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

# May 2023

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- Reports from the following **active** TCNs:

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| ☒ CAP | ☐ oVert | ☒ TPT |
| ☒ DigIn | ☒ PILSBRY | |
| ☒ ESB | | |

- Reports from the following **retired** TCNs are no longer included:

| | | |
|---|---|---|
| ~~Cretaceous World~~ | ~~LBCC~~ | ~~PCC~~ |
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*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.*

# All Asia 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, 2022 (* Report is offset by one month to capture complete statistics)

**Share Progress in Digitization Efforts**

Total Specimens imaged: 74,070
Total Minimal records created: 25,367
Total Full/detailed records created: 21,714
Total Specimens georeferenced: 13,715

*Overview*: We have started Y2 of the project. Some of the smaller collections completed or nearly completed their digitization efforts in Y1. Larger collections started digitizing in earnest this quarter. Y2 is primarily focused on the imaging and detailed data capture of specimens from Southeast Asia; though some collections have specimens filed in broader categories. Technology development started in Y1 continues. This includes the development of the machine learning-based handwriting recognition tool and the Symbiota enhancements for rapid data entry. In Y1 we encountered challenges shipping the photostations to partners, but these were successfully delivered this quarter and are being configured. Partners are discovering various challenges digitizing their Asian specimen collections which are affecting digitization efficiencies, including a) significant repair and other physical curation needs, b) taxonomic, geographic, and collector names that need to be added during data entry, c) identifying unfamiliar localities, and d) interpreting non-English label data. COLO continues to have success in georeferencing specimens from across the collections with highly duplicated localities.

| | Images | Minimal | Detailed | Georef | Comments |
|---|---|---|---|---|---|
| ALA | NA | NA | NA | NA | |
| BISH | 5,873 | 0 | 324 | 0 | Started Y2 |
| BRIT | 0 | 0 | 0 | 0 | Pending photostation after COLO |
| BRU | NA | NA | NA | NA | |
| CHIC | 0 | 0 | 0 | 0 | Pending database migration |
| CINC | 4 | 0 | 4 | 0 | Digitization nearly complete |
| CLM | 0 | 0 | 0 | 0 | Starting in Y2 |
| COLO | 866 | 866 | 0 | 12,206 | Started Y2 |
| HUH | 11,750 | 0 | 11,750 | 0 | Started Y2 |
| MASS | 2,253 | 0 | 2,110 | <100 | |
| MICH | 13,698 | 0 | 4,064 | 0 | Started Y2 |

| | | | | | |
|---|---|---|---|---|---|
| MO | 31,775 | 17,126 | 6 | 1 | Started Y2 |
| MU | 1,106 | 0 | 1,106 | 0 | Starting Y2 |
| NHA | 0 | 0 | 200 | 200 | |
| NY | 5,550 | 6,180 | 611 | 1,247 | |
| OS | 0 | 0 | 0 | 0 | Starting in Y2 |
| RSA | 1,195 | 1,195 | 1,539 | 61 | Started Y2 |
| VT | NA | NA | NA | NA | |

**Share Best Practices, Standards, and Lessons Learned**

*COLO*: Most specimens receive geography during the imaging process, but illegible and or difficult to read labels may go into our database without geography. CO-PI Allen is checking specimens without geography after they are in the database and adding country info where possible. There may be some lag time between imaging and being counted as part of the project.

*MASS***:** Our operation ran into some glitches that were new to us, and caused us to have to backtrack, redo some work, and reassess our practices. We have now ironed out these issues and are ready to proceed with greater speed, using tried-and-true practices that we have used for years.

*MICH:* Specimens from Europe, Africa, & Oceania are filed in folders with collections from Asia, which has proved difficult to efficiently separate for digitization purposes. We have adopted the strategy of imaging all specimens in blue folders, but only transcribing those that are within the study area. Alternative suggestions include a preliminary digitization of geography during imaging but we feel that this would greatly slow down imaging efforts without providing a significant benefit to efficiency in transcription or data management.
A university-wide minimum wage was raised to $15/hour, which is significantly greater than estimated wages used to calculate the budget. This means that some work proposed initially will not be able to be completed.

*RSA*: Our collection is organized first alphabetically by family and genus, then by geographic region. Geographic regions are large and include countries not part of the All Asia TCN. All Asia-targeted specimens are included in brown folders (Eurasia) and green folders (Australasia). Based on our experience with previous digitization projects, it is much easier, and just as fast or faster, to barcode and image the entire folder of specimens, even if non-target specimens were included in the folders. To remedy this situation of barcoding and imaging non-target specimens, we add staff to the project that are supported by institutional funds (supported by core herbarium funds). Our workflow includes the collection of skeletal data simultaneously while imaging, including barcode, taxon name, and geography. Later, in data transcription steps, we can filter out the specimens that require full transcription by conducting a simple search in our live managed CCH2 database (Symbiota platform).

**Share Identified Gaps in Digitization Areas and Technology**

*COLO*: COLO is using the ImagingWorkflow application from the LBCC TCN to capture skeletal data during the imaging process. CO-PI Allen developed a list from World Flora Online to create a list of names for the dropdown menu in the application. The first batch of existing records from the consortium for georeferencing was delivered in May of 2022. Data is currently not in a centralized project portal. Specimens are being georeferenced and the data are being held until the portal goes live.

MASS**:** The one new issue that we are still working on is translating foreign labels, mainly from Russian and Chinese. We have software that works for this and are learning how best to integrate this into workers' transcription procedures.

*RSA***:** RSA received one of the built imaging stations in early December. We now need to purchase the components to put together this imaging station. RSA also has well established imaging and transcription protocols in place, which has given us pause with respect to adopting a new imaging workflow. Our intentions are to perform a trial run it to assess whether this workflow can merge smoothly into our existing workflow. Moreover, since the funding of the Africa TCN, wherein some specimens from that continent are filed into brown folders (Eurasia) as well as our lavender (Africa) folders, it makes more sense for us to combine some of the imaging efforts between the two TCN projects, capture skeletal data of the specimens while imaging, and then parse out through search functions in Symbiota for full transcription those specimens relevant to each project.

**Share Opportunities to Enhance Training Efforts**

*RSA:* Five interns were hired in October for five concurrent digitization projects, including one intern on the All Asia project. To streamline training, sessions included all interns, regardless of project. Interns were trained in barcoding, data entry, imaging, georeferencing, and best practices in herbarium curation. The RSA Herbarium also hosts enrichment sessions for staff and interns, where they have the opportunity to learn more specific information about collections, including botanical nomenclature and classification, type specimens, and various taxonomic databases.

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

*MICH:* Project manager attended iDigBio course on Public Participation in Digitization to begin designing a public outreach component to transcription efforts. MICH & CINC are also part of the GLOBAL bryophyte & lichen project, and efficiencies learned in GLOBAL will be adopted in the All-Asia project (and vice-versa).

*NY*: This TCN is also helping to complete and georeference specimens that were initially digitized under the Endless Forms TCN. We are also collaborating on public outreach stories about cross over taxa.

*RSA*: We are a member of the Consortium of California Herbaria; our data is served on both the CCH1 and CCH2 portals. We have been a partner in the California Phenology Project, a TCN aimed at digitizing its California holdings to assess phenological change in conjunction with shifts in climate. In 2019 we received a PEN for the SoRo TCN to digitize our holdings from the Southern Rocky Mountain region. Lead PI of the TCN is Erin Tripp at COLO. We have also been 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. RSA received an NSF ICBR grant to curate, digitize, and create an extended specimen network for the Sherwin Carlquist collection. We are the lead institution, in collaboration with BRIT. We are part of the Africa TCN to digitize our Africa holdings, recently awarded in August/September of 2022. Lead PI and institution is Town Petersen, at KU.

**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 utilize the CCH2 portal on the Symbiota platform as our primary database. All data generated as part of the All Asia 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**

*MASS*: Now that activities are returning somewhat to normal after two years of altered teaching and research activities, visitation to the University of Massachusetts Herbarium has shot back up. The past semester we gave tours to high-school and college students from schools outside the University of Massachusetts, as well as to our own students. Our digitization efforts and portal accessibility is one of the topics we cover. A result of this has been a recent increase in excellent volunteers in the herbarium.

*MICH:* Multiple women were hired as technicians who are from areas within the All Asia study region (e.g., northeast India & Beijing, China); these students were excited upon being able to work with specimens that were from their hometowns. Undergrads in intro biology lab course (BIO 173 roughly 800 students) were given tours of the herbarium space and introduced to the concept of specimen digitization through explanation of the current efforts on All Asia and other TCN's. Herbarium tours were also given to two other U of M courses Florilegium (ARTDES 352, 20 students) and Herbaceous Flora and Ecosystems (EAS 546, 27 students). Project manager attended iDigBio course on Public Participation in Digitization to begin designing a public outreach component to transcription efforts. Trained volunteer (Michael Machesky) who contributed to imaging and transcription. MIchael has since been hired to officially work on the project.

*CINC:* The All-Asia project at CINC employs three student workers: two are women in STEM fields, one (male) is from an underprivileged Appalachian background. CINC also has a collaboration with the University's Advancement and Transition Services in which students with developmental challenges image specimens with the supervision of a job coach. The repetitive nature of specimen imaging works well for helping the students develop skills, and the acute attention to detail of several of the students has resulted in excellent specimen images.

*NHA*: We continue to offer herbarium tours to courses at UNH, as well as any other interested groups, and we will continue to feature the All Asia TCN project. Between Oct 1 and Dec 31, 2022, an additional 450 students from three courses (BIOL 412 Introductory Biology ~400 students; BIOL 409 Green Life ~25 students; BIOL 408

Plants and Civilization) visited the NHA herbarium and were told/viewed specimens from the AllAsia project. Since the start of the project, we have had approximately 1350 students visit the herbarium.

*RSA*: During this quarter one graduate research assistant and one intern worked on barcoding, imaging and data entry. During this quarter the RSA Herbarium has given five tours to 41 participants. Of those tours, two were given to academic institutions in the Greater Los Angeles Metropolitan area. For all of the tours we emphasize the digitization projects we participate in, including the All Asia project.

**Share Information About Your Website and/or Portal Usage**

HUH is currently coordinating portal development with Symbiota Hub.

**Share Other Activities and/or Progress**

*CHIC*: We are in the process of switching our database platform. Digitization efforts are still not back to full capacity because digitization is conducted by volunteers, many of whom are in high-risk groups for COVID.

*COLO*: Specimens imaged is tracked based on the country field since our specimens are not separated beyond "outside of North America" we are imaging all specimens in any folder that is pulled for imaging. We are finding a slightly lower than expected percentage of specimens from Asia than we had estimated during the proposal. To date ~30.52% of images are from Asia as defined by the project. We had estimated 33.33%-40.0% of the collection would be from Asia when estimating numbers for the project.

*NHA*: In August 2022 we hired hourly worker Ryn McRae, for up to 12 hours a week to assist with pulling and databasing our previously imaged specimens from Asia. Going through the entire collection of vascular plants at NHA, Run has identified approximately 1,000 more Asian specimens, the majority from the former USSR, in need of databasing. I have 2 hourly undergraduate workers dedicated to databasing these specimens
*NY*: A Pace University student who is working at NYBG as an Herbarium intern has been contributing to this project as part of a Pace University program. The student, Harkirandeep Kaur, has been imaging specimens for this project. Two new interns paid on this award were hired during this time period. Both interns are members of groups historically underrepresented in Science.

CALIFORNIA PHENOLOGY TCN – QUARTERLY REPORT – JANUARY 2023

*Assembled by Katie Pearson on January 27, 2023*

## PROGRESS IN DIGITIZATION EFFORTS

The CAP TCN has surpassed our imaging goal by 16% (over 1 million specimens imaged), our transcription goal by 27%, and we have completed 97% of our georeferencing goal (Figure 1).

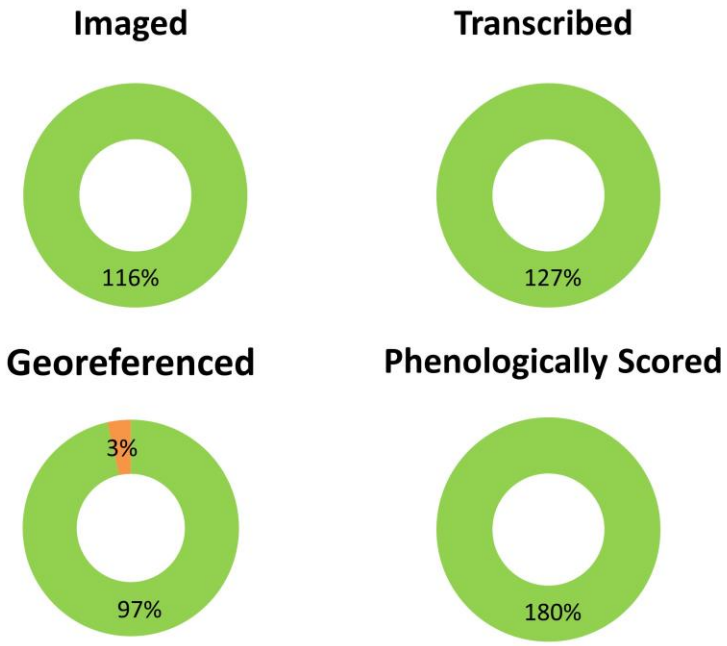



**Figure 1.** Progress in each of our four major digitization goals. Totals represent the original goals of the CAP grant: 902,400 specimens imaged and phenologically scored, and 300,000 transcribed and georeferenced. Additional specimens to be digitized by the PEN grant are tabulated in the PEN section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

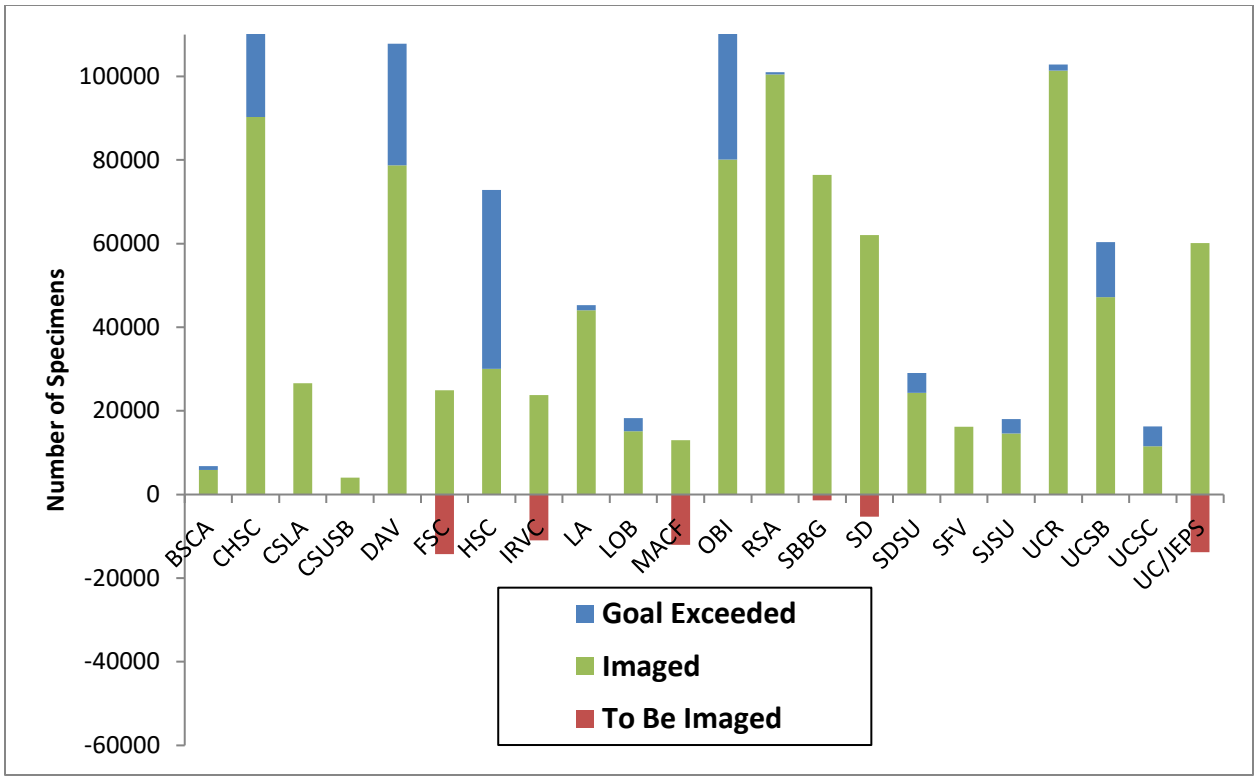



**Figure 2.** Herbarium specimen imaging progress. Blue portions represent the number of specimens that have been imaged, while green portions represent the number of specimens that have been imaged beyond the expected target specimens. Red bars below the zero line indicate the number of target specimens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

## PEN PROGRESS

OSC, SHTC, and UNLV have completed their imaging goals, and OSC continues to digitize. Imaging is ongoing at PUA, SFSU, and SD. CDA has continued to experience delays in procuring their equipment. Figure 3 shows the current imaging progress at PEN institutions. CDA has, instead, focused on georeferencing and has georeferenced nearly 30,000 of their own specimens and 6,600 of other collections' specimens, exceeding their goal by 300%.

