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

February 2022

CONTENTS:

iDigBio is funded by a grant from the National Science Foundation's Advancing Digitization of Biodiversity Collections Program (Cooperative Agreement EF-1115210). Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

TCN Quarterly Progress Report

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: Jonathan Kennedy, Director of Biodiversity Informatics, Harvard University Herbaria

Reporting Period: Oct 1 – Dec 31, 2021 (* We are reporting up to the end of the previous month to capture statistics for the whole period)

Share Progress in Digitization Efforts

Total Specimens imaged: 14,058
Total Minimal records created: 27,484
Total Full/detailed records created: 2,142
Total Specimens georeferenced: 166

Overview: We are in Y1 of the project and most partners are scheduled to begin digitizing in Y2. Y1 is primarily dedicated to technology development/deployment (imaging stations/workflows, portal development, data coordination). Some partners have been able to start digitizing early, while most are coordinating technology deployment and staff hiring, conducting pre-digitization curation, or scheduled for Y2. Lead (HUH) activities for this quarter included coordinating photostation design updates and fabrication, coordinating technology development work with BU Spark, working with partners to understand local digitization workflows, organizing phase 1 georeferencing with COLO, and organizing data needs for upcoming All Asia portal (geography, taxonomy, collectors, Himalaya-Hengduan gazetteer).

	Images	Minimal	Detailed	Georef
ALA	*	*	*	*
BISH	*	*	*	*
BRIT	7,854	7,854	0	0
BRU	18	18	18	0
CHIC	0	0	0	0
CINC	72	72	0	0
CLM	0	0	0	0
COLO	461	461	0	0
HUH	0	0	0	0
MASS	0	0	0	0
MICH	0	0	0	0
MO	0	0	0	0
MU	0	0	0	0
NHA	295	9	275	11

NY	1,219	14,931	0	0
OS	0	0	0	0
RSA	4,139	4,139	1,849	155
VT	*	*	*	*

* Reports from 3 partners still pending.

Share Best Practices, Standards, and Lessons Learned

RSA: Geographic regions are large and include some countries that are not part of the All Asia TCN. We have found that, with previous digitization projects, it was much easier, and just as fast or faster, to barcode and image the whole folder of specimens, even if non-target specimens were included in the folders. To remedy this situation, we add staff to the project that are supported by institutional funds.

MASS: Conducting precapture of pteridophyte names. Decided to accept pteridophyte names "as is" rather than update all names and have to re-folder and synonymize them. Unless entire collection of pteridophytes is updated, it would create too many conflicts between accepted names of Asian genera and those from the rest of our collection.

Share Identified Gaps in Digitization Areas and Technology

COLO: COLO plans to use the ImagingWorkflow application from the LBCC TCN to capture skeletal data during the imaging process. CO-PI Allen is developing a list from World Flora Online to create a list of names for the dropdown menu in the application.

*HUH***:** HUH has begun coordinating digitization workflow issues with certain partners utilizing the HUH photostation design. We are uncovering differences between local practices (file naming conventions, file types, needed metadata) that necessitate workflow adjustments or workarounds.

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

CINC: CINC is also involved with the GLOBAL TCN, and best practices, etc. will be shared between the two projects. CINC is also processing MU specimens for both projects, as well as Cincinnati Museum Center (CMNH) specimens for the All-Asia TCN.

HUH: HUH is also participating in the Southern Rockies TCN led by COLO, TORCH TCN led by BRIT, and the Endless Forms TCN led by NY. We are currently coordinating with collaborators at the Royal Botanic Gardens (Kew), Museum of Natural History (London), and Botanic Survey of India to create a gazetteer of Himalaya-Hengduan localities.

RSA: We are part of the California Phenology TCN (CAP) to digitize target taxa for scoring phenology and using this as a proxy to investigate how climate change may be influencing flowering and fruiting times in California native plant species. California State Polytechnic University, San Luis Obispo is the lead institution. In 2019 we received a PEN for the SoRo TCN to digitize our holdings from the Southern Rocky Mountain region. Lead PI is Erin Tripp at COLO. We are also digitizing for the Endless Forms (EF) digitization project, the goals of which are to fully digitize specimens from 15 plant families exhibiting unusual or peculiar morphological adaptations. The lead TCN and PI are NY and Matthew Pace, respectively.

Share Opportunities and Strategies for Sustainability

RSA: All data (images, databased records, georeferenced coordinates) have been entered directly into RSA's institutional database. This has always been maintained with institutional support and does not rely on external funding. We are completely transitioned into Symbiota as our primary database, which we feel is a much more sustainable solution than our former database. All data generated as part of this project will become part of California Botanic Garden's digital assets, managed in accordance with our digital asset management plan and will persist indefinitely. CalBG has permanent curatorial staff tasked with management duties and is supported by CalBG IT staff. Nazaire is responsible for oversight of all digitization efforts, including specimen image capture, image post processing, electronic data capture and metadata development, and georeferencing. Nazaire ensures consistency in each step of the digitization process through the establishment and documentation of quality assurance measures and training of project staff. All digital assets are backed up on the Herbarium's server with offsite back up to Amazon Web Services Glacier Deep Archive.

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

NHA: Four undergraduate curatorial assistants continue to work with the NHA, in part on the All Asia TCN. Their tasks include mounting, imaging, databasing, and filing specimens including approximately 700 Asian specimens needing digitization from the NHA backlog that were previously unknown, and 200 Asian specimens needing mounting. The four undergraduate curatorial assistants include one woman and one non-traditional aged student. All four undergraduate curatorial assistants had no previous experience with natural history curation or plant systematics. Between September – December 2021, NHA offered tours of the herbarium for three courses (BIOL 409: Green Life, BIOL 601: Biology and Ecology of Plants, and BIOL 412: Introductory Biology) for approximately 335 undergraduate students. In addition to an introduction to the general holdings and research uses of NHA specimens, each tour was given an overview of the NHA's role in the All Asian TCN, the importance of specimen digitization, and a chance to view and hold specimens from Asia.

RSA: With COVID-19 our outreach activities including tours have been restricted, but Nazaire gave a zoom presentation to the California Native Plant Society Orange County Chapter – "Herbaria in the Age of Digitization" highlighting RSA's digitization projects, including the new All Asia TCN. In pre-COVID days we would have classes visit for tours and in exchange for the tour fee, students barcode specimens for about a half hour. This provides an easy and accessible hands-on activity and opportunity to work in a natural history

collection and turns a passive tour into an active one. It simultaneously helps our efforts to digitize specimens for various digitization projects. As we are located in the Greater Los Angeles Metropolitan area, we frequently have many institutions that are Hispanic Serving Institutions visit and tour. Often this is a key approach for us to recruit interns in the herbarium. We anticipate being able to provide this kind of opportunity to undergraduate students in the near future.

Share Information About Your Website and/or Portal Usage

*HUH***:** All Asia portal is under development in Y1.

NHA: NHA has a new website: https://colsa.unh.edu/unh-collections/albion-r-hodgdon-herbarium

RSA: Because the CAP project has set up a CyVerse account where we load images for that project, it is much more efficient for us to load all images to CyVerse (CAP, SoRo, EF, All Asia, and all incoming, new acquisitions) where all images are served in the Symbiota platform. To date we are serving 705,568 images through the CCH2.org portal. We are live managed in Symbiota and database specimens from images with skeletal information.

Share Other Activities and/or Progress

MASS: Progress: Substantial pre-capture progress has been made. New digitization workers hired. Workflow details discussed and planned. Image and data capture to start January 2022.

MO: Suffered delays due to major staff changes and COVID restrictions. Planning to meet with lead to discuss imaging workflow.

RSA: Staff have mostly returned to working in the herbarium, but some staff continue to work on data entry and georeferencing tasks from home, particularly lately in the omicron surge where we have had numerous staff with exposures. Awaiting more information on receiving the HUH imaging station, as we will need to make some moves in our imaging lab to accommodate for the station.

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*
Jan. 26, 2022

TCN Name

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

Person Completing the Report

Katja C. Seltmann, Pam Horsley & Crystal Maier. This is the cumulative report for the Big-Bee project. Individual institution reports can be found at: https://drive.google.com/drive/folders/1VwaFE_EGpAl1lvLGcD2EztZkw0z8cju6?usp=sharing

Share Progress in Digitization Efforts

- Start date for the Big-Bee project was 15 Sept 2021
- MCZC Co-PI Maier, SDMC PI Horsley, and EMEC PI Oboyski set standards for all-network metrics reporting with baseline numbers and project management for Big Bee https://docs.google.com/spreadsheets/d/1twhePUfhI0tZ28LcwAocJLXrlAYzZ4apJYc5_UKm8X4/edit?usp=sharing
- Digitization baseline data and metrics tracking spreadsheet created and populated: https://docs.google.com/spreadsheets/d/1twhePUfhI0tZ28LcwAocJLXrlAYzZ4apJYc5_UKm8X4/edit?usp=sharing
- Exemplar imaging tracking spreadsheet created and under review: https://drive.google.com/drive/folders/1VwaFE_EGpAl1lvLGcD2EztZkw0z8cju6?usp=sharing

- UNHC created 70 bright field focus stacked images of the male genitalia representing 15 Andrena species. Specimen images were uploaded to our Taxonworks content management system. We have processed 89 ethanol stored specimens for CLSM, optimized Nikon CLSM for quick bee male genitalia imaging and trained Charles Staff for using CLSM. So far we have imaged 10 specimens.
- MCZC photographed the labels/low-resolution dorsal habitus images for 341 specimens of bees in the family Andrenidae
- LACM photographed labels with dorsal view for 1,500 specimens in the family Andrenidae; 5,169 *Bombus* records mobilized as a result of Big-Bee
- FSCA has georeferenced 3,705 specimens and the data has been deposited in mbd.osu.edu. Dorsal images have been taken of 3,700 of these specimens, which will be uploaded to Bee Library once the IPT for mbd.osu.edu is operational. 261 focus-stacked images have been uploaded to mbd.osu.edu and these can be found via specimen identifiers or the taxon name.
- EMEC has photographed the labels for 1359 specimens of bees in the family Melittidae
- ASUHIC added 5,871 specimen records of four families of Anthophila have been digitized with 100% georeferenced on Ecdysis portal, along with 232 images for representing 116 specimens (https://serv.biokic.asu.edu/ecdysis/index.php).
- ASUHIC, SDMC, and MCZC have initiated imaging process for specimen-label images using the assembled standardized imaging trays

Share Best Practices, Standards, and Lessons Learned

- Most participating institutions are joining weekly meetings of the BigBee team on Zoom, including newly hired participants
- All participants maintain continuous communication via Slack with other team members to share and test workflows, imaging setups, etc.

Share Identified Gaps in Digitization Areas and Technology

Nothing to report at this time.

Share Opportunities to Enhance Training Efforts

- We are having weekly Zoom project meetings on Wednesday @1:00PT to discuss digitization workflows and help collections get up and running. Meetings are recorded and posted for participants who could not attend.
- Using Big-Bee Slack channel and shared Google Drive for communication. We presently have 100% participation from partner institutions on Slack.
- Project GitHub (https://github.com/Big-Bee-Network).

- CAS existing team member David Bettman has been helping to vet data being shared with the Bee Library, found bugs in data ingestion and logged tickets on GitHub.
- Sharing videos about digitization set-up to help collections new to digitization.

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

- Big-Bee was included as part of a recently submitted RCN-UBE: *The bees and the birds: engaging community college students in biodiversity research* to help expand our outreach and education component of the Big-Bee project. PI Professor Jeannie Chari, College of the Canyons, CA
- Big-Bee Symbiota Database now includes all of the Big-Bee partners. All but one have shared their first dataset and FSCA is working on sharing through the Specimage data system (Norm Johnson). https://library.big-bee.net/portal
- UCSB is in the process of hiring a Digital Imaging Specialist (interviews in January) and a Postdoctoral Scholar for the project. Both positions are to collaborate with all of the Big-Bee partners.
- Continue to have weekly meetings and conversations over Slack.
- UCSB is in the process of updating their in-house Symbiota portal to Symbiota-Light so it will be using the same software as the Bee-Library.
- UNHC received bee specimens from University of Santa Barbara and Vermont Center for Ecostudies and processed them for CLSM imaging. Initiated collaboration between University of Manitoba to send *Lasioglossum* male specimens to our collaborator (Thomas van de Kamp) at the ANKA synchrotron in Karlsruhe, Germany.
- FSCA digitization efforts are supported in part by the digital infrastructure at The Ohio State University, which is serving the data to GBIF and will serve the data to the Bee Library once the IPT is operational

Share Opportunities and Strategies for Sustainability

Nothing to report at this time.

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

- https://www.noozhawk.com/article/ucsb_creating_a_buzz_with_project_to_display_1.5_million_images_of_bee_spec

- Seltmann at UCSB started mentoring a PSTAT 197B Big-Bee Data Science Capstone. This Capstone will focus on methods for describing bee hairyness, extraction of exif data from images and reading barcodes from images. This is in collaboration with the https://centralcoastdatascience.org NSF supported project.
- Seltmann at UCSB worked with GloBI/Jorrit Poelen to index bee taxon names from Discover Life and share them via Zenodo. Discover Life bee checklist is considered the best reference for bee names in North America:

  Seltmann, Katja C., & Poelen, Jorrit H. (2021). Big Bee indexed biotic interactions and review summary (0.1) [Data set]. Zenodo. https://doi.org/10.5281/zenodo.5722445 on 24 Nov 2021
- Spanish language poster about Big-Bee was presented at the XII Congreso Mesoamericano de Abejas Nativas, Centro de Investigaciones Apícolas Tropicales (CINAT), Universidad Nacional, Costa Rica, Nov. 20-21, 2021. Gonzalez, VH., Seltmann, KC., Brown, B., Allen, J., Carper, A., Engel, M., et al. (2021). Big-Bee: Una iniciativa para promover el conocimiento de las abejas a través de la digitalización de imágenes y datos de rasgos. ID 112. Retrieved from https://escholarship.org/uc/item/0856h3d2
- UCSB Seltmann has three undergraduate students whose senior theses involve Big-Bee project and data.
- SEMC has hired a diverse group of students (two females, one male) to assist with management of specimens and photography. Two undergraduate students, one PhD. Two of them are Hispanic.
- UNHC updated public display monitor in Spaulding Life Science Center with newly acquired images.
- EMEC has hired and trained an additional undergraduate student technician (for a current total of 3) that will image labels and specimens for this project. PI Oboyski hosted Alumni/Parents Weekend tours for ~300 visitors - largely UC Berkeley students and their families, but also residents from the local community.
- ASUHIC plans to participate in the 2022 ASU Open Door outreach program in order to educate bees and pollination, also show about the bee specimen digitization efforts.

Share Information About Your Website and/or Portal Usage

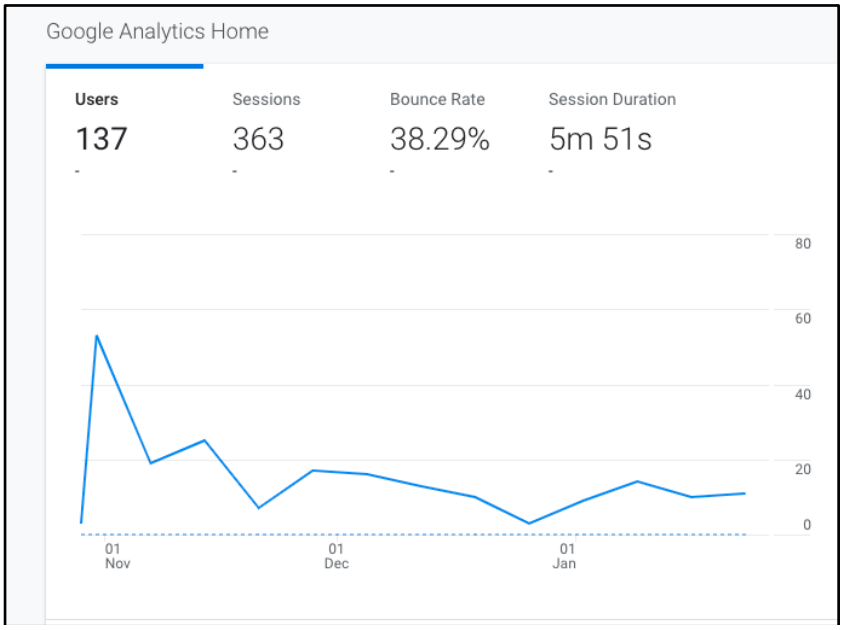
- Indexed biotic interactions and other statistics are being shared quarterly via Zenodo.

Seltmann, Katja C., & Poelen, Jorrit H. (2022). Big Bee indexed biotic interactions and review summary (0.2.2) [Data set]. Zenodo. https://doi.org/10.5281/zenodo.5915003

- The Bee Library is now indexing a total of 16 collections totaling:
  2,041,945 occurrence records
  1,770,179 (87%) georeferenced
  796,155 (39%) occurrences imaged

963,379 (47%) identified to species
11 families
494 genera
10,578 species
11,092 total taxa (including subsp. and var.)

- Based on Google Analytics, Bee Library had 137 unique users in the last 90 days.



- Established new Symbiota portal instance to serve as the BigBee Data Library
  - Portal URL: https://library.big-bee.net
  - Forked Symbiota code into a new Big-Bee Network GitHub organization/project: https://github.com/Big-Bee-Network/Symbiota-light
  - Integrated the configuration styling components (graphics, header, footer, central page content, etc) into the Big-Bee code fork
  - Used the Big-Bee code repository to installed a Symbiota code instance on ASU Symbiota Support Hub server
  - Built MariaDB (MySQL) database to serve as the central backend data source. Nightly MySQL data dumps serve are deposited as on a remote serve storage system that will serve as regular database backups
  - Established storage within an adjacent server mount that will serve to store and publish image and media files associated with the Big-Bee portal
  - Configured server to use the Big-Bee data library domain name (library.big-bee.org) as the central URL
  - Installed a LetsEncrypt SSL security certificate to provide data encryption

    - Setup and configured Google Map API keys, Google Analytics, and Recaptcha spam protection
- Occurrence data mapping and loading
    - Seventeen Natural History Collection profiles were established within the portal with complete collection metadata and contact information.
    - More than 1.6 million specimen and 417 thousand image records were imported in association with the collection profiles. The majority of specimen records were imported from IPT data providers established and maintained by the source collections.
    - One iNaturalist observation dataset was established with an import of 427,945 observations and image records.
- Taxonomic Authority Support
    - A central taxonomic thesaurus was built using several taxonomic authoritative resources. The immediate focus of the taxonomic tree is on Apoidea. The taxonomy from Kingdom to Genus was imported via Catalog of Life (https://www.catalogueoflife.org), which follows the ITIS taxonomy for Apoidea. Species, subgenera, and infraspecific taxa were imported via a data dump obtained from Discover Life.

