ESB: Nothing to report.
HMNS ESB: Nothing to report.
LACM ESB: Nothing to report.
MCZ ESB**:** Information is shared among permanent MCZ staff working on other TCNs: DigIn and PILSBRy (now finished), and an NSF CSBR cryogenic collections grant.
NCSM ESB: Nothing to report.
PRI ESB PEN: Nothing to report.
RSMAS ESB: Nothing to report.
UF ESB**:** Nothing to report.
UMMZ ESB: Continued coordination with PILSBRy TCN
YPM ESB: Nothing to report.

Share Opportunities and Strategies for Sustainability

Share information here. You can also embed graphics if desired.

FMNH ESB: Nothing to report.
ANSP ESB: Nothing to report.
BMSM ESB: Nothing to report.
CM ESB: Nothing to report.
DelMNS ESB: Nothing to report.
FWRI ESB: Nothing to report.
HBOM ESB: Nothing new to report.
HMNS ESB: Nothing to report.
LACM ESB: Nothing to report.
MCZ ESB: Nothing to report.

NCSM ESB: Nothing to report.
PRI ESB PEN: Nothing to report.
RSMAS: We are continuing to develop an educational MPS track program around the collection, which in the future should generate great learning outcomes.
UF ESB: Nothing to report.
UMMZ ESB: Nothing to report.
YPM ESB: Nothing to report.

Share Education, Outreach, Diversity, & Inclusion (EODI) Activities

Share information here. You can also embed graphics if desired.

FMNH ESB: Continued coordination of Mollusk of the Month (MotM) on Instagram, Twitter and Facebook.
ANSP ESB: The PI has continued work with iNaturalist and is the primary person bringing older observations into the ESB iNaturalist portal by flagging their live/dead status. More than 110,000 thousand observations are in the portal, with more than 80 percent having reached research grade.
BMSM ESB: PI Leal is responsible for the ESB Facebook page, having posted regularly via that social media outlet; PI is a member of the ESB TCN steering committee. Facebook social media page currently includes 640 members, among professionals, citizen scientists, and shell enthusiasts.
DelMNS ESB: Submitted abstract for talk at SPNHC 2023 re: photography workflow for taking measurements of many specimens in a single image.
FWRI ESB: Posted items to instagram as part of the outreach committee
HBOM ESB: Nothing to report.
HMNS ESB: The Malacology Curator gave a presentation in March to members of the Shell Club in Chicago on clam and oyster beds and their importance in an environment.
LACM ESB: Provided material for January Mollusk of the Month.
MCZ ESB: The iNaturalist public portal keeps growing and now includes 64 members, 3,455 identifiers, 111,193 observations and 964 species.
https://www.inaturalist.org/projects/eastern-seaboard-mollusks**.** Provided material for February Mollusk of the Month.
NCSM ESB: We use multiple platforms (Instagram, LinkedIn, Twitter, and Facebook) to reach the public. Each platform seems to reach a different audience.
PRI ESB PEN: Provided material for March Mollusk of the Month.
RSMAS ESB: We are continuing to develop an educational MPS track program around the collection, which in the future should generate great learning outcomes. Website is complete.
UF ESB: Nothing to report.
UMMZ ESB: Nothing to report.
YPM ESB: Nothing to report.

Share Information About Your Website and/or Portal Usage

Share information here. You can also embed graphics if desired, such as from Google Analytics.

FMNH ESB: Pushed dataset to Symbiota/InvertEBase, end of March, 2023.
ANSP ESB: Nothing to report.
BMSM ESB: Dataset is live and updated at portal' portal is hosted by Specify Collections Consortium https://webportal.specifycloud.org/shellmuseum. Stats and portal usage data not available.
CM ESB: Collections data last uploaded to InvertEBase 24 Oct 2022. No access to collection data through our museum website.
DelMNS ESB**:** All DelMNS Mollusk collection data are available on Symbiota/InvertEBase. The DelMNS collection (collection acronym: DMNH) has been cited 80 times according to the GBIF widget.
FWRI ESB: Portal is hosted by Specify Collections Consortium and traffic and searches cannot be tracked by FWRI staff. FWRI collection data has been cited over 80 times in GBIF.
HBOM ESB: Nothing to report.
HMNS ESB: Nothing to report.
LACM ESB**:** Nothing to report.
MCZ ESB**:** "Named Group" page in our database allows for researchers and others to gather information about the grant, records/specimen lots associated with ESB, including searchable links/breakdown of records by taxa, geography (ie. by ocean, country, islands), images, collectors/agents; includes links to iDigBio (ESB), MolluscaBase and iNaturalist pages. (https://mczbase.mcz.harvard.edu/grouping/showNamedCollection.cfm?underscore_collection_id=82
NCSM ESB**:** Nothing to report.
PRI ESB PEN: Nothing to report.
RSMAS ESB: We have established an account in the Symbiota portal and will continue to upload Mollusk data.
UF ESB**:** We continue to add images to our museum database. These are live and updated at portal http://specifyportal.flmnh.ufl.edu/iz/. Light photogrammetry images are available at https://sketchfab.com/FloridaMuseum/collections/invertebrate-zoology-b8787873d5384855b4f340781d5e6006
UMMZ ESB**:** Nothing to report.
YPM ESB: Nothing to report.

Share Other Activities and/or Progress

Share information here for things that do not fit into the above categories. You can also embed graphics if desired.

FMNH ESB: Nothing to report.
ANSP ESB: Nothing to report.
BMSM ESB: Nothing to report.
CM ESB: Nothing to report.
DelMNS ESB: Nothing to report.
FWRI ESB: Nothing to report.
HBOM ESB: Nothing to report.
HMNS ESB: Beginning in January of 2023 the Inventory Manager in the project will be given the title of Collections Manager for Malacology and Inventory. This new position should allow him to focus more time on this project and the Malacology Department as whole.
LACM ESB: Nothing to report.
MCZ ESB: Two LHT (less than halftime) employees continue to work in the collection 7 hours a week each on projects pertaining to ESB. They assist with data entry for the collections of Leo A. Burry and the Materials Management Survey of Deep Sea Bivalves..
NCSM ESB: Nothing to report.
PRI ESB PEN: Nothing to report.
RSMAS ESB: Nothing to report.
UF ESB: Nothing to report.
UMMZ ESB: Nothing to report.
YPM ESB: Nothing to report.

TCN Quarterly Progress Report

TCN Name

Building a global consortium of bryophytes and lichens: keystones of cryptobiotic communities (GLOBAL)[1]

Person Completing the Report

Miranda Zwingelberg (GLOBAL Project Manager)

Share Progress in Digitization Efforts

This report covers progress completed during the period of January 1 – March 31, 2023.

Workflows, Equipment, and Personnel

Most GLOBAL institutions continued steady GLOBAL progress during 2023-Q1.

ALA has nearly completed the lichen reorganization, but the mosses are still being reorganized. They continued to digitize and update metadata in ARCTOS, update locality information and georeferences, and upload specimen records from ARCTOS to the portals.

At ASU, specimen digitization continued, focusing on ASU lichen specimens. A new student worker, Ramisa Zaman, was just hired and is being trained in routine image acquisition by her predecessor Tanishq Jain.

[1] Throughout this report, herbaria are referred to by their Index Herbariorum acronyms, which correspond to institutional names as follows: ALA = University of Alaska, Fairbanks, ASU = Arizona State University, BRY = Brigham Young University, CINC & MU = University of Cincinnati & Miami University, COLO = University of Colorado, DUKE = Duke University, F = The Field Museum, FLAS = University of Florida, ILL & ILLS = University of Illinois at Urbana-Champaign & Illinois Natural History Survey, LSU = Louisiana State University, MICH = University of Michigan, MIN = University of Minnesota, MO = Missouri Botanical Garden, MSC = Michigan State University, NY = New York Botanical Garden, OSC = Oregon State University, PH = The Academy of Natural Sciences of Drexel University, TENN = University of Tennessee, Knoxville, UC = University of California, Berkeley, WIS = University of Wisconsin, YU = Yale University

The herbarium of non-vascular cryptogams at BRY started a major renovation project in January. Digitization efforts have been halted in preparation for the major construction that will start in May 2023.

Imaging and transcription continued on CINC bryophytes. They have nearly completed the Fulford collection of liverworts, and are now working on exsiccatae.

COLO continued work on imaging and transcribing specimens. They are getting a start with the bryophyte collection using the same workflow as the lichens to maximize the number of labels in the system. They want to get as many transcribed records into the system as possible to give WIS specimens to georeference.

DUKE continued barcoding, imaging, transcribing, and georeferencing activities for their bryophyte collection.

At F, additional lichen images were added, most entered directly into Emu. Fully transcribed and georeferenced lichen specimens (mostly from Iceland, New Caledonia, and Tasmania) were added to EMu, and will eventually make their way onto the portal with their next IPT update. Bryophyte specimens were barcoded and imaged and skeletal records were developed. In tandem to the portal, they are also updating and adding images to existing records in EMu.

FLAS is amping up transcribing efforts. All mosses have been carded, almost all hepatics carded, and a quarter of the mosses have been imaged for project.

ILL & ILLS continued transcribing bryophytes.

LSU continued training an undergraduate to complete georeferencing of lichen and bryophyte records, continued to image bryophyte specimens, and re-imaged some lichen labels to resolve issues.

MICH continued digitizing lichens and bryophytes. Two technicians and two undergraduate students worked in the herbarium on digitizing lichens this quarter.

MIN continued to image lichen specimens and transcribe label data for bryophyte specimens.

MO continued digitization work on their bryophyte specimens.

NY had two interns dedicated to barcoding and photography, while their lead digitizer focused more directly on transcription.

OSC was able to continue digitization work, barcoding and imaging bryophyte specimens.

At PH one dedicated volunteer transcribed lichen specimens. Continuation of student imaging and transcribing of the remaining moss sheets will start up in the next quarter.

TENN students continued barcoding, imaging, and transcribing bryophyte specimens. They finished the moss collection and have moved on to the liverworts. Three undergrads were hired and trained during a “Herbarium Bootcamp” over the Winter Mini-Term to work on GLOBAL imaging and transcription. The herbarium had 9 undergrads technicians working on the GLOBAL project this quarter. Three undergrad interns were also trained to help on GLOBAL tasks as part of their activities.

With their Herbarium Assistant, Acacia, UC was able to better streamline their digitizing process and to add more skeletal data and images this quarter. Students are currently focusing on skeletal data and imaging before moving on to transcribing and georeferencing.

WIS started imaging and transcribing labels as well as specimens from NEB and WTU. Students continued to image WIS specimens and georeference across the collections.

YU continued digitization work on their bryophyte specimens.

Digitization

Nineteen institutions (ALA, ASU, CINC & MU, COLO, DUKE, F, FLAS, ILL & ILLS, LSU, MICH, MIN, MO, NY, OSC, PH, TENN, UC, WIS, and YU) reported progress on digitization deliverables, with a total of 59,311 specimens barcoded (51,918 bryophytes and 7,393 lichens), 44,348 labels imaged (31,768 bryophytes and 12,580 lichens), 38,655 specimens imaged (24,639 bryophytes and 14,016 lichens), 124,327 specimen records uploaded to the portal (65,484 bryophytes and 58,843 lichens), 66,357 skeletal records created (57,575 bryophytes and 8,782 lichens), 31,261 labels fully transcribed (21,802 bryophytes and 9,459 lichens), and 32,190 specimens georeferenced (24,239 bryophytes and 7,951 lichens) (See Table 1 & Figure 1).

Table 1: Digitization progress by GLOBAL collaborators in 2023-Q1, separated by Bryophyte (B) and Lichen (L) specimens.

	# Barcodes Added		# Labels Imaged		# Specimens Imaged		# Uploaded to Portal		# Skeletal Records Created		# Fully Transcribed		# Georeferenced	
	B	L	B	L	B	L	B	L	B	L	B	L	B	L
ALA					80	5,594	156	1,889	18,797					
ASU		335		335	0	335		1,024		1,024		335		
BRY														
CINC & MU	2,763		2,763		2,763		2,665		2,763		3,089		957	
COLO	4,863	3,455	3,863	3,686			3,863	3,686	3,863	3,686	42	4,033		
DUKE	1,539		2,038		304		2,342		1,539		107		64	
F	12,658	526	3,153	347	3,153	347	1,049		1,549			526		526
FLAS	2,500		1,250		1,250		1,250	50			300			
ILL & ILLS											6,655			
LSU				278	2,584								1,128	903
MICH	3,934	1,119	3,934	1,119	437	124	1,773	8	3,934	1,119	147		34	
MIN		983		983		983				983	669			
MO	4,733		3,070		3,070				75		76		28	
MSC														
NY	16,509	877	221	5,702	221	5,702	44,709	52,055	16,509	877	5,471	3,827	1,721	1,695
OSC			1,249		1,249									
PH								1		1		661		
TENN	1,389		6,791		6,791		6,947		2,024		5,146		3,189	
UC	300		2,007		2,007				2,007					
WIS		45	699	77		878		77	699	77	100	77	17,118	4,827
YU	730	53	730	53	730	53	730	53	3,816	1,015				
Totals	**51,918**	**7,393**	**31,768**	**12,580**	**24,639**	**14,016**	**65,484**	**58,843**	**57,575**	**8,782**	**21,802**	**9,459**	**24,239**	**7,951**
B+L Totals		**59,311**		**44,348**		**38,655**		**124,327**		**66,357**		**31,261**		**32,190**

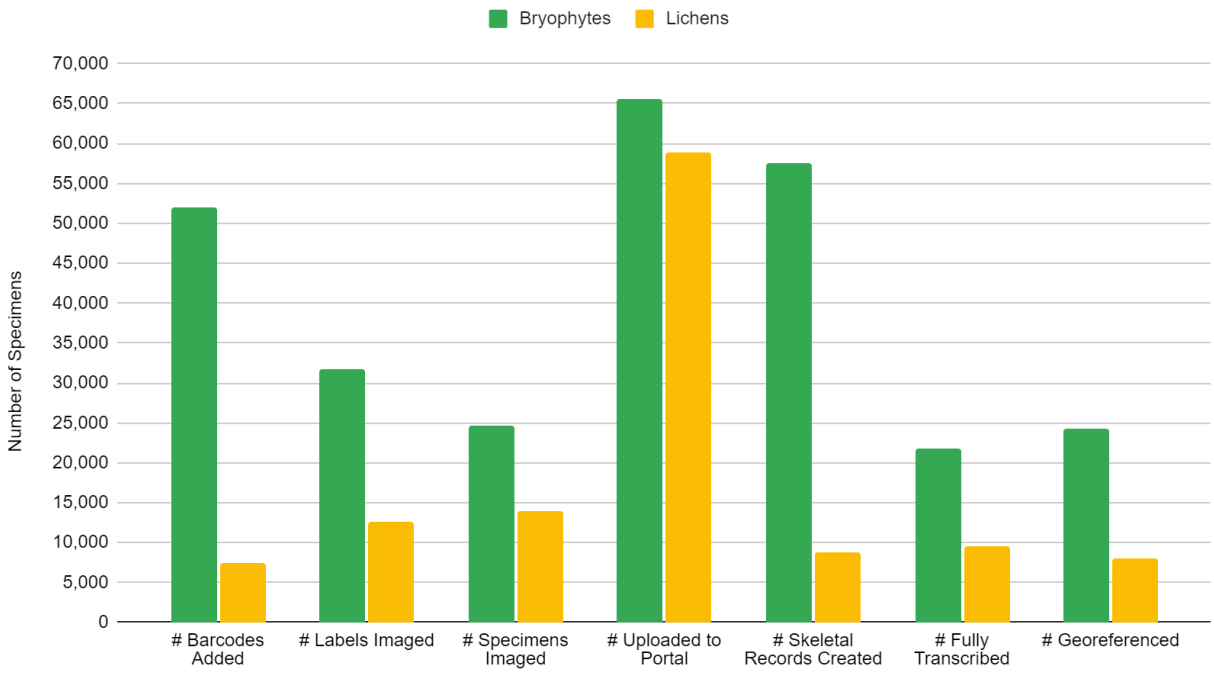


Figure 1: Digitization progress for the GLOBAL collaboration in 2023-Q1, separated by Bryophyte and Lichen specimens.