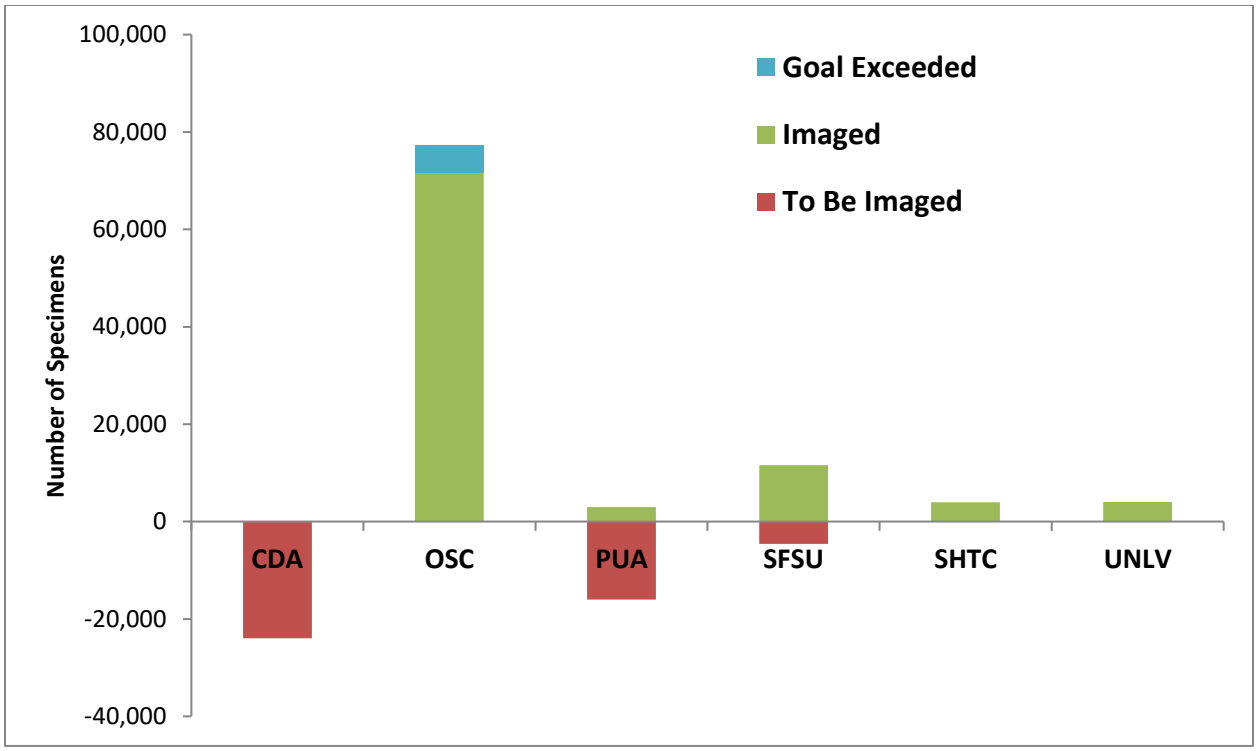



**Figure 3.** Herbarium specimen imaging progress for the seven PEN institutions. Green portions represent the number of specimens that have been imaged, while red bars below the zero line indicate the number of target specimens that have not yet been imaged. For SD, the total number of specimens to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

Our Phenology Standards Task Group was poorly attended, likely due to a scheduling mishap, so we had a brief but productive discussion among the 4 attendees about our next steps in developing data standards for plant phenology. PI Yost and PM Pearson had a separate meeting with Rob Guralnick of the newly NSF-funded project Phenobase (https://phenobase.org/), which has been mapping and coalescing phenological data from different sources in close parallel to our goals. We will continue to work with Phenobase to develop community best practices for mapping phenological data to the Extended Measurement or Fact Darwin Core extension in this year.

## IDENTIFY GAPS IN DIGITIZATION AREAS AND TECHNOLOGY

We and other TCNs are being affected by CyVerse's recent shift away from hosting static images; however, we are working closely with the Symbiota Support Hub at Arizona State University to rehome our web-ready images so they can still be viewed by our portal users. The SSH is developing the necessary tools to transfer our images over to ASU servers and begin hosting there.

## 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 held one quarterly Consortium of California Herbaria meeting in January in which we discussed future funding for California herbarium digitization and curation, cybersecurity of our data, and the importance of disambiguating catalog numbers.

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

Following the imaging of the Klamath National Forest and Shasta-Trinity National Forest herbaria in February, we helped to facilitate the transfer of these specimen images into CCH2, where they are now available for transcription. We directed their staff and interns to the digitization resources that we developed for transcription and georeferencing. We also connected these new collections to our 100 Club of volunteers, who have eagerly begun to transcribe and georeference these specimens.

We were contacted by a former student of our online digitization course who had been interning at the UC Blue Oak Reserve and collecting specimens for their small herbarium. We worked with him and the reserve manager to digitize the 108-specimen Blue Oak Reserve Herbarium (BORR) directly after the California Native Plant Society meeting in late October. These images were immediately uploaded to the CCH2 portal. The Green Diamond Resource Company is currently digitizing their specimens with their own equipment, and the PM helped to facilitate the transfer of these images to CCH2 as well. PM Pearson also provided digitization consulting at the CNPS meeting, particularly for the Santa Monica Mountains National Recreation Area.

We continue to work with the Symbiota Support Hub to mobilize other collections belonging to California herbaria, such as collections of algae, fungi, and bryophytes. These collections are being added to the Macroalgae portal, MyCoPortal, and Bryophyte Portal, respectively.

## SHARE AND IDENTIFY OPPORTUNITIES AND STRATEGIES FOR SUSTAINABILITY:

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

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

We have two Notes from Nature expeditions currently ongoing, consisting of 793 specimens from CSU Fresno and 2,278 specimens from the Inyo National Forest. One Notes from Nature expedition for Oregon State University was completed in January 2023, consisting of 2,733 specimens transcribed by 514 volunteers.

We have continued to maintain our Capturing California's Flowers website (capturingcaliforniasflowers.org) and populate it with useful resources for digitization and herbarium curation, as well as news regarding the CAP project. One article was published by the US Forest Service about our collaboration with them to digitize their National Forest herbaria: https://www.fs.usda.gov/detailfull/r5/home/?cid=fseprd1079367&width=full.

## WEBSITE AND PORTAL USAGE

Our project website (capturingcaliforniasflowers.org) has received 1,804 visits and 2,389 pageviews from November 1, 2022 to January 27, 2023, both metrics approximately equal to those from last quarter. The data portal (cch2.org) has supported 6,966 sessions, 135,132 pageviews, and 1,060 users over the same time period. These metrics cannot be compared to last quarter's due to differences in Google Analytics' tracking and potentially also due to security updates to the CCH2 portal.

## TCN Quarterly Progress Report

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

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

Person Completing the Report: Regina Wetzer (Lead PI)

### Progress in Digitization Efforts

ALMNH: Kevin Kocot: We have been focusing on a backlog of undigitized historical specimens dating back to the early 1900s. Efforts to digitize specimens have been slowed by the necessity of physically reorganizing specimens in the collection to make room for newly added material. I have been also working to learn the TACC/Arctos system to upload specimen images to Arctos, which is a complex process. In the last quarter we digitized 302 lots of specimens, which I am pleased with, given our students were on winter break from early December to 10 January.

AMNH: Chris Johnson, Estefanía Rodríguez, Lily Berniker: To date, we have added 13,042 new records and updated with images, locality information or card catalog records an additional 9,696 preexisting but formerly incomplete records. A total of 18,796 card catalog records have been attached to our database catalog records. A total of 5,764 images of specimens and/or their labels have been taken; 4,808 catalog records have images attached to them; of these 906 new images are for existing, incomplete catalog records; 3,896 new images are for newly created records. Of the 22,738 records for the project, 20,668 databased specimens (catalog records) are associated with a locality record and of these catalog records, 15,744 have an initial set of geographical coordinates. 15,285 Crustacea catalog records have been shared with GBIF & iDigBio; next step is to include images, fix validation issues and share additional phyla subsets from the project.

ANSP: Paul Callomon: Curatorial Assistant, Darius Grosch, has been working with Gary Rosenberg to link the various digital islands created from analog sources. Building this network has been a project lead by Paul Callomon and Kasey Seizova. This will allow several sets of partial accounts (scanned card files; scanned ledgers; newly-conducted digital inventory) to see each other and for all available data to be visible in one interface.

BPBM: Holly Bolick: This quarter was a little slow due to the holidays, but we made significant progress on digitization of specimens and completed two accessions of material. We added 927 new specimen records, we updated and cleaned an additional 4,624 specimen records; we mobilized 155 specimen images and acquired 22 new specimen images. Our specimen imaged total is now 3,556.

CAS: Christina Piotrowski: A total of 5,241 CASIZ specimen records were fully digitized (aside from bulk georeferencing) this quarter. Data records were digitized via a combination of direct data entry and data entry by scanning and transcribing specimen labels. All records were cleaned, edited, and uploaded directly to our Specify database and are now available via GBIF and iDigBio portals. While CAS databased records were not reported in previous

quarters as “uploaded to iDigBio”, since they have not yet been georeferenced, cumulative databased (uploaded) DigIn records (22,402, still to be georeferenced) were reported in this quarterly report, to better align with the reports of some other DigIn collaborators.
CAS volunteers scanned 1,644 specimen labels, to later be hand-transcribed and approximately 1,692 specimen jars were pre-curated this quarter by volunteers. One volunteer completed the pre-curation of CAS photographic slides and recently began scanning the photo slides associated with specimens.

FMNH: Rüdiger Bieler: We have added 471 lot records and 188 unique site records. Imaging is nearly complete, with photographs still to undergo post-editing.

FWRI: Paul Larson: This quarter 1,218 new lots have been completely digitized and cataloged. Tracy, our digitizer, spent several unplanned weeks in California with family this quarter, reducing the output we may have otherwise had. 5,623 field record scans associated with collecting events have been added to those collecting event records, and 300 field records have been added to the database to enable cataloging the specimens associated with those events.

HBOM: M. Dennis Hanisak: This quarter we barcoded 118 samples (total to date 504). Most significantly we started photography of our invertebrate samples, imaging 671 samples. We will continue photography in the next quarter.

MCZ: Adam J. Baldinger: This quarter, 106 uncataloged lots, containing around 1,187 specimens (mostly echinoderms), were databased from spreadsheet data and specimens in hand. As of 24 January 2023, 15,447 records in MCZbase have been cleaned/vetted for accuracy. Of these, 15,259 records contain vetted/verified georeferences.

NCSM-NMI: Megan McCuller: Much of the digitization efforts for the last quarter has been QA/QC and prepping for bulk databasing via image labels. That is, processing images to import into Specify where they can then be databased in Specify.

NHMLA: Dean Pentcheff: We have adjusted our staffing by tapering off the Guest Relations (GR) staff we had hired. Their work was excellent, and being able to provide a half time position in the Museum that was different from their regular guest engagement was a very positive experience. However, because of the federal support that supplements what we pay for work-study undergraduates, GRs cost approximately five times per hour relative to work-study students. Unfortunately, now that work-study students are fully available (post COVID restrictions), we cannot justify the price premium for the GR staff.
This quarter we are beginning to experiment with volunteer work through the Museum's volunteer program. As the volunteers complete training and begin work, we will evaluate whether the digitization production from them offsets the training and supervision time invested.

RSMAS: Maria M Criales: We continue entering collection records. This quarter we digitalized 4,794 new records from catalogued cards and books, capturing a total of 28,593. We completed entering data for: Syphozoa, Anthozoa, Antiphataria, Bivalva, and Scaphopoda. These data have been uploaded into the Invert-E-Base Symbiota portal, bringing the total to 14,122 lots. These lots are almost ready to be uploaded to DigInv. A significant amount of time was spent formatting and data cleaning taxonomic and geographic names using the Symbiota cleaning tool linked to WoRMS. With the assistance of K. Pearson we started georeferencing data via UM cruise station names and taxa names. A total of 4,113 data records were georeferenced; they were not processed through CoGeo, so they are entered as "Records prepared for Georeferencing".

SBMNH: Daniel Geiger: 36,817 records were published in iDigBio.

SIO-BIC: Charlotte Seid: We digitized 231 lots this quarter as incidental work by the collection manager. Our previous DigIn student employees accepted other commitments, so new employees will be recruited in the future and no DigIn funds were expended this quarter.

SIO-PIC: Linsey Sala: As indicated in our Year 2 annual report, in going through the data we produced in the second half of 2022 some of these data needed to be revisited for quality control and to assign additional data. We have completed about half of this QC work on a total of 3,311 records, and digitized an additional 95 new records. We anticipate one more quarters' worth of vetting our records that we had data captured in 2022, Q4.

UCM: Kelly Martin: A total of 1,000 specimen lots have been imaged by student workers. Our undergraduate worker Kayla Vasarhelyi has helped us tremendously in our imaging push this year. A graduate student volunteer, Cameron Pittman, has also been responsible for imaging. We have met our imaging goal and will turn our efforts toward georeferencing. We are currently compiling records to be georeferenced.

VIMS: Jennifer Dreyer: 135 new records have been entered into Excel this quarter. No additional records have been uploaded into Specify this quarter due to continued issues with my Specify taxon tree. I discovered that my taxon tree was missing more random taxa groups (some gastropods, bivalves and polychaetes) and the tree needed to be fixed again. I did continue to QA/QC 310 specimen records so that I would have those ready when the taxon tree was fixed. The tree was fixed right before Christmas but since returning from our institutes holiday break, I have not been able to get back to the database yet. I hope to make more progress in the next quarter. 208 historic/old specimen labels were photographed for an archive to attach to specimen records in Specify. 550 specimen records were precurated and are in the workflow to be added into the database.

Our quantitative table can be accessed here: [2023 Q1 – Production counts]

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

**Best Practices, Standards, and Lessons Learned**

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

ANSP: Paul Callomon: A major decision in this project was to inventory catalog numbers that are present in the collection, appending to each a prefix that denotes the phylum. This was possible because the collections were previously arranged by phylum, family and genus, with each phylum having its own number sequence. We reorganized them on the shelf by catalog number, retaining the phyla as separate prefixes to account for the large number of duplicate catalog numbers.
Creating the inventory (by reading numbers off jars using a voice recognition interface) revealed a large amount of material that had been placed on the shelves by genus but never cataloged. These lots can now be added to the digital catalog by copying data from their labels, bringing them into the light.

BPBM: Holly Bolick: Giving technicians target goals per week or month is helpful in keeping staff and the project on track. As we process older material, we are finding a lack of collection permit information, as well as, minimal collection information (time/place) to catalog certain specimens; assessing data of older specimens takes extra time up front, but helps cut back on wasted time later in the digitization process.

CAS: Christina Piotrowski: We are working towards drafting workflows for specimen imaging, similar to the workflows we have drafted for other digitization processes. This documentation is bound to be helpful during the course of DigIn, but also in future projects. CAS staff continue to serve on the DigIn Steering Committee and participate in general working groups. Three CAS staff (Piotrowski, Loacker, and Baek) participated in the DigIn in person retreat held in Southern California at the beginning of the quarter, which was a great way to share our progress, tips, and workflows and also to get to know our collaborators better. This quarter Piotrowski worked with Alana Rivera (MCZ) and Libby Elwood on the joint DigIn/ESB SPNHC conference symposium intended to present work from our two TCNs in May. The meetings will be hosted at CAS in San Francisco. We have been working to compile contributions from many of the TCNs' 26 (in total) partnering institutions to share with the museum community what we have learned so far during these two large projects.

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

NCSM-NMI: Megan McCuller: Every time I find data that needs to be fixed within our database (that was imported in 2017), it reminds me how important it is to understand the database structure beforehand and wrangle the data accordingly. Fixing errors that existed is important for import of data during this project so they do not persist (e.g., duplicate agents/people). Though time consuming on the front end, wrangling the data beforehand will save time fixing it later.

RSMAS: Maria M Criales: Katie Pearson and Symbiota staff continue being a great help.

SBMNH: Daniel Geiger: Enter all info from record at time of entry.

SIO-BIC: Charlotte Seid: Purchased and reviewed new SPNHC publication "Preservation and Management of Fluid – Preserved Biological Collections"; presented key points and highlights to previous and prospective DigIn student employees during a research group meeting.

SIO-PIC: Linsey Sala: We do not have consistent label types, but have now spent time assessing and digitizing a number of our reference collections. As a result, this quarter we put together a more developed Data Capture and Data Quality Control SOP that capture some of the nuances of our specimen labels and data fields to better assist in vetting and training existing and future digitization staff.

UCM: Kelly Martin: Former student volunteers created standard operating procedures (SOPs) for continued use in the Invertebrate Zoology section for georeferencing and imaging. This has enormously speed up training of new collections assistants as we start a new semester. As our students encounter and SOLVE various camera and software issues, we write these into the protocol to avoid these errors in the future. We have learned that documentation of our workflows and troubleshooting is extremely important and timesaving.

VIMS: Jennifer Dreyer: I attended the DigIn 2022 Retreat Oct 31 - Nov 3 in LA. We worked through issues each individual collection was experiencing, provided feedback, and optimized workflows for maximizing efficiency. This included seeing first hand the digitizing stations that the NHMLA has created and are using which was very helpful. I continue to attend All Hands meetings and participate in the consolidated monthly meetings for any agendized topics and office hours for unagendized topics as often as I can. I continue to actively participate with the general group via Slack to provide content and feedback on publicity content.

**Identified Gaps in Digitization Areas and Technology**

AMNH: Chris Johnson, Estefanía Rodríguez, Lily Berniker: Trying to get light box setup completed to reduce shadows in images and looking to purchase motorized copy stand to improve our ability to use stacked images for a single in focus image for specimens with significant depth.

ANSP: Paul Callomon: So far, the size and scope of the collections have precluded creating complete records for most of the material. Linking cards and ledger entries should allow many to be augmented with data denoting their taxon, locality and collector, but eventually a complete "truthing" of the database against the jars will be necessary. Moving much of the material to the modular storage system that was created for the wet mollusk collection will make this final task much faster and easier.

BPBM: Holly Bolick: Specimen images still not linked to specimen database.

CAS: Christina Piotrowski: CAS is currently working hard to associate existing digital images with CASIZ specimen records, with the aim of enabling attachment of archived and future images to our Specify records. This is no easy task, as we have traditionally maintained tens of thousands of image files that were never associated with unique identifiers by contributing researchers or staff, and this involves a few decades of archived digital files. This linking of files to records will permit image viewing via GBIF, iDigBio, and InvertEBase. We still have much work to do before we've categorized copyright status and terms of use, and before all Creative Commons licensed images are ready for sharing, but we are working towards readying a subset. We plan to report these as "images taken" in a future quarterly report since they were previously inaccessible.

We've continued to experience technical issues with the stacking apparatus on our type specimen imaging station for most of this quarter, but we've had some success in recent weeks. We still have technical and equipment glitches and no means yet for inserting a scale bar (stacking renders use of an analog scale bar problematic). We did not request funds for camera equipment from NSF, but have instead been working with an aging existing system. The tethered computer runs on an operating system that is no longer supported, which presents IT challenges. At the close of this quarter we've finally begun work on creating and testing Primary type imaging workflows, and will concentrate some effort this year on producing archival quality imaging of CASIZ non-Mollusca primary types. We remain concerned about sufficient time to complete this deliverable alongside our primary focus of

specimen record data entry, which remains our highest priority. However, with our existing digital images eventually made accessible we will far surpass our specimen image count deliverables as long as all goes as planned technically.