Share Other Activities and/or Progress

- UMMZ is Interviewing 4 promising candidates this month and should then have someone in the recently vacated Collection Manager position.
- Macropod systems were delivered to all partner institutions (SDMC, UCBC, SEMC, MCZC, LACM, EMEC) after recovering from a few supply chain issues. Online training in both 2D and 3D imaging has started over Zoom. Video tutorials are being shared through Macropod and on the Macropod Community forum.
- UCSB Seltmann and ASU Gilbert loaded bee taxonomy in the Bee Library. Gilbert developed a Catalog of Life taxon name check for Animalia records to help evaluate insect names in Symbiota and help build the taxon tree.
- SEMC received the Macropod Pro imaging system, and we are in the process of assembling it and testing it out. SEMC is in the process of setting up the Research File Storage throughout the University of Kansas. Students at SEMC have started trainings in specimen management, imagining and data management.
- Other SDMC projects being conducted are working on ID'ing bees from past biodiversity sampling projects from the San Diego and Baja California areas. These specimens were not originally accounted for in baseline numbers and will likely provide some high quality material for the project.
- MCZC hired and trained a half time collection assistant and an additional undergraduate student technician that will image labels and specimens for this project. Half time technician was trained on Macropod system through online videos and one-on-one

meetings. Developed workflow for imaging labels and low-resolution dorsal habitus images.

- SDMC hired 2 part-time Big-Bee Technicians in January 2022, Ellie Deer (Point Loma Nazarene University, 4th year student) and Sierra Lippert.
- LACM hired one part-time staff to work on imaging, another position opening for the second part-time technician; plan to hire in the next month
- CAS job description approved and posted on website, recruiting for a full-time position from the bay area community
- ASUHIC recruiting to hire two undergraduate student workers. Hiring anticipated within the month.

CALIFORNIA PHENOLOGY TCN – QUARTERLY REPORT – FEBRUARY 2022

Assembled by Katie Pearson, 19 January 2022

PROGRESS IN DIGITIZATION EFFORTS

Figure 1 shows our progress in imaging, transcribing, georeferencing, and phenologically scoring the target specimens for the original 22 CAP institutions, explained more in detail in the following sections.

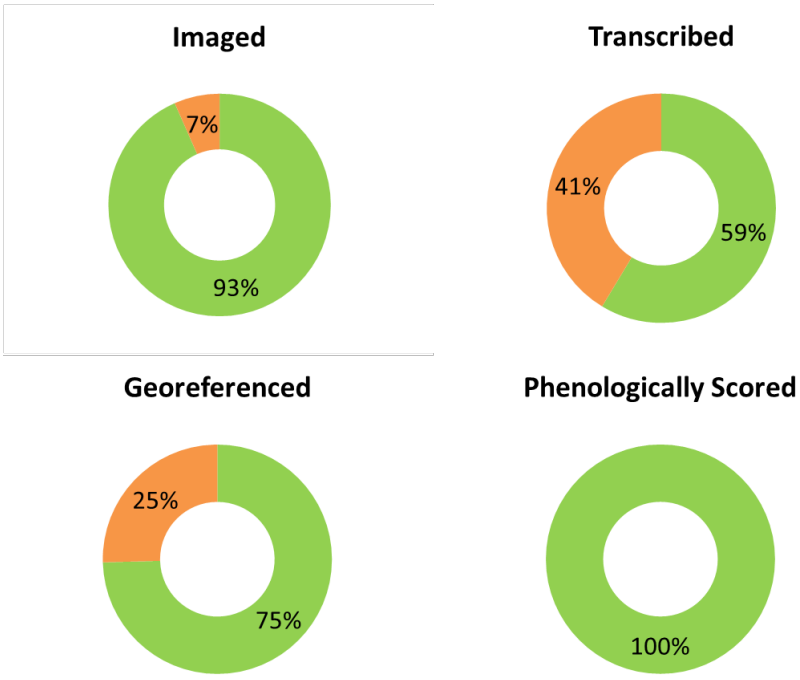


Figure 1. Progress in each of our four major digitization goals. Totals represent the original goals of the CAP grant: 902,400 specimens imaged and phenologically scored, and 300,000 transcribed and georeferenced. Additional specimens to be digitized by the PEN grant are tabulated in the PEN section 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.**

TRANSCRIPTION

Over 175,935 specimen records have been transcribed across the CAP Network since the beginning of the project. This is approximately 58% of our goal.

Transcription has largely been accomplished by institutional volunteers and technicians in CCH2, the online herbarium digitization course, and online volunteers in Notes from Nature.

GEOREFERENCING

We have georeferenced over 223,691 specimen records, which is 75% of our goal. Georeferencing is conducted by trained staff and students at HSC, OBI, and SD, by naturalist volunteers are part of the "100 Club," and by undergraduate students in the herbarium digitization course led by Cal Poly. The CAP 100 Club currently has 26 active members. We have also continued to use the code we developed to convert township, range, section data into decimal coordinates to apply georeferences to specimens from other states, as they are transcribed.

IMAGING

Fourteen of our 22 herbaria (64%) have accomplished their imaging goals (Figure 2). All herbaria have resumed imaging following COVID-19-related shutdowns. Figure 2 shows the current state of CAP imaging as of January 2021.

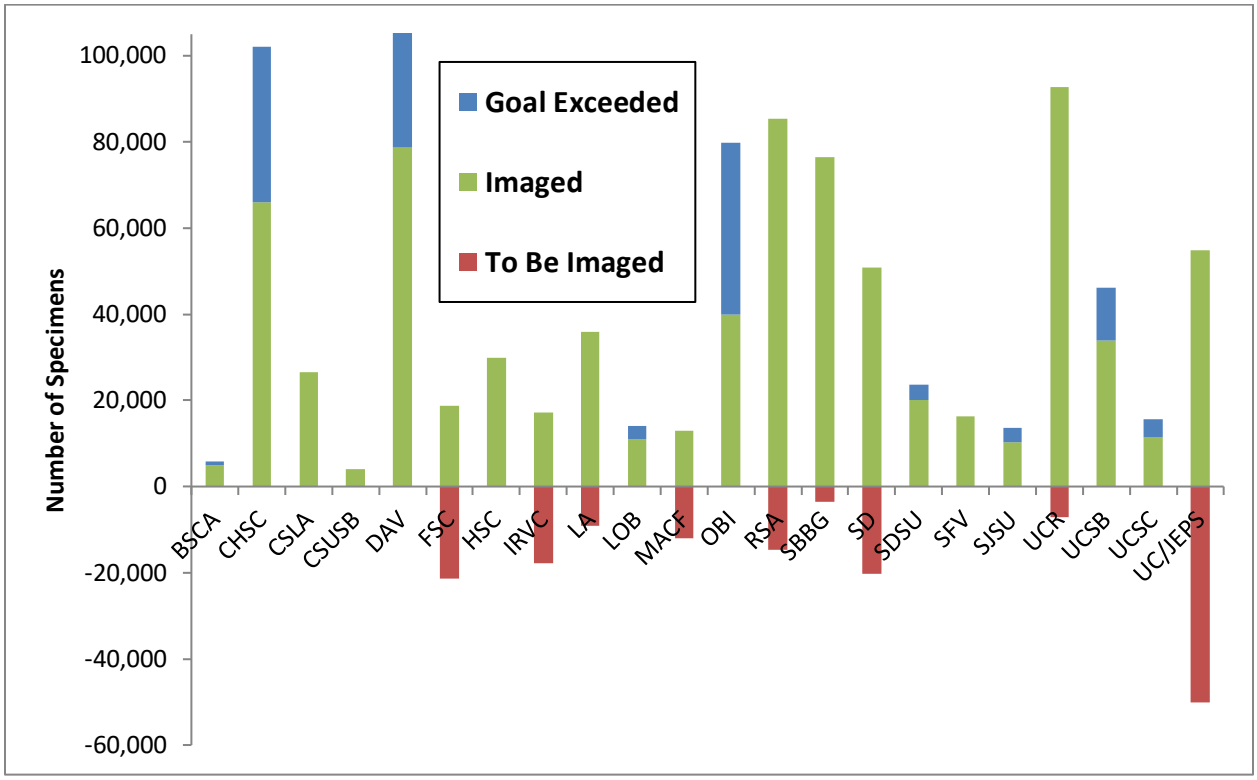


Figure 2. Herbarium specimen imaging progress. Blue portions represent the number of specimens that have been imaged, while green portions represent the number of specimens that have been imaged beyond the expected target specimens. Red bars below the zero line indicate the number of target specimens that have not yet been imaged.

PEN PROGRESS

SHTC completed their imaging goals in January 2022. The PM will transfer their imaging station to the Pacific Union Herbarium (PUA) in early February, pending receipt of barcodes, at which time PUA

students and PI Wyrick will be trained in digitization protocols and workflows. OSC and SFSU are continuing to image specimens as expected and have completed 54% and 11% of their imaging goals, respectively. CDA has been delayed by slow processing of their purchase orders and has not yet received their equipment. Figure 3 shows the current imaging progress at PEN institutions.

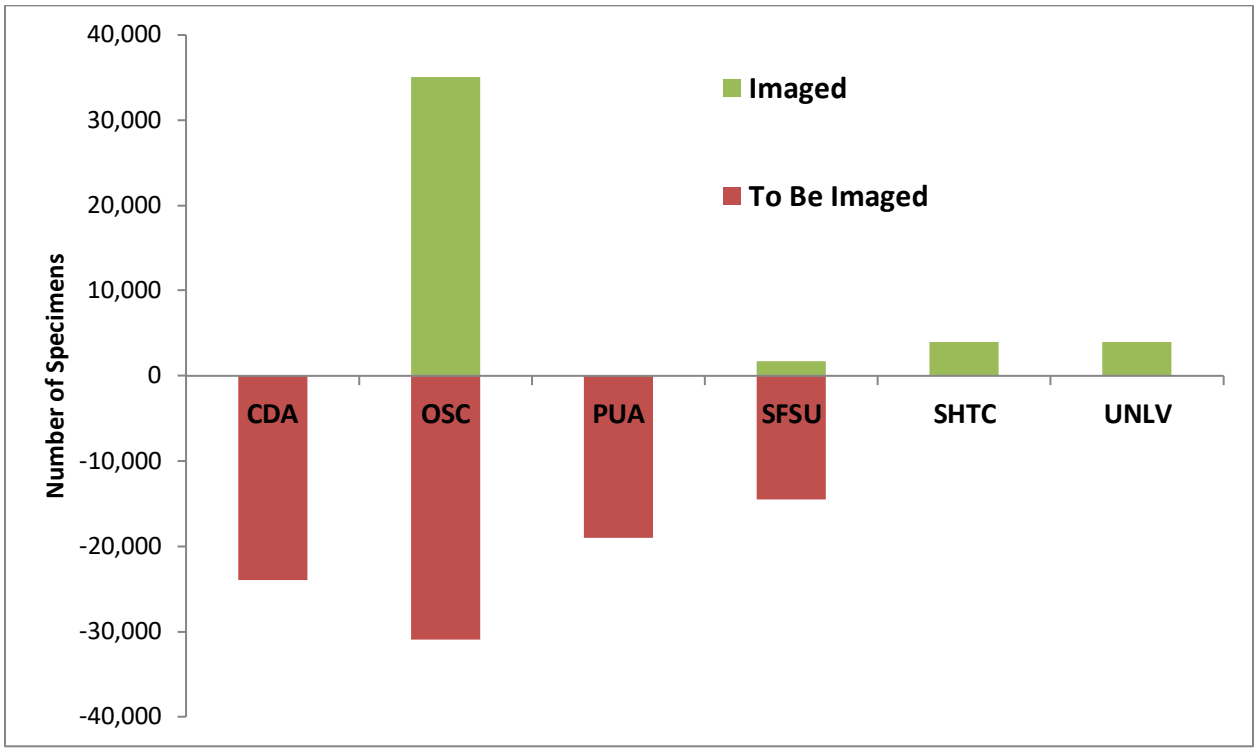


Figure 3. Herbarium specimen imaging progress for the seven PEN institutions. Green portions represent the number of specimens that have been imaged, while red bars below the zero line indicate the number of target specimens that have not yet been imaged. For SD, the total number of specimens to be imaged, 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)

We held our first meeting of the TDWG Phenology Task Group on November 3, 2021. It was attended by 19 participants representing 18 institutions and five countries. The slides from this meeting can be found here. During this meeting, our discussion clarified that we will aim to create a phenology extension for the Darwin Core (rather than, e.g., developing a standard vocabulary for an existing field or extension), drawing from the Plant Phenology Ontology for our terms. We are continuing to develop these standards.

IDENTIFY GAPS IN DIGITIZATION AREAS AND TECHNOLOGY

Our portal, like many Symbiota portals, is not mobile-friendly, and its styling is outdated. While this does not affect the utility of the data, we think it affects access and therefore actual use of the data.

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.

We have continued our "Data Portal Lunch Break" webinar series. These half-hour webinars led by the PM consist of one, brief demonstration of a particular tool or function in the CCH2 portal, followed by Q&A. These webinars are conducted on the first Wednesday of every month from 12:00-12:30 PM Pacific. From November to January, we conducted three Data Portal Lunch Breaks. Their recordings can be found here: https://www.capturingcaliforniasflowers.org/symbiota.html. CCH community members are also encouraged to participate in the Symbiota Support Hub's monthly "Symbiota Support Group" webinars.

We conduct monthly meetings of the Consortium of California Herbaria. These meetings have served as a forum for questions and problems throughout the community, as well as a set time and place to make announcements and update the community on digitization progress. Several important discussions have resulted from this meeting, including discussion of how data are shared with Calflora, where institutions can sustainably store their archival images, and how institutions should manage the proliferation of identifiers (e.g., catalog numbers) that can occur with the addition of barcodes.

We concluded the fall 2021 quarter of our online herbarium digitization course and launched the winter 2022 course (see E&O section). These courses have trained 33 students from 5 institutions and 14 students from 6 institutions, respectively, in transcribing label data, interpreting and converting coordinate systems, and digitally annotating specimens.

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

Thanks to the recently drafted MOU, users of Calflora can now download Consortium of California Herbaria data from the Calflora website (in addition to Calflora observations). The download includes a source column that cites the CCH2 data portal.

We integrated California and Oregon vascular plant data from the Harvard University Herbaria into the CCH2 portal to provide a more comprehensive database of California specimens.

Lead PI Yost is the community liaison for the Symbiota Support Hub, and the PM was hired as the Data Manager for the Symbiota Support Hub in September 2021. Thus, the CAP TCN works closely with the Symbiota team on aspects of Symbiota software.

The PM and other personnel have advised other herbaria, such as the Southern Oregon University Herbarium, in digitization practices and protocols.

SHARE AND IDENTIFY OPPORTUNITIES AND STRATEGIES FOR SUSTAINABILITY:

The Consortium of California Herbaria is continuing to pursue archival image storage through the California Digital Library, which charges a relatively low fee for sustainable storage and curation. Maintaining these data in a safe way is critical for the sustained availability of these data.

The PM trained James Mickley (Oregon State University) and Rebecca Crowe (UC Irvine) to set up and manage Notes from Nature expeditions beyond the funding of the CAP TCN. Mickley has successfully launched two expeditions.

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

The PM shares updates on the project and phenology-related news via the network Twitter account (@CalPhenologyTCN).

Five blog posts were written and published to the CAP website: https://www.capturingcaliforniasflowers.org/blog. Blog posts are publicized via Twitter.

Notes from Nature volunteers completed three expeditions this quarter, resulting in transcribed labels for 4,298 specimens from Cal Poly, Oregon State, and UC Los Angeles. Three Notes from Nature expeditions are ongoing, consisting of 5,152 specimens from Fresno State, Oregon State, and UC Los Angeles.

We concluded the fall 2021 quarter of our online herbarium digitization course, which included 33 students from 5 institutions. In this class, students learned how to transcribe herbarium specimen labels in Notes from Nature and our Symbiota portal, CCH2. Students also learned how to transcribe and convert coordinates from a variety of coordinate systems into decimal latitude and longitude, which they did for specimens that had recently been transcribed through Notes from Nature. Further, they learned how to enter annotations into CCH2, which they also did for specimens that had been transcribed in Notes from Nature. As part of the course, students read and disseminate primary scientific literature about herbarium specimen-based research.

We launched the winter 2022 quarter of the online herbarium digitization course, which includes 14 students from 6 institutions. Because of the smaller class size, we anticipate being able to teach more advanced skills, such as georeferencing.

We led a workshop, “Features of the Consortium of California Herbaria CCH2 Portal”, at the Northern California Botanists annual symposium on January 12, 2022. In this workshop, we trained 21 participants (and additional participants who could not attend in person and watched the recording) how to search for, download, and interpret data in the CCH2 portal. We introduced participants to the Darwin Core, our phenological data, and how to create and manage checklists in CCH2. Further, we demonstrated how collectors could manage their own specimen data in CCH2 to contribute to local herbaria and how they could contribute to the transcription and georeferencing efforts of the CAP TCN. As a result of this

workshop, one collector and one private organization plan to use CCH2 to manage their specimen data, and one volunteer was recruited to help with in-person and online digitization work.

WEBSITE AND PORTAL USAGE

Our project website (capturingcaliforniasflowers.org) has received 1,214 visits (approximately equal to last quarter) and 1,944 pageviews (also equal to last quarter) from November 1 to January 13, 2022. The data portal (cch2.org) has supported 13,572 sessions (20% increase from last quarter), 210,791 pageviews (23% increase from last quarter), and 5,832 users (37% increase from last quarter) 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.

TCN Name

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

Person Completing the Report

Regina Wetzer (Lead PI)

Share Progress in Digitization Efforts

ALMNH: Kevin Kocot: We have been focusing on precurating specimens for digitization and digitizing specimens in Arctos. I have a returning undergraduate assistant and one new undergraduate assistant who both seem very bright and enthusiastic. I expect significantly higher productivity on digitization in the next quarter.

AMNH: Fani Rodriguez, Chris Johnson, Lily Berniker: We are selectively downloading locality records for new & updated catalog records for the project and cleaning/completing/merging the various records that will be sent to Q-quatics to test the georeferencing and reimportation process. We are also sharing taxon records by group based on level of completion with Q-quatics to compare taxon records with WoRMs.

ANSP: Paul Callomon: This quarter we created a bare-bones inventory of the entire dry General Invertebrates collection, recording genus, species and country to allow linkage by catalog number, genus, species and country. This allowed a good percentage of the lots to be linked to their original card file (already scanned and databased).

AUMNH: Nusrat Noor: 368 specimens were entered into excel this quarter but is not yet ready to be uploaded to iDigBio.

BPBM: Holly Bolick: This quarter we pre-curated approximately 300 specimen lots that are ready for digitization, we added an additional 807 new specimen records in the database, and have updated and QC'd an additional 1,309 records. We have linked and mobilized another 420 specimen images to their corresponding specimen records, and we were able to take 25 new specimen images this quarter (some new catalog records, some previously cataloged records).

CAS: Christina Piotrowski: Zooniverse, Notes from Nature Invertebrate Time Machine Project (NfN, ITM): Coll. staff have built a team of more than 2,800 volunteer

transcribers, an estimated one third of whom transcribed records during this quarter. CAS staff trained and directly engaged these volunteers during more than 350 transcriber questions and comments this quarter.
Zooniverse Recent progress: this quarter ITM volunteers transcribed data for more than 4,699 catalog cards, each transcribed independently by 3 volunteers over 28,190 classifications (including 3 X duplicate transcriptions in two separate workflows). We continued preliminary QA/QC/reformatting of previously transcribed data to prepare it for ingestion, checking an equivalent of approximately 1,165 records (data is QA/QC'd by field rather than by record).
– We've launched the final card catalog label transcription expedition in November, posting the 7,682 remaining cards for crowd transcription. Informed by two of our staff attending the iDigBio Public Participation in Digitization of Biodiversity Collection Workshop this quarter, we will soon research new ways to implement Notes from Nature projects to transcribe less standardized label formats once our current expedition set is completed.
– On site CAS volunteers scanned more than 1,110 specimen labels this quarter. By keeping accurate scanning completion records, we confirmed that scanning labels for unallocated taxa is much more rapid than label scanning for well curated specimen lots and that there is a large diversity of scanning rates across workers.