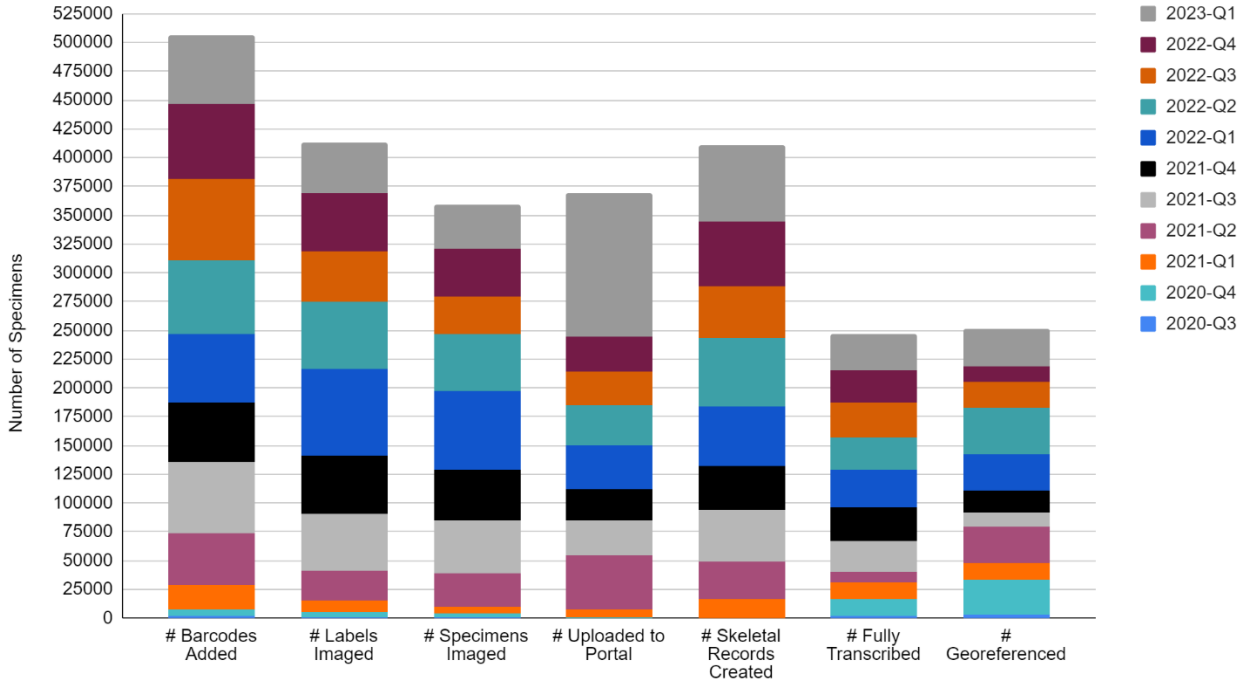


Figure 2: Cumulative digitization progress for the GLOBAL collaboration by quarter.

Share Best Practices, Standards, and Lessons Learned

Flexible Workflows

The GLOBAL teams continued to make use of flexible digitization workflows in 2023-Q1, including some use of virtual transcription work and prioritizing label imaging, while most collaborators were able to continue on-site work.

COLO is splitting digitization time between this project, the Southern Rocky Mountain and the All-Asia project. Right now, they have a shared imaging station for the All-Asia project and are trying to maximize time on that station before it is shipped to BRIT. Most of the change was shifting PM Allen's time to All-Asia with the rest of the digitizers continuing to focus on GLOBAL. Since no transcription work was completed on their non-North American specimens before the project they did not have records for the first wave of georeferencing work at WIS. They are prioritizing records from Australia, Chile, Finland, France, Japan, Norway and Sweden for transcription to build sets for georeferencing. One of their digitizers is going to start graduate school in England in the fall and focused on transcribing labels from the UK. With summer approaching they are planning to shift some hours away from imaging to transcription.

Georeferencing / Duplicate Matching

Georeferencing Manager Smith (WIS) has been verifying completed georeferences and began sending csv files to those with snapshot collections (MO). With Portal Manager K. Pearson's help, they ran the duplicate coordinate matching tool for a few collections to see if they can leverage their georeferencing efforts.

LSU worked with the Symbiota Help Desk to find duplicate records with completed georeferences. After cleaning through a record set of 1136 lichens and 530 bryophytes, they were able to add 164 and 92 corresponding georeferences. They created a criterion for cleaning through the records and would only accept georeferences that included data in remarks and a low uncertainty radius.

MO updated 17,578 Tropicos records with coordinates provided by the centralized georeferencing team. These should be available for duplicate matching when the next snapshot update happens.

TENN reviewed and imported 500+ additional georeferences identified by the R script.

Collaboration

Team members continued to make use of Basecamp, Zoom, and email to communicate and collaborate during 2023-Q1. New collaborators and students were given access to Basecamp group resources. The Georeferencing Working Group and Transcription Working Group met in March to discuss progress, challenges, and plans. The Outreach & Education Group met in March to begin preparation for the April WeDigBio event. A Management Committee Meeting was held in February open to all GLOBAL members to review 2022-Q4 grant progress and provide an open forum to the GLOBAL team.

The TENN Project Manager completed routine check-in's with collaborating teams at ALA, F, MSC, OSC, WIS, UC, and YU to discuss project status, updates, and concerns.

WIS continued its collaborative georeferencing, creating new communities in the CoGe interface and georeferencing as fully transcribed records become available. The GLOBAL Geoferencing Manager (WIS) and Portal Manager (ASU) continued to consult on georeferencing workflows, especially those involving GEOLocate CoGe.

Share Identified Gaps in Digitization Areas and Technology

Database Compatibility

MSC started work on transferring coordinates from the Lichen Portal to their institutional Specify database. Updating existing records isn't possible without assistance from programmers. They went to this effort with the idea that they will share what they learned with other Specify users to streamline the workflow. After finishing this exercise, they concluded that it is necessary to georeference within Specify, or only georeference records that don't exist in Specify yet and await import as new records. Many problems were encountered. Symbiota currently doesn't use collection-unique identifiers of localities. Locality identifiers are needed for uploading new coordinates from Symbiota to existing records in Specify.

MICH's uploading to the project Symbiota portals was been suspended this quarter due to an impediment with their institutional IPT export from Specify. They're optimistic that this issue will be resolved soon.

UC found some issues in translation between their in-house database manager and Symbiota. They are therefore opting to transcribe within their in-house database prior to uploading data to the Symbiota portals.

Share Opportunities to Enhance Training Efforts

The GLOBAL Project Manager (TENN) and Georeferencing Manager (WIS) continued compiling resources during 2023-Q1 to share on Basecamp and all resources were posted to the project website (https://globaltcn.utk.edu), including additional georeferencing and transcription links and resources.

ASU continued to provide regular user support through the Symbiota Support Hub. Monthly Monday meetings by the Support Group are open to all members of the Symbiota community and generally well attended. More tutorials have been added to the Symbiota Documentation by the Symbiota Support Hub at https://biokic.github.io/symbiota-docs/. Student workers and volunteers continue to be trained in routine image acquisition, specimen curation and data management.

The program Mytabolites (for the analysis of thin-layer chromatography plates) continues to be tested and refined at ASU; a new option to filter results for substance classes has been added.

DUKE trained three biology graduate students one hour per week in herbarium management practices.

MIN trained one volunteer to image lichens and add skeletal records.

NY GLOBAL staff attended the Tuckerman Workshop in Alabama, to learn and teach lichen biology and determination basics.

The TENN Project Manager supervised one of the undergraduate technicians in creating a video about the GLOBAL project for his leadership course. The student was able to develop film and audio-recording, editing, and science communication skills.

Share Collaborations with other TCNs, Institutions, and/or Organizations

The Symbiota team at ASU completed the conversion of the Lichen and Bryophyte Portals from being “North American” consortia to being global consortia by remodeling the portals. This included enabling bilingual support on the Bryophyte Portal and merging the Consortium of North American Lichen and Consortium of Latin American Lichen Portals. They also deprecated the *Frullania* and Arctic Lichen Portals in favor of the unified, global portals. Regular updates of

the taxonomic thesaurus continue. Several additional European herbaria have joined the Lichen Portal, e.g., the Senckenberg lichen collections at Frankfurt (FR; 54,794 specimen records) and Görlitz (GLM; 66,049 specimen records), and in Berlin (B; 132,967 specimen records).

Collaboration between GLOBAL teams and other TCN projects occurring concurrently at their sites continued. CINC is also a member of the All-Asia TCN. The students work in the same space and regularly exchange tips and work together to improve workflows. COLO is also a member of the SoRo TCN and the All-Asia TCN and continued to share info and technology between projects to help optimize workflows. F collaborated with the new Africa TCN focusing on flowering plants and continued collaboration with the ongoing Pteridophyte TCN project as well. At MICH, ongoing collaboration continued between the PCC and GLOBAL TCNs, which share many resources including facilities, digitization and management staff, training, some equipment, and workflow. Though the grant objectives and specimens being imaged are separate, much of the institutional infrastructure is shared between the projects. NY shared institutional infrastructure and support with other TCNs (All Asia, Africa). Images generated through GLOBAL TCN used for NEH-funded workshop hosted through NYU. UC is concurrently running multiple digitizing projects at UC, including GLOBAL as well as Ferns, Phenology, and Endless Forms, and students receive the opportunity to gain experience across pipelines.

DUKE collaborated with Symbiota Help Desk and Specify software team on resolving the broken Specify-to-Symbiota updating system (Symbiota Connector). They collaborated with Specify team on figuring out import of coordinates from Symbiota to existing Specify localities. DUKE staff also participated in quarterly NC Lichen Conservation one-day meeting with NC Natural Heritage Program.

TENN Project Manager participated in the quarterly iDigBio Stakeholder Engagement Meeting (Formerly Internal Advisory Committee Meeting) in February with other TCN participants.

Share Opportunities and Strategies for Sustainability

Portal Management

The Symbiota Support Hub at ASU continued to provide portal management and maintenance, including uploading and linking images to GLOBAL collections, updating snapshot data from international partners to facilitate duplicate matching and import, and providing assistance with data cleaning and other issues. The Symbiota Support Hub continued to provide regular training sessions, documentation and tutorials.

The Global IUCN Red-Lists of Lichens continued to be regularly updated in the Consortium of Lichen Herbaria.

To better integrate different information repositories into a Global Consortium, the previous platforms have now been merged and renamed into the "Consortium of Lichen Herbaria" and the "Consortium of Bryophyte Herbaria". Both platforms are now bilingual. The option to switch between English/Spanish language locales was newly added to the Bryophyte Consortium. The Spanish language platform "Consorcio de Herbarios de Líquenes en América Latina" has been integrated into the general Lichen Consortium. It is therefore now available to the Latin American users by simply switching the language. Merging several different platforms into a single platform, only one for lichens and only one for bryophytes, already reduced maintenance, thus improving functionality and facilitating regular updates. Tools using the API to facilitate access to the data from different Symbiota portals continue to be under development.

Back Ups

All of ALA's images and metadata have and will be stored on tape and cloud back-up at Texas Advanced Computing Center (TACC), University of Texas at Austin.

During this quarter, CINC established a new collaboration with Research Computing on campus, and their images are now being stored locally and served to the portals from on-campus servers. All images are also backed up on a local, mirrored external hard drive as well as University-sponsored cloud storage.

COLO's raw images and JPGs continue to be uploaded to the University of Colorado Research Computing. These images are in addition to the local copies housed in the CU Herbarium. The hope is that these images will never need to be accessed, but to serve as a catastrophic backup if they have a computer or hard drive failure. Monthly backups of the COLO database in the Lichen and Bryophyte Portals are made on the first working day of the month. These files are housed locally and will be archived on Research Computing in case they ever need a point in time backup of their data.

This quarter, LSU completed their 3rd tier backup in the cloud! They have their images on a local server "Sassafras", a NAS drive, and in the cloud using Box which is supported by LSU. Using an app in the NAS drive, they are able to create an automated sync for incoming images to the cloud. Previously, they created a script that pushes new images to the NAS drive

and server, as well as creates image derivatives and a mapping of the images to link images with occurrence record data in the Symbiota portals.

TENN continues to back-up project images on external hard drives.

Share Education, Outreach, Diversity, & Inclusion (EODI) Activities

The GLOBAL TCN website (https://globaltcn.utk.edu) was maintained and updated with additional links to developed protocols and workflows. Social media accounts belonging to collaborators continued using #GlobalTCN as a way to share progress with the community.

Plans progressed for producing the GLOBAL educational videos in conjunction with the team at ALA. Members from ALA, F, WIS, and TENN met bi-weekly to discuss updates on logistics and content. Video filming is planned for May 2023 at the UAF Media Studio in Fairbanks, AK.

ASU's collaboration with the community of Latin American lichenologists continued. A survey on how the Latin American community may be better served was conducted by Jesús Hernandez. A publication discussing best practices for creating Symbiota checklists, using the Lichenized and Lichenicolous Fungi of Ecuador as an example, has been accepted for publication.

DUKE PI Shaw held a 10-hour on-line course through the Eagle Hill Institute: "Ecology and Evolution of Peatmosses" (Feb 7-21). Duke Herbarium's Blanka Aguero led two public moss walks on "Mosses of Duke Gardens" (Mar 14) and "Mosses of Duke Forest" (Mar 31). DUKE's Scott LaGreca taught an introductory lichen workshop (with both lab and field components, plus an herbarium tour) for 15 adults (non-students) (Mar 25) and introduced six undergraduate students to lichens (lab and field components) (Mar 26).

In January, F hosted a public volunteer event called Collections Club that meets every quarter and barcoded over 10,000 specimens. They continued to work on developing online education tools.

ILL & ILLS led 5 herbarium tours, which highlighted their lichen and bryophyte collections.

LSU led 3 herbarium tours, totaling 40 students, who were exposed to lichen collections.

The NY team published two public interest pieces The Hand Lens, one about Cyanolichens, and another a biographical sketch of Chicita Culberson. Tours of the lichen herbarium were given to visiting researchers.

The TENN Herbarium hosted a “Specimens and Scones” open house for 29 students, staff, and faculty on campus including tours of the herbarium. TENN continued hosting the GLOBAL weekly transcription event on Fridays during 2023-Q1. Six community science volunteers from three countries participated (US, Canada, Sweden) and transcribed skeletal data for over 1,800 specimens. Volunteers were also able to see a number of “Specimen Spotlight” presentations on specimens and collectors compiled by the TENN GLOBAL Project Manager.