MCZ: Adam J. Baldinger: Images of ophiuroid, asteroid, echinoid and holothuroid types are being generated and uploaded to MCZbase.

NCSM-NMI: Megan McCuller: The issue of getting our data uploaded to GBIF and iDigBio remains an issue.

NHMLA: Vijay Barve: Converting the collections data to Darwin Core is an important task for all of our TCN members, as some of our partner organizations are preparing to mobilize data to iDigBio and GBIF through the Integrated Publication Toolkit (IPT). To aid in this process, a template sheet was created which includes sample data and explanations of the relevant Darwin Core terms, and feedback was requested from teams after an introductory presentation. This vetting has been important for not only introduction of how to get data published, but to build our community as we discover each of our own institution needs. A similar template has also been developed for the Cooperative Geolocation Platform (CoGe) and is currently being finalized.

SBMNH: Daniel Geiger: Specify data clean-up capabilities woefully inadequate.

SIO-BIC: Charlotte Seid: For upload to iDigBio via IPT, we need to align internal database fields with DwC terms; we appreciate the initial training/guidance documents prepared by Dr. Vijay Barve and will participate in upcoming DwC training opportunities.

SIO-PIC: Linsey Sala: Working on developing a database of expedition date ranges, since EventDate is a required DwC field for data upload and date is not always given on our labels. Additionally, will work on aligning our database fields with DwC terms as provided by Vjay Barve.

UCM: Kelly Martin: We have been adjusting to the new spring semester schedule and been working hard to use the limited time we have with our student employees efficiently. We also had quite a few issues this quarter with the camera and software that slowed us down. In some cases, the issues were fixed and the solutions were added to our SOPs.

VIMS: Jennifer Dreyer: I have not made any further progress on georeferencing and intend to tackle that after more records have been uploaded into Specify. We intend to do all georeferencing ourselves but potentially use the DigIn georeferencing resources to double check the data and identify any outliers that need to be revisited.

**Opportunities to Enhance Training Efforts**

CAS: Christina Piotrowski: This quarter several CAS staff members participated in the DigIn Retreat seminars, which included imaging workflow sharing, discussions of taxonomic issues, sustainability, and other training and discussion.
We look forward to sharing our project workflows and experiences via a contribution to the DigIn/ESB symposium at SPNHC 2023, and to discussions with the museum professional community at this international meeting.

MCZ: Adam J. Baldinger: Two MCZ staff members (Alana Rivera and Adam Baldinger) attended the DigIn retreat (Oct 31-Nov 3, 2022).

NHMLA: Dean Pentcheff: Our training sessions and assets continue to be improved, based on continual re-evaluation. This quarter we were able to field the "Training Environment" software, which allows us to create exam-like simulations of the specimen labels that digitizers encounter. That lets us evaluate the results of training each digitizer and provide assistance where needed. This is a huge advantage, since it is unpredictable when new

digitizers will encounter specific label times, making it nearly impossible to comprehensively train them on label types during actual digitization. This is a sizeable issue for us with a work team of 25+ student digitizers.

SIO-BIC: Charlotte Seid: Hosted a scientific visit by PhD student, Luz Botero, Institute of Marine Science and Limnology at the National Autonomous University of Mexico (UNAM), Mexico, to identify and inventory international museum holdings of hexactinellid sponges collected from Mexican waters; Ms. Botero discovered specimens of interest and initiated collaboration with SIO-BIC based on our digital dataset.

SIO-PIC: Linsey Sala: Participated in November 2022 in person DigIn workshop. Will participate in upcoming regular expression workshop and DwC related trainings.

UCM: Kelly Martin: In previous quarters, student workers have used our generated SOPs to train new employees or staff on the grant imaging. This quarter, we experienced many issues with working the cameras and software programs. None of these we had previously experienced. These issues significantly slowed our progress, especially because our students have busy schedules and we need to make efficient use of their time. Despite these setbacks, we have used these opportunities to improve our SOPs. We have added a troubleshooting section that will help prevent/resolve these problems in the future. The students worked together to solve the problems and update the SOPs as needed.

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

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

ALMNH: Kevin Kocot: I am organizing the 2023 American Malacological Society meeting, which will take place in Tuscaloosa, AL in August 2023. We are planning to have a workshop for interested parties to discuss the possibility of an NSF TCN focusing on epibionts in mollusk collections.

AMNH: Chris Johnson, Estefanía Rodríguez, Lily Berniker: Working to establish a relationship with Teaneck High School, which serves a primarily minority student body.

ANSP: Paul Callomon: Our experiences with the DigIn project are helping us shape a large-scale NSF TCN proposal focusing on marine benthic epibionts.

CAS: Christina Piotrowski: We continue to collaborate with the ESB TCN, especially in planning for our SPNHC2023 symposium. This quarter CAS hosted our collaborator Lily Berniker from the AMNH (DigIn partner) for a tour of the CASIZ lab, collections, and workflows at CAS.

Piotrowski serves on the Cordell Bank NMS Advisory Council and regularly interfaces with our NMS colleagues from this sanctuary and neighboring Gulf of the Farallones NMS regarding museum activities, educational, and biodiversity topics which our museum collections and data may help to inform. CAS regularly collaborates with our regulatory partners and NGOs (e.g. NOAA/NMFS, USFW, CDFW, Nature Conservancy, EPA, etc.) for donation vouchering, advice, and taxonomic services. Piotrowski serves on the SDNHM Advisory Committee as their digitization team works to digitize data from their (chiefly marine Mollusca) collections and plans for the transfer of out of scope materials to other institutions including CAS.

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

RSMAS: Maria M Criales: With Symbiota.

SIO-BIC: Charlotte Seid: SIO-BIC and the City of San Diego Public Utilities Department are co-organizing the upcoming (Feb 4) Southern California Unified Malacologists 27th annual meeting. The planning session (Jan 25) made introductions and included collaborative discussions between City of San Diego and SIO-BIC scientists, regarding overlapping specimens/datasets as well as the meeting.

SIO-PIC: Linsey Sala: During the research visit of by PhD student, Luz Botero, Institute of Marine Science and Limnology at the National Autonomous University of Mexico (UNAM) to SIO-BIC, Luz also visited our pelagic collection and borrowed some of our recently catalogued DigIn material that her PI's lab was able to review and use for their work on shallow water Mysida.

**Opportunities and Strategies for Sustainability**

ALMNH: Kevin Kocot: We have been washing and re-using old jars from de-accessioned specimens, which has reduced our need to purchase new jars.

ANSP: Paul Callomon: Reorganizing the general invertebrate collection from a systematic to a catalog-number arrangement allowed condition checks for all lots, with top-ups and lid replacements carried out as necessary.

CAS: Christina Piotrowski: We continue to brainstorm a means to ensure that future incoming non-shell collections added to the CAS Research Collection will be digitized ahead of incorporating them into the physical collections. This will be a financial hardship for our institution at current staffing levels unless we can secure funding from donors, but these resources do not typically exist when important biodiversity collections are submitted for donation. We are exploring a means to secure resources internally for some of this work, at least in the short term. We are making our best effort to digitize all material acquisitioned, despite recently receiving a massive unfunded EPA collection.

NHMLA: Dean Pentcheff: During this past quarter, the DigIn community met for its first in-person retreat in Los Angeles and Cambria, California. None of us had ever met most of the participants in person (though we have a couple of years of remote-meeting experience together). We believe that the experience we shared at the retreat was a significant contribution towards building a community that will persist beyond the funding of this project.

SBMNH: Daniel Geiger: No-data specimens to educational institutions, old glassware to arts supply 501c3.

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

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

ANSP: Paul Callomon: We continue to host Drexel students and other visitors in the collections, demonstrating new techniques and storage designs we have developed via this and other TCN projects. We have several publications in preparation or in press arising from this work.

AUMNH: Nusrat Noor: Conducted multiple tours.

BPBM: Holly Bolick: We now have a link to the DigIn website on the Invertebrate Zoology webpage of the Bishop Museum website.

CAS: Christina Piotrowski: This quarter CAS worked with our public floor Naturalist Center staff to create a mini-exhibit featuring magnified specimens and sediment from one of our local National Marine Sanctuaries, designed to remind museum visitors about our local sanctuaries and to celebrate the 50th anniversary of the ONMS system. We provided 3

Collection tours of the IZ Collection to undergraduate students from Sonoma State University and library staff of Stanford's Hopkins Marine Station. We worked with several local graduate students this quarter, who assisted DigIn directly by either scanning or transcribing specimen labels during digitization work.
Piotrowski reached out to the CAS Education team that works with local educators in an attempt to engage them with the planned DigIn summer 2023 Educators' Workshop. We will be meeting with that team shortly to discuss this potential collaboration. Tentatively one of our DigIn team members who is also a graduate student will attend the meeting with the educator selected. We also posted several sets of invertebrate zoology content for the DigIn project social media sites.

FWRI: Paul Larson: This quarter we have begun preparing for Marine Quest, the annual FWRI outreach event. The event itself will take place in February. We will be giving tours of the collection, which is otherwise not accessible to the public, and describing the activities and functions of a natural history collection.

NHMLA: Dean Pentcheff: The regular social media campaign, with solicited contributions from every institution, has continued in good form. We have begun planning in earnest for the upcoming summer teacher+museum staff workshop scheduled for Los Angeles this summer.

RSMAS: Maria M Criales: We continue developing an educational MPS track program around the collection.

SBMNH: Daniel Geiger: Will present one paper and a poster at SPNH meeting in SF. Working with curatorial assistant on first scientific paper.

SIO-BIC: Charlotte Seid: Conducted 4 E&O presentations (2.25 hrs) for 26 visitors (elementary school through adult learners), highlighting invertebrate biology and the value of digitized museum collections. Provided specimens, learning objectives, and relevant publications for a newly designed lab component of course SIO 190: Special Topics in Earth, Oceans, and Atmosphere. Beginning Oct 28, selected and provided a set of themed specimens and gave short presentations to a new weekly student-led wellness/creativity program, "Art in the Archives," which promotes education and interdisciplinary engagement with SIO-BIC specimens.

SIO-PIC: Linsey Sala: Hosted 7 E&O related collections visits, including conference participants for the CA Cooperative Oceanic Fisheries Investigations Annual meeting. At each of these visits, we present the value and use of digital specimen data and our current work with DigIn.

VIMS: Jennifer Dreyer: I did 2 tours of our Invertebrate Collection to the general public and reached over 12 people. 53 specimens were used from the Collection for outreach or taxonomic comparisons for research projects. I was asked to provide taxonomic identifications for organisms through 14 public requests to our institute, as well as to VIMS researchers. I contribute to the Instagram social media posts based on the publicity assignment and repost them on my personal Instagram to increase distribution. I am in the education outreach working group that has started up in anticipation of the educator workshop in LA this summer. We are working out the logistics and details so that we can maximize participation from all 19 institutions and their associated teachers. A survey was created and ready for educators to complete to help us find the best date, etc. I have reached out to the VIMS marine educator's group and had conversations about the upcoming workshop this summer. I have found a great educator who is very excited about this opportunity and she was able to complete the survey based on her availability.

**Information About Your Website and/or Portal Usage**

To date DigIn has published 140 Instagram posts, 49 Instagram stories, and 34 Twitter posts. Our 140 Instagram posts include 29 Invertebrates of the Week, 30 Scientist Spotlights, 25 Friday Fun Facts, 54 General Content posts, and two Instagram Reels, a short-form vertical video about the digitization workflow at NHMLA. The general content on our Instagram page includes two introductions to DigIn, seven posts that relate to trending hashtags in the scientific community, 17 posts about invertebrate specimens, 12 posts about specimen collection, specimen observation, or outreach events, two posts about relevant international holidays, two project updates, and 12 other posts that highlight various topics, such as publications making scientific discoveries using DigIn digitized specimens. The 49 Instagram stories include one introduction to the project, 34 invertebrates that link to resources on InvertEBase, four inside looks of collection spaces, five stories about relevant international holidays, and five stories about outreach events — an NHMLA donor event, the 2022 DigIn Teacher Workshop, the Friday Harbor Laboratories Biodiversity and Integrative Taxonomy of Invertebrates course, VIM's Marine Life Day 2022, our Los Angeles-Cambria in-person Retreat, and a recent NHMLA tide pool excursion with 16 college undergraduates, who are also our valued Digitizers. Our 34 Twitter posts consist of two introductions to the project, 4 posts about relevant international holidays, 3 posts on trending hashtags in the scientific community, 7 posts about specimen collection, specimen observation, or outreach events, 6 posts about invertebrates, 1 project update, and 11 other posts about various topics, such as the world geographic distribution of polychaete type specimens at NHMLA.

**Other Activities and/or Progress**

ALMNH: Kevin Kocot: I am looking to recruit another undergraduate assistant to help with our digitization efforts.

AMNH: Chris Johnson, Estefanía Rodríguez, Lily Berniker: Volunteers given access to the database to transcribe verbatim data and verbatim & standardized dates directly into the database; new volunteer moved from sorting fiddler crab donation to taking high resolution images of male & female representatives for each species and sometimes each lot of the donated fiddler crab collection.

CAS: Christina Piotrowski: With the help of our IT/Bioinformatics team, CAS successfully launched a new CASIZ specimen portal this quarter (http://specifyportal.calacademy.org/iz/), which now serves all cataloged CASIZ specimen records, rather than our previous older data snapshot. Data is also pushed out to aggregators, including iDigBio. We are working towards capacity for linking and attaching specimen and label images.

MCZ: Adam J. Baldinger: Melissa Merkel's (curatorial assistant) start date on the DigIn project was November 16, 2022. She works 17.5 hr/wk and has been digitizing our echinoid collection.

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

UCM: Kelly Martin: Over the winter holiday, our museum experienced a major flood during an unprecedented cold spell in Colorado (frozen pipes). The museum was shut down for several weeks as the building was fixed (insulation, dry wall, carpets, electrical, etc.). During that time, the collections were closed and students/staff were not able to work - this has contributed to a delay in our progress. In addition, many computers and imaging stations

were destroyed. Fortunately, no specimens within our Invertebrate Zoology section were damaged.

# TCN Quarterly Progress Report

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

## TCN Name

Eastern Seaboard: Mobilizing millions of marine mollusks

## Person Completing the Report

Rüdiger Bieler, FMNH, Lead PI

## Share Progress in Digitization Efforts

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

**FMNH** ESB: Digitized 1,144 de novo lots including vitality status, representing an estimated total of 12,082 specimens; updated 6,780 existing records with vitality status; 117,229 records were cleaned/enhanced/improved; georeferenced 132 de novo localities, and georeferenced 108 existing records. Digitization of ESB material in the bivalve collection is now complete.
**ANSP** ESB: 795 lots totaling 14,512 specimens were newly catalogued and digitized during this period and 1,645 lots had their data upgraded.
**BMSM** ESB: Given the effects of Hurricane Ian (September 28, 2022) on BMSM and general area, work on the project could only be done remotely, and starting in mid-October 2022. No new cataloging took place, but staff cleaned and standardized 699 ESB records (mostly from Florida). BMSM generated only 12 new composite images and georeferenced 171 localities encompassing 1078 existing records (all from Florida), all including error radius.The total number of georeferenced ESB records so far is 21,705. Entire BMSM dataset consists of 133,469 records, of which 23,941 are from ESB, including a total of 150,421 ESB specimens.
**CM** ESB: 5,045 total ESB records data cleaned; 2,331 total ESB records georeferenced. In 4th quarter 2022, 491 additional localities georeferenced representing 1644 records of marine mollusks from the Eastern Seaboard.

**DelMNS** ESB: DelMNS has established photography workflows and will soon advertise for summer interns to begin taking photographs of ESB species. An additional set of 50 test photos were taken in response to a data request. Photographs of *Neoterebra* for an undergraduate project on determining live/dead in the species is next. The photography workflow development has resulted in a new line of inquiry. We are exploring whether we can create an algorithm to reliably measure specimens that are not carefully handled and aligned specifically for measurement. The goal is to maximize the number of specimens that are available for use while minimizing handling time.

**FWRI** ESB: This quarter we have digitized 1,283 new records, with approximately an additional 300 partially digitized (not yet reviewed or uploaded to database). Interns working in the collection have examined the Muricidae to update the taxonomy and organization in the shelving units.

**HBOM** ESB: To date, we have focused on reorganizing 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. The HBOM PI has procured some additional non-NSF support to hire additional student help to help on ESB project. We had planned to initiate digitizing of mollusks in the past quarter but we have had a delay in hiring two students to help in that effort. They are now scheduled to start the week of January 9, 2023.

**HMNS** ESB: Work has also been done on sorting the 28,000 specimens into more manageable groups in order to facilitate data cleaning of specimen collection localities. To date 1,269 catalog records representing 5,755 specimens have had their collection locality records cleaned. Those 1,269 catalog records have also been moved into subdivision of marine specimens to more easily differentiate them from freshwater and terrestrial.

**LACM** ESB: Between October 1 and December 31, 2022, 914 lots were digitized, representing 2,498 specimens. A total of 3,309 lots have been digitized to date, which constitutes 50% of our total goal. Digitization and georeferencing was completed by our ESB-funded assistant collections manager and the Malacology department's Collections Manager.

**MCZ** ESB: 879 lots/records were databased this quarter. To date, 23,023 records in our database were cleaned/vetted for accuracy, and of these, 22,934 with verified georeferences. 18,725 records are available on iDigBio.

**NCSM** ESB: Between October 1 and December 31, 2022 we have digitized 22 lots and 112 lots are in progress. There are 22 lots that have been digitized with the data improved. There were 11 localities that were georeferenced.

**PRI** ESB PEN: Between October 1 and December 31, 2022, we have digitized 130 lots totaling 18,192 specimens. Cumulatively, 2,676 lots (41% of goal) containing 73,945 specimens (47% of goal) have been digitized. 92 lots were added from seven newly georeferenced localities. An additional 83 lots have been coded with live-dead status (2,980 lots in total have been coded so far). Volunteer, Madeleine Wenger, continued photographing specimens. This quarter, photographs were taken of 95 specimens equaling 244 images. Cumulatively we have taken 277 photographs of 106 specimens (23% of goal). We continued developing our mapping for uploading our ESB records to the Symbiota (Invertebase) portal.