FWRI: Paul Larson: 1,867 new lots have been digitized this quarter.

HBOM: M. Dennis Hanisak: We have continued to reorganize HBOM from it remediation and renovation and to train HBOM personnel using non-NSF samples and other funding so that we can maximize our use of our NSF funds for this project.

MCZ: Adam Baldinger: So far this quarter (14 Jan 2022), 425 uncataloged lots, equaling 1,474 specimens, mostly echinoderms were databased from spreadsheet data. To date, 9,339 records in MCZbase were cleaned/vetted for accuracy. Of these, 9,201 contain verified georeferences.

NCSM-NMI: Megan McCuller: We have been making progress primarily in imaging labels and preparing data for import into Specify. However, this was limited this quarter due to acquiring an orphan collection, holidays, and return to work-from-home, as our database is not accessible outside physical work space.

NHMLA: Dean Pentcheff: During this past quarter, we have implemented full use of the four mobile digitizing stations we built last quarter, pushing our total primary digitization counts over 10,000. These workstations have been staffed primarily with Guest Relations personnel from NHMLA, partially-diverted to specimen digitization from their usual guest-facing roles. As the University of Southern California has been opening up to in-person education, we have begun recruiting work-study undergraduates. At present we have a handful in place, but are in the paperwork phase of hiring about twelve students. We are creating job descriptions and job ads to hire a digitizing technician on grant funds in parallel with hiring an entry-level Collections Manager to replace the loss of a senior Collections Manager to retirement and an Assistant Collections Manager to relocation.

RSMAS: Nikki Traylor-Knowles: This quarter we are still focused on getting our collection records into excel spread sheets that can be uploaded into a database. In total we have captured 16,122/55,000 from physical cards or books into excel sheets for digital upload TBD. We also met with IDigBio team about our challeging with choosing a software for digitizing. We decided to try Symbiota, and will work getting a test dataset uploaded this next quarter.

SBMNH: Daniel Geiger: >20,000 specimens cataloged and georeferenced, ~7,500 images mobilized.

SIO-BIC: Charlotte Seid: Digitized 1,398 lots, mostly from an extensive and fairly uniform set of specimens (City of San Diego benthic invertebrate monitoring program) which we are using as a test case and priority for 2022.

SIO-PIC: Linsey Sala: We have continued data capture of our copepod slide collection, n = 1,483 slides digitized this quarter.

UCM: Bridget Chalifour: A total of 391 specimen lots have been imaged this quarter. Bridget Chalifour is continuing work on Specify, including discussion with two other collections at UCM in Specify. We have combined our mollusk and non-mollusk databases with their respective taxonomic information. GA for the section (Erika Nelson) is beginning to georeference this Spring, and has so far georeferenced 50 lots.

UF: John Slapcinsky: Data for 2,219 lots entered into spreadsheets.

VIMS: Jennifer Dreyer: 65 records have been entered into Excel this quarter. Before the holiday break, Specify finally imported the most current invertebrate taxon tree so I can start importing data via the workbench. 27 specimen labels were photographed for an archive to attach to specimen records in Specify. I shared a complete list of VIMS taxa for Q-Quatics to analyze for nomenclatural mistakes, misspellings or updates against the WoRMS taxa match tool as part of the nomenclature WG. Those results have not been implemented yet, but I will go over the errors that were found and resolve as many as possible.

Our quantitative table can be accessed here: 2021 Q2 — Production counts

Guidance:
– Record counts should always be total-to-date (NOT this-quarter's increment). Enter "0" for counts of steps you are not currently performing.
– Time-to-digitize-specimen estimates should be for this quarter only (so, we hope, we will see these get better with time!). Enter "NA" for time in steps you are not currently performing.

Time-to-digitize each specimen is a new set of metrics we are introducing to clarify the various steps in the journey from jar to database, and to help us share efficiencies we are developing. As with the record count numbers, if you haven't been performing a digitizing stage, leave the time estimate blank.

To be clear: these times are *just for specimen data digitizing*, as distinct from digitizing locality data logs, cleaning and processing locality text for georeferencing, or processing photo archives. Those all have their own distinct processing stages and really can't be lumped into a per-specimen metric. So if you've been working hard on those other tasks, and not (yet) on specimen digitizing, don't feel bad *at all* about putting in "NA" for steps you are not doing now.

We are suggesting breaking the digitizing stages for time estimates into three categories:
* **Capture** — This is primary data capture from labels. May be photographing specimen labels, typing specimen data in from vials, etc.
* **Transcription** — This covers turning captured data into digital data, for example typing data from label photos. If “Capture” is direct typing of data, this step might be absent.
* **Processing** — Post-capture and post-transcription work to correct, assemble, and process a specimen record to the point that it is ready for upload to data aggregators.

Because these processes vary so widely, depending on the nature of the collection, we also ask that you give a one-line definition of what

your time-per-specimen means for each of the three categories you use. (Yes, we know these will be hard to read until the spreadsheet is broken out for easier reading.) Examples might be:
“Typing data from labels into spreadsheet”
“Transcribing data from scanned catalog cards”
“QA/QC to fix taxonomy and split coordinates into degrees and decimal minutes”
[Don’t over-think these time estimates! See what you can shoehorn into the metrics we’re proposing, let us know what your estimates cover, and we’ll consider tuning these requests for the next quarter based on our experience.]
Preview below. Click here to go to the table *2021 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 republished 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!".
ALMNH	5,250	-	0	0	0	0	0	0	ca 1,000	0	0	0	0	0	120	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	120 records databased between beginning of Spring 2022 semester and 1/28/22 at 3:05 pm; most recent was ALMNH:Inv:23169
ANSP	22,060	1,600							ca. 7,000							7,207										Physical inventory of the dry collection is linked to scans of card indexes.
AUMNH	10,000	5,000	3,262	0	737	N/A	N/A	N/A	467	n/a	0	n/a	n/a	n/a	n/a	737	737	n/a	n/a	n/a						
BPBM	6,238	3,900			1,370	N/A	N/A	N/A	ca. 300	44	1,870	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
AMNH	56,708	7,000				3,194				3,229	2,139	12,766	11,583	11,583	11,583	199	199		621	imaging labels	317.8	transcribing specimen label data into database				
CAS	59,616	3,500	0	0	0	0	0	0	1,774	17	0	35,912	25,946	6,165	1,153	132	176		200	[sessi	imaging labels (volu	N/A	crowd-sourced trans	204	QA/QC Zooniverse	128	Not feasilbe to time Zooniverse entry but over <3 months 4,622 records were transcribed. Once we begin our data entry phase next quarter we will have data for this process. Just FYI, "Old fashion" hand cataloging to dbase takes on average ~700 seconds/record!
FMNH	1,140	50																								
FWRI	33,582	150	0	0	6,328					0	0						6,328									Will be able to make accurate 'per time' estimates next quarter when new dedicated data entry person starts.
HBOM	10,000	-																								
MCZ	31,564	4,631	8,842	38	550	9,242	0	0	0	0	0	0	0	0	3,618	0	0		NA	NA	NA	NA	420	Data entry of new	0	Asteroid and echinoid data from spreadsheets; once record is
NCSM-NMI	31,283	675	0	0	0	0	0	0	0	0	0	491	0	0	0	350	350									We will begin measuring data capture times
NHMLA	320,000	2,572	0	0	0	0	0	0	1,250	0	0	1,617	0	0	0	12,124	0		133	Mixture of direct ent	N/A		NA			0
RSMAS	55,000	-	0	0	16,122							16,122														I hope I put these in the right catagories!
SBNHM	100,000	4,500	20,571	7,500																						The only thing captured is specimens actually and fully cataloged and images mobilized.
SIO-BIC	29,300	30,000	0	0	3,086	N/A	N/A	N/A	0	564		N/A	N/A	N/A	N/A	3,086	3,086		116	data entry from labe	N/A	N/A	17	QA/QC, cross-refer	N/A	Time estimates are a vast underestimate because they represent work only on a fairly repetitive and uniform set of specimens, used as a test case and low-hanging fruit.
SIO-PIC	34,371	-	0	N/A	0	N/A	N/A	N/A	0	N/A	N/A	N/A	N/A	N/A	N/A	1,483	0		81	data capture from in	N/A	N/A	-	have not begun	N/A	So far our efforts have been focused on direct data capture, and assigning physical locations for easy relocation and loan/use. Future processing effort calculations, which will likely be the more time consuming aspect to come in future reports. The majority of our lots typically have the animal ID, expedition, and station information; however, lack additional collection metadata (lat/long, date, time, gear type). Collection manager is currently working on possible solutions to automate and decrease this sample processing time from known expeditions within our collections.
UCM	3,285	1,000	0	0	0	50	0	0	0	391	0	0	0	0	0	391	0	0	NA	NA	NA	NA	NA	NA	NA	
UF	20,000	400,000	5,861	25,211	0	10,638	0	0	2,219	400,000	7,547	0	0	0	0	0	0	0	NA	NA	NA	NA	NA	NA	NA	Semester break reduced output for December and January
VIMS	6,000	125	0	0	0	65	0	0		27	0	0	0	0	0	65	0		180	data entry from labe	N/A		NA		0	All of our records have lat/long data but no uncertainty associated with them. This still needs to be done within CoGeo or Specify once the records are uploaded. This quarter progress was slower than expected due to my one employee breaking her wrist which significantly slowed down data entry and because of an extended holiday break at our institution. My employee is almost fully recovered and I anticipate we will be able to increase data entry again in the next quarter.

Share Identified Gaps in Digitization Areas and Technology

ALMNH: Kevin Kocot: We have been leveraging Arctos's data quality checks to ensure the completeness and accuracy of our data. This has helped catch a number of errors missed by the person entering the data.

AMNH: Fani Rodriguez, Chris Johnson, Lily Berniker: We are tracking modified & new records separately via our Project Attribution Tab. We are targeting a subset of localities for cleaning and georeferencing to test the process. We established a workflow for new images: digitizers image labels with barcode label and sometimes specimen where appropriate; upload images to a folder with current valid or synonym name; rename images with barcode; permanent staff retrieve images, upload images to database, create new catalog records from these data and populate all standard fields (project attribution, storage, counts, taxon name etc.) and attach images to catalog records. A shared form for digitizers alerts permanent staff an accession record is missing from database; permanent staff investigate, create accession record and attach catalog record to accessions. This also helps identify localities in some instances.

ANSP: Paul Callomon: A new small laptop was purchased and configured for all-wireless inventory work using FileMaker. Making the machine smaller and lighter has enabled more versatility with larger specimens and higher-placed drawers. Voice recognition is used for catalog number and country fields.

BPBM: Holly Bolick: Our current practices are working well with the staff we have. We have incorporated our new microscope camera into the digitization workflow for

targeted specimens which has not had any significant negative impact on overall project progress.

CAS: Christina Piotrowski: The Specify subgroup of the Workflows WG has continued meeting regularly to discuss specific challenges that our new Specify users are tackling. Academy staff have regularly participated in this discussion, and we organize meeting notes and reporting for this WG.
– CAS staff is currently involved on the Steering Committee and in Specify, Expedition, Nomenclature, Georeferencing, and Digitization Working Groups[1]. We also served on the hiring committee for the DigIn Project Manager, to be brought onboard shortly by NHMLA.

FWRI: Paul Larson: I shared our method of storing oversized sea stars and other echinoderms that are not easily jarred with the group.

MCZ: Adam Baldinger: MCZ staff continue to be involved in Steering, Expedition, Nomenclature and Georeferencing committees/workgroups. Information obtained is then shared with others in MCZ's Invertebrate Zoology and Malacology departments, including those working on other TCN's (ESB and PILSBRy). Various staff members working on the project participate (via Zoom) in monthly DigIn ESB general meetings and monitor communications shared on Slack.

NHMLA: Dean Pentcheff: We have succeeded in printing double-sided digitizing number tags with machine-readable barcodes onto Resistal tag paper, then getting those commercially cut. This approach has given us hundreds of thousands of uniquely-numbered, barcoded tags that can be read in any orientation in collection containers.

RSMAS: Nikki Traylor-Knowles: We have been working with our interns to be precise and to increase speed. We have found that having at least two working at a time is helpful.

SBMNH: Daniel Geiger: All established procedures work for us.

SIO-PIC: Linsey Sala: Capturing the physical location of each of our specimen lots as we capture label data will make locating individual lots easier in the future.

UCM: Bridget Chalifour: EDF imaging workflow has been finalized and images are being saved on the museum server. Section GAs are writing SOPs for imaging and georeferencing specifically for invert zoology to save to the museum server for future students'/employees' use.

VIMS: Jennifer Dreyer: I am organizing the Nomenclature WG, and we have started working with Nicolas Bailly and Q-Quatics to resolve mistakes with species names within each of our collections. I also continue to attend All Hands meetings and participate in Specify, workflow, and georeferencing WGs whenever possible. I also participate with the general group via Slack to get answers on questions or to provide feedback on outreach content.

[1] WG

Share Opportunities to Enhance Training Efforts

ALMNH: Kevin Kocot: Having a veteran student worker train a new student worker seems like it will be highly effective and also save me time.

AMNH: Fani Rodriguez, Chris Johnson, Lily Berniker: iDigio workshops are being planned to use tools such as Open Refine, which is expected to be helpful to all.

CAS: Christina Piotrowski: CAS participated in several workshops and webinars this quarter, including (1) iDigBio Resources for digitizing biodiversity collections and managing the digitized data, (2) Dublin Core metadata Initiative (DCMI) Open Refine introduction workshop, and (3) iDigBio: Public Participation in Digitization of Biodiversity Collections.
– During our Specify WG meetings we held informal discussions and "advice sessions", some of which recently resulted in the mobilization of our Nomenclature WG.

FWRI: Paul Larson: I shared a data entry spreadsheet I made that automatically checks the taxa entered onto the sheet for agreement with existing taxa in the database in order to prevent typos, or to alert the data manager to new species names that need to be entered into the database. It does the same with agent names too. This helps because typos are more likely when an inexperienced person is entering hand-written names that are unfamiliar.

NHMLA: Dean Pentcheff: We are assembling a suite of training options (as mentioned above by AMNH) that we will use to survey DigIn program members to identify what subject areas and training delivery will be most useful.

SIO-PIC: Linsey Sala: The use of the daily tracking spreadsheet is working well to monitor student assistant progress and ability of the Collection Manager to summarize quarterly/annual efforts effectively, including newly added 2022-Q1 – lot digitized per unit time.

UCM: Bridget Chalifour: Erika Nielson has trained two fellow graduate students in imaging protocols.

VIMS: Jennifer Dreyer: In our Nomenclature WG, we have discussed potentially having some additional workshops that are focused on learning open refine tools to help clean up taxon names in our databases and how to walk groups through the taxon match tool, if help is needed. Nicolas Bailly will be given a presentation in the next All-Hands meeting on common mistakes and errors for taxon naming.

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

AMNH: Fani Rodriguez, Chris Johnson, Lily Berniker: Eastern Seaboard Mollusks; USC Annenberg Institute for developing our social media tools.

CAS: Christina Piotrowski: ESB TCN; Zooniverse/Notes from Nature; WoRMS .

FWRI: Paul Larson: I participated in WGs that are shared between the DigIn TCN and the ESB TCN.

MCZ: Adam Baldinger: Information continues to be shared among permanent MCZ curatorial staff working on other TCN's–ESB and PILSBRy–and on an NSF-CSBR cryogenic collections grant.
– Here is a great E/V Nautilus 2021 highlight video. The 2021 samples from NA134 and NA135 from areas within the Papahānaumokuākea Marine National Monument should arrive at the MCZ in the next week or two. Jennifer Winifred Trimble has worked very hard over the years to get the E/V Nautilus specimens curated, databased and properly housed in our collections. Images and videos from the E/V Nautilus are continually being uploaded to our database as well.

NHMLA: Dean Pentcheff: We continue to cooperate with the ESB TCN wherever our digitizing development and strategies overlap. USC Annenberg students for social media help.

RSMAS: Nikki Traylor-Knowles: Eastern Seaboard Mollusks.

UF: John Slapcinsky: Participated in Georeferencing WG with ESB.

Share Opportunities and Strategies for Sustainability

ALMNH: Kevin Kocot: Reduction of in-person meetings in favor of Zoom or other online platforms is one of the most impactful ways we can reduce our carbon footprint. Better advertising of available specimens can reduce the need to collect material by others, thus reducing carbon footprint and decreasing impact on native populations of organisms.

AMNH: Fani Rodriguez, Chris Johnson, Lily Berniker: Card catalogs scanned by library & images will be attached to catalog records in the database to ensure data longevity.

CAS: Christina Piotrowski: The CAS Zooniverse - NfN ITM Project results in card label scans, and we are also scanning other jar labels during our onsite volunteer workflows. These scans will be invaluable for future reference/online accessibility as a specimen data QA resource; scanned CAS station list files and field notes creates the potential for historical marine data resource uploads and sharing for reference by future workers.

RSMAS: Nikki Traylor-Knowles: We have exciting news, and while it is still in the beginning stages, it gives us hope. We finally got some traction with RSMAS administration for preservation of the collection by incorporating it into a Masters of Professional Science Track. I am working with Maria Criales and Angela Clark to develop this track, but the idea would be that through the revenue of this track, we could hire a full time curator and research technician to help maintain the collection! So, like I said we are still in the planning stage, but excited that there is a future way forward for the collection where we can integrate education and research-which will hopefully revitalize the collection for future generations.

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

ALMNH: Kevin Kocot: We hosted two high school students in the ALMNH as part of the Scientist for a Day program on 12/3 where students learned microscopy and DNA barcoding techniques using museum specimens.

ANSP: Paul Callomon: Two field trips to the New Jersey shore with co-op students and curatorial assistants focused on large invertebrates such as sponges and horseshoe crabs. Paul Callomon gave a presentation on the South Carolina Marine Resources Institute collection at the Academy's annual members' event.

CAS: Christina Piotrowski: NfN ITM Project: mobilized approximately 900 volunteer transcribers to crowdsource collections data this quarter (more than 2,800 transcribers from Oct 2020-Jan 2022). This quarter we received 350 questions and comments from our ITM transcribers and CAS staff responded to questions about label data that inspired transcribers' curiosity.

– We provided content describing the value of historical marine collections data and engagement by describing captivating collections and collector "stories" in the collaborative Zooniverse Talk tool. Transcribers have researched and discussed historically significant collections, researched geography and taxonomy of diverse specimen records, and have encountered and digitized records of several extinct species. We've had a few students working on the project this quarter, as well as several docents who work on our museum's main floor engaging with the public, and this project enhances their connection with museum collections in their own building.

NHMLA: Regina Wetzer: I hosted two (2) University of Southern California undergraduate marine biology classes (~35 students) for a immersive invertebrate lab and collections experience. It was a delight to have our Guest Relations staff share the uses of our collections and show off the digitizing process.

RSMAS: Nikki Traylor-Knowles: As mentioned before we are developing an educational MPS track around the collection, which in the future should generate a lot of great learning outcomes. We are also currently training 4 different interns.

SIO-BIC: Charlotte Seid: E&O was paused this quarter due to the Collection Manager being away for 7 weeks of field work.

SIO-PIC: Linsey Sala: Collection Manager continues to support requests for remote collection tours/presentations and the use of Pelagic Invertebrate Collection's materials in our Marine Invertebrate course this academic quarter.