UC led 3 herbarium tours, with a particular focus on lichen and bryophyte collections and led a Lichen Walk with a focus on lichens of central California for ca. 20 adults.

WeDigBio

Six GLOBAL collaborators (CINC & MU, DUKE, F, FLAS, PH and TENN) agreed to participate in the April 2023 WeDigBio and were joined by the Cornell Plant Pathology Herbarium. They held two WeDigBio Planning Meetings in March to discuss scheduling, roles, presentations, and advertising. The team from F will again help host and manage the registration for the event, with assistance from the GLOBAL team. It was decided to hold two GLOBAL-specific days on Thursday and Saturday.

Share Information About Your Website and/or Portal Usage

The GLOBAL project website, https://globaltcn.utk.edu, was utilized by 263 users during 2023-Q1, including 16 from Asia, 13 from Europe, and 3 from South America (see Figure 3).

The Bryophyte and Lichen Portals, created as part of the original LBCC grant, host new images and data produced by the GLOBAL collaborators. 254 users visited the Bryophyte Portal and 696 users visited the Lichen Portal during 2023-Q1 (see Figures 4 & 5).

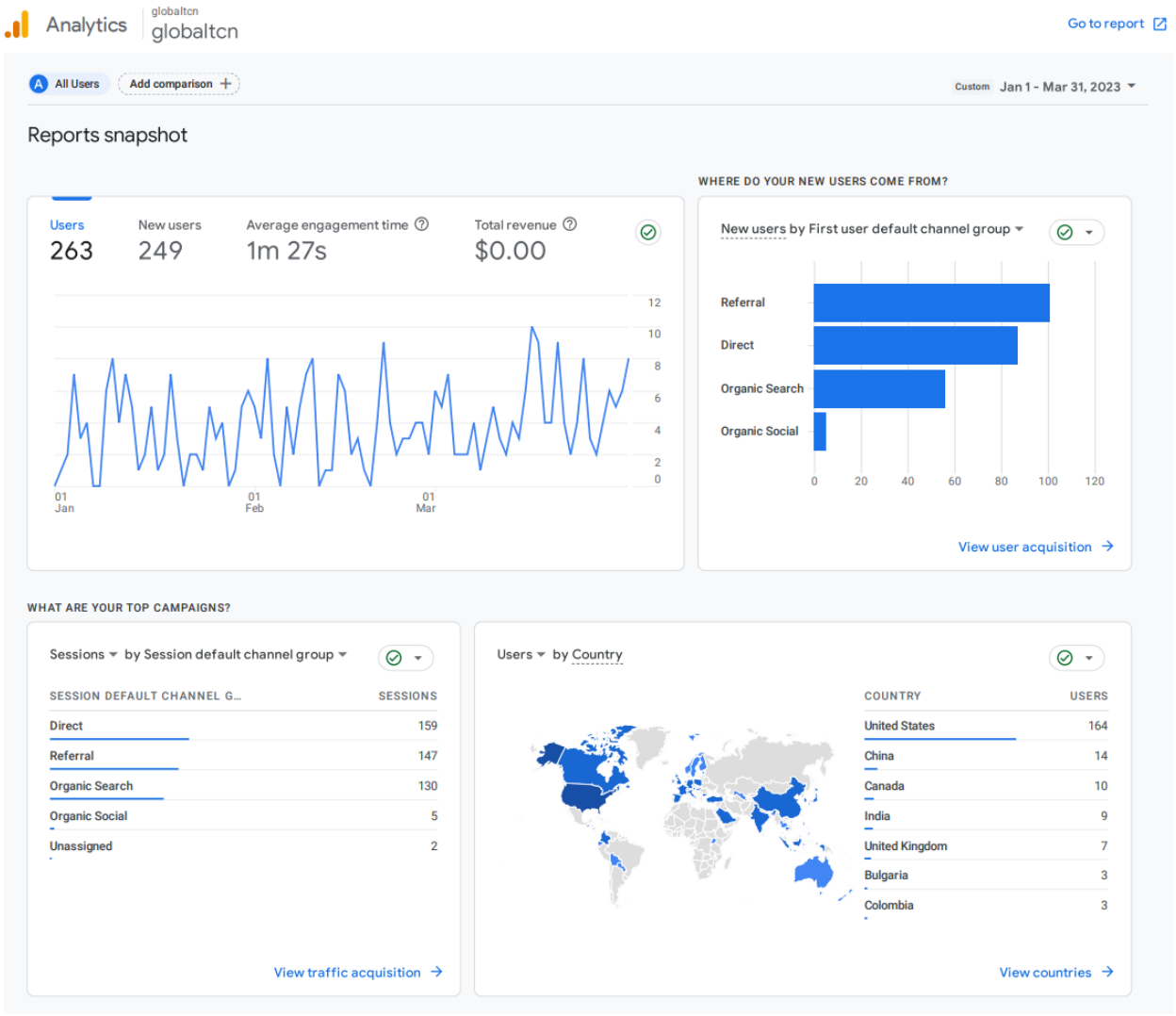


Figure 3: Use metrics for the GLOBAL project website (https://globaltcn.utk.edu) from January 1 – March 31, 2023.

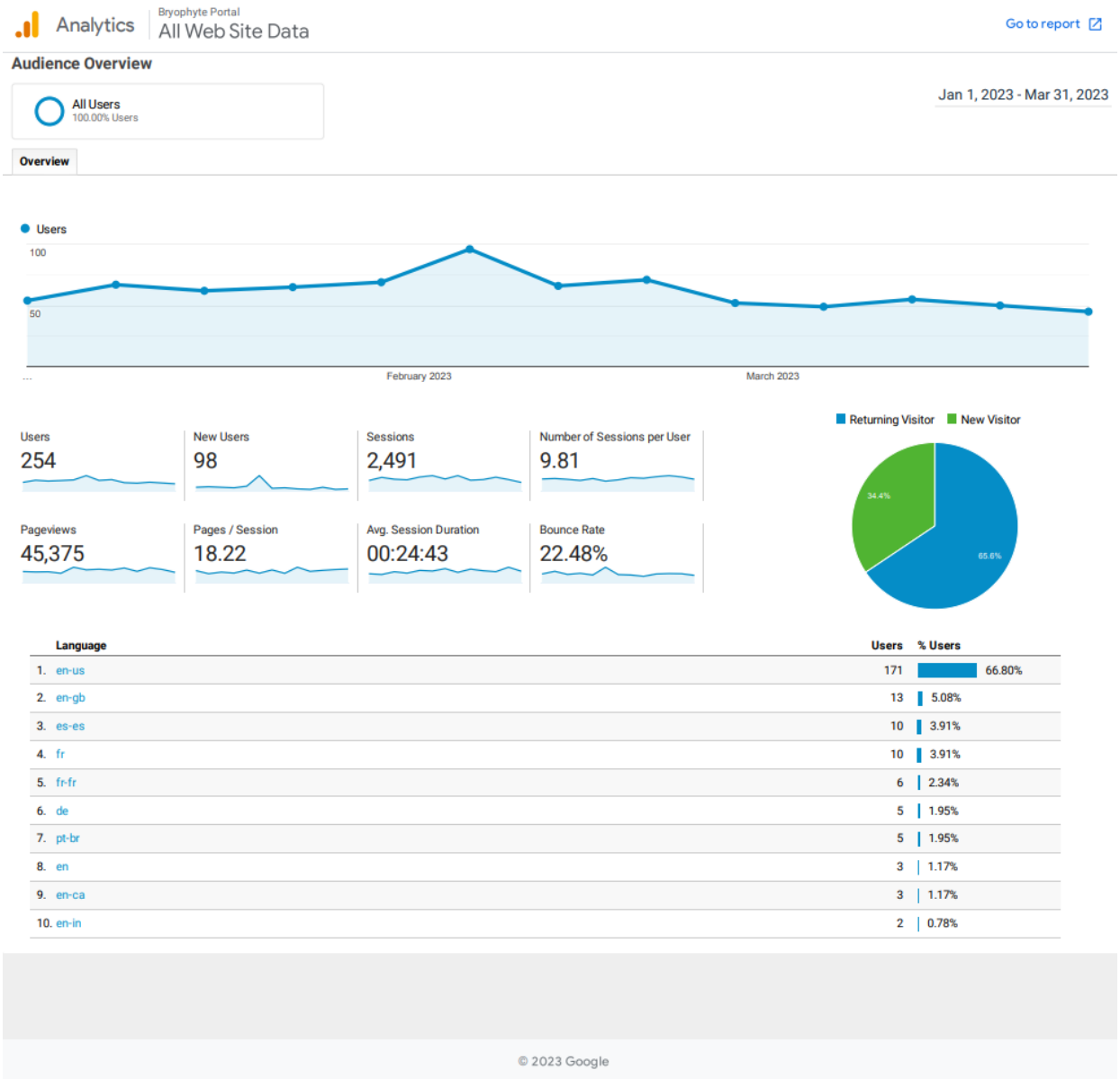


Figure 4: Use metrics for the Bryophyte Portal (https://bryophyteportal.org/portal/) from January 1 – March 31, 2023.

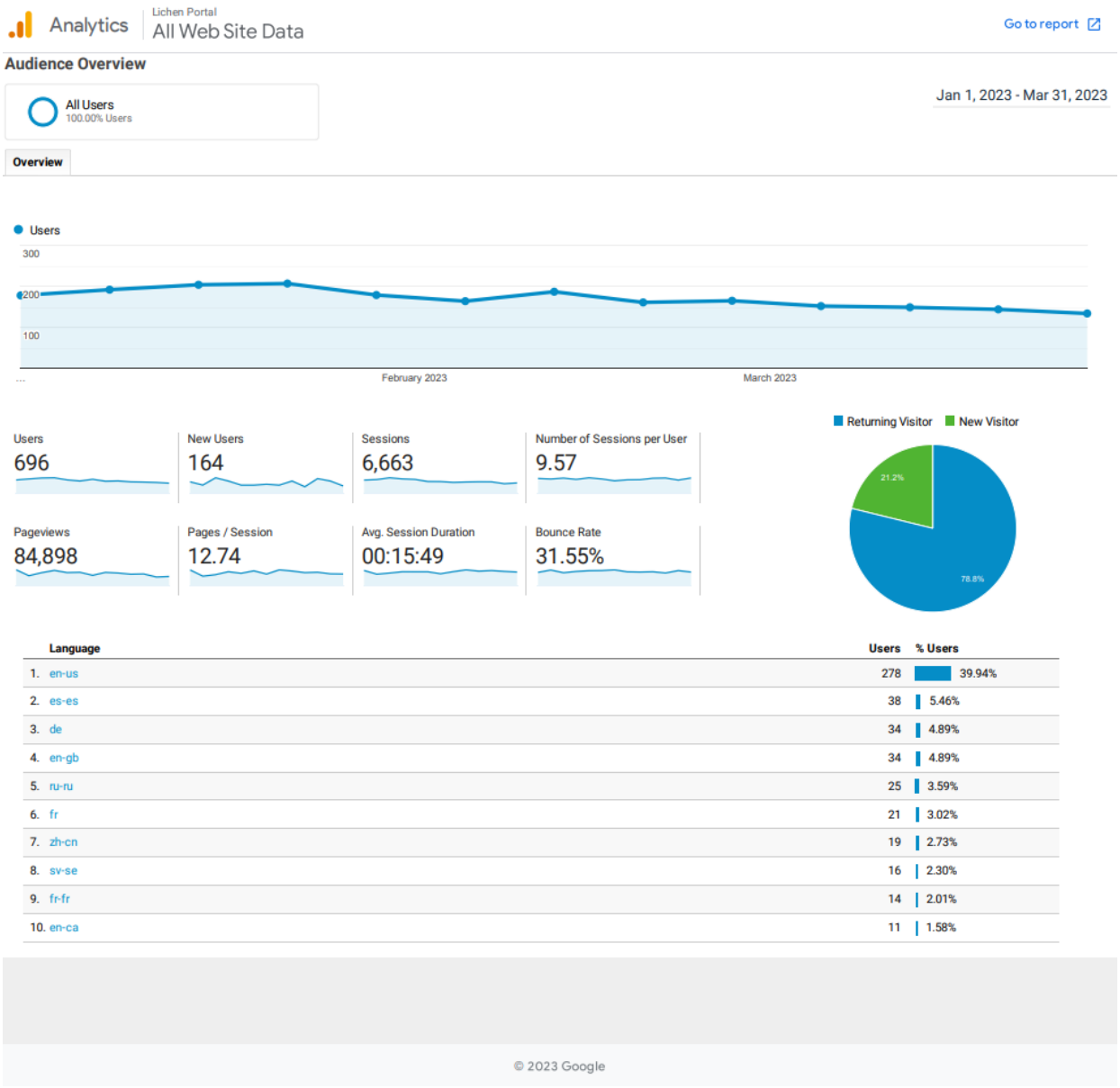


Figure 5: Use metrics for the Lichen Portal (https://lichenportal.org/cnalh/) from January 1-March 31, 2023.

Share Other Activities and/or Progress

Image Tagging

Progress continued at ASU on the character revision for tagging and identification keys. The glossary with 2,000+ terms is in the process of being linked to the key characters. Chemical characters have been revised and a program for the analysis of secondary metabolites can access this information directly from the portal.

GenBank Linking

A new tool developed by ILL & ILLS for downloading GenBank source modifiers is now available on the MyCoPortal: https://www.mycoportal.org/portal/tk/?/genbank.

TCN Quarterly Progress Report

Prior to each IAC meeting, TCNs are asked to complete a quarterly progress report in the areas outlined below. The TCN Lead PI or Project Manager collects information from all collaborators and compiles them into one overall progress report for the TCN. The TCN Lead PI or Project Manager then submits the quarterly reports via an email to Cat Chapman. An archive of previously submitted reports is available on the Internal Advisory Committee wiki page.:

TCN Names

SCAN: Digitization TCN: Collaborative Research: Southwest Collections of Arthropods Network (SCAN): A Model for Collections Digitization to Promote Taxonomic and Ecological Research

LepNet: Digitization TCN: Collaborative Research: Lepidoptera of North America Network: Documenting Diversity in the Largest Clade of Herbivores.

iDigBees: Collaborative Research: Digitization TCN: iDigBees Network, Towards Complete Digitization of US Bee Collections to Promote Ecological and Evolutionary Research in a Keystone Clade

Person Completing the Report
Neil Stanley Cobb (Lead PI)

Share Progress in Digitization Efforts

All three TCNs are still active and serve specimen records and images through the data portal SCAN (https://scan-bugs.org/portal/). Many museums are involved in one or more of these TCNs, including collections that have received direct funding from a TCN and collections that are unfunded and/or funded by the other sources. SCAN also serves arthropod data for InverteBase and Terrestrial Parasite Tracker TCN data. Results may include progress for the three Thematic Collections Networks (TCNs) SCAN, LepNet, and iDigBees, although for most reporting periods we will only show progress for iDigBees. Summary statistics presented here were compiled from data accessed on the SCAN portal, April 16, 2023.