**RSMAS** ESB: During this last quarter we digitized 1,990 lots reaching 98.9% of our target goal. We spend a significant amount of time cleaning taxonomic names using the Symbiota tool and

1,984 mollusks data were uploaded into InvertEbase via Symbiota. We started georeferencing data from UM cruises with Symbiota cooperation and 887 mollusks data were georeferenced. Two students finished their internship and one graduate student was hired and trained on digitization in October.
**UF** ESB: This quarter we moved our entire fluid preserved collections to a new state of the art facility designed to house alcohol collections. This move is now entirely completed but as a result we had a slowdown in digitization activities this quarter. We digitized 50 lots containing 75 specimens that are available in our online Specify Portal and InvertEBase. Georeferenced and estimated error radii for 49 specimen lots.
**UMMZ** ESB: 1,392 lots representing 8,577 specimens have been newly digitized; 2,924 lots uploaded to InvertEBase portal; 1,390 images generated, and 90 lots georeferenced.
**YPM** ESB: During this quarter we continued to maintain georeferencing infrastructure and provide day-to-day support and training. The GEOLocate/CoGe application was also updated to support integration of locality identifiers used in Specify but passed through Symbiota when using the CoGe-Symbiota linkage. This feature will eventually facilitate repatriation of georeferenced data into Specify. Finally the darwin core fields representing minimum and maximum depth and elevation were integrated into the user interface of the CoGe web client so that end-users have access to those data during georeferencing.

## Share Best Practices, Standards, and Lessons Learned

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

**FMNH** ESB: Our team of volunteers continue to implement the geographic workflows developed in preparation for digitization now in the gastropod collection. This same group of volunteers is also verifying taxonomy of the gastropod collection using the authoritative taxonomic database MolluscaBase.
**ANSP** ESB: Nothing to report.
**BMSM** ESB: Nothing to report.
**CM** ESB: Nothing to report.
**DelMNS** ESB: Based on conversations within the RCN-UBE network BCEENET, DelMNS is looking for ways to quickly increase the number of mollusk specimens that are imaged and made available through iDigBio, Symbiota/InvertEBase and other portals so they are available for use in digital natural history collection CUREs.
**FWRI** ESB: Nothing to report.
**HBOM** ESB: Nothing to report.
**HMNS** ESB: Nothing to report.
**LACM** ESB: Nothing to report.
**MCZ** ESB: Permanent staff involved in the project continue to participate in 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 TCNs (DigIn). Various staff members working on the project participate (via zoom) in ESB monthly ESB general meetings and monitor communications shared on various

Slack channels. MCZ is now hosting museum wide, monthly imaging workshops to set standards for photography of specimens.
**NCSM** ESB: Nothing to report.
**PRI** ESB PEN: Nothing to report.
**RSMAS** ESB: The Symbiota cleaning tool linked to WoRMS works well; Katie Pearson continues to be a great help.
**UF** ESB**:** Nothing to report.
**UMMZ** ESB**:** Nothing to report.
**YPM** ESB: Nothing to report.

## Share Identified Gaps in Digitization Areas and Technology

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

**FMNH** ESB: Nothing to report.
**ANSP** ESB: Nothing to report.
**BMSM** ESB: Nothing to report
**CM** ESB: Nothing to report.
**DelMNS** ESB: Nothing to report.
**FWRI** ESB: Nothing to report.
**HBOM** ESB: Nothing to report.
**HMNS** ESB: The previous collections database did not include fields for GPS coordinates, water depth, and distance from shore. This important data was stored in the notes field of the collection record and in order to bring the data up to current standards all ESB and Gulf of Mexico records are having to be checked and fixed as necessary.
**LACM** ESB: Nothing to report.
**MCZ** ESB: Nothing to report.
**NCSM** ESB: Nothing to report.
**PRI** ESB PEN: Nothing to report.
**RSMAS** ESB: We are ready to start Georeferencing, but we will need advice on it.
**UF** ESB: Nothing to report.
**UMMZ** ESB: Nothing to report.
**YPM** ESB: Nothing to report.

## Share Opportunities to Enhance Training Efforts

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

**FMNH** ESB: Nothing to report.

**ANSP** ESB: A co-op student and Computer Sciences major from Drexel University (Juwhan Jung) has been learning about nomenclature as he applies his programming skills to improve our database.
**BMSM** ESB: BMSM following the departure of our previous part-time Collection Assistant, BMSM hired a recent graduate from Eckerd College, Chris Whitt.
**CM** ESB: Nothing to report.
**DelMNS** ESB: DelMNS continues to collaborate with a Widener University faculty/student on a research project about shell morphology and predation in rt working on *Neoterebra dislocata.*
**FWRI** ESB:
**HBOM** ESB: Nothing to report.
**HMNS** ESB: Our Inventory Manager has recruited a volunteer (Kimberly Dear) and an unpaid intern (Winter Bourland) to begin cleaning collection localities and assigning the marine subdivision to catalog records in our database. Winter Bourland started her work with the Malacology Department in November and Kimberly Dear will begin work in January of 2023. Another unpaid Intern, Tara Carron, has passed her background check and application process and should begin assisting the department in January of 2023.
**LACM** ESB: Nothing to report.
**MCZ** ESB: Nothing to report.
**NCSM** ESB: Nothing to report.
**PRI** ESB PEN: Nothing to report.
**RSMAS** ESB: Nothing to report
**UF** ESB**:** One ESB student has expressed interest in independent research projects and are being trained in systematics research.
**UMMZ** ESB: Nothing to report.
**YPM** ESB: Nothing to report.

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

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

**FMNH** ESB: Continued coordination with DigIn and PILSBRy TCNs, as well as WoRMS/MolluscaBase.
**ANSP** ESB: Juwhan Jung has built an interface that finds basis of record for names in ANSP malacology database that are not in WoRMS. Those that have been published will be uploaded to MolluscaBase.
**BMSM** ESB: Nothing to report.
**CM** ESB: Nothing to report.
**DelMNS** ESB: Continued collaboration with BCEENET (RCN-UBE) to understand the types of information that undergraduate faculty and students need to incorporate specimen data into CUREs.
**FWRI** ESB: Nothing to report.

**HBOM** ESB: Nothing to report.
**HMNS** ESB: Nothing to report.
**LACM** ESB: Nothing to report.
**MCZ** ESB**:** Information is shared among permanent MCZ staff working on other TCNs: DigIn and PILSBRy, and an NSF CSBR cryogenic collections grant.
**NCSM** ESB: Nothing to report.
**PRI** ESB PEN: Nothing to report.
**RSMAS** ESB: Nothing to report.
**UF** ESB**:** Nothing to report.
**UMMZ** ESB: Nothing to report.
**YPM** ESB: Nothing to report.

## Share Opportunities and Strategies for Sustainability

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

**FMNH** ESB: Nothing to report.
**ANSP** ESB: Nothing to report.
**BMSM** ESB: Nothing to report.
**CM** ESB: Nothing to report.
**DelMNS** ESB: Nothing to report.
**FWRI** ESB: Nothing to report.
**HBOM** ESB: Nothing new to report.
**HMNS** ESB: Nothing to report.
**LACM** ESB: Nothing to report.
**MCZ** ESB: Nothing to report.
**NCSM** ESB: Nothing to report.
**PRI** ESB PEN: Nothing to report.
**RSMAS**: We are continuing to develop an educational MPS track program around the collection, which in the future should generate great learning outcomes.
**UF** ESB: Nothing to report
**UMMZ** ESB: Nothing to report.
**YPM** ESB: Nothing to report.

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

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

**FMNH** ESB: Continued coordination of Mollusk of the Month (MotM) on Instagram, Twitter and Facebook.

**ANSP** ESB: The PI has continued work with iNaturalist and is the primary person bringing older observations into the ESB iNaturalist portal by flagging their live/dead status. To date he has contributed more than 20,000 identifications to the ESB project, with about 2,000 made in the 4th quarter of 2022.
**BMSM** ESB: PI Leal is responsible for the ESB Facebook page, having posted regularly via that social media outlet; PI is a member of the ESB TCN steering committee. On December 1, 2022, PI Leal presented the BMSM collection and ESB project in the "Specify Spotlight" series.
**CM** ESB: Submitted material (*Naticarius canrena*) for December, 2022 Mollusk of the Month.
**DelMNS** ESB: Nothing to report.
**FWRI** ESB: Posted items to instagram as part of the outreach committee
**HBOM** ESB: Nothing to report.
**HMNS** ESB: The Malacology Curator gave a presentation in October at the Texas Sheller's Jamboree on Oyster Reef Reclamation and Conservation along the Texas Coast. In November the Curator and Inventory Manager took a group of paid museum patrons on a field trip to the Texas Coast to show which marine malacology species were present and also to show the current risks to the Texas coast and marine environments. Also in November the Curator gave a presentation to the Houston Conchology Society on Special Specimens in the Collection that are Not Currently on Display.
**LACM** ESB: Contributed material (*Lucina pensylvanica)* for November's Mollusk of the Month (MotM) posts on Instagram, Twitter and Facebook, which were posted by the ESB members responsible for those accounts.
https://www.facebook.com/groups/easternseaboardmollusks https://twitter.com/EMollusks.
**MCZ** ESB: The iNaturalist public portal keeps growing and now includes 62 members, 3,115 identifiers, 91,622 observations and 939 species.
https://www.inaturalist.org/projects/eastern-seaboard-mollusks
On December 8th 2022 Curatorial Associate Jennifer W. Trimble co-hosted with the MCZ Ornithology Department, a Members Night at the Museums: Exploring New England. This event specifically highlighted the digitization efforts of the ESB project.
**NCSM** ESB: We continue to use Instagram, TikTok, Twitter, and Facebook to reach the public. Each platform seems to reach a different audience.
**PRI** ESB PEN: Nothing to report.
**RSMAS** ESB: We are continuing to develop an educational MPS track program around the collection, which in the future should generate great learning outcomes. Website is complete.
**UF** ESB: Nothing to report.
**UMMZ** ESB: Nothing to report.
**YPM** ESB: Nothing to report.

## Share Information About Your Website and/or Portal Usage

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

**FMNH** ESB: Pushed dataset to Symbiota/InvertEBase, end of October, 2022.

**ANSP** ESB: Nothing to report.
**BMSM** ESB: Dataset is live and updated at portal' portal is hosted by Specify Collections Consortium https://webportal.specifycloud.org/shellmuseum. Stats and portal usage data not available.
**CM** ESB: Collections data upload to InvertEBase 24 Oct 2022 adding 11,158 records (11,018 newly georeferenced since 20 Dec 2020), for total of 168,766 records of which 43,496 are georeferenced; HOWEVER, unknown how many of those new records pertain to ESB. No access to collection data through our museum website.
**DelMNS** ESB**:** All DelMNS Mollusk collection data are available on Symbiota/InvertEBase.
**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.
**LACM** ESB**:** Nothing to report.
**MCZ** ESB**:** "Named Group" page in our database allows for researchers and others to gather information about the grant, records/specimen lots associated with ESB, including searchable links/breakdown of records by taxa, geography (ie. by ocean, country, islands), images, collectors/agents; includes links to iDigBio (ESB), MolluscaBase and iNaturalist pages. (https://mczbase.mcz.harvard.edu/grouping/showNamedCollection.cfm?underscore_collection_id=82
**NCSM** ESB**:** Nothing to report.
**PRI** ESB PEN: Nothing to report.
**RSMAS** ESB: We have established an account in the Symbiota portal and will continue to upload Mollusk data.
**UF** ESB**:** Collection database and images are live and updated at portal http://specifyportal.flmnh.ufl.edu/iz/. Light photogrammetry images are available at https://sketchfab.com/FloridaMuseum/collections/invertebrate-zoology-b8787873d5384855b4f340781d5e6006
**UMMZ** ESB**:** Nothing to report.
**YPM** ESB: Nothing to report.

## Share Other Activities and/or Progress

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

**FMNH** ESB: Nothing to report
**ANSP** ESB: Nothing to report
**BMSM** ESB: Complete record set was last uploaded to iDigBio on December 7, 2022, to GBIF and OBIS on November 9, 2022 (last update to InvertEBase on 22 June 2022). BMSM was seriously hit by Hurricane Ian on September 28, 2022.
**CM** ESB: Nothing to report.

**DelMNS** ESB: Nothing to report.
**FWRI** ESB: Nothing to report.
**HBOM** ESB: Nothing to report.
**HMNS** ESB: Beginning in January of 2023 the Inventory Manager in the project will be given the title of Collections Manager for Malacology and Inventory. This new position should allow him to focus more time on this project and the Malacology Department as whole.
**LACM** ESB: Nothing to report.
**MCZ** ESB: Two LHT (less than halftime) employees continue to work in the collection 7 hours a week each on projects pertaining to ESB. They are digitizing records, and completed a shelf inventory for the entire malacology fluid collection.
**NCSM** ESB: Nothing to report.
**PRI** ESB PEN: Nothing to report.
**RSMAS** ESB: Nothing to report.
**UF** ESB: Nothing to report.
**UMMZ** ESB: Nothing to report.
**YPM** ESB: Nothing to report.

# TCN Quarterly Progress Report

## TCN Name

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

## Person Completing the Report

Miranda Zwingelberg (GLOBAL Project Manager)

## Share Progress in Digitization Efforts

This report covers progress completed during the period of October 1 – December 31, 2022.

**Workflows, Equipment, and Personnel**

Most GLOBAL institutions continued steady GLOBAL progress during 2022-Q4 and our final delayed collaborator (OSC) was able to begin digitization work.

ALA is reorganizing and incorporating several large loans while reorganizing the cryptogam collections. They continue to digitize and update metadata in ARCTOS, working with one curatorial assistant and support from a graduate student assistant.

At ASU, specimen digitization continued with their new student worker, currently focusing on ASU lichen specimens and progressing well.

[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

CINC & MU hired two additional student workers to replace students who left the project (one graduated and one got a full-time internship). They are nearing completion of the CINC "normal" specimens and have started preparing to image bound exsiccatae.

At COLO, digitization numbers for the quarter were similar to last quarter, but slightly down due to final exams and winter break in December. This was their second-best quarter for the project. They will train more students to contribute to transcription work to boost numbers during the upcoming quarter.

DUKE's bryophyte team hired and trained three new work-study students, and two work-study students continued transcribing labels from previous semester. The lichen team re-mapped and/or deleted 270 "orphaned" lichen specimen photographs in Lichen Portal (i.e., photographs generated as part of the GLOBAL project which were attached to blank, "dummy" records in Lichen Portal).

At F, almost all of the undatabased lichen specimens on sheets have now been photographed. The last ones will be loaded onto the portal soon. They are working on photographing specimens that are already databased (15,000-20,000 estimated). They also continued bryophyte imaging and databasing.

ILL & ILLS continued transcribing bryophytes.

LSU trained an undergraduate to complete georeferencing of lichen and bryophyte records and continued to image bryophyte specimens.

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

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

MO continued digitization work on their bryophyte specimens.

NY continued their focus on photographing lichens and skeletally digitizing the general collection of mosses and liverworts.

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

PH had no students actively imaging. Progress was made, however, in new or updated lichen and bryophyte records by the collection manager and recently retired curatorial assistant.

TENN students continued barcoding, imaging, and transcribing bryophyte specimens. Four new undergraduate technicians were hired, trained, and began work during the Fall term. Four additional new undergraduates were interviewed and hired to begin training in January 2023. The table for one imaging stations was swapped with a different table to improve the ergonomics.

UC officially completed the lichen digitization and imaging, and are now working through barcoding and imaging the bryophyte collection. They plan to move to transcribing after imaging is completed.

WIS hired and began training three new student georeferencers. They are quickly picking up the basics and will continue when the semester resumes in January. They continued to image specimens from the WIS collection. Georeferencing Manager Smith spent time reviewing verifications that were completed up to this point. She began to send csv files with corrected coordinates to collection managers. They have arranged to have specimens shipped from WTU and Nebraska for digitizing.

YU continued digitization work on their bryophyte specimens.

**Digitization**

Nineteen institutions (ALA, ASU, CINC & MU, COLO, DUKE, F, FLAS, ILL & ILLS, LSU, MICH, MIN, MO, NY, OSC, PH, TENN, UC, WIS, and YU) reported progress on digitization deliverables, with a total of 65,805 specimens barcoded (45,603 bryophytes and 20,202 lichens), 50,371 labels imaged (23,688 bryophytes and 26,683 lichens), 41,739 specimens imaged (24,004 bryophytes and 17,735 lichens), 30,681 specimen records uploaded to the portal (17,399 bryophytes and 13,282 lichens), 56,520 skeletal records created (39,641 bryophytes and 16,879 lichens), 27,884 labels fully transcribed (21,315 bryophytes and 6,569 lichens), and 13,223 specimens georeferenced (3,675 bryophytes and 9,548 lichens) (See Table 1 & Figure 1).