UF: John Slapcinsky: Tour given to UF Conservation Club generated two new volunteers.

Share Information About Your Website and/or Portal Usage

NHMLA: Victoria Westover: DigIn's Instagram account @diginverts has published 10 posts and two story highlight reels. The Instagram posts include two project introductions, two Invertebrate of the Week posts, two Scientist Spotlight posts, two Friday Fun Fact posts, and two weekly hashtag posts. One story highlight reel

explains why DigIn is important and the second links each Invertebrate of the Week post to DigIn's data portal, InvertEBase. We have also created a Twitter account @DigInverts and will begin posting on the Twitter feed this week sharing interesting finds while digitizing. *The Invertebrate of the Week* posts showcase a specimen each week. *The Scientist Spotlight* posts highlight someone who works on DigIn, explains their role and shares what the person most likes about the project. *The Friday Fun Fact* posts share an interesting fact about an invertebrate species and the weekly hashtag posts coincide with trending hashtags in the scientific community (i.e. #MolluskMonday or #SeaSpiderSaturday.)
– Also visit our DigIn website https://www.digin-tcn.org.

Share Other Activities and/or Progress

ALMNH: Kevin Kocot: This Fall I had two graduate student interns working in the collections to do maintenance work on specimens, cleaning, and organization. They helped make room for newly digitized specimens and helped us identify specimens that are not yet digitized.

CAS: Christina Piotrowski: On site: This quarter CAS added one new on-site volunteer to our team of label scanners.
We currently have 3 on-site volunteer label scanners and one pre-curation volunteer who works ahead of label scanners to pre-curate ethanol lots. We hope to bring on at least 2 more scanners next quarter.
– This quarter another remote volunteer using WoRMS researched accepted vs. unaccepted name greatly assisting staff with cleanup of crowd-transcribed specimen records. Next quarter they will work on-site helping to troubleshoot our data entry protocols to prepare them for our data entry technician.
– Current data/database: After completing our database migration to a new customized Specify database, we are continuing to work towards full implementation and troubleshooting.

FWRI: Paul Larson: Austin Smith has left the project to take on a full-time position in the collection. He will be replaced in late January by Tracy Shaw.

NCSM-NMI: Megan McCuller: During this quarter we acquired the SERTC Collection (Southeastern Regional Taxonomic Center), comprising an estimated 4,500 lots of marine invertebrates. A portion of the quarter was spent on manual tasks necessary for bringing in this invaluable collection.

SBMNH: Daniel Geiger: Just about to hire new curatorial assistant.

SIO-PIC: Linsey Sala: We have completed the purchasing and setting up of two additional student computer workstations (laptops, monitors, software, ethernet wiring). We have gone live with two student assistant position postings and recruitment is forthcoming. Database development is still ongoing, but progressing.

UF: John Slapcinsky: 7,547 photos edited for upload, but not yet uploaded.

VIMS: Jennifer Dreyer: This quarter progress was slower than expected due to my one employee breaking her wrist which significantly slowed down data entry and

because of an extended holiday break at our institution. My employee is almost fully recovered, and I anticipate we will be able to increase data entry again in the next quarter.

Additional costs due to COVID pandemic

AMNH: Fani Rodriguez, Chris Johnson, Lily Berniker: Shipped monitor to a volunteer to facilitate remote transcription of excel data.

ANSP: Paul Callomon: Material costs have rocketed, especially specimen trays and glass vials.

CAS: Christina Piotrowski: 1. We've incurred additional supplies expenses to support remote scanning of cards and documents. For efficiency we'll require more than one scanning work station, which we will attempt to staff with volunteers, once our museum's Volunteer Services program is reactivated, as we have been unable to image a sufficient number of labels this FY due to staff working remotely. Equipment for multiple scanning stations (including computers) are an unexpected cost.
– 2. Staff remain unable to work on site full time, but we are preparing to ramp up by hiring/training our project technician.
– There remains uncertainty re: the impact of COVID conditions on our project budget over long term, however we're currently spending significantly more CAS staff time on basic project work in the absence of student and project staff support, and we will require many more hours of highly trained staff later in the funding period to complete the more high level tasks such as data research, cleaning, and upload. The current higher load of grant supporting activities and remote work have prevented staff from attending to non-grant related projects, which will cut in to time available for these complex tasks later in the project. Full impact of this remains to be determined, but we may be unable to finish the work in the remaining funded 3 years and will need project staff to extend beyond the 4th year (currently not budgeted for).

HBOM: M. Dennis Hanisak: Not really additional costs, but significant delays in the required remediation and renovation of our collection space and in receiving orders from vendors.

NHMLA: Dean Pentcheff: As noted earlier, we have been relying of hours from our museum Guest Relations staff. With USC students physically back on campus, we have been interviewing and are in the process of hiring 8-12 workstudy students. Their semester ends mid-May. We are hopeful to be able to retain at least a few over the summer. We are still waiting to be able to bring back volunteers on site which will be imperative to keep salary costs within budget, but for now – to make the much needed progress we need to emphasize non-volunteer digitizers. We will also need go from four (4) workstations to eight (8) workstations to make up for earlier low capture rates.

SIO-PIC: Linsey Sala: We have not had any monetary costs associated with COVID, but continue to experience pandemic related challenges, shortages/shipping, and less time for staff on-site work due to illness, exposures, etc.

UCM: Bridget Chalifour: We were unable to use the university library book scanner to digitize our paper ledgers due to COVID restrictions. Depending on other resources available at the university or museum, we may incur costs to buy our own scanner. COVID-related restrictions continue to affect productivity particularly in our small imaging space.

==========

Key to Abbreviations

ALMNH	University of Alabama Tuscaloosa, AL (K.Kocot)
AMNH	American Museum of Natural History, New York, NY (E.Rodríguez, C.Johnson, L.Berniker)
ANSP	Academy of Natural Sciences, Philadelphia, PA (P. Callomon)
AUMNH	Auburn University, Auburn, AL (N. Noor)
BPBM	Bishop Museum, Honolulu, HI – (H.Bolick)
CAS	California Academy of Sciences, San Francisco, CA (C.Piotrowski)
FWRI	Fish and Wildlife Research Institute, St. Petersburg, FL (P.Larson)
HBOM	Florida Atlantic University, Fort Pierce, FL (D. Hanisak)
MCZ	Harvard University, Cambridge, MA (A.Baldinger)
NCSM-NMI	North Carolina Museum of Natural Sciences, Raleigh, NC (M.McCuller)
NHMLA	Natural History Museum of Los Angeles County (lead), Los Angeles, CA (D. Pentcheff)
RSMAS	University of Miami, Rosenstiel School of Marine & Atmospheric Science, Miami, FL (N.Traylor-Knowles)
SBNHM	Santa Barbara Museum of Natural History, Santa Barbara, CA (D.Geiger)
SIO-BIC	Scripps Institution of Oceanography, University of California San Diego, CA (C.Seid)
SIO-PIC	Scripps Institution of Oceanography, University of California San Diego, CA (L.Sala)
UCM	University of Colorado, Boulder, CO (B.Chalifour)
UF	University of Florida, Gainesville, FL (J.Slapcinsky)
VIMS	College of William & Mary—Virginia Institute of Marine Science, Gloucester Point, VA (J.Dreyer)

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: 1,132 lots representing 26,140 specimens have been newly digitized.
ANSP ESB: 4,557 records for 30,183 for mollusks taken off South Carolina have been digitized in Excel, but not yet imported to the collection database or assigned catalogue numbers.
BMSM ESB: The Museum continues to digitize new acquisitions, having cataloged 1,717 new lots from the ESB during the period in question, for a total of 4,054 specimens. In addition, BMSM cleaned and standardized ESB locality names (mostly in Florida) for 5,537 lots. BMSM uploaded 258 new composite images and georeferenced localities encompassing 16,848 lots.
CM ESB: 1,647 records data cleaned; 454 lots georeferenced.
DMNH ESB: The Museum has continued to standardize locality names in preparation for uploading to InvertEBase. Over 47,800 records were quality enhanced as part of this effort. In addition, we found the family Rissoidae has almost no digital footprint and will need to be added *de novo*.
FWRI ESB: 2,500 lots georeferenced and 215 denovo digitized specimen records
HBOM ESB: We have continued to reorganize HBOM from its remediation and renovation and to train HBOM personnel using non-NSF samples and other funding so that we can maximize our use of our NSF funds for this project.

HMNS ESB: 866 lots representing 9,802 specimens had their records updated and cleaned. 351 lots representing 3,974 specimens were able to be determined if they were collected live or dead.
MCZ ESB: No uncataloged lots/records were databased this quarter; to date, 10,027 records in our database were cleaned/vetted for accuracy, and of these, 9,992 with verified georeferences. 9,579 records are available on iDigBio.
LACM ESB: 427 specimen lots have been entered and/or modified. These include records within the families Neritidae, Phenacolepadidae, Aporrhaidae, Solemyidae, Nuculidae, Nuculanidae, Yoldiidae, and Arcidae.
NCSM ESB: 347 lots representing 1,986 specimens have been digitized, data cleaned and georeferenced.
RSMAS ESB: We have to date digitized by getting the data into spreadsheets- Mollusca : 10,751 lots
UF ESB: 108 lots of 427 specimens were newly digitized, georeferenced and are available in InvertEBase. an additional 204 lots were georeferenced and data for 570 lots were cleaned and prepared for georeferencing. Two new UF students were hired to replace graduating students.
UMMZ ESB: 552 lots representing 3,912 specimens have been digitized; 538 lots uploaded to InvertEBase portal; 570 images generated, and 56 lots georeferenced.
PRI ESB PEN: Nothing to report.

Share Best Practices, Standards, and Lessons Learned

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

FMNH ESB: Development of geographic workflows/protocols; recruited 3 new volunteers to implement these workflows in preparation for digitization.
ANSP ESB: Nothing to report.
BMSM ESB: Nothing to report.
CM ESB: Nothing to report.
DMNH ESB: Nothing to report.
FWRI ESB: I shared a document that checks species names and agent names against our database entries in the Workflows working group.
HBOM ESB: Nothing to report.
HMNS ESB: Nothing to report.
MCZ ESB: Permanent staff involved in the project continue to participate in Outreach, Steering, Expedition, Nomenclature and Georeferencing committees/work groups. Information is then shared with others in MCZ's Malacology and Invertebrate Zoology departments, including those working on other TCN's (DigIn and PILSBRy). Various staff members working on the project participate (via zoom) in ESB monthly ESB general meetings and monitor communications shared on various Slack channels.
LACM ESB: Nothing to report.
NCSM ESB: All specimens that have been digitized for this grant have a live/dead determination.

RSMAS ESB Nothing to report.
UF ESB**:** Nothing to report.
UMMZ ESB**:** Nothing to report.
PRI ESB PEN: 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.
DMNH ESB: Nothing to report.
FWRI ESB: Nothing to report
HBOM ESB: To increase our capacity we have set up a second imaging station and plan to add more personnel (part-time assistant, volunteers).
HMNS ESB: Currently GeoLocate is not embedded in the HMNS EMu CMS. The Inventory Manager has been working with Axiell and GeoLocate functionality will be included in the next HMNS update for EMu. The museum has also signed a contract with Axiell for use of another product called CultureConnect that will allow the institution to publish images and information for the objects currently on display. Once the Inventory Manager has worked out any potential issues with integrating CultureConnect into EMu the plan will be to add GeoLocate functionality as well.
MCZ ESB: Nothing to report.
LACM ESB: Nothing to report.
NCSM ESB: Nothing to report.
UF ESB: Nothing to report.
UMMZ ESB: Nothing to report.
RSMAS ESB: Nothing to report.
PRI ESB PEN: 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: Nothing to report.
BMSM ESB: Nothing to report.
CM ESB: Nothing to report.

DMNH ESB: Nothing to report.
FWRI ESB: Nothing to report.
HBOM ESB: Nothing to report.
HMNS ESB: Nothing to report.
MCZ ESB: Nothing to report.
LACM ESB: Nothing to report.
NCSM ESB: Technician and PI attended iDigBio Workshops and/or recordings by Nelson Rios on georeferencing.
RSMAS ESB: Nothing to report.
UF ESB**:** Nothing to report.
UMMZ ESB: Nothing to report.
PRI ESB PEN: 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: Stations for digitization of South Carolina mollusks will also be used for digitization of other invertebrates for DigIn TCN.
BMSM ESB: Nothing to report.
CM ESB: Nothing to report.
DMNH ESB: Nothing to report.
FWRI ESB: Nothing to report
HBOM ESB: Nothing to report.
HMNS ESB: Nothing to report.
MCZ ESB**:** Information is shared among permanent MCZ staff working on other TCN's: DigIn and PILSBRy, and an NSF CSBR cryogenic collections grant.
LACM ESB: Nothing to report.
NCSM ESB: We are currently working with the North Carolina Shell Club to use this data for a new Seashells of North Carolina Seashells book.
RSMAS ESB: Nothing to report.
UF ESB**:** Nothing to report.
UMMZ ESB: Nothing to report.
PRI ESB PEN: 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.
DMNH ESB: Nothing to report.
FWRI ESB: Nothing to report.
HBOM ESB: Nothing new to report.
HMNS ESB: Nothing to report.
MCZ ESB: Nothing to report.
LACM ESB: Nothing to report.
NCSM ESB: Nothing to report.
RSMAS: We are starting to work with the dean of RSMAS to incorporate the collection into teaching initiatives. Basically we would develop a professional master's track about this collection and have classes that align with the collection preservation. Still very new and very early, but we are excited.
UF ESB: Nothing to report
UMMZ ESB: Nothing to report.
PRI ESB PEN: Nothing to report

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

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

FMNH ESB: Coordinated Mollusk of the Month on Instagram, Twitter and Facebook.
BMSM ESB: The PI presented the goals and results updates in two sessions at a Zoom series "Coffe with Science, at the Brazilian University Veiga de Almeida (Rio de Janeiro), as a part of a podcast titled "Working with Mollusks!"
CM ESB: Nothing to report.
DMNH ESB: Nothing to report.
FWRI ESB: Posted items to instagram as part of the outreach committee
ANSP ESB: The PI prepared text and images for Mollusk of Month for January, *Noetia ponderosa*, the Ponderous Ark Shell. This was released on ESB feeds on Facebook, Twitter and Instagram. The PI has also continued work with iNaturalist (see MCZ report below) and is the primary person bringing older observations into the ESB iNaturalist portal by flagged the live/dead status.

MCZ ESB: The iNaturalist public portal keeps growing and now includes 55 members, 2,528 identifiers, 64,952 observations and 845 species.
https://www.inaturalist.org/projects/eastern-seaboard-mollusks
HBOM ESB: Nothing to report.
HMNS ESB: Nothing to report.
LACM ESB: Nothing to report.
NCSM ESB: We began a Twitter account in January. We continue to gain followers on TikTok, Instagram, and Facebook. Our technician was interviewed by NC State University on what her job consists of, in hopes of reaching a larger audience. We have increased our audience of women to 29.3% on Instagram. For Instagram we have had 13 posts, Facebook has had 125 posts, and Instagram has had 25 Tweets in this time period.
RSMAS ESB: Nothing to report.
UF ESB: Wrote Twitter post for the Mollusk of the Month for December
UMMZ ESB: Nothing to report.
PRI ESB PEN: 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: Nothing to report.
ANSP ESB: Nothing to report.
BMSM ESB: Nothing to report.
CM ESB: Nothing to report.
DMNH ESB**:** In conjunction with the renovation of the Museum, DMNH has recently changed its name to The Delaware Museum of Nature and Science (DelMNS). The website is currently being updated to reflect the change. There is no access to the digitized collections data from the new DelMNH website but there are plans to update in the future.
FWRI ESB: Portal is hosted by Specify Collections Consortium and traffic and searches cannot be tracked by FWRI staff.
HBOM ESB: Nothing to report.
HMNS 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
LACM ESB**:** Nothing to report.
NCSM ESB**:** Nothing to report.

RSMAS ESB: Currently still developing the website, hope to have it launched by the end of the spring semester.
UF ESB**:** Nothing to report.
UMMZ ESB**:** Nothing to report.
PRI ESB PEN: 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: After the sudden retirement of Collections Manager Jochen Gerber, a search for a successor has been initiated.
ANSP ESB: The PI is spending part of a sabbatical working with Rob Guralnick at the University of Florida in Gainesville. One goal is to learn programming in R which will help with automation for finding basis of records in BHL for names in partner collections that are not in MolluscaBase.
BMSM ESB: Nothing to report.
CM ESB: Nothing to report.
DMNH ESB: The Museum has rebranded and changed its name to the Delaware Museum of Nature and Science.
FWRI ESB: Nothing to report.
HBOM ESB: Nothing to report.
HMNS ESB: Nothing to report.
MCZ ESB: Nothing to report.
LACM ESB: Nothing to report.
NCSM ESB: Nothing to report.
RSMAS ESB: Nothing to report.
UF ESB: Nothing to report.
UMMZ ESB: Nothing to report.
PRI ESB PEN: 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 October 1 – December 31, 2021.

All GLOBAL institutions were able to continue GLOBAL work in some capacity during 2021-Q4, although the end of an academic semester and end of the year holidays reduced productivity for some institutions compared with the prior quarter.

Imaging Equipment & Workflows

Additional progress was reported in setting up and optimizing imaging equipment and workflows during 2021-Q4.

ALA updated their digitization station with LED lights and a better light box. With digitization in full swing again, they installed an easy to use SQL code for keeping track of progress internally. ASU established a standardized image acquisition workflow using BCRWatcher (a barcode renaming and skeletal metadata program). A student worker is currently being trained in this

[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

workflow. Once the workflow has been tested more extensively, it will be shared with participating institutions via Basecamp. COLO explored options to start capturing images of specimens and hope to have a workflow in place soon. Specimen imaging began in earnest at LSU this quarter. NY completed barcoding of the general lichen collection and started progress on lichen exsiccate. OSC consolidated the location of over 750 specimens related to GLOBAL work which were dispersed throughout their collection. They optimized imaging protocols and identified necessary improvements to their imaging platform.

Personnel

COLO began hiring another in-person digitizer and may have one remote digitizer switch to in-person work. This should help speed up progress. Final exams were on the early side this year and they did not have students in the collection for most of December. The university has also announced that they will start the semester remotely which means they will also have limited in-person student help in January. LSU trained a new student and a new volunteer to digitize bryophytes. MSC hired two undergraduates. TENN interviewed and hired four new undergraduate technicians in December 2022 to start work during the January 2022 Winter Mini-Term.

Digitization

Nineteen institutions (ALA, ASU, CINC & MU, COLO, DUKE, F, FLAS, ILL & ILLS, LSU, MICH, MIN, MO, MSC, NY, PH, TENN, UC, WIS, and YU) reported progress on digitization deliverables, with a total of 52,099 specimens barcoded (25,834 bryophytes and 26,265 lichens), 50,055 labels imaged (23,402 bryophytes and 26,653 lichens), 43,766 specimens imaged (17,620 bryophytes and 26,146 lichens), 27,318 specimen records uploaded to the portal (14,509 bryophytes and 12,809 lichens), 38,991 skeletal records created (17,054 bryophytes and 21,937 lichens), 28,696 labels fully transcribed (22,483 bryophytes and 6,213 lichens), and 18,042 specimens georeferenced (8,638 bryophytes and 9,404 lichens).