Institution	April 16 2023 Total Specimen records	April 16 2023 Specimen georeferenced	April 16 2023 # of specimens imaged	April 16 2023 Specimen identified to species	% expectation - # Specimen Records	% of Records Georeferenced	% expectation - # Images	% Records identified to species	Total expectation - Total Specimen records	Total expectation - # of specimens for High-Res imaging	Total Expected Specimen records May 15, 2023	# of specimens expected for High-Res imaging May 15, 2023	per year records	per year images
American Museum of Natural History	0	0		0	0%	#DIV/0!		#DIV/0!	40,000	40,000	4,100	4,100	10,000	10,000
Brigham Young University	311	298		52	14%	96%		17%	22,440	850	2,300	87	5,610	213
Colorado State University	17,026	16,657	2,965	8,520	189%	98%	2127%	50%	87,778	1,360	8,997	139	21,945	340
Mississippi State University	8,720	3,748		5,728	394%	43%		66%	21,577	275	2,212	28	5,394	69
New Mexico State University	1,839	1,259		1,134	26%	68%		62%	16,999	0	6,970	0	4,250	0
North Carolina State University & RMBL	7,164	7,046		14	116%	98%		0%	60,500	0	6,201	0	15,125	0
Southeast Missouri State University	48	48		48	9%	100%		100%	5,000	375	513	38	1,250	94
University of Connecticut	6,395	0		5,391	236%	0%		84%	26,457	709	2,712	73	6,614	177
University of Kentucky	10,028	10,078		597	885%	100%		6%	11,050	170	1,133	17	2,763	43
University of Nebraska State Museum (UNSM)	0	0		0	0%	#DIV/0!		#DIV/0!	47,834	0	4,903	0	11,959	0
University of Wyoming	658	656		271	42%	100%		41%	15,300	0	1,568	0	3,825	0
Washington State University	0	0		0	0%	#DIV/0!		#DIV/0!	29,729	850	3,047	87	7,432	213
TOTAL or AVERAGE	52,189	39,790	3,544	21,756	217%	76%	127%	42%	384,664	44,589	24,042	2,787	96,166	11,147

Share Best Practices, Standards, and Lessons Learned

Colorado State video summary of digitization workflow https://youtu.be/fw-4nfsSiXg

Share Opportunities to Enhance Training Efforts

Share information here. You can also embed graphics if desired.

Share Collaborations with other TCNs, Institutions, and/or Organizations

iDigBees is actively collaborating with and sharing ideas with the Big-Bee TCN and the TPT TCN. The three TCNs have already shared workflows, scripts, and tips on imaging and digitizing specimens which will save iDigBees numerous hours in workflow development and troubleshooting. As both iDigBees and Big-Bee are focused on bee specimens, we plan to share both images and data produced from the two projects across multiple publicly accessible databases to increase accessibility. This includes integrating iDigBee partners into the Bee Library Symbiota portal and Big-Bee partners into the SCAN portal.

iDigBees is lending expertise to the USDA funded National Native Bee Monitoring RCN and co-PI Tucker co-organized the Native Bee Biodiversity Data Management Workshop which addressed topics relating to bee monitoring data preservation, management, best practices and standards, sharing, and contributor attribution (https://www.nativebeemonitoring.org/workshops). This will not only help develop better monitoring protocols, but also better standardize data collection methods which will hopefully lead to pre-digitization efforts and smoother incorporation of new collection data into both internal and shared databases.

iDigBees is actively working with the Wisconsin Statewide Community Science Project. Co-PI Tucker is co-managing the project and lending expertise. This project collects biological survey data (with a focus on insect pollinators, plants, and birds), while engaging with and providing

educational materials and activities for the public and community scientists. Citizen science data is largely collected via iNaturalist: https://www.inaturalist.org/projects/wisconsin-statewide-community-science.

Share Opportunities and Strategies for Sustainability

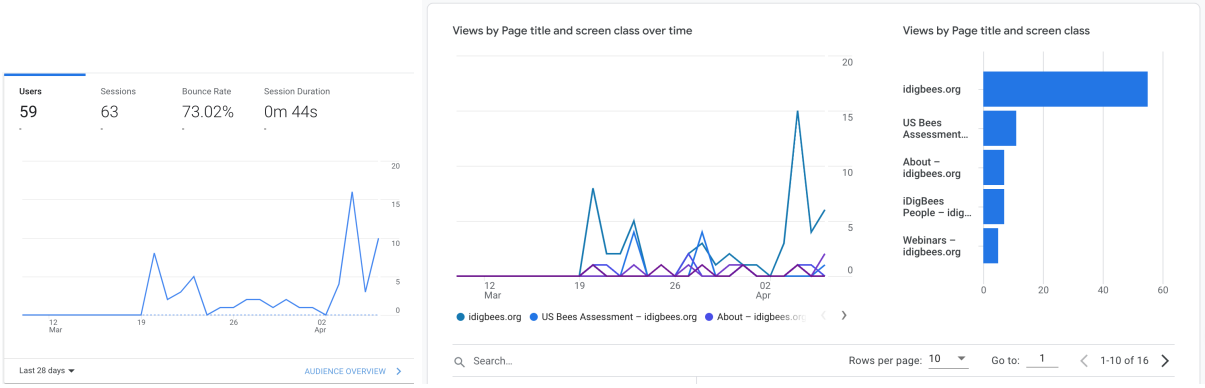
Share information here. You can also embed graphics if desired.

Share Education, Outreach, Diversity, & Inclusion (EODI) Activities

In collaboration with FLAAR, iDigBees has set up a new iNaturalist project to document the diversity of bees and wasps in Guatemala: https://www.inaturalist.org/projects/guatemalan-bee-project

Share Information About Your Website and/or Portal Usage

iDigBees set up Google Analytics for iDigBees.org mid March:



Share Other Activities and/or Progress

Share information here for things that do not fit into the above categories. You can also embed graphics if desired.

Publications:

- A globally synthesised and flagged bee occurrence dataset and cleaning workflow (2023). James B. Dorey, Paige R. Chesshire, Angela N. Bolaños, Robert L. O'Reilly, Silas Bossert, Shannon M. Collins, Elinor M. Lichtenberg, Erika M. Tucker, Allan Smith-Pardo, Armando Falcon-Brindis, Diego A. Guevara, Bruno Ribeiro, Diego de Pedro, Erica E.

Fischer, John Pickering, Keng-Lou James Hung, Katherine A. Parys, Lindsie M. McCabe, Matthew S. Rogan, Robert L. Minckley, Santiago J.E. Velazco, Terry Griswold, Tracy A. Zarrillo, Walter Jetz, Yanina V. Sica, Michael C. Orr, Laura Melissa Guzman, John A. Ascher, Alice C. Hughes, Neil S. Cobb. *Scientific Data: SUBMITTED*. Acknowledged DBI-2209978.

- Completeness analysis for over 3000 United States bee species identifies persistent data gaps (2022). Chesshire, P.R., Fischer, E.E, Dowdy, N.J., Griswold, T. Hughes, A.C., Orr, M.J., Ascher, J.S, Guzman, L.M., Hung, J.K.L., Cobb, N.S., McCabe, L.M. *Ecography:* doi https://doi.org/10.1111/ecog.06584. Acknowledged DBI-2209978.
- A century of sampling at an ecological preserve reveals declining diversity of wild bees (2023). Kelsey K. Graham, Paul Glaum, Joseph Hartert, Jason Gibbs, Erika Tucker, Rufus Isaacs, Fernanda S. Valdovinos. *bioRxiv: PREPRINT*. doi: 10.1101/2023.01.15.524123.

Presentations:

- SCAN (2023). Harp, C. *Native Bee Biodiversity Data Management Workshop:* 2023-03-28. https://www.youtube.com/watch?v=nTmrgCLbFFc
- Responsible Use of Museum Specimens & Their Data (2023). Tucker, E. M. *Native Bee Biodiversity Data Management Workshop:* 2023-03-30. https://www.youtube.com/watch?v=V2PvOmzSQrA

TCN Quarterly Progress Report

Prior to each IAC meeting, TCNs are asked to complete a quarterly progress report in the areas outlined below. The TCN Lead PI or Project Manager collects information from all collaborators and compiles them into one overall progress report for the TCN. The TCN Lead PI or Project Manager then submits the quarterly reports via an email to Cat Chapman. An archive of previously submitted reports is available on the Internal Advisory Committee wiki page.

TCN Name

TCN Name and short code, such as: Enhancing Access to Taxonomic and Biogeographical Data to Stem the Tide of Extinction of the Highly Imperiled Pacific Island Land Snails (PILSBRy)

Person Completing the Report

Name and role of the person completing the report, such as: Norine Yeung (Lead PI)

Share Progress in Digitization Efforts

Share information here. You can also embed graphics if desired.

Digitization Overview

- We have started the repatriation process, returning ~9,000 lots to the Field Museum for cleanup of data in their own database. We have started conversations with UMMZ and MCZ for repatriation. ANSP is currently missing key staff for repatriation of their data.
- Bishop Museum is in the process of transcribing the last of its literature – field notebooks. This requires a lot of time however and is unlikely to be finished, given the data is completely unstructured and OCR attempts have proven relatively unsuccessful.
- Georeferencing for the Hawaiian Islands continues, but is also unlikely to be completed given the large amount of data.
    - Current working islands are Maui (32% remaining), Oʻahu (80% remaining) and Kauaʻi (35% remaining),
    - Finished Hawaiian Islands are Niʻihau, Kahoʻolawe and Lānaʻi.
    - Molokaʻi (38% remaining) and Big Island (85% remaining) need to be assigned volunteers
- Georeferencing for the last three Pacific Island Groups – Cook Islands, Samoa, and Tuvalu continues.

Share Best Practices, Standards, and Lessons Learned

Share information here. You can also embed graphics if desired.

Same as previous report

Share Identified Gaps in Digitization Areas and Technology

Share information here. You can also embed graphics if desired.

- Though we have standards for specimen sharing (e.g. DarwinCore), this is only marginally helpful for repatriation into other structured databases. Collections databases are often very different from each other and though we can share back the cleaned data in DarwinCore format, this may result in extra work for collections managers to actually repatriate that into differently structured fields if the database itself is relational or does not conform to DarwinCore.

Share Opportunities to Enhance Training Efforts

Share information here. You can also embed graphics if desired.

- Interns have developed species profiles that contain conservation status, latin name, distribution, and short trivia facts. These have been shared on Facebook and Twitter

Share Collaborations with other TCNs, Institutions, and/or Organizations

Share information here. You can also embed graphics if desired.

- We are continuing to provide updated historical and current distribution of species for conservation managers.

Share Opportunities and Strategies for Sustainability
Share information here. You can also embed graphics if desired.

Share Education, Outreach, Diversity, & Inclusion (EODI) Activities

Share information here. You can also embed graphics if desired.

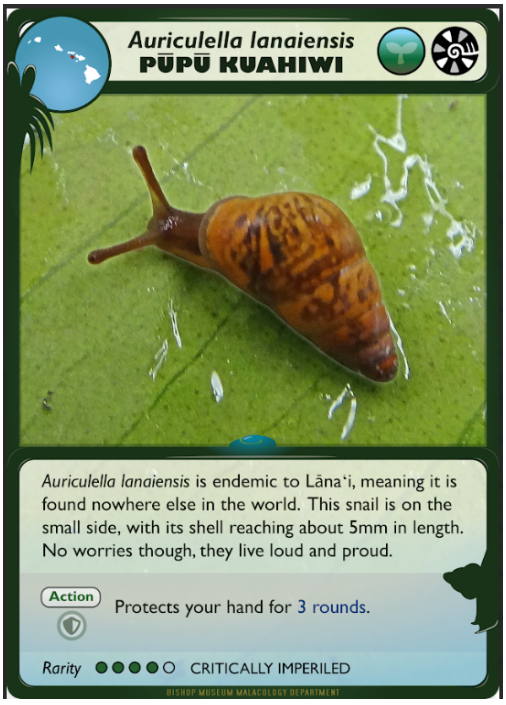
Share Information About Your Website and/or Portal Usage

Share information here. You can also embed graphics if desired, such as from Google Analytics.

Share Other Activities and/or Progress

Share information here for things that do not fit into the above categories. You can also embed graphics if desired.

We have developed TCG cards to raise awareness and appreciation for snails. We have been working with the state to do so also and was able to get the governor to declare this year as the Year of the Kahuli. Kahuli is one of the Hawaiian words for land snail. Out interns developed a banner for our emails.



TCN Quarterly Progress Report

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TCN Name

Using Herbarium Data to Document Plant Niches in the High Peaks and High Plains of the Southern Rockies - Past, Present, and Future (SoRo)

Person Completing the Report

J Ryan Allen Project Manager

Share Progress in Digitization Efforts

Most digitization efforts for the project have finished. Collectively for the current quarter roughly February-April 2023 we have entered 1,302 new records into databases, barcoded 302 new specimens, imaged 797 new specimens and georeferenced 1,470 new records.

Our overall project totals are: 491,064 new database records, 1,028,932 newly barcoded specimens, 1,061,032 new images and 512,688 new georeferences.
The project after ~68 months (out of 48) has completed.
Data Entry 89.0%
Barcodes 118.4%
Images 123.9%
Georeferencing 83.2%

The SoRo TCN requested a second no-cost extension to finish the project and the project has been extended to 8/2023. Most collections have finished digitizing or will finish during the next quarter. The focus of the second no cost extension will be website upgrades and consortium wide georeferencing.

Share Best Practices, Standards, and Lessons Learned

Nothing to report

Share Identified Gaps in Digitization Areas and Technology

CSCN: The major focus of this last period is to get our remaining image files available online and to connect and correct existing Specify database records to images, as well as completing data entry for our legacy vasculars. We have about 1000 specimens left to enter at this point. We currently have 40,738 database entries tied to images or close to 75% of our total records, of which 38,237 have been corrected. Most of the remaining CSCN images have been processed and images should be uploaded by the end of May.

Share Opportunities to Enhance Training Efforts

Nothing to report

Share Collaborations with other TCNs, Institutions, and/or Organizations

COLO: is also on the GLOBAL TCN and All-Asia TCN, we have been sharing resources and tips from the SoRo TCN to help the project.

HUH, NYBG, RSA, BRU and COLO are all members of the All-Asia TCN and we hope to apply lessons learned in this project to the new TCN.

Share Opportunities and Strategies for Sustainability

COLO: We are continuing to work with collections that do not have an institutional backup in place to store and archive a JPG version of the images captured under the project. Our goal was to get local backups in place at all institutions if possible. Where needed, these images will be stored on CU research computing along with the data generated at CU for this and other digitization projects.

Share Education, Outreach, Diversity, & Inclusion (EODI) Activities

Nothing to report

Share Information About Your Website and/or Portal Usage

Google Analytics
This Quarter (February 1st 202-April 30th 2023) had 12 users over 215 sessions and 20,010 pageviews.

Last Quarter (November 1st 2022-January 31st 2023) had 20 users over 154 sessions and 12,763 pageviews.

We saw a significant decline in usage on the site the past two quarters. New security measures to help prevent bot accounts and web injection via checklists seem to be working, but I have trouble believing we only had 12 unique users for the quarter. Some of this could be from multiple users accessing the site from the same computer (i.e. a work computer in a collection) so that several people are showing up as the same user. We suspect that most of the data use is still through the primary SEINet portal. COLO should be updating its Symbiota instance for its institutional database this year and it will be interesting to see if we have a similar decline in number of users.