Table 1: Digitization progress by GLOBAL collaborators in 2022-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 | 250 | 2,215 | 250 | 2,215 | 250 | 2,215 | | | | | 6 | 1,820 | 6 | 1,820 |
| ASU | | 689 | | 689 | | 689 | | | | | | 689 | | |
| BRY | | | | | | | | | | | | | | |
| CINC & MU | 2,810 | | 2,810 | | 2,810 | | 2,810 | | 2,810 | | 2,933 | | | |
| COLO | 667 | 7,006 | 167 | 8,006 | | | 167 | 8,006 | 167 | 8,006 | 90 | 2,757 | | |
| DUKE | 1,741 | | 2,294 | | 278 | | 2,572 | | 2,491 | | 617 | | 14 | |
| F | 3,200 | | 1,298 | 3,397 | 1,647 | 3,397 | 883 | 3,600 | | | | | | |
| FLAS | 3,500 | | 1,250 | | 1,250 | | 1,250 | | | | | | | |
| ILL & ILLS | 100 | | | | | | | | 100 | | 10,000 | | | |
| LSU | | | | 39 | 2,150 | | | | | | | | 661 | 1,832 |
| MICH | | 3,203 | | 3,203 | | 384 | 1,785 | 257 | | 3,203 | 1,318 | 186 | 90 | 2 |
| MIN | | 2,009 | | 2,009 | | 2,009 | | | 2,147 | 2,009 | 3,229 | | | |
| MO | 3,188 | | 5,027 | | 5,027 | | | | 4,653 | | 325 | | 53 | |
| MSC | | | | | | | | | | | | | | |
| NY | 20,987 | 3,661 | 210 | 5,706 | 210 | 5,706 | 0 | 0 | 20,987 | 3,661 | 151 | 11 | 306 | 25 |
| OSC | 1,500 | | 650 | | 650 | | | | | | | | | |
| PH | | | | | | | | | | | 402 | 1,106 | | |
| TENN | 4,268 | | 5,022 | | 5,022 | | 4,940 | | 4,021 | | 2,244 | | 1,039 | |
| UC | 400 | | 1,718 | | 1,718 | | | | 1,718 | | | | | |
| WIS | | | | | | 1,916 | | | | | | | 1,506 | 5,869 |
| YU | 2,992 | 1,419 | 2,992 | 1,419 | 2,992 | 1,419 | 2,992 | 1,419 | 547 | | | | | |
| **Totals** | **45,603** | **20,202** | **23,688** | **26,683** | **24,004** | **17,735** | **17,399** | **13,282** | **39,641** | **16,879** | **21,315** | **6,569** | **3,675** | **9,548** |
| **B+L Totals** | | **65,805** | | **50,371** | | **41,739** | | **30,681** | | **56,520** | | **27,884** | | **13,223** |

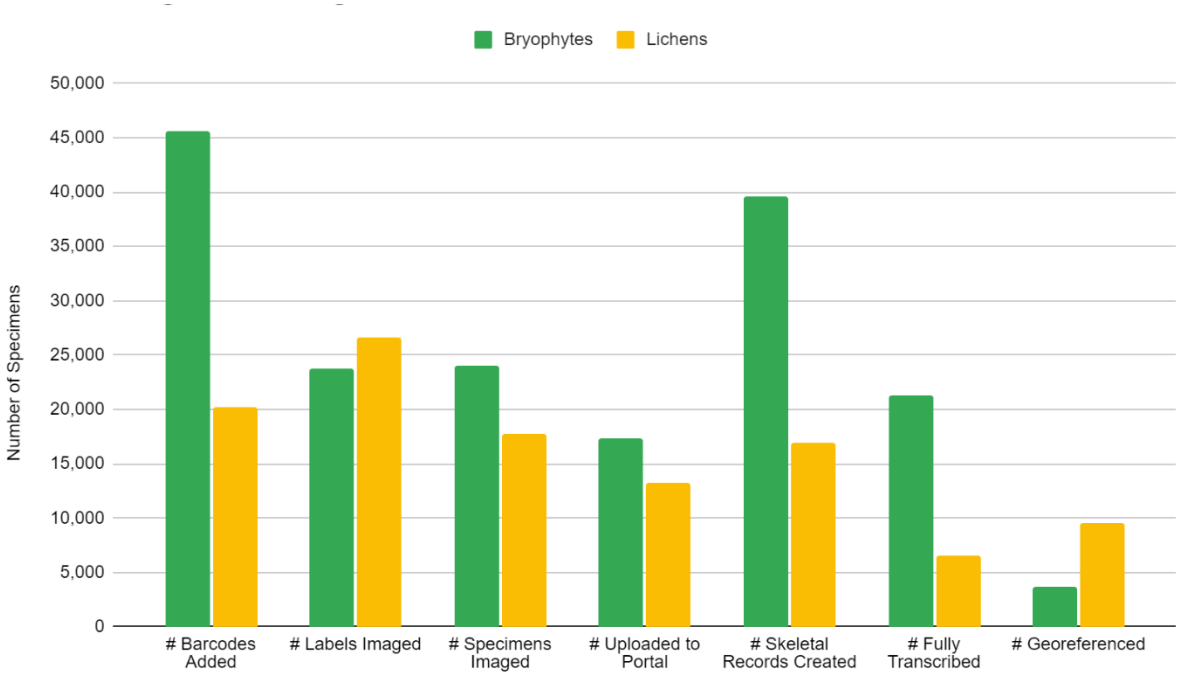



Figure 1: Digitization progress for the GLOBAL collaboration in 2022-Q4, separated by Bryophyte and Lichen specimens.

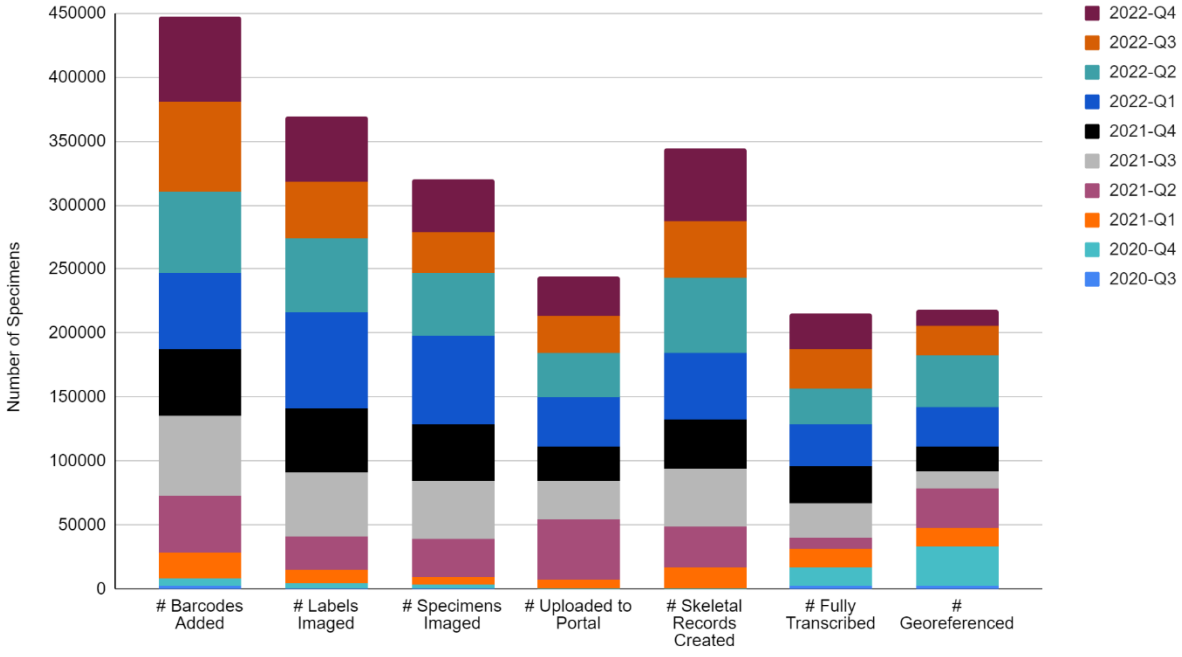



Figure 2: Cumulative digitization progress for the GLOBAL collaboration by quarter.

# Share Best Practices, Standards, and Lessons Learned

**Flexible Workflows**

The GLOBAL teams continued to make use of flexible digitization workflows in 2022-Q4, including some use of virtual transcription work and prioritizing label imaging, while most collaborators were able to continue on-site work.

At COLO, based on preliminary work, the quality of specimen images is hampered by using a fixed imaging system to capture both packet/label data and specimens. They will most likely retake the specimen images later in the project when they have a system in place for capturing better specimen images. They are planning to capture both packets and specimens for the bryophyte collection in the same pass using two separate cameras and will circle back for lichen specimen images. Since no transcription work was completed on their non-North American specimens, they did not have records for the first wave of georeferencing work at WIS. They are prioritizing records from Australia, Chile, Finland, France, Japan, Norway and Sweden for transcription to build sets for georeferencing.

UC is trouble-shooting the idea of using “floating barcodes” so that the barcode can be part of the label and the specimen images. It is also useful for older specimens where the barcode was placed on the back of the packet.

**Collaboration**

Team members continued to make use of Basecamp, Zoom, and email to communicate and collaborate during 2022-Q4. New collaborators and students were given access to Basecamp group resources. The Outreach & Education Group met in October to finalize preparation for the WeDigBio event. A Management Committee Meeting was held in November open to all GLOBAL members to review 2022-Q3 grant progress and provide an open forum to the GLOBAL team.

The TENN Project Manager completed routine check-in’s with collaborating teams at ASU, CINC & MU, COLO, DUKE, FLAS, ILL & ILLS, LSU, MICH, MIN, MO, and PH to discuss project status, updates, and concerns.

WIS continued its collaborative georeferencing, creating new communities in the CoGe interface and georeferencing as fully transcribed records become available. The GLOBAL

Geoferencing Manager (WIS) and Portal Manager (ASU) continued to consult on georeferencing workflows, especially those involving GEOLocate CoGe.

## Share Identified Gaps in Digitization Areas and Technology

**Taxonomy**

At COLO, the taxonomic dropdown for the ImagingWorkflow application was missing many of the names they use in our collection. Last fall they worked with Portal Manager Katie Pearson to get an export of the lichen taxonomic thesaurus and Ryan Allen reformatted this list so it could be added to the application. It is difficult to quantify the impact since every imaging session is different, but most specimens do not require manual entry.

**Database Compatibility**

A broken Symbiota connecter in DUKE's institutional Specify 6 database continued to be a problem. They were not able to update their data for a year. Upgrading to Specify 7 was recommended by both Symbiota and Specify teams. The DUKE IT team encountered issues with the upgrade. For now, they are not able to send updates to either of the two portals.

F did not report several thousand images taken of specimens only. These are in a holding stage and will be reconciled with partially databased records prior to the current project and need careful coordination so they do not disrupt the workflow between EMu and Symbiota. When this is reconciled they will update their regular statics accordingly.

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

## Share Opportunities to Enhance Training Efforts

The GLOBAL Project Manager (TENN) and Georeferencing Manager (WIS) continued compiling resources during 2022-Q4 to share on Basecamp and all resources were posted to the project website (https://globaltcn.utk.edu), including WIS's updated imaging workflow, an image-stacking protocol from NTBG, and a training course on bryophytes and lichens shared by the UCONN Herbarium.

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

A completely new version of a program facilitating the analysis of lichen secondary metabolites will soon be released via the Lichen Consortium Help & Resources site. This new program called Mytabolites will replace the current program called WinTab. The new version now not only contains a huge database of 800+ secondary metabolites, but it directly displays which lichen taxa contain particular metabolites, receiving/downloading that information directly from the online database of the Consortium.

F and DUKE are planning a joint bryophyte and lichen workshop at Oak Spring Garden Foundation in Virginia. Blanka Aguero, Matt Von Konrat, and Todd Widhelm will be going there in April 2023 to teach a class of around 20 participants the basic biology and bryophytes and lichens and how to find them in the field.

NY Digital Asset Manager presented GLOBAL-specific photography and photo processing in a BioDigiCon presentation.

The TENN Project Manager attended the Symbiota Support Hub meeting to learn more about creating and using keys in the portals. She also completed a number of Diversity and Inclusion trainings during 2022-Q4.

The three new WIS students hired to assist in georeferencing used the training course that was created by Katie Pearson for CCH2. It quickly introduced them to the basic concepts and GeoLocate interface and has been a tremendous asset. It reduces the time to explain the best practices required for the project.

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

Ongoing collaboration between GLOBAL teams and other TCN projects occurring concurrently at their sites continued. CINC is part of the All-Asia TCN (also processing MU collections) and these projects occur at separate imaging stations, but in the same space so training is shared,

especially regarding label transcription) between the two projects, and students share tips and tricks. COLO is also a member of the SoRo TCN and the All-Asia TCN and continued to share info and technology between projects to help optimize workflows. F collaborated with the new Africa TCN focusing on flowering plants and continued collaboration with the ongoing Pteridophyte TCN project as well. At MICH, ongoing collaboration continued between the PCC and GLOBAL TCNs, which share many resources including facilities, digitization and management staff, training, some equipment, and workflow. Though the grant objectives and specimens being imaged are separate, much of the institutional infrastructure is shared between the projects. NY continued ongoing internal collaboration with All Asia TCN and an NSF Collaborative Research grant (award number 2115190).

ASU's collaboration with the community of Latin American lichenologists continues. Jesús Hernandez developed a user survey and is planning interviews with key collaborators to investigate how the Latin American community can be better served.

As a case-study how to make use of existing tools to establish best practices for sharing biodiversity information, a checklist of Lichenized and Lichenicolous Fungi has been developed by ASU in close collaboration with international researchers and scientists from Ecuador (Grupo Ecuatoriano de Liquenología). A publication discussing these best practices and outlining the advantages of using Symbiota as the platform for establishing dynamic species checklists has been submitted for peer review.

The project by ASU undergraduate student Erin Eggenberger has been successfully completed and several Latin American lichen checklists have been added to the database of the Lichen Consortium.

TENN Project Manager participated in the quarterly iDigBio Internal Advisory Committee Meeting in November with other TCN participants.

TENN PI and Project Manager reviewed the drafted image-stacking procedure from prospective PEN partner NTBG.

TENN Project Manager contacted the Harvard Index of Botanists and Bionomia about adding the signature images compiled as part of the project to botanist records online. She shared the document with the Harvard team and met virtually with David Shorthouse of Bionomia to be trained to begin adding images of signatures to Wikidata entries.

GLOBAL imaging protocols were shared with Colleen Hatfield from CSU-Chicago.

An External Advisory Committee (EAC) group was created on Basecamp and all members of the EAC and Executive Committee were invited to join to share resources and discuss topics related to the GLOBAL project.

## 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. The Symbiota Support Hub continues to provide regular training sessions, documentation and tutorials.

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

Merging several different platforms (North American, Latin America, Arctic Lichens) into a global, single Consortium of Lichen Herbaria provides opportunities to reduce maintenance, improve functionality and facilitate regular updates to better reflect the international character of the information being managed. Accordingly, a single Consortium of Bryophyte Herbaria will integrate the current North American and the *Frullania* data portal. Tools using the API to facilitate access to the data from different Symbiota portals are under development. The Symbiota Support Hub at ASU is enacting the portal changes requested by the Executive Committee to make the Lichen and Bryophyte Portals more global in scope, including updating text on pages, making styling changes, etc. The Hub is also updating the Symbiota code to make it more responsive (i.e., mobile friendly) and aesthetically pleasing.

**Taxonomy**

ASU continued regular updates of the taxonomic thesaurus continue with support of Gary Perlmutter, Jason Hollinger, and Alan Fryday. As part of uploading the North American Checklist ca. 6,000+ taxon names have been reviewed; as part of establishing an Ecuadorian Checklist ca. 3,000+ names have been reviewed. In the process of this work, 1,000+ of names previously not part of the thesaurus have been added and accepted names and their synonyms have been linked.

MO's dataset that forms the bryophyte taxonomic thesaurus is now included in the Catalogue of Life and is freely available at doi: 10.48580/dfqt-8zmp.

**Back Ups**

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

## 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.

CINC held herbarium tours for two classes and a sent a loan of specimens to the Lloyd Library and Museum for display in an exhibit entitled "Visions of Nature Across Time and Place."

DUKE's Scott LaGreca participated in Darwin Day at the NC Museum of Natural Sciences, Raleigh, NC, on November 12, 2022. The theme for the Darwin Day was "Fungi" and their exhibit table was entitled "The Secret Life of Lichens." A total of 3,579 people visited the museum that day. He also gave a Lichen Herbarium Tour on November 17, 2022 for 11 undergraduate students. In addition, Duke's Lichen Herbarium was featured in an article in the Duke Research Blog, Fall 2022: https://researchblog.duke.edu/2022/09/19/what-are-lichens-and-why-does-duke-have-160000-of-them/?fbclid=IwAR0gvVyTr4R8FaoilLNu793h2PyR0oBZKN_2lzSvCZMmcc_35Z9JxTjWLmw.

F's digitization projects have continued to reach out to broader audiences and contributed to outreach and education programs, including numerous behind-the-scenes tours involving Field Museum members, school classes, educators and the general public – all achieved and adapted to a virtual experience as well as onsite and in-person. F has become a leading institution with WeDigBio, with the PI serving on the Board, and helping with global event organization. Beyond

WeDigBio, the project continues to participate in several virtual public transcription events. In collaboration with educators and the Field Museum Learning Center, lesson plans were finalized during the reporting quarter for elementary and middle school on 1) Plant biomimicry; 2) Plant Structure & Function; 3) Biodiversity & Ecosystems. These are in accordance with Next Generation Science Standards (MS-ETS1-1; 4-LS-1; MS-LS2-51).

GLOBAL staff members at NY wrote several outreach pieces for The Hand Lens, including a series celebrating cryptogam specialists from Latin America for Hispanic Heritage Month.

OSC Hosted a WeDigBio event and Herbarium Open House on October 13, 2022.

The TENN Herbarium held a “Cupcakes and Collections” open house in November for students, staff, and faculty on campus which included tours of the herbarium and our newly installed compactors (and a gross of mini-cupcakes).

TENN continued hosting the GLOBAL weekly transcription event on Fridays during 2022-Q4. Eight community science volunteers from three countries participated (US, Canada, Sweden) and transcribed skeletal data for over 500 specimens. Volunteers were also able to see a number of “Specimen Spotlight” presentations on specimens and collectors compiled by the TENN GLOBAL Project Manager.

Plans progressed for producing the GLOBAL educational videos in conjunction with the team at ALA. The participating individuals and dates were selected for May 2023.

UC conducted several herbarium tours which included a tour and demo of the digitizing lab and process.

**WeDigBio**

Members from seven GLOBAL collaborators (CINC & MU, COLO, DUKE, F, FLAS, MSC, TENN) participated in the October 2022 WeDigBio. The team from F again helped host and manage the event with assistance from the GLOBAL team. Over 40 community scientists participated on each of the two GLOBAL days. A hybrid event, the virtual volunteers (including participants from across the globe) databased over 2,700 records and those in-person barcoded over 6,000 specimens. The event included three student presentations: Madison Winter (CINC) "Where do specimen images come from? A demonstration at the University of Cincinnati Herbarium," Karn Imwattana (DUKE) "Tracing history of plants using field and herbarium collections: genetic

structure of some circumboreal peat mosses (Sphagnum),” and Stephanie Maari (F) "Mosses as Bioindicators."

## Share Information About Your Website and/or Portal Usage

The GLOBAL project website, https://globaltcn.utk.edu, was utilized by 247 users during 2022-Q4, including 23 from Asia, 14 from Europe, and 7 from South America (see Figure 3).