Table 1: Digitization progress by GLOBAL collaborators in 2021-Q4, 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	2	823	52	164	54	987								
ASU		526		15		44		15		15		15		
BRY														
CINC & MU	1,380		1,380		1,380		1,380		1,380		3,412	30		
COLO		3,270		3,270				3,270		3,270		1,368		
DUKE	1,770		2,141		906		3,047	8,903	1,770		543		40	
F	3,000	928	3,450	482	3,450	482			1,285	917	2,096	446		446
FLAS	3,600													
ILL & ILLS	1,754		1,754		1,754									
LSU	583	82	1,000	6	383		583	82	583	82	334	87	70	214
MICH	4,504		4,515		400		2,620		3,536		1,335		184	
MIN		6,365		6,365		6,365				6,365	5,052			
MO	3,377		2,260		2,260				2,427		2,428		310	
MSC	2,416	484	2,416	484	2,416	484	2,421		3,310	484	3,242	484		
NY	833	13,244		12,127	183	12,127			721	6,976	113	3,244	3,864	4,136
OSC														
PH	5	393	5	393	5	393		393		393		393		
TENN	646		2,465		2,465		2,494		2,042		2,933	146	654	
UC		150		3,312		3,312				3,400				
WIS				35		1,952		146		35			3,516	4,608
YU	1,964		1,964		1,964		1,964				995			
Totals	**25,834**	**26,265**	**23,402**	**26,653**	**17,620**	**26,146**	**14,509**	**12,809**	**17,054**	**21,937**	**22,483**	**6,213**	**8,638**	**9,404**
B+L Totals		**52,099**		**50,055**		**43,766**		**27,318**		**38,991**		**28,696**		**18,042**

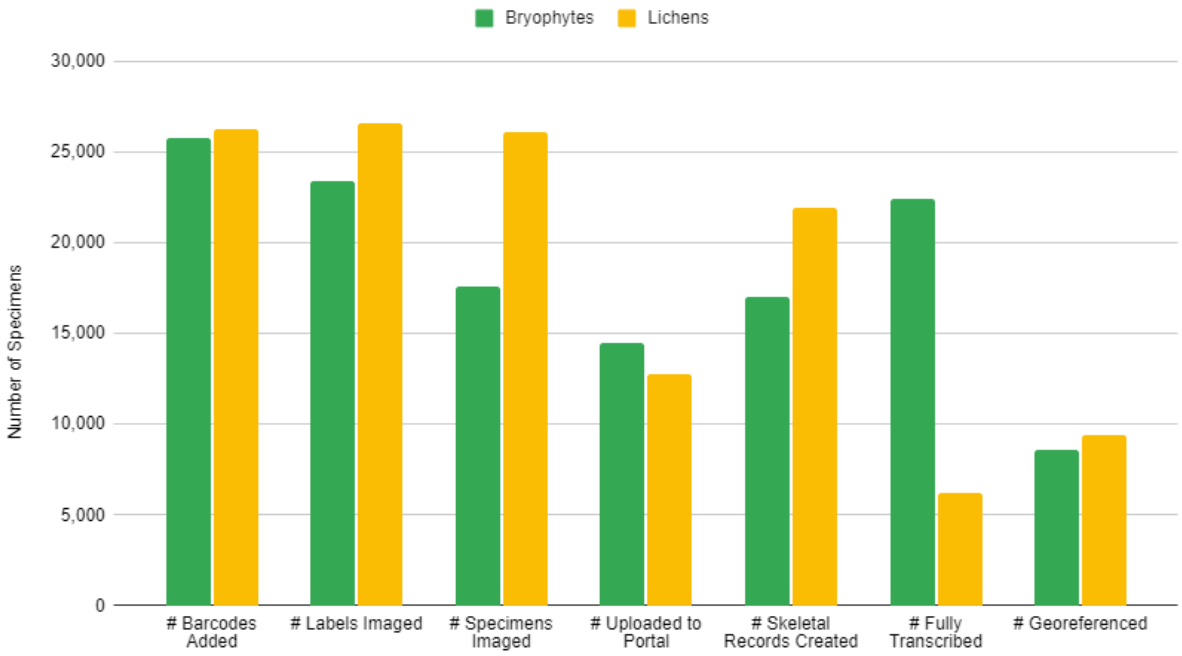


Figure 1: Digitization progress for the GLOBAL collaboration in 2021-Q4, separated by Bryophyte and Lichen specimens.

Share Best Practices, Standards, and Lessons Learned

Flexible Workflows

The GLOBAL teams continued to make use of flexible digitization workflows in 2021-Q4, including some use of virtual transcription work and prioritizing label imaging, while most collaborators were able to begin or continue on-site work.

Based on preliminary work at COLO, the quality of specimen images is hampered by using a fixed imaging system to capture both packet/label data and specimens. Access to the collection improved for the fall semester, but they did not have as many digitizers as they have had in the past. COLO will most likely take the specimen images later in the project when they have a system in place for capturing better specimen images.

NY, while continuing imaging, pivoted to some transcription to accommodate reduced on-site schedules.

OSC discovered that implementing scalable movement of imaging platform to camera lens can increase depth of field and image resolution.

PH found that swim meets, final exams and COVID-19 university closures prevented their work-study student imager from coming into the herbarium.

UC worked to continue creating a positive, supportive, and safe atmosphere for their students, which is especially important during these stressful (COVID) times.

Transcription

LSU found that merging data from a large dataset of duplicate records requires careful review and an understanding of the quality of different herbaria's work. This is good work for experts, as lots of decisions need to be made in order for the task to be most efficient and effective. Whereas, when searching duplicates for single record entry, the task is much more manageable and can be done by any trained individual. Lesson is that it might be easiest to transcribe a full record at once, rather than reviewing the merge of a duplicate record with errors. If duplicate records are blindly added in, errors can easily extrapolate!

MSC found that having spreadsheets submitted with contemporary specimens saves an enormous amount of time transcribing.

Collaboration

Team members continued to make use of Basecamp, Zoom, and email to communicate and collaborate during 2021-Q4. New collaborators and students were given access to Basecamp group resources. A meeting of the Transcription Working Group was held in December to discuss best practices and standards. The Nomenclature & Taxonomy Group also met in December to discuss and demo how taxonomy is maintained in the portals and to brainstorm possible improvements. The Outreach & Education Group met three times in preparation for the October WeDigBio event and a fourth time as a post-event debrief. They also held a higher level meeting in December to discuss Outreach, Education, Diversity and Inclusion goals and plans for the collaboration. The Georeferencing Manager (WIS) held a meeting to update the GLOBAL team on centralized georeferencing progress and to share associated resources. She and her students are continuing to create communities and georeference in the Collaborative Georeferencing Client (CoGe).

A Management Committee Meeting was held in November open to all GLOBAL team members to review quarterly grant progress. The GLOBAL Project Manager (TENN) completed the check-

in meetings that started in 2021-Q3, Zooming with the remaining collaborators in October (FLAS, NY, and OSC) to discuss progress, concerns, and plans.

Data Cleaning

Symbiota's taxon cleaning tool was used to verify all scientific names in the LSU profile of Bryophyte Portal. A back-end duplicate search was conducted to pull in data from other collections to merge into LSU's records. This work requires careful review and is ongoing.

UC Curator Scharnagl was responsible for making sure lichen species names are in the CSpace database, and for updating any missing or duplicate barcodes (most lichen specimens in our collection are already barcoded).

Share Identified Gaps in Digitization Areas and Technology

Image Uploading

ASU IT continued to facilitate the upload of images into the Lichen and Bryophyte portals. While an image uploading workflow has been established, those institutions with alternate hosting may have separate challenges. UC is taking two images per lichen record; one of the label and one of the specimen. However, they seem to be having trouble uploading both images to the Symbiota portal (one simply replaces the other). They will reach out on the GLOBAL platform for troubleshooting ideas.

Barcode Renaming

The development of the BCRWatcher a program at ASU was finalized and subjected to rigid testing. The program reads barcodes from image files, rename the files using these barcodes and allows the user to capture skeletal image metadata as part of the image acquisition workflow.

GLOBAL Interface

A discussion began in 2021-Q4 to determine the best way forward for a combined Lichen and Bryophyte data portal interface. The grant proposal was reviewed and meetings were scheduled for the Executive Committee and IT Team to discuss further in 2022-Q1.

Share Opportunities to Enhance Training Efforts

ALA PI Ickert-Bond demoed a number of outreach tools and resources during the December Outreach & Education Meeting.

The ASU IT team continued to develop tutorial videos, which are posted on the Symbiota YouTube channel: https://www.youtube.com/channel/UC7glMVLRnTA6ES3VTsci7iQ.

The program BCRWatcher will be distributed through https://help.lichenportal.org/index.php/en/cnalh-help-resources/.

COLO Senior Personnel Ryan Allen demoed Zoom tools for some of the team in preparation for WeDigBio, including the use of break-out rooms.

F developed workflows using google sheets to train volunteers to assist with barcoding and sheet-to-packet processing of lichen specimens. Once specimens are barcoded by volunteers, their part time staff will do the photography. After photography, the specimens come back to the volunteers who convert the sheets into packets.

The MSC team learned a lot about volunteer transcription from WeDigBio. In the past, they had volunteers use a guide detailing how to do FULL transcriptions, with no retainment of volunteers. After observing how WeDigBio went, they found that partial transcriptions are so much better for keeping volunteers from getting overwhelmed and discouraged. Their main student transcriber also said that partial transcriptions save her a lot of time.

TENN Collections Manager Oliver took undergraduate interns on a field trip to the local Ijams Nature Center to experience field collecting in October.

The GLOBAL Project Manager (TENN) and Georeferencing Manager (WIS) continued compiling transcription and georeferencing resources during 2021-Q4 to share on Basecamp and all resources were posted to the project website (https://globaltcn.utk.edu). Students continued contributing to a shared document of Transcription tips and tricks available to student digitizers across the collaboration.

The GLOBAL Project Manager (TENN) completed CCH2 Georeferencing Course for CoGe and attended a number of webinars and trainings including: NSF Funding Opportunities for Scientific Collections and the iDigBio Coffee Break and Orientation Series.

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

ALA hosted the October 9th online ARCTOS Webinar, University of Alaska Herbarium (ALA): Documenting Alaska's flora at the crossroads of Beringia https://www.youtube.com/watch?v=1zMgQYwWArI.

ASU jointly organized a October 20-22 online webinar with the Ecuadorian Instituto Nacional de Biodiversidad (INABIO) about "Lichenology in Ecuador." Part of the webinar was a presentation about best practices in data management for the Latin American Lichen Consortium and integrating/exchanging data with the Ecuadorian National Biodiversity Database (https://bndb.sisbioecuador.bio/bndb/).

COLO is also a member of the SoRo TCN and the All-Asia TCN. They continued to share information and technology between projects to help optimize workflows.

Ongoing collaboration between PCC and GLOBAL TCNs continued at MICH, 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.

At NY, there was ongoing collaboration between PCC, All-Asia, SoRo TCNs, as well as a new NSF DEB grant that is funding digitization of Appalachian lichens, which shares the same work flow and equipment.

The GLOBAL Lead PI and Project Manager (TENN) participated in the November iDigBio Quarterly IAC meeting to connect with other active TCN's.

The GLOBAL Project Manager (TENN) shared the GLOBAL Annual Integrated Report with the DigIn TCN and offered feedback on some of their reporting questions.

WIS worked on a resubmission to NSF for a new TCN, using some of the successful practices implemented with GLOBAL.

Share Opportunities and Strategies for Sustainability

Portal Management

ASU continued to host and maintain the Bryophyte and Lichen Portals, including nightly backups, regular software updates, adjustments to portal configurations and layout, etc. They have also continued to support image uploading, regularly update snapshot collections from international collections monthly, and troubleshoot any import issues that accompany this procedure. During 2021-Q4, ASU acquired more storage capacity for hosting GLOBAL-generated images.

Back Ups

Images from ALA continue to be stored at TACC. TACC provides both cloud storage as well as tape back-up of their data.

COLO's raw images and JPGs are being 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.

UC creates monthly image backups on external hard drives in addition to the in-house server. Records are kept on which specimens have been digitized.

Taxonomy

The taxonomic dropdown for the ImagingWorkflow application used by COLO was missing many of the scientific names they use in their collections. They worked with ASU's Frank Bungartz and Katie Pearson to get an export of the lichen taxonomic thesaurus. COLO's Ryan Allen reformatted this list so it could be added to the application. This helped to speed up the imaging process because they do not need to manually enter as many names while imaging. The new list is in active use at COLO and seems to cover most names in their collection.

DUKE's B. Aguero assisted with cleaning the bryophyte portal thesaurus, removing non-bryophyte names.

MO PI Brinda began work on an API to allow the taxonomic cleaning tool to access the bryonames.org data.

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. The #GlobalTCN Twitter feed was added to the GLOBAL website, in addition to the pre-existing Instagram feed.

ALA PI Ickert-Bond presented to the GLOBAL community on outreach using the Learning Glass and virtual herbarium tour using ThingLink.

On October 28th, ASU held the BioKIC online webinar about using Symbiota software for managing biodiversity data portals throughout Latin America (Guatemala, Mexico, Ecuador, etc.); also see our collaboration with the Ecuadorian Instituto Nacional de Biodiversidad (INABIO) and ASU [detailed above under: Share Collaborations with other TCNs, Institutions, and/or Organizations].

In December 2021, F's application of digitized specimens using community scientists to generate data was launched. This was designed by two high school students and supervised by REPS student Heaven Wade. A description of the event and the Zooniverse launch can be accessed here.

ILLS hosted a "packet-folding party" on December 17 where volunteers folded nearly 3000 bryophyte paper packets that will be used to upgrade our collections to archival-quality packets.

The GLOBAL Project Manager (TENN) discussed natural history collections work and the GLOBAL project with two undergraduate Field Botany Classes during Herbarium tours in October 2021.

The GLOBAL Project Manager (TENN) completed several trainings and workshops on increasing diversity and reducing challenges and harassment including: STRIDE for Staff Training, EEB

seminar on Transformative Justice in STEM, and Safe Zone Tier 2 training. She also communicated with the university's Office of Diversity and Inclusion on resources / links to creating inclusive forms for demographic information.

The annual Wisconsin Science Festival had "Fungi" as its theme this year. Several activities related to mycology (but also lichenology!) were held. A news story mentioned WIS' digitization activities and our large collection of lichenized fungi: https://news.wisc.edu/uw-scientists-decipher-the-mysteries-of-enigmatic-fungi/.

WeDigBio

GLOBAL team members from CINC & MU, COLO, DUKE, F, MSC, and TENN collaborated on a GLOBAL WeDigBio event on October 15-16. The two day event was attended by 80 community science volunteers, including participants from across the United States, as well India, Indonesia, the Philippines, and Sweden. F co-organized the GLOBAL days as part of their routine Field Museum WeDigBio event, and included GLOBAL specimens on October 14 and 17 as well. A total of 205 volunteers participated across all 4 days and 6,363 GLOBAL records were completed. Review of these partial transcriptions (Collector, Number, Date, and Country) was conducted during and after the event. The GLOBAL days included live virtual tours of the herbaria at F, COLO, and DUKE, and a number of presentations by staff and students at F, COLO, and TENN. A full description of the event, including media attention on Fox news and other outlets can be accessed here.

OSC co-organized with Dr. James Mickley an outreach event for specimen label transcription as part of the global WeDigBio week. It was attended by 25 students in person and 10 remote.

Share Information About Your Website and/or Portal Usage

The GLOBAL project website, https://globaltcn.utk.edu, was utilized by 565 users during 2021-Q4, including 88 from Asia, 47 from Europe, 16 from Oceania, and 1 from Africa (see Figure 2). The total number of users more than doubled the previous quarter and a large jump during the WeDigBio event in mid-October can be seen in the data.

The Bryophyte and Lichen Portals, created as part of the original LBCC grant, host new images and data produced by the GLOBAL collaborators. Over 3,200 users visited the Bryophyte Portal and over 16,000 users visited the Lichen Portal during 2021-Q4 (see Figures 3 & 4).

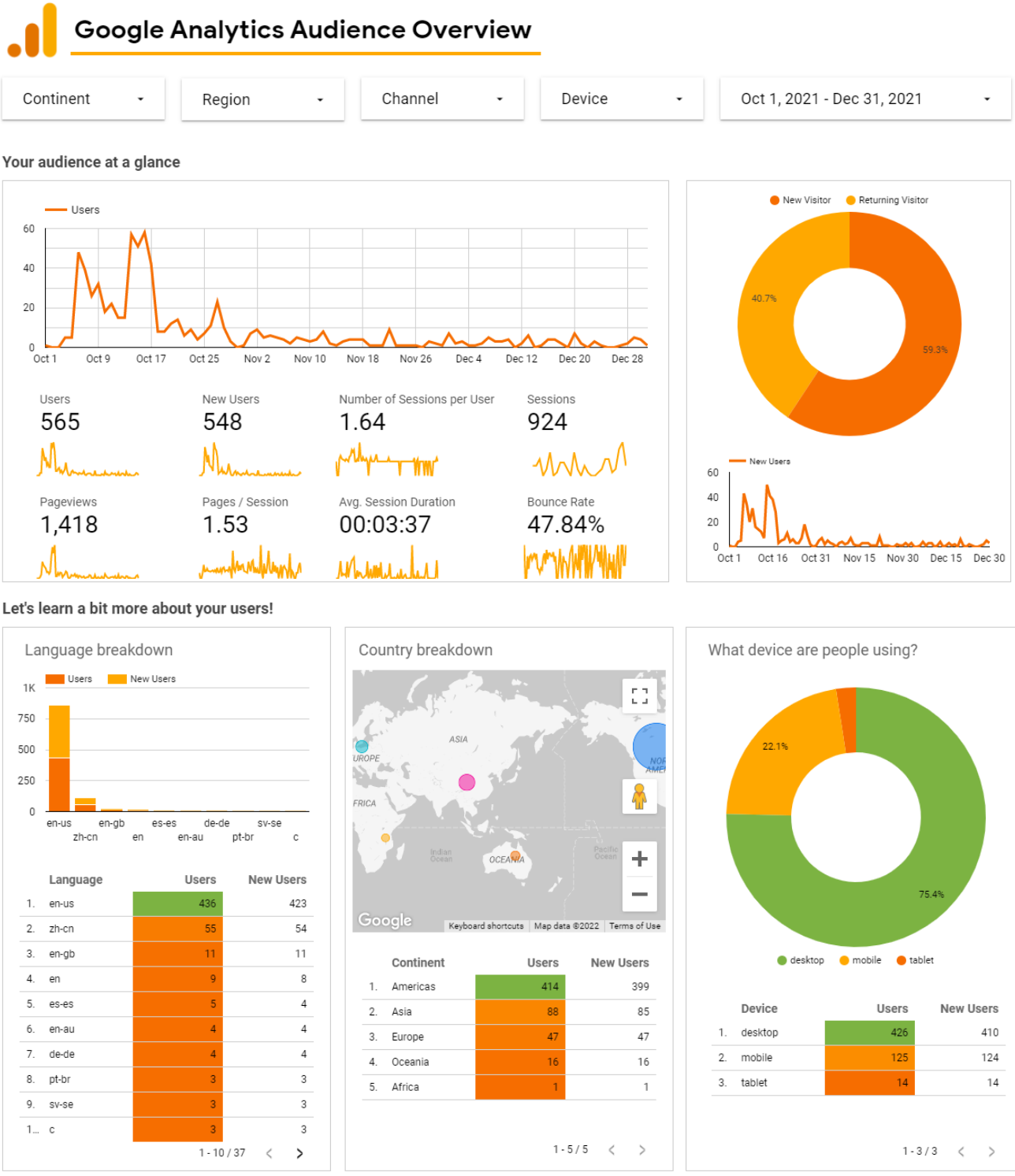


Figure 2: Use metrics for the GLOBAL project website (https://globaltcn.utk.edu) from October1 – December 31, 2021.