Share Other Activities and/or Progress

Most of the collections on the project have now exhausted funding. Three of the four collaborative awards (HUH, NY and RM) have finished digitization and have submitted their final report as has the RSA PEN awar. All of the subawards are now closed on the COLO budget. We are currently evaluating the residual funds left after the subawards were closed along with the remaining COLO budget. Remaining funds will mostly be dedicated be working on upgrades to the soroherbaria web portal and making sure all project data and images are available in the SoRo portal. We will devote any remaining funds to georeferencing and data entry.

TCN Quarterly Progress Report

TORCH TCN – Quarterly Report

Reporting Period: February 1st, 2023 - April 30th, 2023

Assembled at BRIT on May 2nd, 2023, for May 3rd IAC meeting

TCN Name

American Crossroads: Digitizing the Vascular Flora of the South-Central United States
(Short name: TORCH TCN)

Person Completing the Report

Diego Barroso, TORCH TCN Project and Data Manager <dbarroso@brit.org>

Institutions Reporting

BAYLU – Baylor University
BRIT – Botanical Research Institute of Texas
MO – Missouri Botanical Garden
OKL – University of Oklahoma
OKLA – Oklahoma State University
SHST – Sam Houston State University
TAES – Texas A&M University-College Station
TEX-LL – University of Texas at Austin

Institutions that have completed their contribution to the TORCH TCN and/or have depleted their funding under this grant:

HUH – Harvard University
KANU – University of Kansas
NOSU – Northeastern State University
NY – New York Botanical Garden
TAMUCC – Texas A&M University-Corpus Christi
TTC – Texas Tech University
UTEP – University of Texas at El Paso

Share Progress in Digitization Efforts

Progress in Digitization Efforts:

BRIT notes: Digitization numbers were pulled for the period encompassing January 24th to April 24th; all other BRIT reporting is for February 1st through May 3rd.

- Number of skeletal records created:

BAYLU =	0
BRIT =	0
MO =	3,044
OKL =	0
OKLA =	36 (23,235 cumulative)
SHST =	N/A [24,168 cumulative]
TAES =	0

TEX-LL (including Data-Provider Institutions) =

University of Texas at Austin (TEX-LL)	0
Angelo State University (SAT)	0
Fort Worth Nature Center (FWNC)	0 (completed)
Howard Payne University (HPC)	0
Johnson Wildflower Center (JWC)	0 (completed)
Our Lady of the Lake University (LLC)	0
Saint Edward's University (SEU)	0 (completed)
Sul Ross State University (SRSC)	45
Texas Lutheran University (TLU)	0
Texas State University (SWT)	0
UT Rio Grande Valley-Edinburg (PAUH)	0
University of Houston Coastal Center (UHCC)	0
TEX-LL Sub-Total	45

Total skeletal records created this quarter by 8 reporting institutions: 3,125

- Number of fully-transcribed records created:

BAYLU = 5,027

BRIT = 12,876 (2,323 staff transcriptions + 10,553 transcriptions by volunteers via Symbiota crowdsourcing)

MO = 57

OKL = 9

OKLA = 1,200 (23,199 cumulative)

SHST = N/A [26,868 cumulative (Plus or minus identified duplicates of found records of no more than 200)]

TAES = 0

TEX-LL (including Data-Provider Institutions) =

University of Texas at Austin (TEX-LL)	1,405
Angelo State University (SAT)	0
Fort Worth Nature Center (FWNC)	0 (completed)
Howard Payne University (HPC)	71
Johnson Wildflower Center (JWC)	0 (completed)
Our Lady of the Lake University (LLC)	0
Saint Edward's University (SEU)	0 (completed)
Sul Ross State University (SRSC)	300
Texas Lutheran University (TLU)	50
Texas State University (SWT)	0
UT Rio Grande Valley-Edinburg (PAUH)	2
University of Houston Coastal Center (UHCC)	0
TEX-LL Sub-Total	1,828

Total fully-transcribed records created this quarter by 8 reporting institutions: 20,977

- Number of specimens imaged:

BAYLU = 40

BRIT = 1,782 (1,100 TCSW + 682 BRIT-SMU-VDB)

MO = 3,044

OKL = 6,831 (1,709 OKL + 5,122 (OCLA, University of Science and Arts of Oklahoma)

OKLA = 2,112 (853 OKLA (77,810 cumulative) + 1,259 at Cameron University)

SHST = N/A [24,168 cumulative]

TAES = 10,000

TEX-LL (including Data-Provider Institutions) =

University of Texas at Austin (TEX-LL)	12,059	
Angelo State University (SAT)	0	
Fort Worth Nature Center (FWNC)	0	(completed)
Howard Payne University (HPC)	2,129	
Johnson Wildflower Center (JWC)	0	(completed)
Our Lady of the Lake University (LLC)	0	
Saint Edward's University (SEU)	0	(completed)
Sul Ross State University (SRSC)	370	
Texas Lutheran University (TLU)	0	
Texas State University (SWT)	0	
UT Rio Grande Valley-Edinburg (PAUH)	0	
University of Houston Coastal Center (UHCC)	0	
TEX-LL Sub-Total	14,558	

Total number of specimens imaged this quarter by 8 reporting institutions: 38,367

- Number of specimens georeferenced:

BAYLU = 2,389

BRIT = 0

MO = 20

OKL = 0

OKLA = 1,602 (13,275 total)

SHST = 350

TAES = 0

TEX-LL (including Data-Provider Institutions) =

University of Texas at Austin (TEX-LL)	730
Angelo State University (SAT)	0
Fort Worth Nature Center (FWNC)	0 (completed)
Howard Payne University (HPC)	12
Johnson Wildflower Center (JWC)	0 (completed)
Our Lady of the Lake University (LLC)	0
Saint Edward's University (SEU)	0 (completed)
Sul Ross State University (SRSC)	113
Texas Lutheran University (TLU)	41
Texas State University (SWT)	0
UT Rio Grande Valley-Edinburg (PAUH)	164
University of Houston Coastal Center (UHCC)	0
TEX-LL Sub-Total	1,060

Total number of specimens georeferenced this quarter by 8 reporting institutions: 5,421

- Other digitization or pre-digitization efforts:

BAYLU: Approximately 150 specimens mounted and labeled, awaiting imaging.

BRIT: Completed the pre-digitization curation of the Texas Woman's University Herbarium collection (Herbarium Code TCSW), on loan to BRIT for digitization by BRIT Herbarium Assistant Kimberlie Sasan. Began imaging this collection.

19 volunteers transcribing Texas records through Symbiota's Crowdsourcing module.

TAES: We have been uploading many images to TACC, and are continuing to link accession numbers to barcode numbers (in order to link pre-existing occurrence records with their corresponding specimen image).

TEX-LL: We have ceased separate tracking of our digitization efforts for UT Rio Grande Valley – Brownsville (RUNYON) for purposes of this grant because its merger into TEX is now complete. Its holdings are being incorporated into the TEX-LL workflow and reporting.

All other institutions: Nothing new to report.

- Comments about the digitization process:

MO: Staff at MO have been focusing on completing specimens for the Endless Forms and Pteridophytes TCNs, both of which are coming to the end of no-cost extensions. Once these are finished, the TORCH project will be one of the top priorities for the collection.

OKL: We are making a big imaging push now, instead of databasing as we go.

OKLA: Imaging at Cameron University commenced.

SHST: Digitization soon to be completed.

TAES: We are migrating our local data from a server to Sharepoint. The advantages of this move include better connectivity, faster processing, and more streamlined backup services. However, the transition is causing some delays as we optimize an updated pipeline.

TEX-LL: We are still behind our schedule due to the earlier COVID shutdown, which was exacerbated by the slow recovery of in-person efforts and the occasional student worker who becomes infected and misses a week or more of work.

We are also continuing to experience slower than expected progress with a few of our data provider institutions (who are doing their own digitization), notably Howard Payne (HPC) and Sul Ross (SRSC).

We finished barcoding and imaging nearly all of the specimens from Texas Lutheran University (TLU) and UT Rio Grande Valley–Edinburg (PAUH), and are working on associating the images with their records in Symbiota. We have started to image specimens from Texas State University (SWT) and have finished imaging for the University of Houston Coastal Center (UHCC).

We have borrowed the first set of specimens from Our Lady of the Lake (LLC) and will begin the digitization process on them soon. We will be starting on Sul Ross in May as well, as we have finally received permission to begin borrowing their specimens.

We have begun to incorporate the georeferencing data mass-developed by the Symbiota Support Hub (utilizing duplicate-matching) into our database.

We are discovering, based on our imaging efforts, that the number of specimens reported in the original proposal table for Texas Lutheran University (TLU) was an underestimate, and a significant number of sheets previously had not been transcribed into Symbiota. Thus, the task of completing records from this data provider institution will take longer than expected.

We have also discovered multiple duplicate records in the Symbiota portal for UT Rio Grande–Edinburg (PAUH) that were likely created as a result of user error during the data entry process, spanning around 400 catalog numbers. We have started assessing and removing excess records. Despite this reduction, the original estimate from that herbarium was still *ca*. 1,000 sheets less than we have actually imaged.

For TEX and LL holdings of Oklahoma specimens, we have discovered a gross clerical error. The number of Oklahoma-collected specimens in the original grant proposal was listed as 90,000, but it should have been 9,000. We have completed data entry and imaging of Oklahoma specimens and the actual number total turned out to be 9,633. Thus, in the original proposal an extra zero was added accidentally, resulting in a gross overestimate of the number of specimens in the Oklahoma category, which also caused the estimates in other categories to become artificially inflated. This has been offset by the extra labor of adding three additional data provider institutions to our workload and the underestimates of specimen numbers at most of our assigned data providers.

All other institutions: Nothing new to report.

- Number of records available in iDigBio portal (cumulative):

  BAYLU = N/A

  BRIT = Searched all collections on April 24th, 2023 (search parameters: Kingdom=Plantae, and collected in Texas or Oklahoma):

BRIT-SMU-VDB-NLU:	187,820
TAC:	7,064
NTSC:	0
ACU:	0
HSU:	0
TCSW:	0
BCNWR:	0

  Sub-Total for BRIT Lead = 194,884

MO = N/A

OKL = 0

OKLA = 0

SHST = 0 [Searched all collections on April 1st 2023. All data is in DiscoverLife through John Pickering, and assumed that iDigBio would pick-up the records through their regular data-swapping.]

TAES = N/A

TEX-LL, Subawards, and Data Providers =

University of Texas at Austin (TEX-LL)	211,143*
Angelo State University (SAT)	0
Fort Worth Nature Center (FWNC)	0
Howard Payne University (HPC)	22,910
Johnson Wildflower Center (JWC)	0
Our Lady of the Lake University (LLC)	0
Saint Edward's University (SEU)	0
Sul Ross State University (SRSC)	0
Texas Lutheran University (TLU)	8,424
Texas State University (SWT)	0
UT Rio Grande Valley-Edinburg (PAUH)	0
University of Houston Coastal Center (UHCC)	0
TEX-LL Sub-Total	242,477

*The number of records for TEX-LL mysteriously differs from the previously reported values (fewer records now than previously). We do not know exactly why this is, but it seems to have happened at the iDigBio end.

Total number of records in iDigBio portal (cumulative) from 8 reporting institutions: 437,361

- Number of records available in TORCH Symbiota portal (cumulative):

BAYLU = 50,665

BRIT = Searched TORCH Portal on April 24th for geographic distributions within each collection profile, without taxonomic restraints, and collected in Texas or Oklahoma:

BRIT-SMU-VDB-NLU:	214,461
TAC:	7,029
NTSC:	11,324
ACU:	3,747
HSU:	3,965
TCSW:	0
BCNWR:	1,555

Sub-Total for BRIT Lead = 242,081

MO = N/A

OKL = 139,911 [138,861 (OKL) + 1,050 (OCU, Oklahoma City University)]

OKLA = 77,484 Texas and Oklahoma records (80,005 total)

SHST = 0

TAES = 238,835

TEX-LL, Subawards, and Data Providers =

University of Texas at Austin (TEX-LL)	243,036
Angelo State University (SAT)	39,044
Fort Worth Nature Center (FWNC)	1,918 (completed)
Howard Payne University (HPC)	22,920
Johnson Wildflower Center (JWC)	3,304 (completed)
Our Lady of the Lake University (LLC)	0
Saint Edward's University (SEU)	6,326 (completed)
Sul Ross State University (SRSC)	32,100
Texas Lutheran University (TLU)	8,474
Texas State University (SWT)	0
UT Rio Grande Valley-Edinburg (PAUH)	7,002**
University of Houston Coastal Center (UHCC)	779

TEX-LL Sub-Total 364,903

**The number of records for PAUH is less than previously reported due to substantial data cleaning through duplicate removal and re-association of images with records.

Total number of records available in TORCH Symbiota Portal (cumulative) from 8 reporting institutions: 1,113,879

Share Best Practices, Standards, and Lessons Learned

OKLA: Georeferencing standards are being revised.

All other institutions: Nothing new to report.

Share Identified Gaps in Digitization Areas and Technology

OKLA: Need segmentation/OCR of accession stamp to link existing database records to images as they are obtained—this may not be feasible and manual accession number entry may be needed. Work is in progress at BRIT to solve this.

SHST: Newly found duplicate specimens, delaying digitization and imaging.

TEX-LL: We are still trying to develop a workflow to allow uploading of records from some of our data provider herbaria into iDigBio. Hopefully, workflows will be developed to permit this to happen directly from SEINet, where the records currently reside.

At Angelo State University (SAT), the faculty curator retired in May 2022 and the staff collections manager left for a different job at around the same time. Thus, there has been no new activity at this data provider institution during the quarter. Apparently the start date of a new curator has been delayed by immigration issues of a foreign candidate, and the collections manager position will not be filled until the curator has started.

In-house progress at Howard Payne University (HPC) has been glacially slow because of a chronic lack of student help. TEX-LL has started borrowing portions of that collection to image at its facility in an effort to accelerate progress. Our colleagues at BRIT may help with further off-site imaging in the future, time permitting.

The faculty curator of the herbarium at Our Lady of the Lake (LLC) has accepted a position at another university, and thus is leaving at the conclusion of the spring semester. We recently traveled to that institution to pick up the first set of specimens, and will likely need to take another few trips to complete their herbarium. We have an active contact in the department there to facilitate this process in the future.

All other institutions: Nothing new to report.

Share Opportunities to Enhance Training Efforts

BAYLU: Ran an online georeferencing seminar (30 minutes) with three student workers.

BRIT: TORCH Staff participated in Symbiota Support Hub meetings.

OKLA:
Trained one new community member in geoferencing.
Trained six undergraduate assistants in georeferencing.
Trained two new undergraduate assistants in imaging at Cameron University.

SHST:
Learned about Orchids from Joe Liggio.
Offered additional weekly trainings on barcoding, imaging, and digitizing.
Organizing more volunteers.

TEX-LL: Lauren Hoff and student intern Tammy Huynh attended the "*Whirlwind Tour of California Herbaria*", a virtual tour of five herbaria across the state hosted by the California Consortium of Herbaria, as representatives of the Billie L. Turner Plant Resources Center.

All other institutions: Nothing new to report.

Share Collaborations with other TCNs, Institutions, and/or Organizations

During this reporting period, the TORCH TCN Project held two virtual Executive Committee meetings, on February 23rd and March 31st, 2023.