The Bryophyte and Lichen Portals, created as part of the original LBCC grant, host new images and data produced by the GLOBAL collaborators. 254 users visited the Bryophyte Portal and 1,086 users visited the Lichen Portal during 2022-Q4 (see Figures 4 & 5). Totals are dramatically lower than previous quarters, but are likely a more accurate representation of true usage. Increased security measures were enacted on the portals during this quarter, protecting against bots and malicious IP addresses.

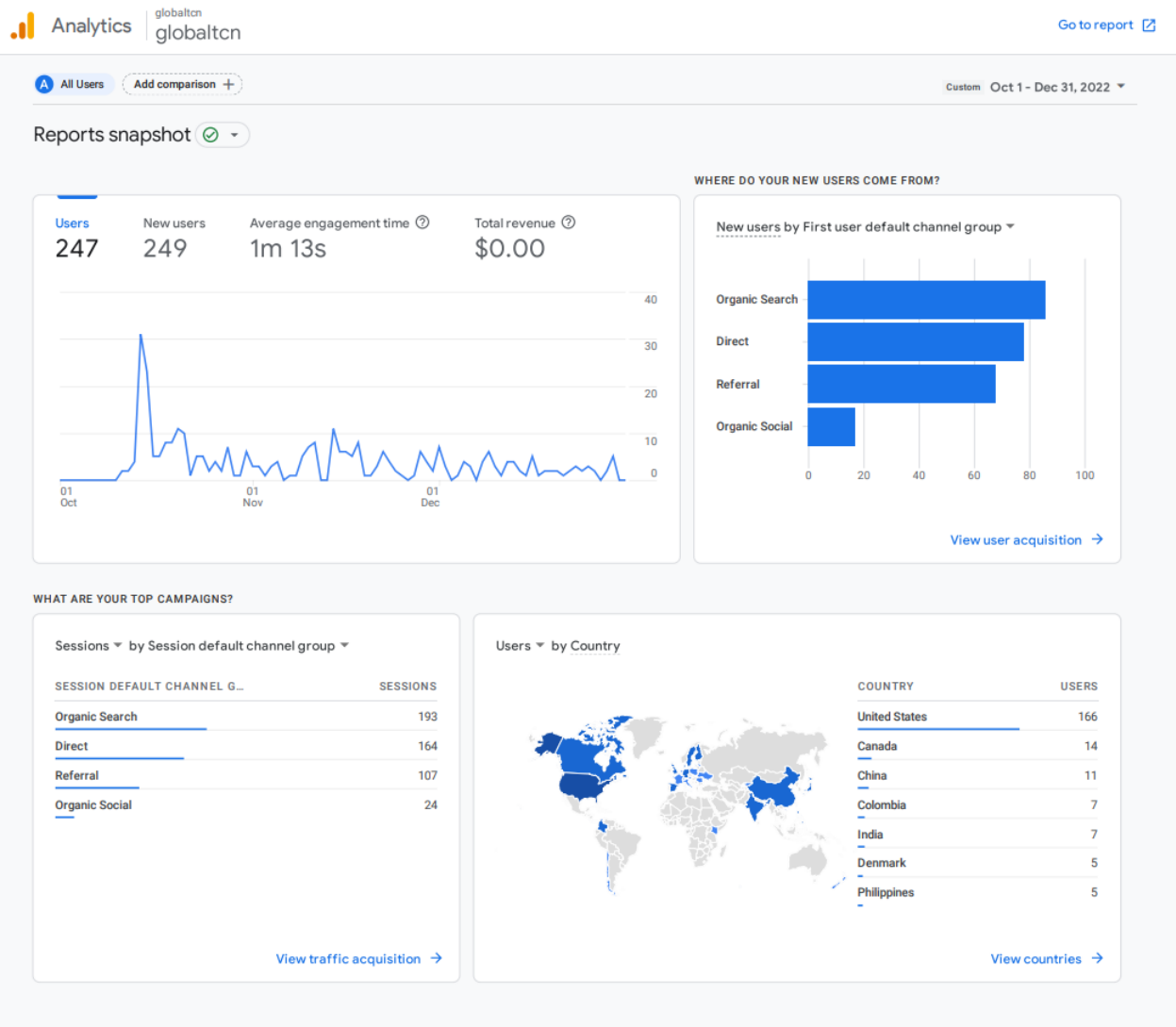



Figure 3: Use metrics for the GLOBAL project website (https://globaltcn.utk.edu) from October 1 – December 31, 2022.

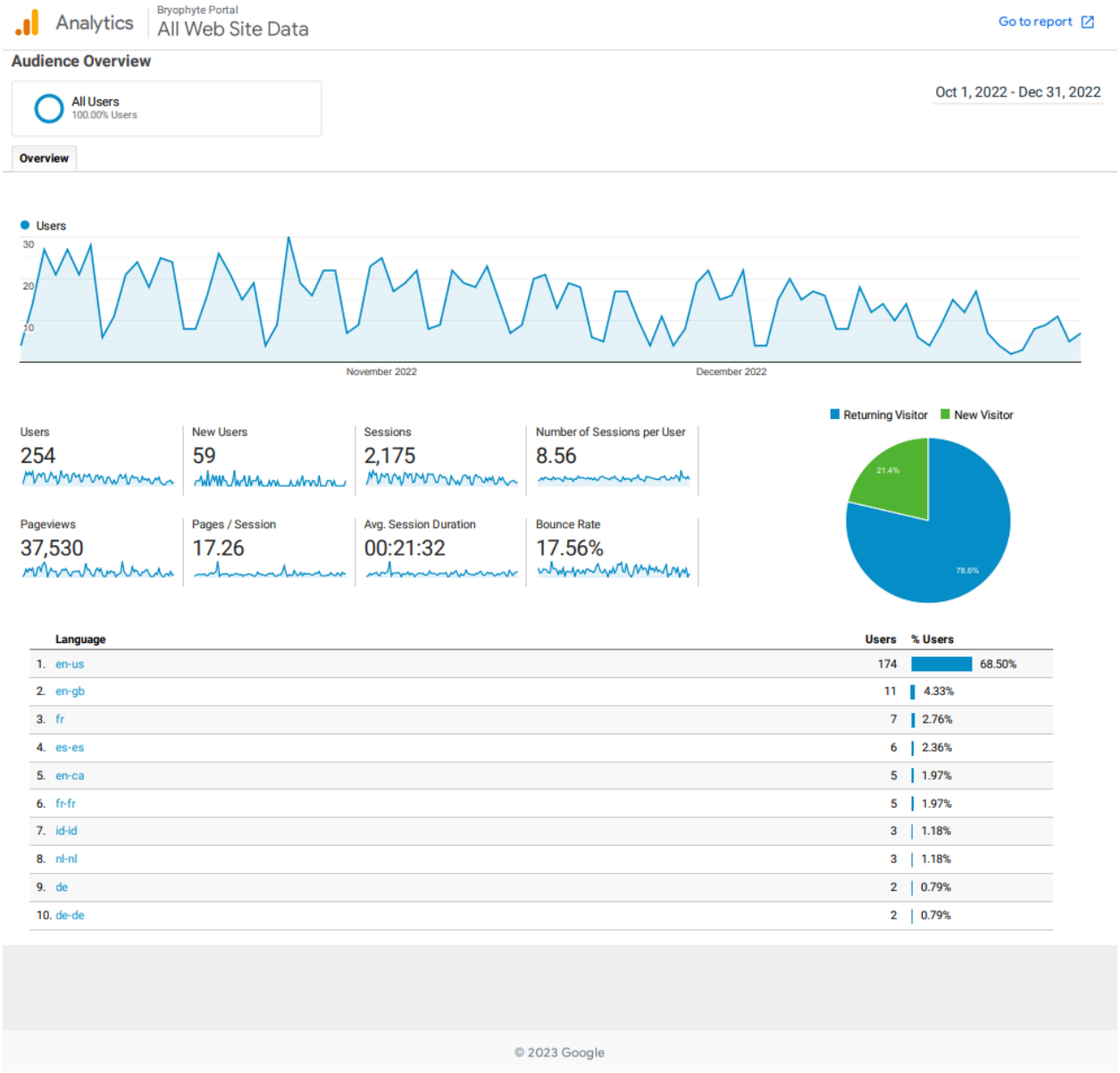



Figure 4: Use metrics for the Bryophyte Portal (https://bryophyteportal.org/portal/) from October 1 – December 31, 2022.

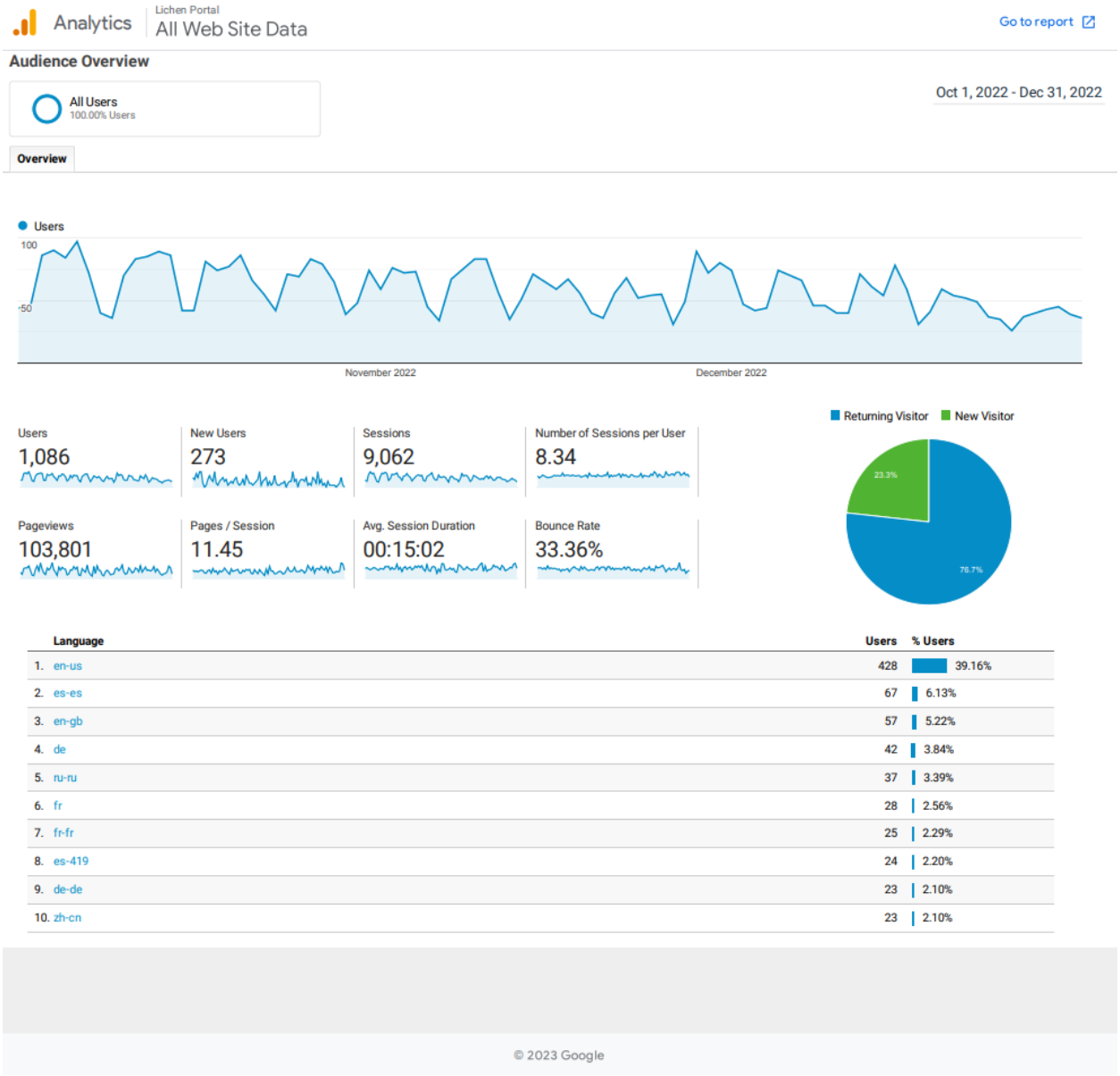



Figure 5: Use metrics for the Lichen Portal (https://lichenportal.org/cnalh/) from October 1-December 31, 2022.

# Share Other Activities and/or Progress

**Image Tagging**

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

# TCN Quarterly Progress Report

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

## TCN Names

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

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

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

Person Completing the Report
Neil Stanley Cobb (Lead PI)

## Share Progress in Digitization Efforts

All three TCNs are still active and serve specimen records and images through the data portal SCAN (https://scan-bugs.org/portal/).

## Share Best Practices, Standards, and Lessons Learned

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

## Share Identified Gaps in Digitization Areas and Technology

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

## 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

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

## Share Opportunities and Strategies for Sustainability

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

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

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

## Share Information About Your Website and/or Portal Usage

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

## Share Other Activities and/or Progress

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

# 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

- The digitization of specimen data has ended, resulting in 277,191 lots, 3,386,167 specimens across the 6 institutions. These data are continually refined.
- We have started the repatriation process, returning ~9,000 lots to the Field Museum for cleanup of data in their own database.
- Bishop Museum is in the process of transcribing the last of its literature – field notebooks. This requires a lot of time however and is unlikely to be finished, given the data is completely unstructured and OCR attempts have proven relatively unsuccessful.
- All collector's maps have been transcribed and linked to specimens.
- Georeferencing for the Hawaiian Islands continues (~36% of lots finished), but is also unlikely to be completed given the large amount of data.
- Georeferencing for the last three Pacific Island Groups – Cook Islands, Samoa, and Tuvalu (>1000 localities) has started.
- Taxonomic clean up for three clades (Achatinellinae, Amastridae and Auriculellinae) has started, resulting in the clean up or verification of ~50,000 lots to ~1,000 names.

## 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.
- 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.
- On an efficient note, setting the start date of your project around the time of quarterly or annual idigbio meetings is rather handy. You've written all the info in your annual report and can easily translate into these idigbio reports and annual summit presentations =)

## Share Identified Gaps in Digitization Areas and Technology

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

- Though we have standards for specimen sharing (e.g. DarwinCore), this is only marginally helpful for repatriation into other structured databases. Collections databases are often very different from each other and though we can share back the cleaned data in DarwinCore format, this may result in extra work for collections managers to actually repatriate that into differently structured fields if the database itself is relational or does not conform to DarwinCore.
- While digitizing literature is a start, it is not finished until the data in the literature has been transcribed. This often requires staff to do this by hand, which takes an enormous amount of effort. OCR can help for typed text, but handwritten notes, photos, drawings and journals require more care.

## Share Opportunities to Enhance Training Efforts

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

- We are continuing to recruit and train students to assist with project activities.

- We have helped organize several public outreach activities that highlight the PILSBRy portal and continue to train conservation managers to utilize the site.

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

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

- Similar to previous reports:

- 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.
- Now that a significant number of records have been clean up taxonomically and geographically, some agencies are using these data to develop habitat suitability models for endangered species. Additionally, these data are allowing others to update conservation status for IUCN and state lists.

## 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.

- See above in training section

## 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, 2022 - January 31st, 2023

Assembled at BRIT on January 31st, 2023, for February 1st IAC meeting

## TCN Name

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

## Person Completing the Report

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

Institutions reporting:

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

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

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

# Share Progress in Digitization Efforts

**Progress in Digitization Efforts**:

- Number of skeletal records created:

BAYLU = 0

BRIT = 0

MO = 7,193

OKL = 0

OKLA = 160 (22,159 total)

SHST = N/A [22,400 cumulative]

TAES = 0

TEX-LL (including Data-Provider Institutions) =

| | |
|---|---|
| University of Texas at Austin (TEX-LL) | 0 |
| Angelo State University (SAT) | 0 |
| Fort Worth Nature Center (FWNC) | 0 (completed) |
| Howard Payne University (HPC) | 1 |
| Johnson Wildflower Center (JWC) | 0 (completed) |
| Our Lady of the Lake University (LLC) | 0 |
| Saint Edward's University (SEU) | 0 (completed) |
| Sul Ross State University (SRSC) | 725 |
| Texas Lutheran University (TLU) | 0 |
| Texas State University (SWT) | 0 |
| UT RGV Edinburg (PAUH) | 0 |
| University of Houston Coastal Center (UHCC) | 0 |
| TEX-LL Sub-Total | 726 |

**Total skeletal records created this quarter by 8 reporting institutions: 8,079**

- Number of fully-transcribed records created:

BAYLU = 10,077

BRIT = 9,498 (3,998 staff and volunteer transcriptions + 5,500 community

science Notes from Nature-generated transcriptions)

| | | |
|---|---|---|
| MO = | 0 | |
| OKL = | 980 total | (835 OKL + 145 Oklahoma City University, OCU) |
| OKLA = | 3,514 | (21,999 total) |
| SHST = | N/A | [25,000 cumulative, staff and volunteer transcriptions] |
| TAES = | 0 | |

TEX-LL (including Data-Provider Institutions) =

| | | |
|---|---|---|
| University of Texas at Austin (TEX-LL) | 1,686 | |
| Angelo State University (SAT) | 0 | |
| Fort Worth Nature Center (FWNC) | 0 | (completed) |
| Howard Payne University (HPC) | 0 | |
| Johnson Wildflower Center (JWC) | 0 | (completed) |
| Our Lady of the Lake University (LLC) | 0 | |
| Saint Edward's University (SEU) | 0 | (completed) |
| Sul Ross State University (SRSC) | 0 | |
| Texas Lutheran University (TLU) | 94 | |
| Texas State University (SWT) | 0 | |
| UT RGV Edinburg (PAUH) | 0 | |
| University of Houston Coastal Center (UHCC) | 0 | |
| TEX-LL Sub-Total | 1,780 | |

**Total fully-transcribed records created this quarter by 8 reporting institutions: 25,849**

- Number of specimens imaged:

| | |
|---|---|
| BAYLU = | 0 |
| BRIT = | 1,931 |
| MO = | 7,193 |

OKL = 2,960 total (900 OKL + 2,060 University of Science & Arts of Oklahoma, OCLA)

OKLA = 6,603 total (212 (76,957 total) + 6,391 (17,227 total) at University of Central Oklahoma, CSU)

SHST = N/A [22,400 cumulative]

TAES = 3,000

TEX-LL (including Data-Provider Institutions) =

| | |
|---|---|
| University of Texas at Austin (TEX-LL) | 4,030 |
| Angelo State University (SAT) | 0 |
| Fort Worth Nature Center (FWNC) | 0 (completed) |
| Howard Payne University (HPC) | 3,099 |
| Johnson Wildflower Center (JWC) | 0 (completed) |
| Our Lady of the Lake University (LLC) | 0 |
| Saint Edward's University (SEU) | 0 (completed) |
| Sul Ross State University (SRSC) | 1,491 |
| Texas Lutheran University (TLU) | 0 |
| Texas State University (SWT) | 0 |
| UT RGV Edinburg (PAUH) | 0 |
| University of Houston Coastal Center (UHCC) | 781 |
| TEX-LL Sub-Total | 9,401 |

**Total number of specimens imaged this quarter by 8 reporting institutions: 31,088**

- Number of specimens georeferenced:

BAYLU = 550

BRIT = 114

MO = 0

OKL = 298 total (248 OKL + 50 OCU)

OKLA = 74 (11,673 total)

SHST = 200

| | |
|---|---|
| TAES = | 0 |
| TEX-LL (including Data-Provider Institutions) = | |
| University of Texas at Austin (TEX-LL) | 700 |
| Angelo State University (SAT) | 0 |
| Fort Worth Nature Center (FWNC) | 0 (completed) |
| Howard Payne University (HPC) | 7 |
| Johnson Wildflower Center (JWC) | 0 (completed) |
| Our Lady of the Lake University (LLC) | 0 |
| Saint Edward's University (SEU) | 0 (completed) |
| Sul Ross State University (SRSC) | 128 |
| Texas Lutheran University (TLU) | 113 |
| Texas State University (SWT) | 0 |
| UT RGV Edinburg (PAUH) | 69 |
| University of Houston Coastal Center (UHCC) | 0 |
| TEX-LL Sub-Total | 1,017 |

**Total number of specimens georeferenced this quarter by 8 reporting institutions: 2,253**

- Other digitization or pre-digitization efforts:

**BAYLU:** Nothing new to report.

**BRIT:** Completely uploaded all images into Symbiota for Balcones Canyonlands National Wildlife Refuge Herbarium (Herbarium Code BCNWR).