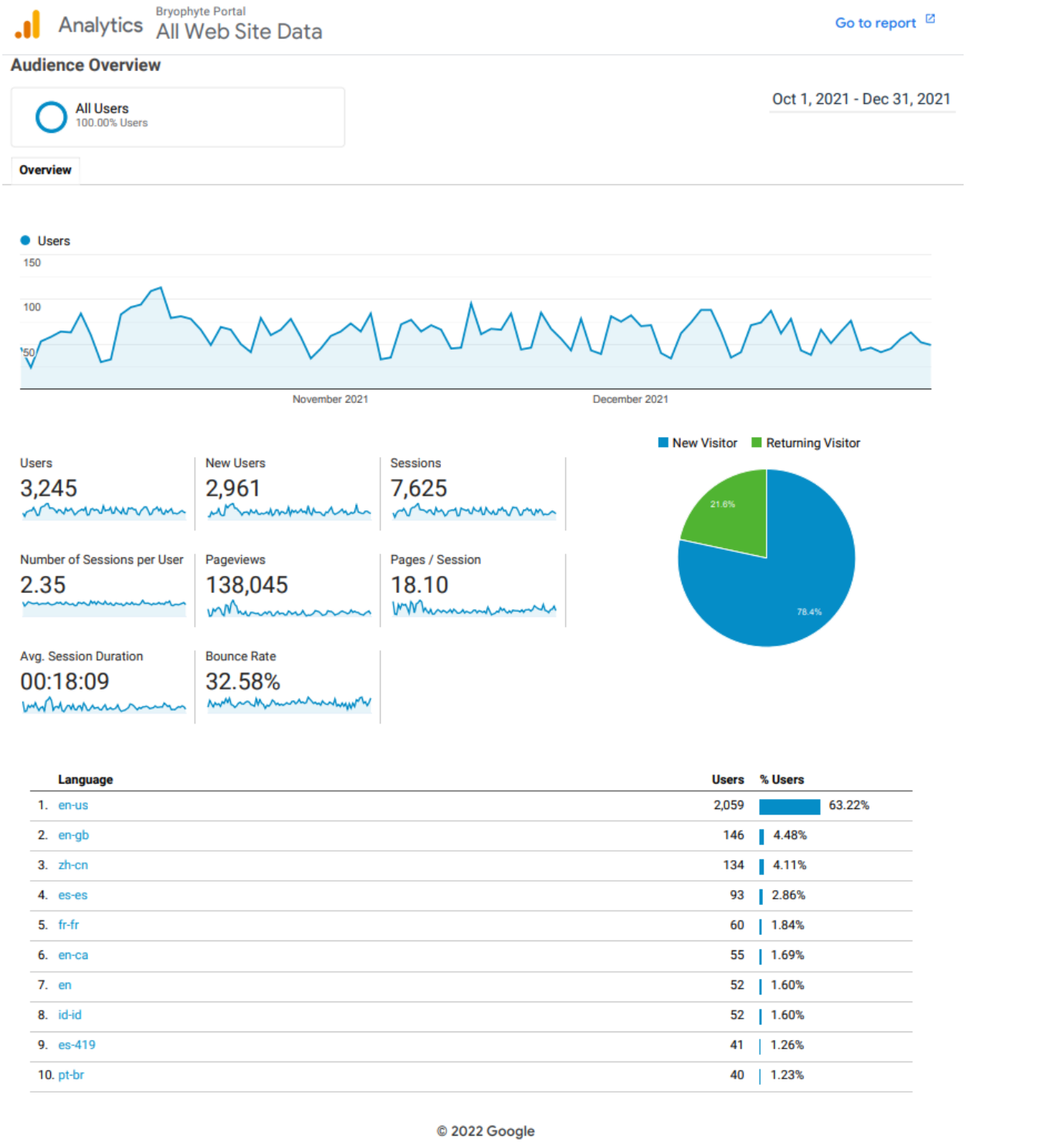


Figure 3: Use metrics for the Bryophyte Portal (https://bryophyteportal.org/portal/) from October 1 – December 31, 2021.

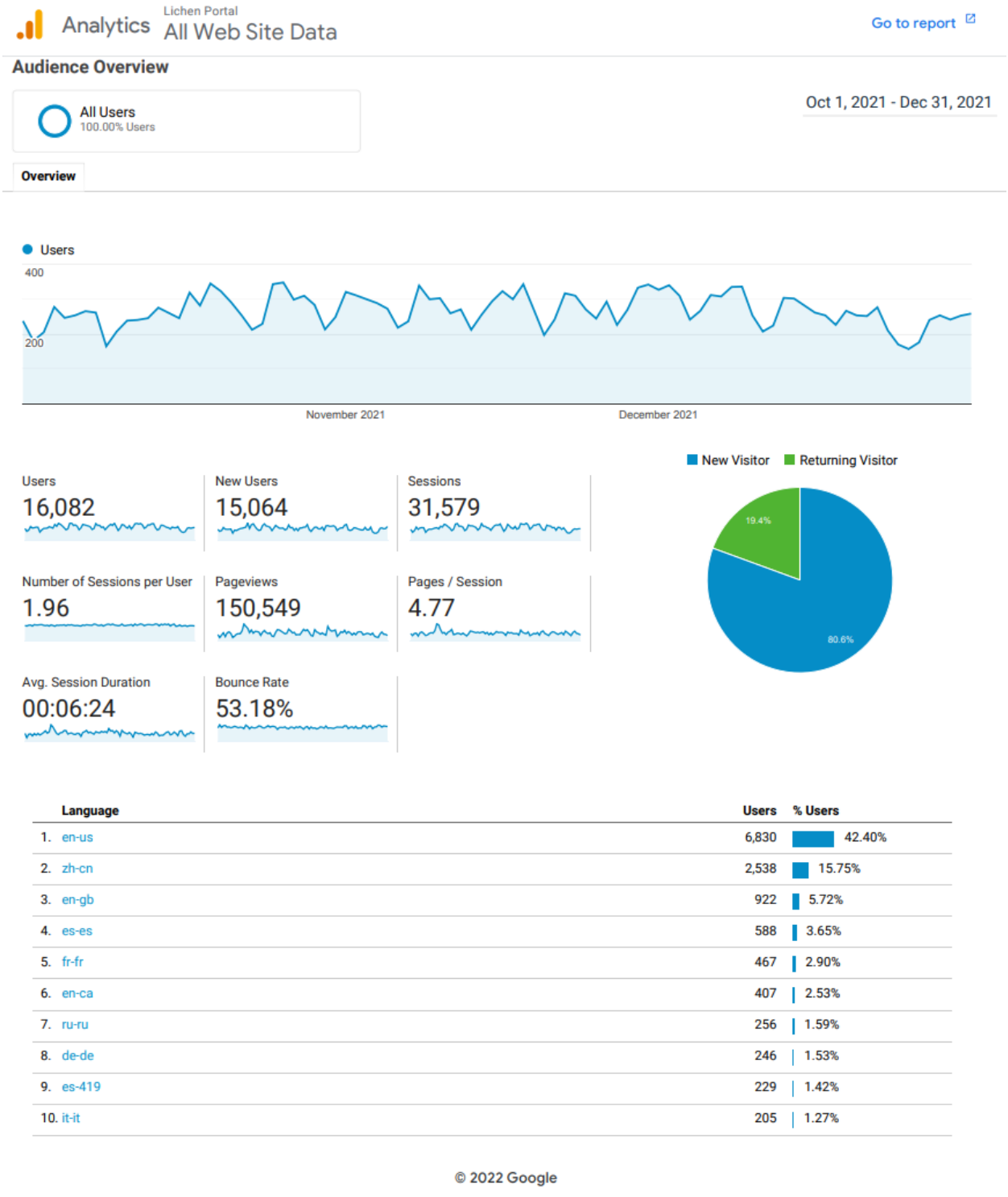


Figure 4: Use metrics for the Lichen Portal (https://lichenportal.org/cnalh/) from October 1 – December 31, 2021.

Share Other Activities and/or Progress

Bryophyte Packet Labels

A new label format was integrated into the Lichen and Bryophyte Portals by the ASU team, where labels can be directly printed onto full paper sheets that can then be folded into lichen/bryophyte packets (the Symbiota YouTube channel has an instructive video how this new label printer works, which was recently shared via Basecamp).

Image Tagging

ASU PI Bungartz made progress on the development of a Controlled Vocabulary of lichen characters for image metadata tagging as part of the ongoing revision of the key character matrix of the Lichen Consortium and the online glossary.

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

The Pteridological Collections Consortium: An integrative Approach to Pteridophyte Diversity Over the Last 420 Million Years (PCC)

Person Completing the Report

Amy Kasameyer (Project Manager)

Share Progress in Digitization Efforts

For extant specimen progress during this reporting period, Pteridophyte Collections Consortium members created skeletal records for **12,853** specimens, fully transcribed **15,410** specimens, imaged **36,543** specimens, and geo-referenced **5,682** specimen records. The total pteridophyte extant specimen progress including work done prior to the start of the grant is **633,871 (38% of goal)** skeletal records created, **1,198,285 (72% of goal)** extant specimens imaged, **1,129,714 (68% of goal)** extant specimens fully transcribed, and **296,347 (18% of goal)** extant specimens geo-referenced.

In the Pteridoportal (http://pteridoportal.org), we currently have **1,717,475** extant specimen records, **1,435,799** (84%) of which are imaged and **456,940** (27%) of which are georeferenced.

For fossil specimen progress during this reporting period, Pteridophyte Collections Consortium members databased **1502** specimens, imaged **1829** specimens, and geo-referenced **658** specimen records. The total pteridophyte fossil specimen progress including work done prior to the start of the grant is **38,599** (44% of goal) specimens databased, **35,875** (41% of goal) specimens imaged, and **19,023** (21% of goal) specimen records geo-referenced.

In the Pteridoportal (http://pteridoportal.org), we currently have **13,098** fossil specimen records, **10,560 (**81%) of which are imaged and **6,135** (47%) of which are georeferenced.

COVID-19 continues to impact progress at many institutions with the omicron surge limiting in-person work and access to collections. Hiring technicians remains a challenge for some institutions.

The **University of Texas** loaded their images into the Pteridoportal during this project period.

Share Best Practices, Standards, and Lessons Learned

For future projects, **MSU** recommends to do name updates before imaging. They started name updates halfway through the collection, which means the first half of the collection have correct names in Symbiota but not on the images. Funds to do this work are sorely needed and should be included in future grants when there is a comprehensive, reliable taxonomic resource.

CHRB arranged for days where all interns that came in worked on the Fern project and its digitization. This allowed for a lot of group engagement, and a lot of productivity!

Share Identified Gaps in Digitization Areas and Technology

CHRB found working with pre-existing spreadsheet data to be tough and time consuming and it would like to be able to barcode specimens using the add skeletal function in the portal and then be able to upload the spreadsheet to fill in areas that are missing without clearing out existing data.

Share Opportunities to Enhance Training Efforts

CHRB trained students from the Fall 2021 semester in digitizing fern specimens.

Yale trained two Yale undergraduate students on imaging and cataloging of fossil specimens.

UC trained one new undergraduate student to digitize specimens.

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

At **NYBG**, Permanent Herbarium staff not funded by this award along with digitization staff funded by other TCNs at NYBG (TORCH, Endless Forms, Asia) georeferenced for their respective projects specimens with localities that overlapped with specimens for this project. This work contributed 1266 georeferenced specimens to this project.

Share Opportunities and Strategies for Sustainability

N/A

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

The **Field Museum** is finalizing lesson plans for K-12 involving flagellate plants, including ferns; collaborating and coordinating with the NSF funded GoFlag with education activities.

Diane Erwin at the **UCMP** continues to promote the project on Twitter at: https://twitter.com/pterido_TCN

Share Information About Your Website and/or Portal Usage

N/A

Share Other Activities and/or Progress

N/A

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

- All 6 collections have uploaded their Pacific Island land snail specimen records onto the PILSBRy symbiota portal – these are continually refined as data are cleaned
    - Totals: 261,855 lots, 3,224,929 specimens (increase from 250,015 lots, 3,142,715 specimens)
- All data has been coded to fall under a specified region, to ease in parsing out georeferencing data, as this process is being done by region rather than by collection.
    - Totals: Georeferenced (Lat/Long): 151,122 (increase from 97,437)
      Georeferenced (Lat/Long/Error): 80,533 (increase from 43,267)
- Families for all taxa have been cleaned or added to the data, to ease in parsing out taxonomic data.
- The taxonomic authority file now contains 4,080 names including authorship information. (same as previous report)
- Images for all collections have been uploaded into the portal (16,234 images)
    - 6,507 specimen images (plated and unplated) (increase from 4,360)
    - BPBM and UMMZ have linked ledger pages (5,663 ledger pages) (new addition)
    - BPBM has linked collection maps to lots (264 maps images) (new addition)
    - Bibliocards have been uploaded and linked to taxa (3,799 cards) (new addition)

Share Best Practices, Standards, and Lessons Learned

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

Same as previous report

- Standardized higher level data is imperative for reporting, gathering and querying data. We continue to discover incorrect or missing records purely due to discrepancies in these areas.
- Scripts are being written to search BHL for certain taxonomic names, to help potentially find hidden names in literature.
- If a collection already has protocols specifically designed for their collection management system, it is better to let the collection continue to use those systems and gather that data periodically.

Share Identified Gaps in Digitization Areas and Technology

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

Same as previous report

- COVID19 continues to impact access to collections and recruitment of staff and volunteers. For example, per MCZ: work from home; staff occupancy in MCZ limited to 25 -50%. (= 1 staff member 1 day per week). This is similar at the Field Museum and UMMZ.
- Digitization tools (Symbiota/GeoLocate) are not designed for use by insular specimens, highlighting a large gap in biodiversity digitization. This makes it difficult to manage and disseminate data that would be useful to these types of species (ie island and island group). Extra, unexpected time has to be spent to work around or code updates into these tools.
- Gazetteers and other digitized location information are not widely available for Pacific Regions in general, highlighting a need to make those resources digitally available.
- Repatriating data is and remains an issue for Symbiota portals. These data could be published from the portal to GBIF directly, but we've decided not to do this since most (4/6) of our collections already share their data via an IPT and we want to avoid duplicates.

Share Opportunities to Enhance Training Efforts

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

Same as previous report

- Similar to the last report, COVID19 continues to impact physical training within the collection. However, we have created ppt presentations, protocol documents, videos, and organized virtual sessions to facilitate training within the project. Discussion are through Slack and meetings are recorded via Zoom and shared via Google Doc through Slack.

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

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

Same as previous report

- We are continuing to work with local conservation agencies to incorporate species data and GPS information. Additional geographic areas besides Hawaii are now parsed out to the various collections to start tackling GPS data.

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.

Same as previous report

- Most of the collections are still constrained by the COVID19 pandemic. But any recruitment of staff or volunteers/interns are cognizant in providing opportunities to minorities and reaching out to local residents. However, we have been able to recruit women in science and Pacific Islanders as interns and volunteers for this TCN.

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.

TCN Quarterly Progress Report

TORCH TCN — Quarterly Report

Reporting Period: November 1st, 2021 - January 31st, 2022

Assembled by BRIT on February 1st, 2022, for Feb. 2nd IAC meeting

TCN Name

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

Person Completing the Report

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

Institutions reporting:

BAYLU – Baylor University
BRIT – Botanical Research Institute of Texas
HUH – Harvard University
KANU – University of Kansas
MO – Missouri Botanical Garden
NOSU – Northeastern State University
NY – New York Botanical Garden
OKL – University of Oklahoma
OKLA – Oklahoma State University
TAES – Texas A&M University-College Station
TEX-LL – University of Texas at Austin
TTC – Texas Tech University
UTEP – University of Texas at El Paso

Non-reporting Institutions:

SHST – Sam Houston State University
TAMUCC – Texas A&M University-Corpus Christi

Share Progress in Digitization Efforts

Progress in Digitization Efforts:

- Number of skeletal records created:

BAYLU =	0
BRIT =	0 (but see, "Other digitization or pre-digitization efforts")
HUH =	0
KANU =	0
MO =	N/A
NOSU =	0
NY =	1,036 (project total: 30,423)
OKL =	0
OKLA =	101 (10,900 cumulative)
TAES =	7,000

TEX-LL (including Data-Provider Institutions) =

University of Texas at Austin	0
Angelo State University	0
Fort Worth Nature Center	0
Howard Payne University	0
Johnson Wildflower Center	0
Our Lady of the Lake University	0
Saint Edward's University	0
Sul Ross State University	0
Texas Lutheran University	0
Texas State University	0
UT RGV Brownsville	0
UT RGV Edinburg	0

TEX-LL Sub-Total	0
TTC =	0

UTEP = 0 [has completed its contribution to the TORCH TCN Project]

Total skeletal records created this quarter: 8,137

- Number of fully-transcribed records created:

BAYLU =	2,236
BRIT =	17,353 (11,353 staff and volunteer transcriptions + 6,000 community science Notes from Nature-generated transcriptions)
HUH =	1,239 (45,039 cumulative)
KANU =	6 (total fully transcribed from OK and TX = 27,550)
MO =	N/A
NOSU =	0
NY =	426 (project total: 63,233)
OKL =	200?
OKLA =	8,320 (63,583 cumulative, including import from Oklahoma Vascular Plants Database / OBIS)
TAES =	0

TEX-LL (including Data-Provider Institutions) =

University of Texas at Austin	59
Angelo State University	121
Fort Worth Nature Center	0
Howard Payne University	300
Johnson Wildflower Center	769
Our Lady of the Lake University	0
Saint Edward's University	521
Sul Ross State University	490
Texas Lutheran University	135
Texas State University	0

UT RGV Brownsville	423
UT RGV Edinburg	0

TEX-LL Sub-Total 2,818

TTC = 521

UTEP = 0 [has completed its contribution to the TORCH TCN Project]

Total fully-transcribed records created this quarter: 33,119

- Number of specimens imaged:

BAYLU = 2,770

BRIT = 465

HUH = 1,239 (45,235 cumulative)

KANU = 6 (total number of imaged specimens from OK and TX = 23,998)

MO = N/A

NOSU = 0

NY = 7,424 (project total: 50,870)

OKL = 874

OKLA = 200 (75,501 cumulative)

TAES = 7,000

TEX-LL (including Data-Provider Institutions) =

University of Texas at Austin	17,362
Angelo State University	114
Fort Worth Nature Center	0
Howard Payne University	200
Johnson Wildflower Center	0
Our Lady of the Lake University	0
Saint Edward's University	76
Sul Ross State University	3,810

Texas Lutheran University	0
Texas State University	0
UT RGV Brownsville	423
UT RGV Edinburg	1,526

TEX-LL Sub-Total 23,511

TTC = 557

UTEP = 0 [has completed its contribution to the TORCH TCN Project]

Total number of specimens imaged this quarter: 44,046

- Number of specimens georeferenced:

BAYLU = 0

BRIT = 0

HUH = 2,705 (24,358 cumulative)

KANU = 52 (total georeferenced specimens from OK and TX = 27,334)

MO = N/A

NOSU = 0

NY = 1,966 (project total: 73,798)

OKL = 200?