BRIT: Collaborating with TORCH Steering committee for organization of 2023 TORCH annual meeting, to be held in August 2023 in conjunction with the Texas Plant Conservation Conference (TPCC).

TEX-LL: Image files for the TORCH project continue to be housed at the Texas Advanced Computing Center (TACC), which also is the source of a part-time data manager at TEX-LL.

All other institutions: Nothing new to report.

Share Opportunities and Strategies for Sustainability

All institutions: Nothing new to report.

Share Education, Outreach, Diversity, & Inclusion (EODI) Activities

Methods of disseminating results to communities of interest (presentations, lectures, etc.):

All institutions: Nothing new to report.

Other Education and Outreach activities:

BAYLU: Modern Biosciences course (BIO 1306) led by Ms. Melissa Mullins at Baylor used the TORCH Symbiota Portal database and class visits to the herbarium to help discovery and to understand the use and functioning of the herbarium.

BRIT: Hosted three Zoom presentations with the Armchair Botanist program, to engage FWBG volunteers transcribing project specimens, and advertised to the general public: 1) the February 9th, 2023, Armchair Botanist Forum: "*Plant Phenology: How Herbarium Specimens can Inform of us Nature's Seasonal Changes*" (https://fwbg.org/events/plant-phenology/; 15 attendees); 2) the March 9th, 2023, Armchair Botanist Forum: "*March Madness - Carnivorous & Parasitic Plants of Texas*" (https://fwbg.org/events/march-madness/ ; 12 attendees); and 3) the April 13th, 2023, Armchair Botanist Forum: "*From Pressed Plant to Pixels*" (https://fwbg.org/events/wedigbio-2023/ ; 9 attendees).

WeDigBio (April 2023): 626 records transcribed.

Hosted in-person event for FWBG volunteers (April 15th, 2023) and *From Pressed Plants to Pixels*: Two ways (community) scientists document plant diversity to discuss how TORCH and iNaturalist are documenting our flora (9 attendees).

Outreach table at the Fort Worth Nature Center & Refuge's NatureCon(servation) public event, discussing how TORCH is digitizing herbarium specimens that document the local flora (TORCH specimens from this location were showcased; talked with 65 individuals).

Abstract submitted and accepted for May 2nd, 2023, presentation: "*Armchair Botanist: Mapping the Plants of Texas*" for the May 2023 Texas Master Naturalist Virtual Volunteer Fair, showcasing this community science project to this engaged plant-enthusiast state-wide organization (attendance numbers will be reported next quarter).

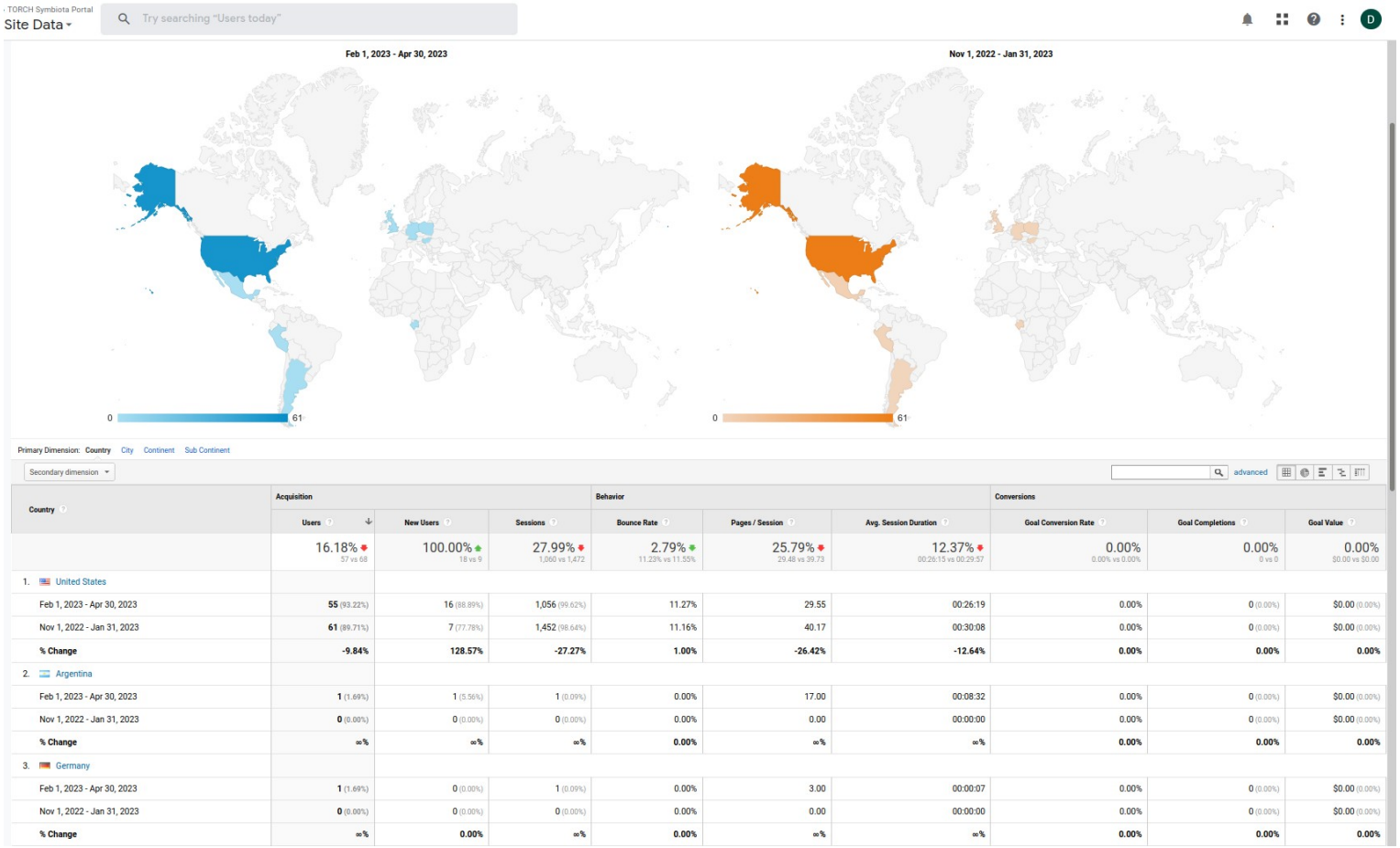
TEX-LL: We gave herbarium tours to two biology classes that included information on the TORCH digitization activities. In-person tours continue to recover from disruptions caused during the pandemic. Some of the students from these tours expressed an interest in working at the Plant Resources Center.

We provided a tour for two drawing classes in the UT Fine Arts program, and allowed students to use specimens in our facility for an exercise in learning to draw natural history objects.

All other institutions: Nothing new to report.

Share Information About Your Website and/or Portal Usage

Users by country, Feb. 1st , 2023 – April 30th , 2023, vs. previous quarter

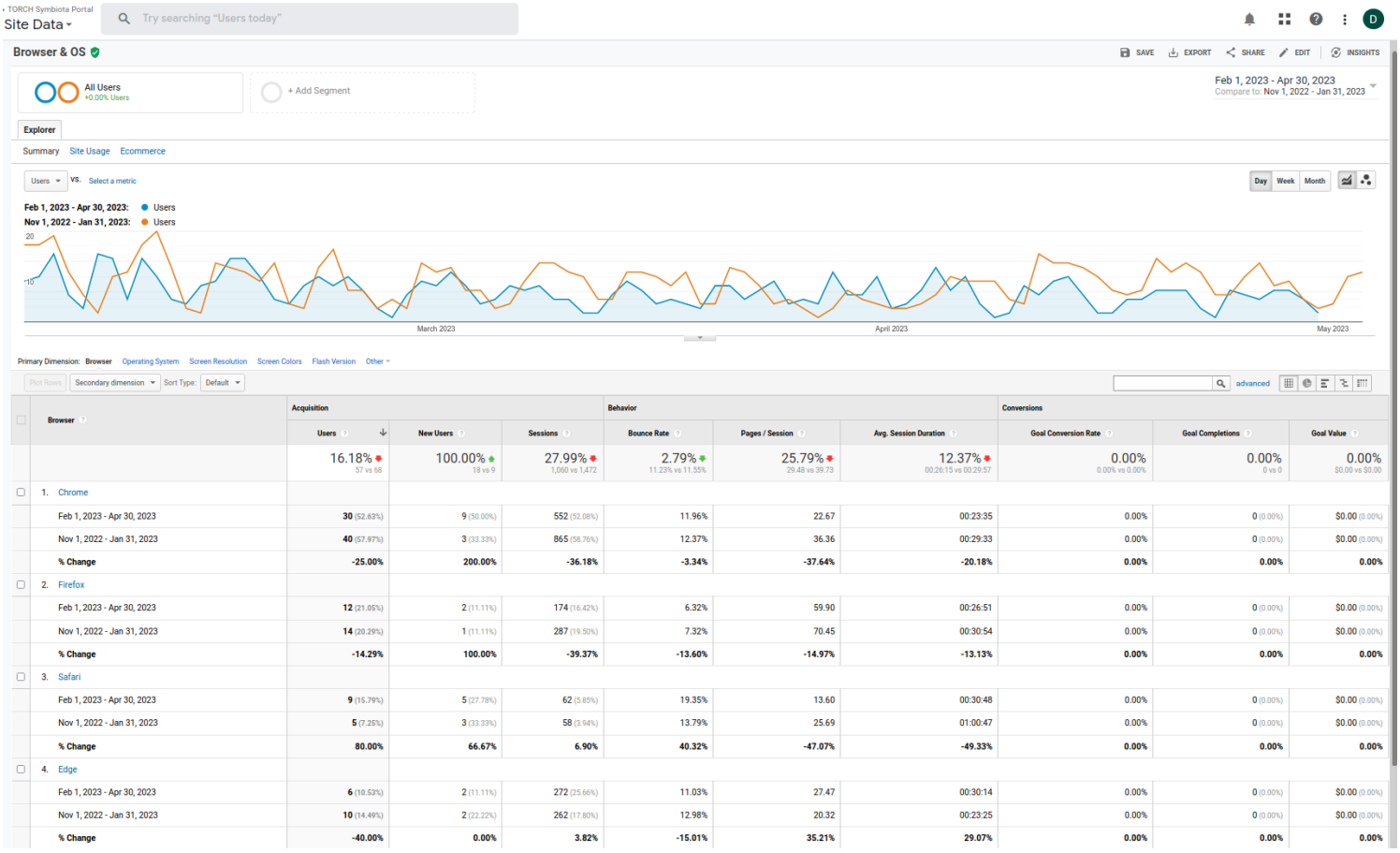


Primary Dimension: Country City Continent Sub Continent

Secondary dimension | advanced

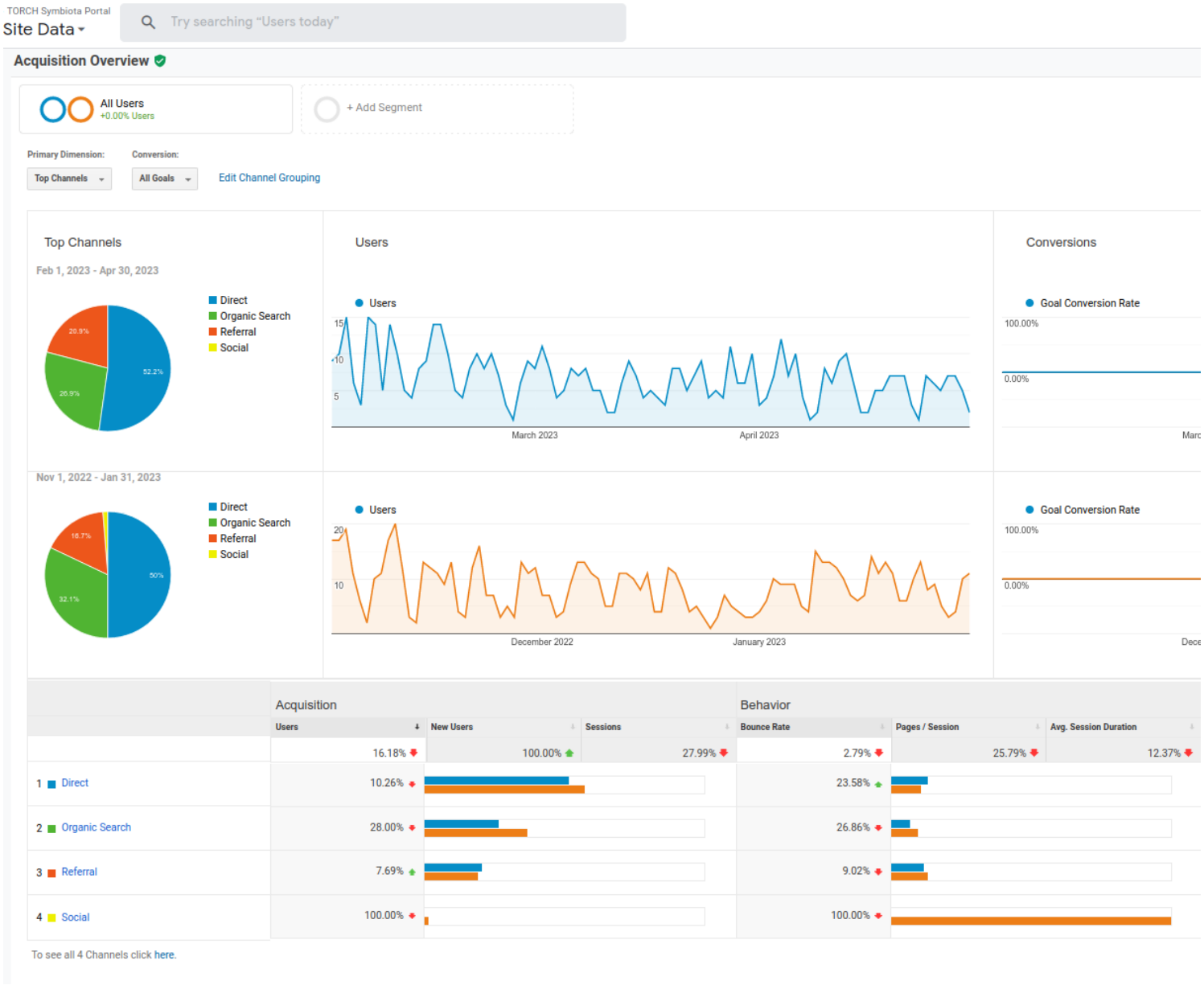
Country	Acquisition			Behavior			Conversions		
	Users	New Users	Sessions	Bounce Rate	Pages / Session	Avg. Session Duration	Goal Conversion Rate	Goal Completions	Goal Value
	16.18% 57 vs 68	100.00% 18 vs 9	27.99% 1,060 vs 1,472	2.79% 11.23% vs 11.55%	25.79% 29.48 vs 39.73	12.37% 00:26:15 vs 00:29:57	0.00% 0.00% vs 0.00%	0.00% 0 vs 0	0.00% $0.00 vs $0.00
1. United States									
Feb 1, 2023 - Apr 30, 2023	55 (93.22%)	16 (88.89%)	1,056 (99.62%)	11.27%	29.55	00:26:19	0.00%	0 (0.00%)	$0.00 (0.00%)
Nov 1, 2022 - Jan 31, 2023	61 (89.71%)	7 (77.78%)	1,452 (98.64%)	11.16%	40.17	00:30:08	0.00%	0 (0.00%)	$0.00 (0.00%)
% Change	-9.84%	128.57%	-27.27%	1.00%	-26.42%	-12.64%	0.00%	0.00%	0.00%
2. Argentina									
Feb 1, 2023 - Apr 30, 2023	1 (1.69%)	1 (5.56%)	1 (0.09%)	0.00%	17.00	00:08:32	0.00%	0 (0.00%)	$0.00 (0.00%)
Nov 1, 2022 - Jan 31, 2023	0 (0.00%)	0 (0.00%)	0 (0.00%)	0.00%	0.00	00:00:00	0.00%	0 (0.00%)	$0.00 (0.00%)
% Change	∞%	∞%	∞%	0.00%	∞%	∞%	0.00%	0.00%	0.00%
3. Germany									
Feb 1, 2023 - Apr 30, 2023	1 (1.69%)	0 (0.00%)	1 (0.09%)	0.00%	3.00	00:00:07	0.00%	0 (0.00%)	$0.00 (0.00%)
Nov 1, 2022 - Jan 31, 2023	0 (0.00%)	0 (0.00%)	0 (0.00%)	0.00%	0.00	00:00:00	0.00%	0 (0.00%)	$0.00 (0.00%)
% Change	∞%	0.00%	∞%	0.00%	∞%	∞%	0.00%	0.00%	0.00%

Sessions by Browser and Operating System, vs. previous quarter.