Began pre-digitization curation of the Texas Woman's University Herbarium collection (Herbarium Code TCSW).

Began investigating the dataset received from Symbiota Support Hub (Katie Pearson) during the TORCH Portal Advancement Campaign for harvesting geocoordinates from duplicate records across Symbiota.

Launched and completed what is expected to be the last Notes from Nature expedition, concentrating on Texas specimens, and completed an additional expedition. We have moved to engaging volunteers in transcription efforts utilizing the Symbiota crowdsourcing module.

**MO:** Sorting of the Texas and Oklahoma plants from North American folders has been completed for approximately half of the collection and is being done by herbarium staff prior to the imaging process.

**OKL:** Nothing new to report**.**

**OKLA:** Nothing new to report.

**SHST:** Nothing new to report.

**TAES:** Tens of thousands of images have been loaded to the TACC portal, in staging for linkage to the TORCH Symbiota Portal. Significant progress has been made in linking barcoding numbers to TAES accession numbers. Our data have been shared with GBIF.

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

- Comments about the digitization process:

**BAYLU:** Two new students hired for transcription.

**BRIT:** None.

**MO:** As soon as the sorting is completed, we will turn all of our imaging attention to these specimens. At our current rate, we expect to finish imaging within 3 months, or sometime this Spring.

**OKL:** We are starting to prepare our images for uploading to TACC, but we need to re-export them all to make a DNG, instead of a JPG and a camera raw image only, as we had been doing before.

**OKLA:** Imaging of the University of Central Oklahoma Herbarium (CSU) was completed.

**SHST:** Progressing very fast with barcoding and imaging of specimens. We should be completing our contribution to the TORCH TCN Project by the end of next quarter (May 2023).

**TAES:** Nothing new to report.

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

We are also continuing to experience slower-than-expected progress with a few of our data provider institutions (who are mostly doing their own digitization), notably Howard Payne and Sul Ross. We did secure permission to borrow sets of specimens from Howard Payne University so that we can speed along that institution's imaging, but the folks at Sul Ross refuse to allow us to borrow specimens.

We finished barcoding and imaging nearly all of the specimens from Texas Lutheran University (TLU) and UT Rio Grande Valley–Edinburg (PAUH), and are working on associating the images with their records in Symbiota. We have started to image specimens from Texas State University (SWT) and have finished imaging for the University of Houston Coastal Center (UHCC). Note that for the University of Houston Coastal Center, we were only responsible for imaging; the uploading of the spreadsheet with transcribed labels was handled by the TORCH Project Manager and has also now been completed.

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

We have also discovered multiple duplicate records in the Symbiota portal for UT Rio Grande at Edinburg (PAUH) that were likely created as a result of user error during the data entry process, spanning around 400 catalog numbers. We have started assessing and removing excess records.

During December, especially during our winter break, workflow slowed to a trickle. The spring semester began on 9 January 2023, with students slowly matriculating back into the city a few days before then. During this time, our TORCH-dedicated student employees returned to begin work, and we hired additional new employees under the grant. This significantly increased our workflow progress in recent weeks as these new workers become fully trained.

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

BAYLU = N/A

BRIT = Searched all collections on 23 January 2023, with "Kingdom = Plantae," and collected in TX or OK):

| | |
|---|---|
| BRIT-SMU-VDB-NLU: | 187,820 |
| TAC: | 7,064 |
| NTSC: | 0 |
| ACU: | 0 |

HSU: 0
TCSW: 0
BCNWR: 0

Sub-Total for BRIT Lead = 194,884

MO = N/A

OKL = 0

OKLA = 0

SHST = 0 [Searched all collections on Jan. 28th, 2023. All data is in DiscoverLife through John Pickering, and assumed that iDigBio would pick-up the records through their regular data-swapping.]

TAES = 0

TEX-LL (including Data-Provider Institutions) =

| | |
|---|---|
| University of Texas at Austin (TEX-LL) | 245,872 |
| Angelo State University (SAT) | 0 |
| Fort Worth Nature Center (FWNC) | 0 |
| Howard Payne University (HPC) | 22,910 |
| Johnson Wildflower Center (JWC) | 0 |
| Our Lady of the Lake University (LLC) | 0 |
| Saint Edward's University (SEU) | 0 |
| Sul Ross State University (SRSC) | 0 |
| Texas Lutheran University (TLU) | 8,424 |
| Texas State University (SWT) | 0 |
| UT RGV Edinburg (PAUH) | 0 |
| University of Houston Coastal Center (UHCC) | 0 |
| TEX-LL Sub-Total | 277,206 |

**Total number of records in iDigBio portal (cumulative) from 8 reporting institutions: 472,090**

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

BAYLU = 50,663

BRIT = Searched TORCH Portal on January 23rd, 2023, for geographic distributions within each collection's profile, without taxonomic constraints, collected in TX or OK):

| | |
|---|---|
| BRIT-SMU-VDB-NLU: | 211,701 |
| TAC: | 7,029 |
| NTSC: | 11,305 |
| ACU: | 3,739 |
| HSU: | 3,965 |
| TCSW: | 0 |
| BCNWR: | 1,551 |

Sub-Total for BRIT Lead = 239,290

MO = 20,503 from TX or OK (Total 527,787 records, but has not been updated since November 29th, 2017)

OKL = 133,170 from TX or OK (138,852 total)

OKLA = 76,716 TX or OK (79,206 total)

SHST = 0

TAES = 238,835

TEX-LL (including Data-Provider Institutions) =

| | |
|---|---|
| University of Texas at Austin (TEX-LL) | 243,036 |
| Angelo State University (SAT) | 38,984 |
| Fort Worth Nature Center (FWNC) | 1,918 |
| Howard Payne University (HPC) | 22,909 |
| Johnson Wildflower Center (JWC) | 3,304 |
| Our Lady of the Lake University (LLC) | 0 |
| Saint Edward's University (SEU) | 6,326 |
| Sul Ross State University (SRSC) | 32,057 |
| Texas Lutheran University (TLU) | 8,424 |
| Texas State University (SWT) | 0 |
| UT RGV Edinburg (PAUH) | 7,119 |
| University of Houston Coastal Center (UHCC) | 779 |

TEX-LL Sub-Total = 364,856

**Total number of records available in TORCH Symbiota Portal (cumulative) from 8 reporting institutions:**
**1,124,033**

# Share Best Practices, Standards, and Lessons Learned

**MO:** We did a test run during this quarter, comparing rates of imaging and folder data capture with and without pre-sorting. In our collection, sorting specimens ahead of the digitization more than doubled the speed (88 specimens per hour on average with pre-sorting versus 35 specimen per hour with sorting done by the digitization technician). However, this is a substantial investment in staff time that must be funded by other means.

**OKLA:** Received tips from Symbiota Support Hub on the taxonomic backbone and georeferencing.

**All other institutions:** Nothing new to report.

# Share Identified Gaps in Digitization Areas and Technology

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

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:** At Angelo State University (SAT), the faculty curator retired in May 2022 and the staff collections manager left for a different job at around the same time. Thus, there has been no new activity at this data provider institution during the quarter. Apparently the start date of a new curator has been delayed by immigration issues of a foreign candidate, and the collections manager position will not be filled until the curator has started (hopefully early in 2023).

In-house progress at Howard Payne University (HPC) has been glacially slow because of a chronic lack of student help there. Recently, TEX/LL borrowed ca. 2500 sheets to image at its facility in an effort to accelerate progress. Our colleagues at BRIT may help out with further off-site imaging in the future, time permitting.

**All other institutions:** Nothing new to report.

## Share Opportunities to Enhance Training Efforts

During this reporting period, the TORCH TCN partnered with the Symbiota Support Hub for a Portal Advancement Campaign. Four sessions were held, on November 3rd, 10th, and 17th, and on December 8th.

**BRIT:**
Training Sessions for staff on OpenRefine and the Image Processing workflow.
BRIT TORCH Staff participated in Symbiota Support Hub meetings.
BRIT TORCH Staff participated in the TORCH Portal Advancement Campaign.

**OKLA:**
Trained one new volunteer community member in transcribing.
Trained one new undergraduate assistant in imaging at University of Central Oklahoma.

**SHST:**

Learned about Fungi from David Lewis
Learned about Orchids from Joe Lig
Offered additional weekly trainings on barcoding, imaging, and digitizing
Organizing more volunteers

**All other institutions:** Nothing new to report.

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

During this reporting period, the TORCH TCN partnered with the Symbiota Support Hub for a Portal Advancement Campaign. Four sessions were held, on November 3rd, 10th, and 17th, and on December 8th.

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

**All other institutions:** Nothing new to report.

# Share Opportunities and Strategies for Sustainability

**All reporting institutions:** Nothing new to report.

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

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

**All reporting institutions:** Nothing new to report.

**Other Education and Outreach activities:**

**BAYLU:** Undergraduate student (Sydney Ovaise) used Symbiota portal to find and sort herbarium specimens of *Chasmanthium latifolium* for her independent research project titled “The Effects of Rising Atmospheric CO2 Levels on Stomata: *Chasmanthium latifolium* Adaptation Over Time.” Herbarium specimens were imaged utilizing a 3-D laser microscope to assess non-destructively stomatal density and structures.

**BRIT:** Four volunteer training sessions for new TORCH Crowdsourcing program were held in January 2023.

Hosted two Zoom presentations with the Armchair Botanist program to engage Notes from Nature volunteers transcribing project specimens, and advertised to the general public.

The November 10th, 2022, Armchair Botany session was presented by the team, spearheaded by Natch Rodriguez and our invited speaker, Anthropologist Grace Bascope: "Past to Present: Indigenous Culinary Arts of Lower Turtle Island" (https://fwbg.org/events/armchairbotany-indigenous-culinary-arts/; 25 attendees).

The December 8th, 2022, Armchair Botany session, titled "Winter Tree Identification," was presented by the team (https://fwbg.org/events/winter-tree-id/; 19 attendees).

**TAES:** Students in P.I. Spalink's ECCB 312: Agrostology course use data generated through this project to develop research projects – these were all presented during an in-class poster session at the end of the Fall semester (2022).

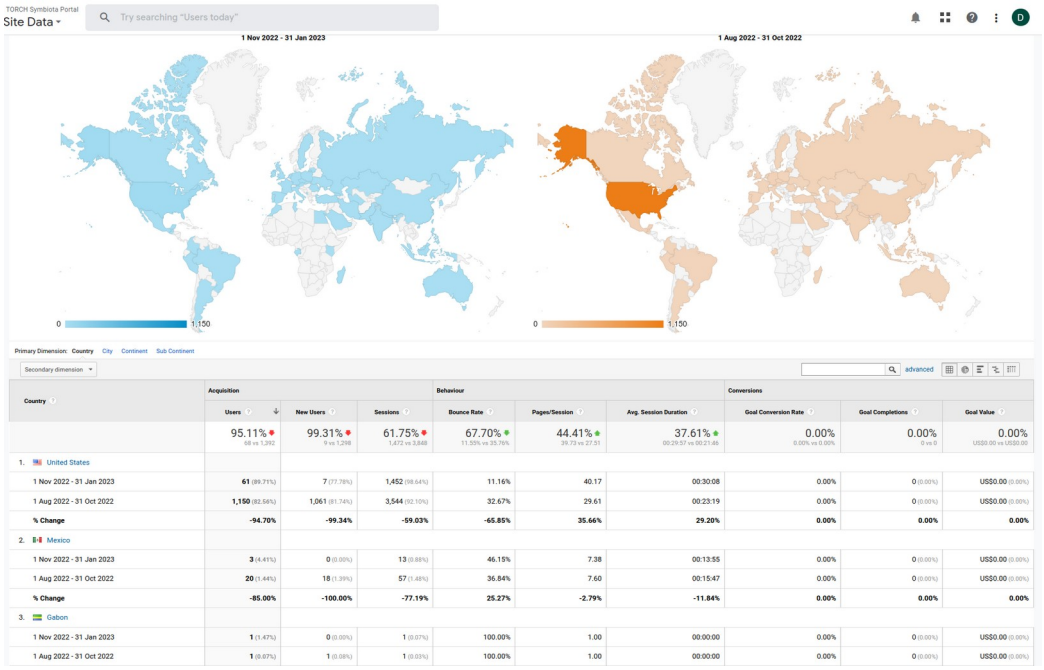
**TEX-LL:** We gave herbarium tours to two classes from the UT Integrative Biology Department, which both contained information on the TORCH digitization activities. Some of the students from these tours expressed an interest in working at the Plant Resources Center.

We additionally hosted students from the plant systematics course in the UT Integrative Biology Department while they identified personal collections and verified their findings using the Texas flora reference collection.

**All other institutions:** Nothing new to report.

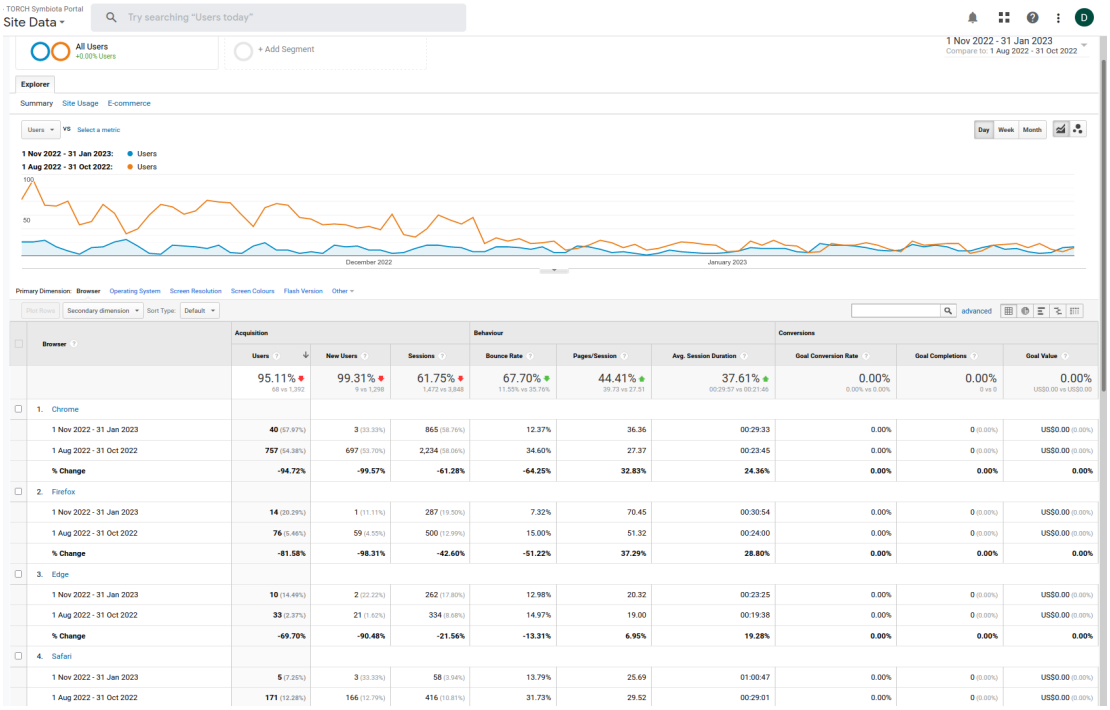
# Share Information About Your Website and/or Portal Usage