OKLA = 126 (11,344 cumulative)

TAES = 0

TEX-LL (including Data-Provider Institutions) =

University of Texas at Austin	19
Angelo State University	32
Fort Worth Nature Center	0
Howard Payne University	0
Johnson Wildflower Center	440
Our Lady of the Lake University	0
Saint Edward's University	5
Sul Ross State University	0
Texas Lutheran University	125
Texas State University	0

UT RGV Brownsville	0
UT RGV Edinburg	0
TEX-LL Sub-Total =	621
TTC =	250

UTEP = 0 [has completed its contribution to the TORCH TCN Project]

Total number of specimens georeferenced this quarter: 5,920

- Other digitization or pre-digitization efforts:

BAYLU: Botanist currently mounting, identifying many more Texas collected specimens.

BRIT: Data-cleaning of records generated from Notes from Nature.

We continue skeletal transcriptions of images from image sets containing a mix of project and non-project specimens in the VDB collection at BRIT to prioritize records for complete transcription for the TORCH TCN. Utilizing the crowd sourcing module in Symbiota, providing training (outside of business hours to accommodate attendance) and ongoing support (via email, Zoom, and Google Docs) has resulted in 9,766 skeletal transcriptions (scientific name, country, state, county) this reporting period, some of which will now be prioritized for complete transcription by staff as they've been identified to have been collected in Texas or Oklahoma.

HUH: Nothing to report

KANU: Nothing to report

MO: N/A

NOSU: All images are taken. We are working with Project Manager Diego Barroso at BRIT on getting the images in the database; then we can begin georeferencing and transcribing.

NY: OCR has been performed on all specimen labels to aid in transcription.

OKL: Nothing to report

OKLA: Nothing to report

TAES: We have started to set up a Notes from Nature project for our specimens. This was initiated just as former Data Manager Clay Barrett was leaving, and was never finished. We are working now to get this up and running.

TEX-LL: UT-Rio Grande Valley-Brownsville (RUNYON) was formally transferred to the University of Texas at Austin (TEX) in August 2021. However, we are continuing to track our digitization efforts separately for the purposes of this grant. P.I. George Yatskievych and Assistant Curator Amber Horning also visited UT Rio Grande Valley – Edinburg to install an imaging station (which that institution purchased under a different grant). We hired a former grad student on contract to begin imaging specimens and transcribing labels for a residue of unprocessed specimens, and we trained him during our visit.

TTC: Nothing to report

UTEP: Nothing to report. We have completed our contribution to the TORCH TCN Project.

- Comments about the digitization process:

BAYLU: On-going with continued work by Texas Master Naturalist volunteers on-line.

BRIT: Nothing to report

HUH: Nothing to report

KANU: All KANU specimens from OK and TX are transcribed, georeferenced, and imaged, except for occasional ones that we find that were missed during earlier work, problematic specimens (such as ambiguous locality data), or new accessions. We completed post-processing of images in December 2021. Images will be uploaded to our attachment server and made available via web portals during our next cache refresh, expected in early February 2022.

MO: We are just starting to build up our digitization and herbarium staff after several retirements and COVID closures, so unfortunately nothing to report this quarter for MO. We'll be getting started on this soon, though!

NOSU: Nothing to report

NY: Due to state and city restrictions, we are limited to only a small number of onsite staff each day, and each staff member can only work onsite three days per week.

NY Table summarizing total count of NY records contributed to TORCH (includes those fully or partially digitized before the beginning of TORCH funding):

	Imaged	Transcribed	Transcribed coords / Georeferenced
Texas	73,570	**73,781**	68,869
Oklahoma	10,460	**10,470**	10,300
Arkansas	18,372	18,399	18,075
Total	**102,402**	**102,650**	**97,244**

Deliverables from the original proposal budget justification:

TORCH Budget Justification:
For this project, NYBG will provide 95,000 completely digitized specimens (i.e., database record including geocoordinates and image) to the project. This total includes 57,000 specimens that require complete digitization; 77,000 that require data transcription and 91,022 that require georeferencing.

Thus, we have completed about 107% of the work promised. Please note that this will be the last progress report to include significant work. Our funding for TORCH will be expended by the end of February 2022 or the beginning of March, so our contributions to the project are nearly complete.

OKL: Nothing to report

OKLA: Nothing to report

TAES: This was a slow season for us with the holidays and COVID resurgence.

TEX/LL: We are still behind our schedule due to the earlier COVID shutdown, which was exacerabated by the more recent spike in cases. We are also experiencing slower-than-expected progress with a few of our data provider institutions, notably Howard Payne and Sul Ross.

TTC: Nothing to report

UTEP: We have completed our contribution to the TORCH TCN Project, but still have some images waiting on TACC servers to be linked to the TORCH Symbiota Portal.

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

BAYLU = 0

BRIT = Searched all collections on 26 Jan 2022, without taxonomic constraints collected in TX or OK):

BRIT-SMU-VDB-NLU:	203,153
TAC:	7,064

NTSC:	0
ACU:	0
HSU:	336

Sub-Total for BRIT Lead = 210,553

HUH = 45,912

KANU = A new instance of our database is uploaded to GBIF and iDigBio at the beginning of each month. This continues to be done for all transcribed records. Uploading of images should occur in February 2022. [**for this count, assumed 27,544, same as last Quarterly Report]**

MO = N/A

NOSU = 0

NY = [**for this count, assumed ~ 84,000**; See table and comments under "Comments about digitization progress" section, above, for TX and OK specimens]

OKL = 0

OKLA = 0

TAES = 0

TEX-LL (including Data-Provider Institutions) =

University of Texas at Austin	238,178
Angelo State University	0
Fort Worth Nature Center	0
Howard Payne University	22,907
Johnson Wildflower Center	0
Our Lady of the Lake University	0
Saint Edward's University	0
Sul Ross State University	0
Texas Lutheran University	7,563
Texas State University	0
UT RGV Brownsville	0
UT RGV Edinburg	0

TEX-LL Sub-Total 268,648

TTC = 0

UTEP = 85,504 [**assumed same as TORCH Portal number**]

Total number of records available in iDigBio portal (cumulative): 722,161*

***[Note: This number is lower than that in the previous Quarterly Report (734,314) due to discrepancies in the way totals were reported from one report to the next. In the previous report, some institutions may have included taxa outside the scope of the TCN (such as bryophytes), or records available in the portal but from outside this TCN's region of interest (only Texas and Oklahoma)]

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

BAYLU = 50,657

BRIT = Searched all collections on 26 Jan 2022, without taxonomic constraints collected in TX or OK):

BRIT-SMU-VDB-NLU:	204,572
TAC:	7,064
NTSC:	11,324
ACU:	3,746
HSU:	3,965

Sub-Total for BRIT Lead = 230,671

HUH = 45,912

KANU = All KANU records uploaded to GBIF and iDigBio should be accessible via the TORCH portal. [**for this count, assumed 27,544, same as last Quarterly Report]**

MO = N/A

NOSU = 0

NY = [**for this count, assumed ~ 84,000**; See table and comments under "Comments about digitization progress" section, above, for TX and OK specimens.]

OKL = 136,186

OKLA = 64,417

TAES = 238,854

TEX-LL (including Data-Provider Institutions) =

University of Texas at Austin	238,288
Angelo State University	38,948
Fort Worth Nature Center	1,918
Howard Payne University	22,907
Johnson Wildflower Center	2,663
Our Lady of the Lake University	0
Saint Edward's University	5,751
Sul Ross State University	27,186
Texas Lutheran University	7,578
Texas State University	0
UT RGV Brownsville	974
UT RGV Edinburg	6,403

TEX-LL Sub-Total = 352,616

TTC = 22,479

UTEP = 85,504

Total number of records available in TORCH Symbiota Portal (cumulative): 1,338,840*

***[Note: This number is lower than that in the previous Quarterly Report (1,341,822) due to discrepancies in the way totals were reported from one report to the next. In the previous report, some institutions may have included taxa outside the scope of the TCN (such as bryophytes), or records available in the portal but from outside this TCN's region of interest (only Texas and Oklahoma)]

Share Best Practices, Standards, and Lessons Learned

All reporting institutions: Nothing to report

Share Identified Gaps in Digitization Areas and Technology

BAYLU: Technician (A. Zertuche) has had to reduce number of hours (was 20, now 9 hours per week). We anticipate hiring 4 student workers for the Spring semester.

NOSU: The holidays slowed us down. Also, we are trying to reassign money that was for travel (that didn't happen due to COVID-19) to pay student workers to transcribe records.

NY: McKenna Coyle (and all herbarium staff) continue to work onsite three days per week – return to full time onsite work is not anticipated until early 2022. Given the Garden's COVID restrictions, we decided not to offer a second TORCH internship, but instead are using the funds to continue McKenna's employment on the project. We anticipate that these funds will be expended in late early February or early March of 2022.

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. The TORCH TCN Data manager position is vacant as of November 2021, following the resignation of Clay Barrett. Replacement plans are in progress.

TEX-LL: One of our imaging light-boxes died last July. Until we can get it replaced or re-wired, this will continue to cause a bottleneck in our imaging progress.

TTC: We have requested that TTC be ingested by iDigBio but no progress has been made since October 2021. In communication with iDigBio staff, there is apparently a software upgrade issue causing this delay.

Share Opportunities to Enhance Training Efforts

BRIT: Continue to host weekly zoom conversations with the Armchair Botanist program to engage Notes from Nature volunteers transcribing project specimens.

NY: Digitization staff have taken advantage of a wide range of webinars and online conferences sponsored by New York Botaical Garden, iDigBio, Royal Botanical Gardens, Kew, etc.

OKLA: Trained one new undergraduate assistant in transcription.

TEX-LL: New workers have been trained in digitization techniques.

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

The TORCH TCN Project held a virtual Executive Committee meeting (with all lead PI's in attendance), on Wednesday, January 19th, 2022.

NOSU: We are continuing to use a BCEENet Natural History CURE in the classroom.

TTC: We initiated collaboration with Dr. Matthew Allen at Wayland Baptist University, who is interested in setting up a new profile on the TORCH Symbiota Portal for their herbarium.

Share Opportunities and Strategies for Sustainability

BAYLU: Recycling all paper (boxes, mounting sheets, newspaper used for pressing collected specimens)

All other reporting institutions: Nothing new to report

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

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

OKLA: Graduate advisee Sierra Hubbard won best oral presentation at the Oklahoma Academy of Science Meeting for her talk on the status of georeferenced records in the portal available for research at a 0.5˚ scale resolution in Texas and Oklahoma (November 2021). Ms. Hubbard was also a finalist in the Oklahoma State University 3-Minute-Thesis Competition, presenting her research plans using TORCH-portal data (November 2021).

Other Education and Outreach activities:

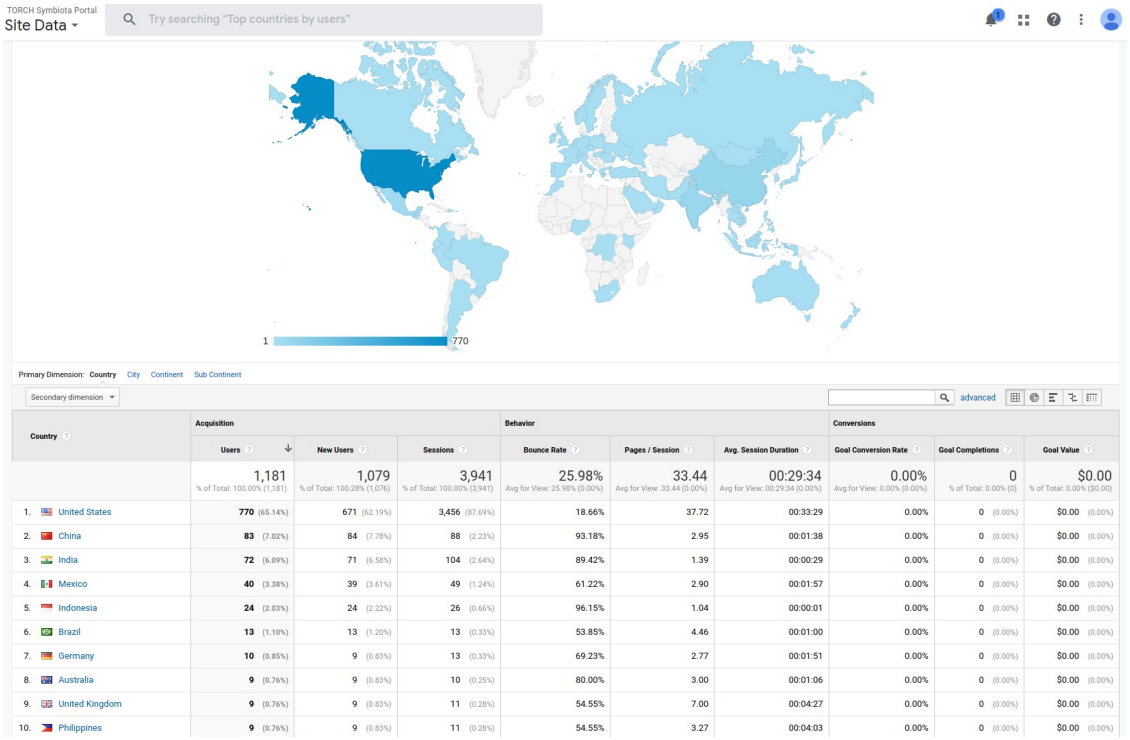
BAYLU: Continued work with Texas Master Naturalist, training individuals as needed.

NY: We had several days of programming for iDigBio this year, including webinars, volunteer training sessions, and volunteer meet-and-greet sessions.

TTC: Students in the BIOL4301-012 “Field Botany and Natural History Collections” class completed herbarium curation projects as part of their final grade. Projects included georeferencing 250 specimens from New Mexico (especially Carlsbad Caverns National Park), mounting a backlog of pressed specimens from the 1970s, collection of new specimens from Lubbock Lake National Landmark, organization of our moss herbarium, exploration of mounting techniques (tape vs glue vs sewing), and launching several social media accounts (Twitter, Instagram, and TikTok).

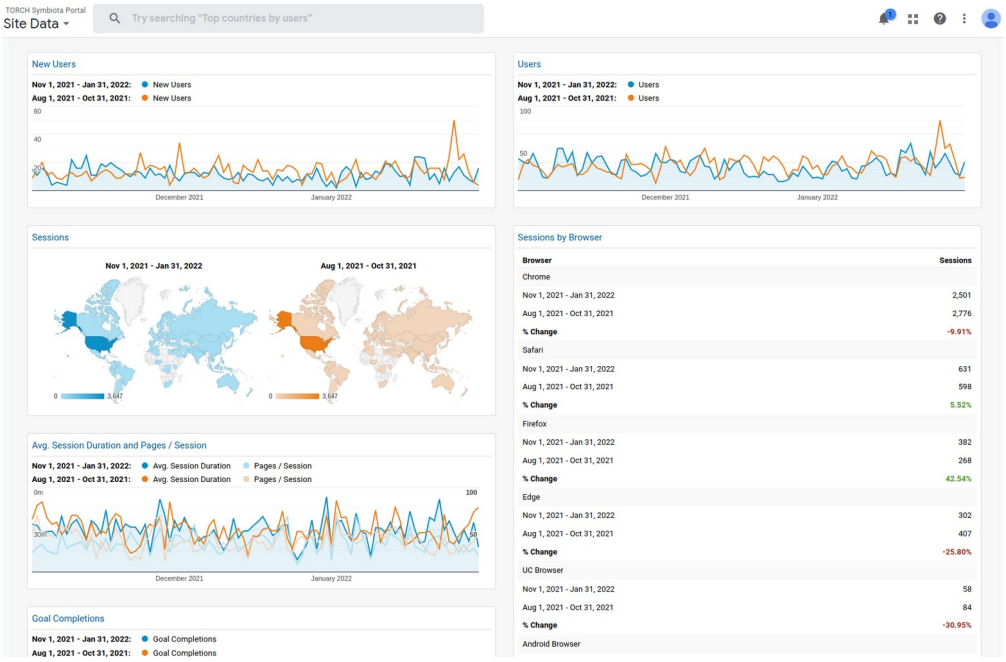
Share Information About Your Website and/or Portal Usage

Users by country, Nov. 1st , 2021 – Jan. 31st , 2022

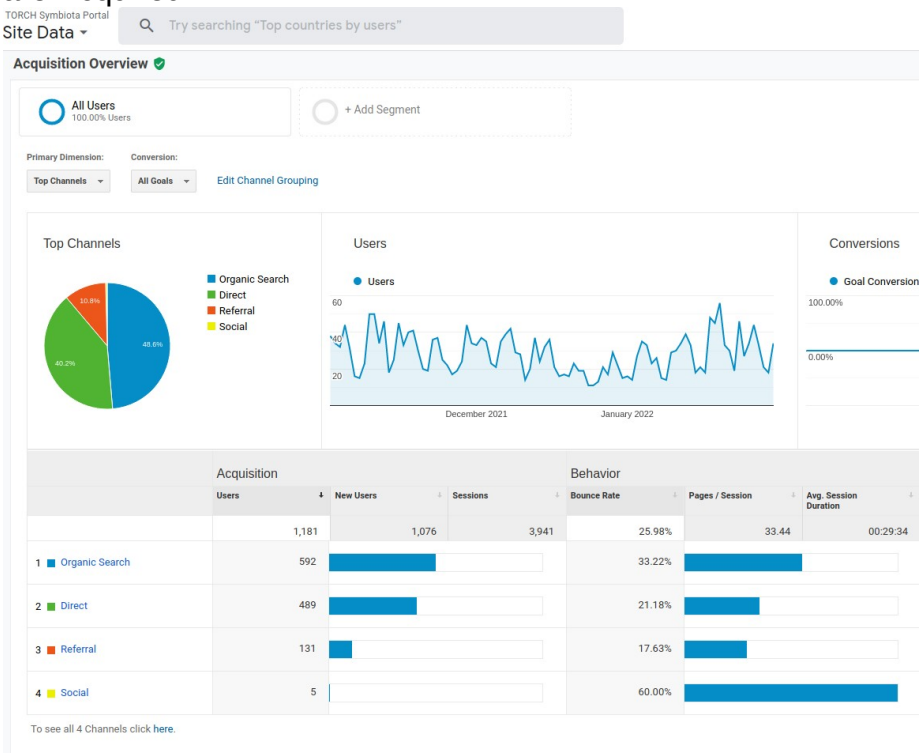


Country	Acquisition			Behavior			Conversions		
	Users	New Users	Sessions	Bounce Rate	Pages / Session	Avg. Session Duration	Goal Conversion Rate	Goal Completions	Goal Value
	1,181 % of Total: 100.00% (1,181)	1,079 % of Total: 100.28% (1,076)	3,941 % of Total: 100.00% (3,941)	25.98% Avg for View: 25.98% (0.00%)	33.44 Avg for View: 33.44 (0.00%)	00:29:34 Avg for View: 00:29:34 (0.00%)	0.00% Avg for View: 0.00% (0.00%)	0 % of Total: 0.00% (0)	$0.00 % of Total: 0.00% ($0.00)
1. United States	770 (65.14%)	671 (62.19%)	3,456 (87.69%)	18.66%	37.72	00:33:29	0.00%	0 (0.00%)	$0.00 (0.00%)
2. China	83 (7.02%)	84 (7.78%)	88 (2.23%)	93.18%	2.95	00:01:38	0.00%	0 (0.00%)	$0.00 (0.00%)
3. India	72 (6.09%)	71 (6.58%)	104 (2.64%)	89.42%	1.39	00:00:29	0.00%	0 (0.00%)	$0.00 (0.00%)
4. Mexico	40 (3.38%)	39 (3.61%)	49 (1.24%)	61.22%	2.90	00:01:57	0.00%	0 (0.00%)	$0.00 (0.00%)
5. Indonesia	24 (2.03%)	24 (2.22%)	26 (0.66%)	96.15%	1.04	00:00:01	0.00%	0 (0.00%)	$0.00 (0.00%)
6. Brazil	13 (1.10%)	13 (1.20%)	13 (0.33%)	53.85%	4.46	00:01:00	0.00%	0 (0.00%)	$0.00 (0.00%)
7. Germany	10 (0.85%)	9 (0.83%)	13 (0.33%)	69.23%	2.77	00:01:51	0.00%	0 (0.00%)	$0.00 (0.00%)
8. Australia	9 (0.76%)	9 (0.83%)	10 (0.25%)	80.00%	3.00	00:01:06	0.00%	0 (0.00%)	$0.00 (0.00%)
9. United Kingdom	9 (0.76%)	9 (0.83%)	11 (0.28%)	54.55%	7.00	00:04:27	0.00%	0 (0.00%)	$0.00 (0.00%)
10. Philippines	9 (0.76%)	9 (0.83%)	11 (0.28%)	54.55%	3.27	00:04:03	0.00%	0 (0.00%)	$0.00 (0.00%)