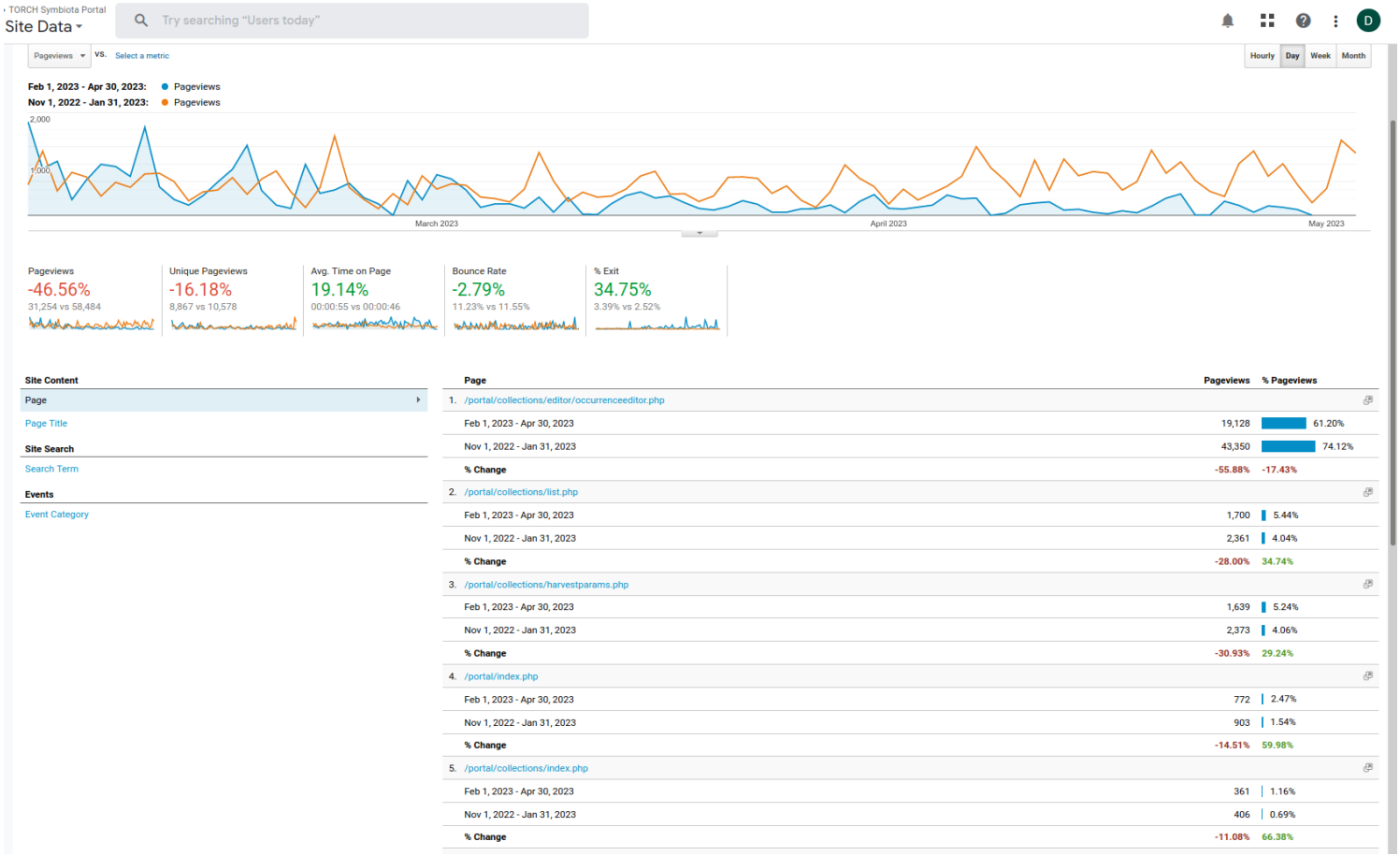


Browser	Acquisition			Behavior			Conversions		
	Users	New Users	Sessions	Bounce Rate	Pages / Session	Avg. Session Duration	Goal Conversion Rate	Goal Completions	Goal Value
	16.18% ↓ 57 vs 68	100.00% ↑ 18 vs 9	27.99% ↓ 1,060 vs 1,472	2.79% ↑ 11.23% vs 11.55%	25.79% ↓ 29.48 vs 39.73	12.37% ↓ 00:26:15 vs 00:29:57	0.00% 0.00% vs 0.00%	0.00% 0 vs 0	0.00% $0.00 vs $0.00
1. Chrome									
Feb 1, 2023 - Apr 30, 2023	30 (52.63%)	9 (50.00%)	552 (52.08%)	11.96%	22.67	00:23:35	0.00%	0 (0.00%)	$0.00 (0.00%)
Nov 1, 2022 - Jan 31, 2023	40 (57.97%)	3 (33.33%)	865 (58.76%)	12.37%	36.36	00:29:33	0.00%	0 (0.00%)	$0.00 (0.00%)
% Change	-25.00%	200.00%	-36.18%	-3.34%	-37.64%	-20.18%	0.00%	0.00%	0.00%
2. Firefox									
Feb 1, 2023 - Apr 30, 2023	12 (21.05%)	2 (11.11%)	174 (16.42%)	6.32%	59.90	00:26:51	0.00%	0 (0.00%)	$0.00 (0.00%)
Nov 1, 2022 - Jan 31, 2023	14 (20.29%)	1 (11.11%)	287 (19.50%)	7.32%	70.45	00:30:54	0.00%	0 (0.00%)	$0.00 (0.00%)
% Change	-14.29%	100.00%	-39.37%	-13.60%	-14.97%	-13.13%	0.00%	0.00%	0.00%
3. Safari									
Feb 1, 2023 - Apr 30, 2023	9 (15.79%)	5 (27.78%)	62 (5.85%)	19.35%	13.60	00:30:48	0.00%	0 (0.00%)	$0.00 (0.00%)
Nov 1, 2022 - Jan 31, 2023	5 (7.25%)	3 (33.33%)	58 (3.94%)	13.79%	25.69	01:00:47	0.00%	0 (0.00%)	$0.00 (0.00%)
% Change	80.00%	66.67%	6.90%	40.32%	-47.07%	-49.33%	0.00%	0.00%	0.00%
4. Edge									
Feb 1, 2023 - Apr 30, 2023	6 (10.53%)	2 (11.11%)	272 (25.66%)	11.03%	27.47	00:30:14	0.00%	0 (0.00%)	$0.00 (0.00%)
Nov 1, 2022 - Jan 31, 2023	10 (14.49%)	2 (22.22%)	262 (17.80%)	12.98%	20.32	00:23:25	0.00%	0 (0.00%)	$0.00 (0.00%)
% Change	-40.00%	0.00%	3.82%	-15.01%	35.21%	29.07%	0.00%	0.00%	0.00%

How Users are Acquired, vs. previous quarter



Pageviews by URL, vs. previous quarter



Page	Pageviews	% Pageviews
1. /portal/collections/editor/occurrenceeditor.php		
Feb 1, 2023 - Apr 30, 2023	19,128	61.20%
Nov 1, 2022 - Jan 31, 2023	43,350	74.12%
% Change	-55.88%	-17.43%
2. /portal/collections/list.php		
Feb 1, 2023 - Apr 30, 2023	1,700	5.44%
Nov 1, 2022 - Jan 31, 2023	2,361	4.04%
% Change	-28.00%	34.74%
3. /portal/collections/harvestparams.php		
Feb 1, 2023 - Apr 30, 2023	1,639	5.24%
Nov 1, 2022 - Jan 31, 2023	2,373	4.06%
% Change	-30.93%	29.24%
4. /portal/index.php		
Feb 1, 2023 - Apr 30, 2023	772	2.47%
Nov 1, 2022 - Jan 31, 2023	903	1.54%
% Change	-14.51%	59.98%
5. /portal/collections/index.php		
Feb 1, 2023 - Apr 30, 2023	361	1.16%
Nov 1, 2022 - Jan 31, 2023	406	0.69%
% Change	-11.08%	66.38%

Share Other Activities and/or Progress

Products generated (publications, conference presentations, technologies/techniques, websites, etc.):

OKLA: Presentation at OSU Undergraduate Research Symposium, April 2023, by Taylor Nickles.

SHST: Working on a publication.

All other institutions: Nothing new to report.

Participants (especially those who have newly joined the project):

BAYLU:
Undergraduate student transcribers:
Andy Conley
Anna Claire Brewer
Anayah Akita
Crystal Phi

Technician: Albert Zertuche

BRIT:

Ashley Bordelon, Herbarium Collections Manager; abordelon@brit.org
Diego Barroso, TORCH TCN Project and Data Manager; dbarroso@brit.org
Tiana Rehman, BRIT Herbarium Director/Institutional Rep; trehman@brit.org
Jason Best, Dir. Biodiv. Informatics/Technological Innovator; jbest@brit.org
Peter Fritsch, VP of Research/PI; pfritsch@brit.org
Jessica Lane, Herbarium Coordinator; jlane@brit.org
Natch Rodriguez, Digitization Technician; nrodriguez@brit.org
Kelly Carroll, Digitization Technician; kcarroll@brit.org
Kimberlie Sasan, Herbarium & Research Assistant; ksasan@brit.org

MO:
Daniel Tarazona
Victoria Patrick (institutionally funded)
Colin Robinson (institutionally funded)
Isaiah Oakes (institutionally funded)
Lauren Boyle (institutionally funded)
Mike Blomberg

OKL: One new undergraduate student hired, Samantha Huff.

OKLA:
Undergraduate assistants Wilson, Bardin, Wright, Rillo, and Short continued transcription activities and began georeferencing.

New undergraduate research assistant Nickles contributed to georeferencing.

Graduate research assistant Hubbard is providing georeferencing training at OSU and imaging training at Cameron University, and performed imaging and georeferencing at OSU.

New participant Patrick McAnerney, instructor at Cameron University, oversaw imaging.

New undergraduate assistants Barber and Mitchell began imaging at Cameron University.

SHST:
Shae Stafford (Paid Employee) Srs111@shsu.edu
Rosario Rocha (Paid Employee) Rxr117@shsu.edu
Luke Holmes (Paid Employee) Lah069@shsu.edu
Landon McCoy (Paid Employee) Lam124@shsu.edu
Danielle Garbarnio (Paid Employee) dgg026@shsu.edu

TAES:
New digitization techs:
Adam Pastrano
Kate Morton
Katy Heilman
Kieran Means
McKenna Sanchez
Neo Koite
Sarah Du Plessis

TEX-LL:
Two continuing volunteers:
Suzanne Labry
Vicky Wold

Seven continuing part-time undergraduate student workers paid by the grant:
Stephanie Nuñez
Phong Le
Sofia Bautista
Annabelle Young

Elizabeth Reed
Sophia De Mendoza
Travis Langford

Two new part-time undergraduate student workers paid by the grant:
Ryann Ramirez
Macie Hartzog

Other Progress not listed above (anything else to share):

MO: A new imaging rig developed by Harvard has been successfully installed for the All-Asia TCN. This rig allows for substantially faster imaging rates (*ca*. 250 specimens per hour), and will free up rig space for other projects. Over the summer, the herbarium will be hosting several interns who will be introduced to the digitization process and will get some time and experience on the imaging rigs.

OKLA: Imaging at Cameron University began.

All other institutions: Nothing new to report.

Questions/comments:

MO: This was a light quarter for TORCH for us, with some hard deadlines coming and us still struggling to meet those. We had to pivot the available staff to dive head-first into Endless Forms and Pteridophytes.

On a separate issue, our IT department tells me they think our IPT should be up and running again. Let me know if you are still running into issues.

SHST: Our progress has improved and increased dramatically.

TEX-LL: We encountered a few issues with our data, some of which will have to wait until next quarter to get fixed (mainly, some of our georeferencing doesn't seem to have made it into the database). Let's go with the values in this report for this quarter.

All other institutions: Nothing new to report.

TCN Quarterly Progress Report

Prior to each IAC meeting, TCNs are asked to complete a quarterly progress report in the areas outlined below. The TCN Lead PI or Project Manager collects information from all collaborators and compiles them into one overall progress report for the TCN. The TCN Lead PI or Project Manager then submits the quarterly reports via an email to Cat Chapman. An archive of previously submitted reports is available on the Internal Advisory Committee wiki page.

TCN Name

Digitizing collections to trace parasite-host associations and predict the spread of vector-borne disease (TPT)

Person Completing the Report

Jennifer Zaspel (Lead PI), Erika Tucker (PM)

Share Progress in Digitization Efforts

This quarter (January through April 2023) coincides with Year 4 of the TPT project. The last overarching annual report was submitted to NSF on July 05, 2022 along with a one-year no-cost extension request due to pandemic related digitization impacts. Below is a summary of our digitization progress (cumulative). Several of our collections have already met their digitization goals and many more are expected to finish this year. We plan on requesting a 2nd no-cost extension year to allow time for some of the collections that were more greatly impacted by lingering effects of the COVID-19 pandemic.

Institution	Transcribed records	High resolution & pinned images	Scanned slides	Scanned vials
ANS	19,468	359	12,368	1,226
BPBM	27,0975	4,928	19,103	10,247
BYU	19,169		19,169	
CAS	41,078	2,336	17,615	
CMNH	35,562	303	303	
CU	11,837			11,837
FMNH	10,774	2,138	98,881	141
HWML	45,640		23,230	

Institution	Transcribed records	High resolution & pinned images	Scanned slides	Scanned vials
INHS	37,142	348	5,788	7,095
MPM	2,609		1,228	1,500
MSB	5,049	618	1,500	2,140
MSU	13,323	260	1,100	505
OSU	6,000		6,000	
PERC	10,082	10,082		
PSU	29,525	1,165	2,571	1,816
TAMU	74,147	425	6,773	13,595
UH	8,768	95	7,152	
UM	114,873	259	51,606	
UMSP	52,060		52,060	
UNH	12,767	2,413	2,409	1,763
UU	17,125		20,000	
UWSP	7,833		8,376	
WIRC	36,525	26,350	7,024	3,151
YPM	17,607	2,015	3,409	2,581
Totals	**658,935**	**82,237**	**373,665**	**56,097**
Total records	**1,170,934**			

Collections starred and highlighted in green have **completed or exceeded their digitization goals!**

So far, TPT has completed 44 Notes from Nature expeditions and transcribed 186,444 slide images with the help of volunteers. We currently have one active expedition: *Jumping into the Field Museum Flea Collection 9.0*.

Share Best Practices, Standards, and Lessons Learned

Taxonomy. This quarter, the GloBI group just published the Taxon Name Alignment Workshop, which includes a video. The Taxon Name Alignment tool can be used to align a list of taxonomic names against multiple catalogs, including the TPT taxon name lists. This workshop is directed toward assisting curators in standardizing their collections and helping evaluate lists of taxon names. The overall goal of this workshop is to provide a tutorial on the usage of the

name-alignment-tool in resolving large taxonomic lists as well as illustrate common issues one should be aware of when aligning names. Video and PDF are available here:

> Miller, JT, Poelen, Jorrit, & Seltmann, Katja. (2023, April 14). Big Bee Name Alignment Workshop. Zenodo. https://doi.org/10.5281/zenodo.7829969

A generalized version of the workflow with detailed instructions is also available here: https://github.com/globalbioticinteractions/name-alignment-template and a full lesson plan for a name alignment workshop presented by JT Miller (USCB) and Katja Seltmann (USCB) is available here: https://big-bee-network.github.io/name-alignment-workshop/. The tool will be available at the overall project level as well as for individual collection name lists so the group can easily review name alignments across all collections in the project or for their specific collection. The TPT specific project level name alignment review tool is available here: https://github.com/jhpoelen/align-tpt-names-with-tpt-taxonomy.

Compiled and cleaned parasite and host taxonomy name lists for the TPT network and other the taxonomic resources and tools produced by TPT, are available on the TPT Taxonomy Hub here: https://github.com/njdowdy/tpt-taxonomy/tree/main (or https://bit.ly/TPTresourceHub). Files are also available via git on your local machine. Each taxonomic names list (i.e., higher-level taxon) has a different liaison for, 1) taxonomic information, and 2) the digital resource(s). You will find relevant contact information for each resource as well as the overall project in the readme file. The readme file also gives some additional status information for each resource (e.g., whether synonyms were provided by the name providers). Taxonomic resources are also available with citable doi through Zenodo: https://doi.org/10.5281/zenodo.5562742 and a publication documenting the taxonomy workflow for this project is planned for submission at the end of May 2023. This project has prompted collaboration with GBIF and other stakeholders in the community to strive to find ways to share and maintain these resources for long-term use.

Associations. The GloBI team continues to create new and exciting functions that further improve the functionality and usefulness of the website. Recently, TPT PM Tucker worked with GloBI to produce a help, or 'How-to' page (https://www.globalbioticinteractions.org/how-to), that consolidated pre-existing, but disparate GloBI instructional resources as well as added additional documentation for both new and existing methods that can be used for GloBI data.

Updates to the TPT full dataset are regularly published on Zenodo with all versions citable here: doi 10.5281/zenodo.3685364. TPT data publications are important because they track how the project data has changed over time and provide a permanent and citable record of the data we are creating. Creating data publications of TCN projects is a new concept and the TPT is leading the way in how to create citable datasets of natural history collection data. The GloBI and TPT Research Advisory Board is actively working to get more data providers involved in these data publications as authors so that everyone can get credit for their hard work. Everyone involved in

the TPT project can be a coauthor of this data publication. Please contact Jorrit Poelen or Katja Seltmann if you would like to be included.

Reports. Nick Dowdy (MPM) wrote a script to help collections track their digitization progress and project transcription rates needed to meet goals. This "TPT progress reporting" script and instructions for use are available on GitHub (https://github.com/njdowdy/digitization_progress_reports). The idea is that this script can be easily modified as needed for any collection(s) and TCN projects in the future - not just for the TPT group. Progress graphs have been created for all collections in the TPT group and the graphs, as well as the script to create them, have been shared with each collection to help with planning out digitization strategies specific to each collection's specimens, resources, and team.

Jorrit Poelen and PI Seltmann created a script to extract association data from GloBI for any contributing collection and automatically create a report. The script is available on GitHub here: https://github.com/ParasiteTracker/tpt-reporting. Reports for all TPT collections are regularly generated and published on Zendo (see above).

Share Identified Gaps in Digitization Areas and Technology

TPT network members continue to progress towards completing their digitization goals. Yale (YPM), the Ohio State Arthropod Lab (OSU), and the Bernice P. Bishop Museum (BPM) have already completed their digitization goals for the project. The Harold W. Mantor Parasitological Laboratory at the University of Nebraska State Museum (HWML) has already well exceeded their digitization goals, but are still actively digitizing parasites. Most of the remaining collections anticipate completing the project by the end of the 1st no-cost extension year (needed due to COVID-19 related impacts), although some anticipate needing an additional no-cost extension year..

PI Zaspel and PM Tucker continue to reach out to all PIs and collaborators in the network keeping participants engaged and offering assistance whenever needed.

Share Opportunities to Enhance Training Efforts

BPBM - Completed their digitization goals by the end of 2022. Since the project wrapped up at BPBM, one of the technicians working on the TPT project was hired on as a full-time entomology collection technician.

FMNH - The museum trained one new volunteer to work on the TPT project this quarter. 7k slides (144 boxes) were inventoried; 11k slides (151 boxes) were scanned; and 2.6k Inselect crops were created. Additionally, one new NfN expedition was launched and the museum participated in the two day long WeDigBio event.

PSU - Antonio Casadei has continued to work on the TPT project since starting February 13th, 2023. Since then he has transcribed the label data from approximately 3,008 specimens, 2,448

from the KC Kim Anoplura slide collection and 558 from the ethanol preserved specimens in the family Simuliidae.

TAMU - There were some database issues last year, but TAMU was able to restore the database back in late November so that data entry could proceed. Ethanol specimens have all been entered into the database and are currently going through quality checks, and 85% of pinned specimens have been entered into the database. Slide specimens are still in progress with and attention has been shifted to Lice specimens. River Martinez has kept a steady pace of imaging going with the Macropod system. With the end of the fall semester, several student employees graduated and moved on from TAMU, so new students were hired over the span of December. New employees were trained on data entry and assigned to a team workflow of pinned or slide specimens. During this quarter, not much happened in terms of progress on Dr. Light's side of things. All ectoparasites brushed from host specimens have been organized. The hope is to enter all data into the TAMUIC database over summer 2023. There has been a shift in general workflow and supervision due to Dr. Karen Wright (the day to day curation manager) moving on to a new and exciting career opportunity.

WIRC - The collection plans to complete all digitization goals this year.

UNH - Two students have been hired on the TPT grant. Since the last report (2022 August), Grace Gaucher has databased mosquito specimens and created high-resolution images of them using the Macropod system. She has cell phone imaged 2,409 specimens, of which she completed databasing 2,267 records (including georeferencing). She has also completed the workflow on using Taxonworks in digitization and created 21 high-resolution images. The second student on the grant, Tucker White has collected 267 3D datasets of chewing lice with the confocal laser scanning microscope and generated volume rendered animated GIF files that he uploaded to Taxonworks.

Share Collaborations with other TCNs, Institutions, and/or Organizations

Databases & Repositories. TPT has collaborated with Vectorbase, NMNH, and Walter Reed to aggregate occurrence and observation data, deliver association data to GloBI, and provide taxonomy resources to the arthropod collections community. TPT has also worked with the Denver Museum of Nature & Science (DMNS) and the Florida Museum of Natural History Herp Collection (FMNH) to help them connect their data to SCAN and GBIF. We have mobilized and made accessible >1,100 parasite records from the DMNS collection that were previously “dark data”. Mobilizing and connecting the FMNH Herp parasite data to the world is still in progress, but once done will not only result in thousands of new parasite records, but also add new names to our Ixodes taxon list and likely result in a related publication.

Multiple members of the TPT group are also collaborating with and adding extensive expertise to BugFlow (https://entcollnet.github.io/BugFlow/) to help the greater global entomological and collections community with digitization efforts.

PI Mike Caterino (CU) is coordinating and working closely with Flyod Shockley at the Smithsonian Institution to digitize specimens from Adler's blackfly collection, which will eventually be housed at the Smithsonian.

Other TCNs & Grants. TPT is collaborating with the **NSF TCN Big-Bee** group and the **NSF TCN iDigBees** digitization initiative by sharing workflows, digitization and project management insights, and technical expertise. In addition, members of TPT provided expertise to the **USDA funded National Native Bee Monitoring RCN** and PM Tucker co-organized the data management workshop on topics relating to bee monitoring data preservation, management, best practices and standards, sharing, and contributor attribution. This will not only help develop better monitoring protocols, but also better standardize data collection methods which will hopefully lead to pre-digitization efforts and smoother incorporation of new collection data into both internal and shared databases. Recordings from the workshop can be found here: https://www.youtube.com/@nativebeemonitoringRCN/videos.

PI Zaspel is co-organizing and planning the implementation of the 2023 NSF funded **Entomological Collections Management Workshop** (https://ecnweb.net/workshop/). Partially due to COVID concerns, but largely to make the course more accessible to a broader and more diverse attendee population, the course will be offered as a hybrid model. Student feedback for the new hybrid model used last year (and course in general) was very positive. This workshop is the only one of its kind for the entomological community and is extremely important in training the next generation of entomological collections stewards - many of whom will be implementing digitization protocols at their institutions. PI Zaspel's involvement has been instrumental in incorporating more modern collection management techniques into the curriculum, with part of the course emphasizing digitization methods and existing workflow resources. These tools and resources will well equip new managers and curators to care for and improve their collections.

Other Institutions. PI Grinter (CAS) continues collaboration with Hassan Dawah of the National Museum of Wales and provides images of Culicidae for a publication Dawah is writing on the mosquitoes of Saudi Arabia for an upcoming publication in Zootaxa.

Share Opportunities and Strategies for Sustainability

Multiple TPT PIs are actively involved with and are collaborating on the BugFlow repository project. Workflows and tools developed by TPT have started to be added to the repository and continue to be added as each item is completed. Workflows and tools shared on this platform are available through the working side of GitHub (https://github.com/EntCollNet/BugFlow). In order to make the workflows more accessible to a broader audience, all workflows and

information deposited on BugFlow are also available through a public facing webpage for those not comfortable using GitHub directly (https://entcollnet.github.io/BugFlow/). Many TPT providers are contributors of various modules, including slide imaging (both high and low resolution), papered specimen archival protocols, project management, curation, georeferencing, and data transcription.

The TPT group continues to work closely with GloBI creator Jorrit Poelen on improving the "how-to" page (https://www.globalbioticinteractions.org/how-to) on GloBI. GloBI is an amazing resource for the scientific community, but it can often be a bit challenging to navigate and find a particular resource needed. The 'How-to' page on GloBI consolidates pre-existing, but disparate GloBI instructional resources, as well as adds additional documentation for both new and existing methods that can be used for GloBI data. One of the new functions we developed and documented is a script that can query and download records for multiple taxa in a given list all at once. We believe usability of a given resource, such as GloBI, goes a long way in helping to sustain these types of resources in the long term.

Involvement with TPT helped PI Orlofske (UWSP) secure support for new collection infrastructure and a larger collection space that will allow students and staff to continue to be able to work within the museum space and provide room for future collection growth. Furthermore, involvement in the TPT grant helped justify financial support for three students who were already involved in the project to assist with the collection move. This assured the move could be accomplished in a timely manner and that specimens would be handled professionally.

Share Education, Outreach, Diversity, & Inclusion (EODI) Activities

PI Orlofske hosted an outreach event at **UWSP** March 4th, 2023 in honor of the Parasite Day activities organized by the American Society of Parasitologists.

UNH continues to showcase the interactive educational exhibit about Bird Lice created by PI Miko (**UNH**). This exhibit allows users to learn about the bird parasites by matching a bird with the lice that use it as a host. This interactive exhibit uses CLSM based 3d images.

PIs Cameron and Gall (**YPM**) continue to conduct outreach activities in collaboration with the YPM EVOLUTIONS (Evoking Learning and Understanding through Investigations of the Natural Science) program. This is a free after school youth program for highschool students that helps prepare students for college and careers in science through classes, museum jobs, research internships, and other events.

As part of the Entomological Collections Management workshop and to facilitate the remote attendees at the workshop, multiple TPT participants contributed to the creation of a website with a reusable lesson plan and hands-on activity examining species interaction data and

interpretations. The goal of the website activity is to help data providers better understand the data they may come across in their collections, what it means, and how it may be used by future researchers downstream. Website and reusable/modifiable lesson/interactive activity, the Interaction Data Interpretation Workshop, are available online here: www.globalbioticinteractions.org/ecm-workshop.

Share Information About Your Website and/or Portal Usage

To date, the TPT Notes from Nature project has completed **44 expeditions, 186,444 transcriptions** for 58,890 unique specimens, and provided learning experiences for **2,729 citizen Scientists** and **volunteers**. TPT Notes from Nature statistics: https://www.zooniverse.org/projects/md68135/notes-from-nature-terrestrial-parasite-tracker.

The latest GloBI report included all TPT collections and collaborators indexed as of October 13, 2022. The total number of interactions included in this reporting period is **794,320** records (500,000 interactions was the overall goal for TPT). The full TPT biotic interaction dataset published on Zendo has been **viewed 1,158 times** and been **downloaded 446 times:** https://zenodo.org/record/7194486#.Y1wVtezMKjQ.

Share Other Activities and/or Progress

The TPT group actively shares research and results at a variety of different venues. Below are some of the ways we have shared our knowledge over the last quarter.

Conferences, Presentations, & Symposia

Annual Midwestern Conference of Parasitologists Meeting

Scientific Program Officer for the Midwestern Association of Parasitologists, PI Orlofske (**UWSP**), invited Jen Zaspel (**MPM**) and Julie Allen (**UNR**) to be symposium Speakers for the Annual Midwestern Conference of Parasitologists meeting hosted by UWSP this June.

National Native Bee Monitoring RCN Data Workshop

Several people involved in TPT attended the virtual National Native Bee Monitoring RCN Data Workshop hosted by the University of California, Riverside. The following also gave presentations:

- (**UCSB**): Seltmann, K. and Paul, D. Data Life Cycle. Recording available here.
- (**MPM**): Tucker, E. M. Responsible use of Museum Specimens & Their Data. Recording available here.
- (**NHMLAC**): Barve, V. R scripts for nomenclature cleaning. Recording available here.
- (**GloBI**): Poelen, J. Global Biotic Interactions. Recording available here.

Publications

- Kathryn A. Sullivan, Erika M. Tucker, Nicolas J. Dowdy, Vijay Barve, Teresa Mayfield-Meyer, Julie M. Allen, Sarah Bush, Jessica E. Light, Katja C. Seltmann, Jorrit H.

Poelen, Jennifer M. Zaspel. Building a community-based taxonomic resource for digitization of parasites and their hosts. *Insect Systematics and Diversity.* ***IN PREP.***