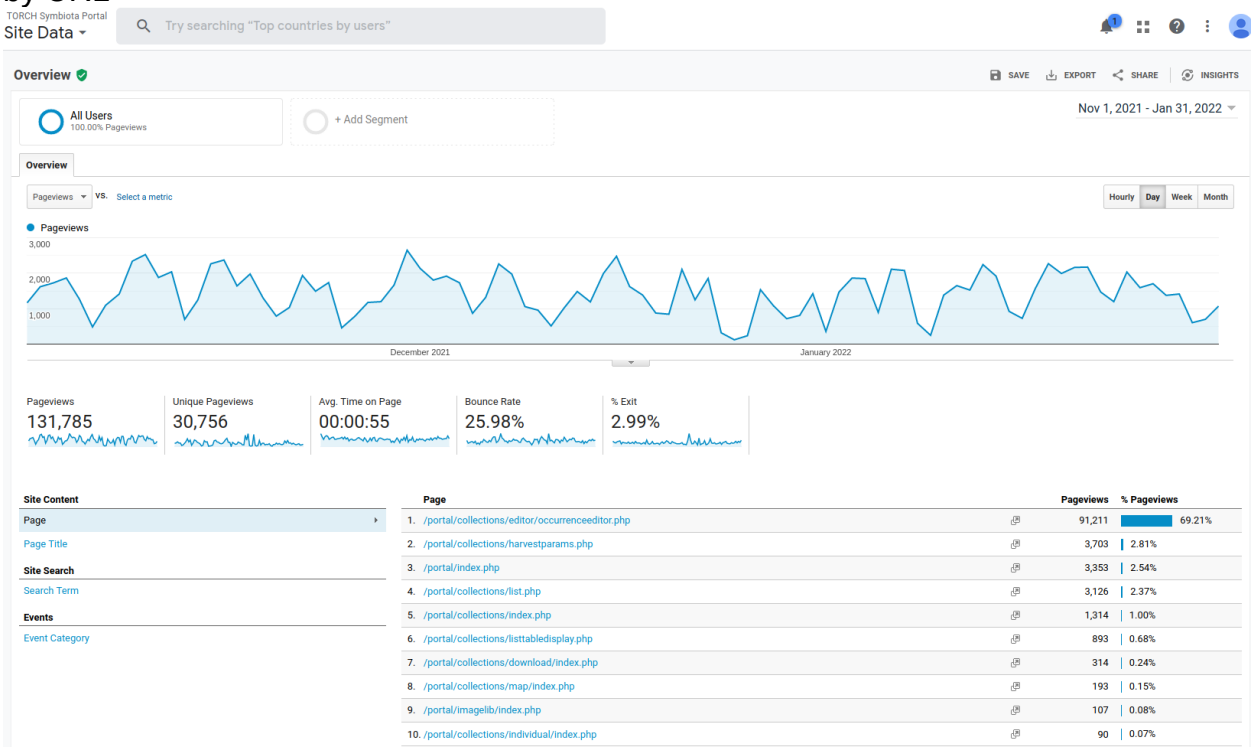
Session Duration & Sessions by Browser. Comparison with previous Quarter.



How Users are Acquired



Pageviews by URL



Share Other Activities and/or Progress

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

All reporting institutions: Nothing new to report.

Participants (especially those who have newly joined the project):
BAYLU: Albert Zertuche; Prof. Walter Holmes

BRIT:

Ashley Bordelon, Digitization Coordinator (virtual engagement); abordelon@brit.org
Joe Lippert, Digitization Technician; jlippert@brit.org
Diego Barroso, TORCH TCN Project Manager; dbarroso@brit.org
Tiana Rehman, Collections Manager/Institutional Rep; trehman@brit.org
Jason Best, Director of Biodiversity Informatics/Technovator; jbest@brit.org
Peter Fritsch, VP of Research/PI; pfritsch@brit.org
Jessica Lane, BRIT Herbarium Assistant; jlane@brit.org
Rachel Carmickle, Herbarium Technician, rcarmickle@brit.org
Kelly Carroll, Digitization Technician, kcarroll@brit.org
Natch Rodriguez, Digitization Technician, nrodriguez@brit.org

NY: McKenna Coyle, Lead Digitizer

OKL: No new participants, although Teraye Gillum-Morrisette is taking over from Leann Monaghan as the GA for this semester.

OKLA: Five undergraduate workers (one new) continued transcribing.

TAES: Cassandra Gomez, digitization tech, newly hired
Catherine Deden, digitization tech, newly hired

TEX-LL: Four student workers have been hired since 1 November 2021. These were replacements for seven students whom we lost for spring semester.

Sofia Bautista	sofiabautista@utexas.edu
Brian Matibag	brian10matibag@gmail.com
Ethan Schommer	ethan.schommer02@gmail.com
Dylan T Sheng	dylansheng@utexas.edu

We also hired Zachary Johnson, a recent Master's graduate from UTRGV-Edinburg on a contract to complete imaging and residual databasing of that data provider herbarium, zachary.johnson01@utrgv.edu

TTC: Undergraduate Digitizers:
Chase Bergeron, Jared Salzmaan, Travis Schubert, Norma Ruvalcaba

Also, graduate student Lindsay Williams, PhD Student, TA assigned to Herbarium.

UTEP: UTEP Collections Manager Mingna "Vicky" Zhuang continues to work with TORCH Project Manager Diego Barroso to link images to the TORCH Symbiota Portal and to the UTEP Arctos database.

Other Progress not listed above (anything else to share):
The TORCH TCN has advertised the 2022 TORCH Summer Internship program, and has now received over 20 applications. The extended application deadline is February 14th, 2022.

TORCH TCN Technological Innovator Jason Best began discussions with Brian Witte, software developer, to start work on designing and implementing the TORCH Digitization Hub. The Hub will be a web-based application which will simplify the upload process for all participants and will provide quality control and file management features which will remove many existing workflow bottlenecks. Details of the contract and scope of work are being finalized and Witte is expected to begin work on the project in February.

Jason Best also began work on another batch of light boxes, including three units which will be the second set of boxes for some participants. A second box was shipped to Oklahoma State University in January, and second boxes are expected to be sent in February to Texas A & M (TAES) and University of Texas (TEX-LL). A box will be sent to Mercer Botanic Gardens, and another box will be used at BRIT on-site and as a roving unit. These are all expected to be completed and delivered in Q1 of 2022.

BRIT:
Two part-time digitization technicians have left the project, Tessa Boucher and Sydney Jackson, to continue graduate school and begin a career teaching abroad, respectively. We have posted online a job position located at FWBG|BRIT to meet our digitization obligations on the grant and hope to fill that position in March/June 2022: https://fwbg.org/about-us/careers/

We have ordered barcodes for two new collections to join our effort and have begun discussions for loan of the materials for digitization of specimens.

The Hardin-Simmons University Herbarium curate by Rick Hammer was previously imaged and transcribed by BRIT on the TORCH TCN; the herbarium has since been permanently transferred to BRIT and is currently maintained as a unique collection in the TORCH portal. Curator Rick Hammer has been established as a Research Associate with BRIT and continues to assist with the curation and outreach for the HSU herbarium now at BRIT.

NY: Remaining work to do: We are essentially done with our work on the project. There are possibly still some overlooked specimens to digitize and georeference, but most of the remaining time on the project will be spent on data editing/cleanup.

OKLA: Subaward work at University of Kansas is complete, as of end of October 2021. Subaward work at New York Botanical Garden is on track to be completed in early 2022.

Questions/comments:

MO: We are just starting to build up our digitization and herbarium staff after several retirements and COVID closures, so unfortunately nothing to report this quarter for MO. We'll be getting started on this soon, though!

NY: This has been a great project for NY, sort of a capstone to our digitization of U.S. specimens, which is now about 99% complete!

OKL: For this report, we had a problem getting good numbers for anything except the number of imaged specimens. […] People have been busy databasing and georeferencing over the last couple of months, but the number of specimens on the TORCH portal do not seem to reflect this, so I am not sure what is happening [...]. It is possible that it was the previous numbers that were incorrect, [but they seem to be] reasonably accurate for this period. [...We have] a better system [...] now.

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 (November 2021 through January 2022) coincides with Year 3 of the TPT project. The overarching report was submitted to NSF on July 30, 2021. Below is a summary of our digitization progress (cumulative). Most reported numbers are the same as last quarter. As we are just returning from holiday break, in addition to dealing with the continued impacts of the COVID-19 pandemic with all its continuously emerging variants still impacting collection access and staffing capabilities, we have decided to primarily update this table every-other quarter instead of quarterly. Instead, for this report we will focus on other TPT activities our group has been actively involved in.

Of special note: **Yale Peabody Museum (YPM) has not just **completed their digitization goals**, they have exceeded them! **

Institution	Transcribed records	High resolution images	Scanned slides	Scanned vials
ANS	5,842	359	6,463	1,226
BPBM	19,262	4,147	17,248	9,885
BYU	2,597		2,597	
CAS	17,878	1,785		
CU	9,995			1,758
FMNH	10,676	809	29,758	10
INHS	19,979	348	10,813	5,296

Institution	Transcribed records	High resolution images	Scanned slides	Scanned vials
MPM	2,609		1,228	1,500
MSU	11,902		1,100	
OSU	2,254		2,254	
PSU	19,112		2,139	801
PERC	6,404			
TAMU	43,182		4,573	13,595
UH	5,018		3,402	
UM	110,458	259	40,602	
UMSP	55		94,495	
HWML	19,943		3,666	
UNH	10,500	250	10,500	
MSB	1,617	618	1,500	2,140
UU	10,926		8,185	
UWSP	5,727		7,053	
WIRC	26,451		1,310	2,327
YPM	17,607	325	3,409	2,581
Totals	**381,150**	**11,322**	**266,909**	**39,619**
Total records	**684,386**			

So far, TPT has completed 35 NfN expeditions and transcribed 125,691 slide images with the help of volunteers. We currently have one active expedition, *Jumping into the Field Museum Flea Collection 4.0* with 2,000 records (UU).

Share Best Practices, Standards, and Lessons Learned

Taxonomy. The TPT Taxonomy team continues to work on compiling and cleaning lists of names for the network. 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. You can now find the taxonomic resources and tools produced by TPT, as well as cleaned parasite and host taxonomy lists here: https://github.com/njdowdy/tpt-taxonomy/tree/main or 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.

Associations. Global Biotic Interactions team continues to working on incorporating the taxonomies created by TPT into GloBI and has created a way for data providers to check their taxon names against the TPT taxonomies via the GloBI TPT webpage (https://www.globalbioticinteractions.org/parasitetracker/). Individual data providers can also review their taxonomic names by clicking the heart logo next to their institution listing on the GloBI webpage. The GloBI team continues to create new and exciting functions that further improve the functionality and usefulness of the website.

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.

FieldGuide. The Phthiraptera (lice) taxonomy and images have been imported into Field Guide and testing of a new AI neural network model workflow has begun! Results of the model testing for the Phthiraptera datas are expected soon.

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

While TPT network members continue to progress toward their digitization goals, COVID-19 and the new variants that keep emerging have notably impacted our original digitization timelines.

The network continues to struggle not just with access to collections and specimens, as many institutions have limited or restricted collection access, but also with the constant changing of institutional policies to try and keep everyone safe during the pandemic. The combination of access restrictions, fluctuating policies, and smaller student and faculty populations allowed on some campuses, have made it challenging to find reliable staff, student, and volunteer help for the TPT project. With fewer people working in person at many institutions, finding appropriate IT help when needed has additionally contributed to some productivity delays.

The pandemic has also impacted many planned outreach and educational activities, but the TPT network has been very creative in overcoming these challenges. Not only have we made the best of a situation we have little control over by continuing to make collections and parasite science available and accessible, but in many ways we have used this pandemic to create resources and activities that are even more versatile, robust, and meaningful, than we ever may have thought to without the pandemic pushing us to greater efforts.

As always, PI Zaspel continues 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

PIs Cook & Campbell (MSB) have uploaded over 600 diagnostic images of key characters for 140 individuals and 93 North American Siphonaptera (fleas) taxa to the Texas Advanced Computing Center (TACC) (Malpais Flea Project). These images are linked to catalog records in Arctos and shared with GloBI. The specimens in these images are also planned for DNA barcoding and morphological character coding. Once sequences are obtained and coding completed, both sequences and morphological traits will be linked to the original records and available online. This will become an amazing resource currently much needed in the community for learning diagnostic characteristics of Siphonaptera and training students in their identification.

PI Klompen (OSU/OSAL) has hired a new undergrad and is working with MPM to determine the best way to separate slide scans with multiple slide images on them into single files that work with the OSU database. TPT has developed a couple ways to do this image splitting process, but it must be incorporated in a way that works for the holding institution. We are working closely together to develop and modify a workflow that satisfies these needs.

PI Orlofske (UWSP) has started training a new undergraduate student Lee Osgood who will be starting work during spring semester 2022. Kaitlyn Goetz will be joining the TPT team as a High School student volunteer in Spring 2022.

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

Databases & Repositories. TPT is continuing collaborations 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. 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.

TPT has recently started working 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. So far 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.

Other TCNs & Grants. TPT is collaborating with the newly funded **NSF TCN Big-Bee** digitization initiative and the recently submitted **NSF TCN iDigBees** proposal sharing workflows as well as digitization and project management insights and expertise. In addition, members of TPT are lending expertise to the **USDA funded National Bee Monitoring RCN**. 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.

PI Zaspel & PM Tucker are working with and helping organize and plan the NSF funded Entomological Collections Management Workshop for 2022. This is the first year the workshop will be adopting a hybrid implementation, due not just to COVID concerns, but also in order to make the course more accessible to a broader and more diverse student population. This workshop is the only one of its kind for the entomological community and is extremely important in training the next generation of collections managers - many of whom will be implementing digitization protocols at their institutions. With TPT's assistance, this year's curriculum will incorporate more modern collection management techniques with an emphasis on digitization methods and existing workflow resources which will well equip new managers and curators to care for and improve their collections.

Share Opportunities and Strategies for Sustainability

Multiple TPT PIs are actively involved with and are collaborating on 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 is playing an important role in the upcoming 2022 Entomological Collections Management Workshop. In addition to TPT members presenting at the workshop, PI Zaspel (MPM) has been instrumental in advising, planning, and organizing the new hybrid version of the workshop (part online/remote participation, part in person for those who can physically attend). This workshop is one of the most important collections training opportunities within the entomological community and offers the perfect venue for sharing digitization practices and resources developed by TPT, as well as many others, resulting in significantly higher chances of long-term sustainability.

TPT PM Tucker was an integral part planning out the newly submitted iDigBees TCN proposal and if funded will continue to offer expertise and support to the new project. A key part in continued digitization efforts that improve upon existing infrastructure and methods while innovating new methods and technologies (instead of having to figure out the same things repeatedly) is having experienced TCN participants actively participating in newly fledged and submitted TCNs. It is important to foster this kind of cross-collection or inter-institutional communication and collaboration between experienced TCN participants and newer ones to facilitate sustainability, productivity, and reduce stress for everyone involved.

To additionally help foster sustainability and knowledge sharing, Lead PI Zaspel is co-organizing a symposium for the 2022 Ecological Society of America on collections and digitization. While many of our efforts to increase sustainability and share knowledge are centered in the entomological and collections community, to truly be able to reach a sustainable system it is essential we communicate and share with the broader scientific community. Ecologists are some of the researchers that most heavily utilize digitized materials and frequently contribute fresh specimens to collections. Working together and sharing information between the collections and ecological community will vastly improve long-term sustainability plans.

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

PI Orlofske (UWSP) created a public exhibit about the TPT project which is on display in the public galleries in the UWSP Natural History Museum. Orlofske also provided hands-on activities and opportunities for over 400 members of the public to participate in and view specimens at the Destination Infestation event at the UWSP Natural History Museum. In addition, PI Orlofske has continued to actively work with the UWSP Diversity and College Access Staff and Summer

Bridge Program for underrepresented students. This led to the lab hosting four undergraduate students during the two-week program, one of which returned to continue on the TPT project for fall semester. A post-survey to gain feedback for future implementation on the Bridge Program has also been developed.

PIs Cameron and Gall (YPM) are currently conducting 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.

Share Information About Your Website and/or Portal Usage

To date, the TPT Notes from Nature project has completed **35 expeditions, 125,691 transcriptions** for 39,538 unique specimens, and provided learning experiences for **1,836 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 15, 2021. The total number of interactions included in this reporting period is **427,775** records (500,000 interactions is the overall goal for TPT). The full TPT biotic interaction dataset published on Zendo has been **viewed 590 times** and been **downloaded 271 times:** https://zenodo.org/record/5572874#.Yeck61jMKGR.

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

- Ecological Society of America (2022): Lead PI Zaspel was invited to develop a symposium section on collections and digitization in collaboration with Sandra Rehan (York University)

Publications

Multiple taxonomic resources were published and made publicly available:

- TPT. GitHub repository (2021). https://github.com/njdowdy/tpt-taxonomy/tree/main
- Dowdy, N.J., Barve, V., Mayfield-Meyer, T., Sullivan, K., & Zaspel, J.M. (2021). njdowdy/tpt-taxonomy: TPT Taxonomic Resource v1.0.3 (v1.0.3) [Data set]. Zenodo. https://doi.org/10.5281/zenodo.5562742
- Poelen, Jorrit H., Seltmann, Katja C., Campbell, Mariel, Orlofske, Sarah A., Light, Jessica E., & Tucker, Erika M. (2021). Terrestrial Parasite Tracker indexed biotic interactions and review summary (0.5) [Data set]. Zenodo. https://doi.org/10.5281/zenodo.5572874

Publications in Prep

Papers that are currently in progress and being developed:

- Enhancing visibility and sustainability of taxonomic resources. Led by Kat Sullivan (MPM).
- Biotic host associations confidence paper. Led by PI Julie Allen (UNR).
- Computer learning to examine differences between GloBI and literature association data. Led by PI Seltmann (UCSB).