Users by country, Nov. 1st , 2022 – Jan. 31st , 2023, vs. previous quarter



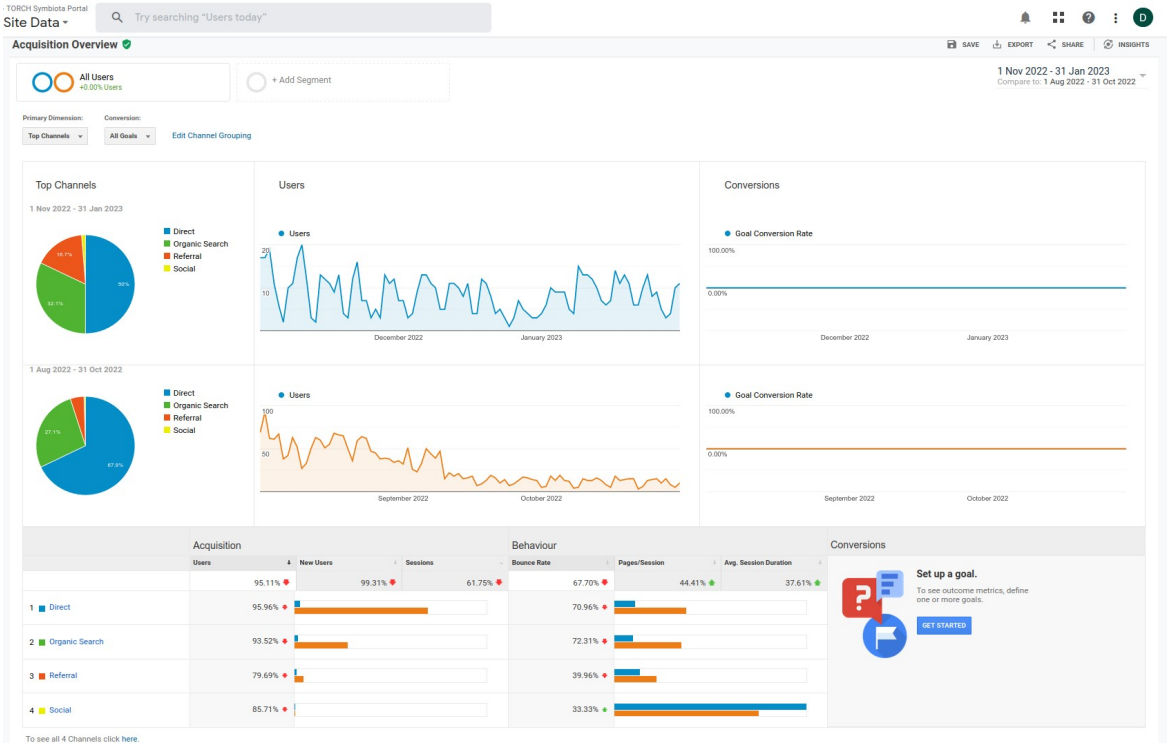

| Country | Users | New Users | Sessions | Bounce Rate | Pages/Session | Avg. Session Duration | Goal Conversion Rate | Goal Completions | Goal Value |
|---|---|---|---|---|---|---|---|---|---|
| | 95.11% | 99.31% | 61.75% | 67.70% | 44.41% | 37.61% | 0.00% | 0.00% | 0.00% |
| 1. United States | | | | | | | | | |
| 1 Nov 2022 - 31 Jan 2023 | 61 (89.71%) | 7 (77.78%) | 1,452 (98.64%) | 11.16% | 40.17 | 00:30:08 | 0.00% | 0 (0.00%) | US$0.00 (0.00%) |
| 1 Aug 2022 - 31 Oct 2022 | 1,150 (82.56%) | 1,061 (81.74%) | 3,544 (92.10%) | 32.67% | 29.61 | 00:23:19 | 0.00% | 0 (0.00%) | US$0.00 (0.00%) |
| % Change | -94.70% | -99.34% | -59.03% | -65.85% | 35.66% | 29.20% | 0.00% | 0.00% | 0.00% |
| 2. Mexico | | | | | | | | | |
| 1 Nov 2022 - 31 Jan 2023 | 3 (4.41%) | 0 (0.00%) | 13 (0.88%) | 46.15% | 7.38 | 00:13:55 | 0.00% | 0 (0.00%) | US$0.00 (0.00%) |
| 1 Aug 2022 - 31 Oct 2022 | 20 (1.44%) | 18 (1.39%) | 57 (1.48%) | 36.84% | 7.60 | 00:15:47 | 0.00% | 0 (0.00%) | US$0.00 (0.00%) |
| % Change | -85.00% | -100.00% | -77.19% | 25.27% | -2.79% | -11.84% | 0.00% | 0.00% | 0.00% |
| 3. Gabon | | | | | | | | | |
| 1 Nov 2022 - 31 Jan 2023 | 1 (1.47%) | 0 (0.00%) | 1 (0.07%) | 100.00% | 1.00 | 00:00:00 | 0.00% | 0 (0.00%) | US$0.00 (0.00%) |
| 1 Aug 2022 - 31 Oct 2022 | 1 (0.07%) | 1 (0.08%) | 1 (0.03%) | 100.00% | 1.00 | 00:00:00 | 0.00% | 0 (0.00%) | US$0.00 (0.00%) |

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

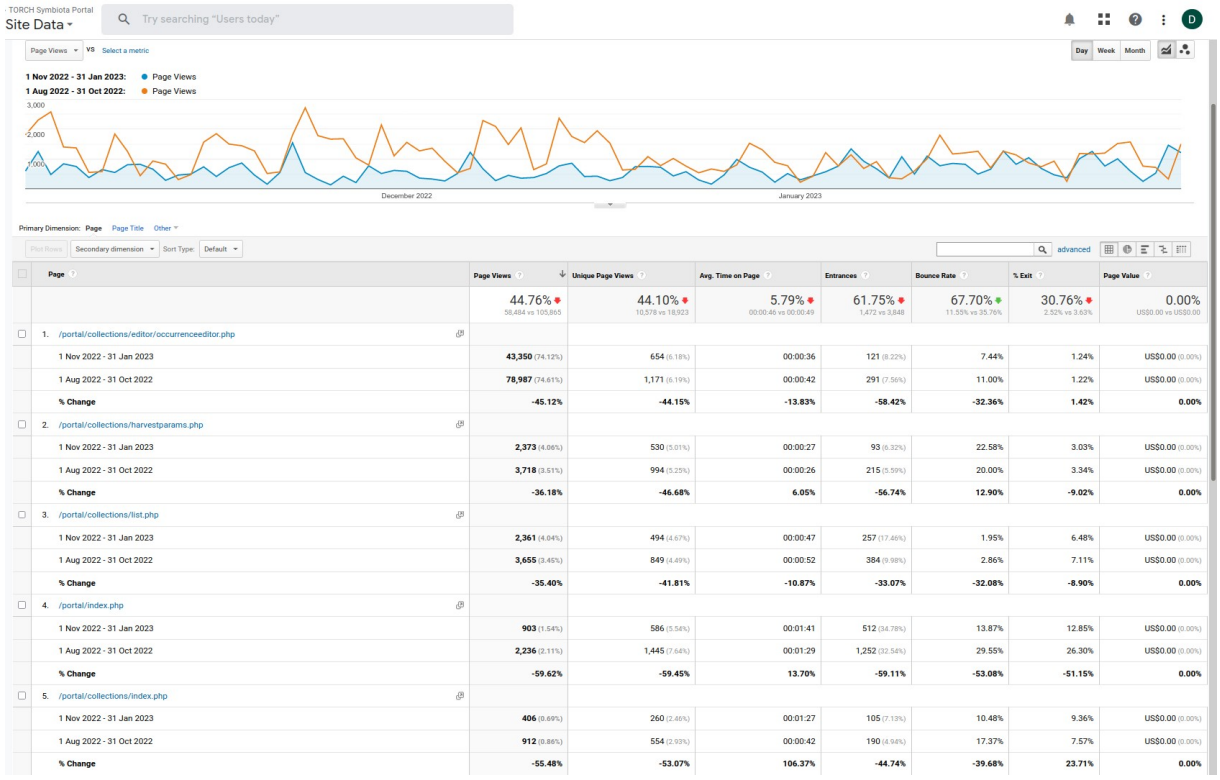



| Browser | Users | New Users | Sessions | Bounce Rate | Pages/Session | Avg. Session Duration | Goal Conversion Rate | Goal Completions | Goal Value |
|---|---|---|---|---|---|---|---|---|---|
| | 95.11% | 99.31% | 61.75% | 67.70% | 44.41% | 37.61% | 0.00% | 0.00% | 0.00% |
| 1. Chrome | | | | | | | | | |
| 1 Nov 2022 - 31 Jan 2023 | 40 (57.97%) | 3 (33.33%) | 865 (58.76%) | 12.37% | 36.36 | 00:29:33 | 0.00% | 0 (0.00%) | US$0.00 (0.00%) |
| 1 Aug 2022 - 31 Oct 2022 | 757 (54.38%) | 697 (53.70%) | 2,234 (58.06%) | 34.60% | 27.37 | 00:23:45 | 0.00% | 0 (0.00%) | US$0.00 (0.00%) |
| % Change | -94.72% | -99.57% | -61.28% | -64.25% | 32.83% | 24.36% | 0.00% | 0.00% | 0.00% |
| 2. Firefox | | | | | | | | | |
| 1 Nov 2022 - 31 Jan 2023 | 14 (20.29%) | 1 (11.11%) | 287 (19.50%) | 7.32% | 70.45 | 00:30:54 | 0.00% | 0 (0.00%) | US$0.00 (0.00%) |
| 1 Aug 2022 - 31 Oct 2022 | 76 (5.46%) | 59 (4.55%) | 500 (12.99%) | 15.00% | 51.32 | 00:24:00 | 0.00% | 0 (0.00%) | US$0.00 (0.00%) |
| % Change | -81.58% | -98.31% | -42.60% | -51.22% | 37.29% | 28.80% | 0.00% | 0.00% | 0.00% |
| 3. Edge | | | | | | | | | |
| 1 Nov 2022 - 31 Jan 2023 | 10 (14.49%) | 2 (22.22%) | 262 (17.80%) | 12.98% | 20.32 | 00:23:25 | 0.00% | 0 (0.00%) | US$0.00 (0.00%) |
| 1 Aug 2022 - 31 Oct 2022 | 33 (2.37%) | 21 (1.62%) | 334 (8.68%) | 14.97% | 19.00 | 00:19:38 | 0.00% | 0 (0.00%) | US$0.00 (0.00%) |
| % Change | -69.70% | -90.48% | -21.56% | -13.31% | 6.95% | 19.28% | 0.00% | 0.00% | 0.00% |
| 4. Safari | | | | | | | | | |
| 1 Nov 2022 - 31 Jan 2023 | 5 (7.25%) | 3 (33.33%) | 58 (3.94%) | 13.79% | 25.69 | 01:00:47 | 0.00% | 0 (0.00%) | US$0.00 (0.00%) |
| 1 Aug 2022 - 31 Oct 2022 | 171 (12.28%) | 166 (12.79%) | 416 (10.81%) | 31.73% | 29.52 | 00:29:01 | 0.00% | 0 (0.00%) | US$0.00 (0.00%) |

## How Users are Acquired, vs. previous quarter




## Pageviews by URL, vs. previous quarter



# Share Other Activities and/or Progress

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

**BRIT:** The TORCH Project webpage was created on fwbg.org to display and update the progress for the BRIT-SMU-VDB-NLU collections. See: https://fwbg.org/research/research-resources/herbarium-curation-projects/torch/

**All other institutions:** Nothing new to report.

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

**BAYLU:**

Undergraduate student transcribers (2 new):
Andy Conley
Anna Claire Brewer (Anna_Brewer1@baylor.edu)
Anayah Akita (anayah_akita1@baylor.edu)

Technician:
Albert Zertuche

**BRIT:**

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

**MO:**

Emily Hughes
Victoria Patrick (institutionally funded)
Lauren Boyle (institutionally funded)
Mike Blomberg

**OKL:** Nothing new to report.

**OKLA:** Undergraduate assistants Wilson, Bardin, Wright, Rillo, Sutton, and Short continued transcription and imaging activities.

New undergraduate assistant Settles and former intern Wood conducted imaging at University of Central Oklahoma.

Dr. Jenna Messick, curator at University of Central Oklahoma, worked with Project Manager Barroso on transferring legacy database and newly obtained images to the portal.

**SHST:**
Shae Stafford (Paid Employee) Srs111@shsu.edu
Rosario Rocha (Paid Employee) Rxr117@shsu.edu
Luke Holmes (Paid Employee) Lah069@shsu.edu
Tomas Lewis (Paid Employee) Til003@shsu.edu
Landon McCoy (Paid Employee) Lam124@shsu.edu
Danielle Garbarnio (Paid Employee) dgg026@shsu.edu
Marla Neigo (Paid Employee) mbn015@shsu.edu

**TAES:**
New digitization techs:
Steven A. Pastrano II
Katy Heilman
Samantha Watkins
Hanna Sosnowski
Kieran Means
Kate Morton
Neo Koite

**TEX-LL:**
Two part-time volunteers:
Suzanne Labry
Vicky Wold

Six returning part-time undergraduate student workers paid by the grant:
Stephanie Nuñez
Sofia Bautista
Annabelle Young
Elizabeth Reed
Sophia De Mendoza
Travis Langford

Three new part-time undergraduate student workers paid by the grant:

Hau Lin
Macie Hartzog
Ryann Ramirez

In addition, we have several part-time undergraduate student workers who are not paid by the grant, but are completing tasks in part relating to TORCH.

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

**MO:** Specimen changes in Tropicos, the database at MO, are mostly finished and include a more streamlined specimen-editing module for digitization projects. Additionally, filed-as folder information can be captured during the imaging process and reflected on records, increasing the findability of the physical specimens from images.

**OKLA:**

Imaging at University of Central Oklahoma (CSU) completed.
Imaging at Cameron University (CAMU) will take place in the next quarter.

**SHST:** Progress has improved and increased dramatically. We will be completing our contribution to the TORCH TCN Project by May 2023.

**All other institutions:** Nothing new to report.

**Questions/comments:**

**OKL:** We are going to start working on making new DNGs for all of our images soon. At least we've made some progress with the OCLA collection.

**TTC:** I plan on submitting a report – I discovered several hundred images that we had not uploaded to TACC! I plan to do that this afternoon and then add it to our quarterly report.

**TEX-LL:** We counted the UHCC images but not data records in our report.

**All other institutions:** None.

# 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 2022 through January 2023) coincides with Year 4 of the TPT project, and our 1st no-cost extension year. The last overarching annual report was submitted to NSF on July 05, 2022. We also filed a one-year no-cost extension request with NSF summer of 2022 due to pandemic related digitization impacts. Below is a summary of our digitization progress (cumulative). While we still have a significant amount of digitizing to complete, we are making great progress and expect all our collections to complete the project within the no-cost extension period.

| Institution | Transcribed records | High resolution & pinned images | Scanned slides | Scanned vials |
|---|---|---|---|---|
| ANS | 19,468 | 359 | 12,368 | 1,226 |
| **BPBM** | 27,0975 | 4,928 | 19,103 | 10,247 |
| BYU | 19,169 | | 19,169 | |
| CAS | 40,449 | 1,865 | 17,615 | |
| CMNH | 35,562 | 303 | 303 | |
| CU | 11,837 | | | 11,837 |
| FMNH | 10,774 | 2,138 | 86,350 | 141 |
| **HWML** | 45,640 | | 23,230 | |

| Institution | Transcribed records | High resolution & pinned images | Scanned slides | Scanned vials |
|---|---|---|---|---|
| INHS | 37,142 | 348 | 5,788 | 7,095 |
| MPM | 2,609 | | 1,228 | 1,500 |
| MSB | 5,049 | 618 | 1,500 | 2,140 |
| MSU | 13,323 | 260 | 1,100 | 505 |
| **OSU** | 6,000 | | 6,000 | |
| PERC | 10,082 | 10,082 | | |
| PSU | 26,517 | 1,165 | 2,571 | 1,816 |
| TAMU | 67,445 | | 6,773 | 13,595 |
| UH | 8,768 | 95 | 7,152 | |
| UM | 114,084 | 259 | 51,606 | |
| UMSP | 52,060 | | 52,060 | |
| UNH | 10,500 | 2,125 | 10,500 | 1,763 |
| UU | 17,125 | | 20,000 | |
| UWSP | 7,845 | | 8,383 | |
| WIRC | 36,525 | 26,350 | 7,024 | 3,151 |
| **YPM** | 17,607 | 2,015 | 3,409 | 2,581 |
| | | | | |
| **Totals** | **648,954** | **81,053** | **367,232** | **56,097** |
| **Total records** | **1,153,336** | | | |

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

So far, TPT has completed 42 Notes from Nature expeditions and transcribed 180,747 slide images with the help of volunteers. We currently have three active expeditions, *Flea Circus V, Jumping into the Field Museum Flea Collection 8.0,* and *Mite at the Museum 2.0*.

## Share Best Practices, Standards, and Lessons Learned

*Taxonomy.* This quarter, Jorrit Poelen has started creating a reusable workflow template to help align taxonomic names in collections with the Terrestrial Parasite Tracker taxonomy (see https://bit.ly/TPTresourceHub). The hope is that the workflow will make it easier to review taxonomic names in collections without requiring coding skills. The template is still being developed, but suggestions for improvements to the draft are actively being collected (https://github.com/globalbioticinteractions/name-alignment-template/issues). A generalized

version of the workflow with detailed instructions is available here: https://github.com/globalbioticinteractions/name-alignment-template and a full lesson plan for a name alignment workshop presented by JT Miller (USCB) and Katja Seltmann (USCB) is available here: https://big-bee-network.github.io/name-alignment-workshop/. The tool will be available at the overall project level as well as for individual collection name lists so the group can easily review name alignments across all collections in the project or for their specific collection. The project level name alignment review tool in development is available here: https://github.com/jhpoelen/align-tpt-names-with-tpt-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 https://bit.ly/TPTresourceHub) 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.* The GloBI team continues to create new and exciting functions that further improve the functionality and usefulness of the website. Recently, TPT PM Tucker worked with GloBI to produce a help, or 'How-to' page (https://www.globalbioticinteractions.org/how-to), that consolidated pre-existing, but disparate GloBI instructional resources as well as added additional documentation for both new and existing methods that can be used for GloBI data.

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

*Reports.* Nick Dowdy (MPM) wrote a script to help collections track their digitization progress and project transcription rates needed to meet goals. This "TPT progress reporting" script and instructions for use are available on GitHub (https://github.com/njdowdy/digitization_progress_reports). The idea is that this script can be easily modified as needed for any collection(s) and TCN projects in the future - not just for the

TPT group. Progress graphs have been created for all collections in the TPT group and the graphs, as well as the script to create them, have been shared with each collection to help with planning out digitization strategies specific to each collection's specimens, resources, and team.

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

*Symbiota Portal.* A dedicated TPT portal has been developed using Symbiota2 programming and is now launched (https://s2.parasitetracker.org/). Taxonomic backbones and record data are in the process of being imported and there are still improvements being made, but the portal has some limited functionality already. This portal will provide a lot of very useful and interactive tools, such as mapping, checklists, and association overlays, to help better understand the parasite data this project has been digitizing.

## Share Identified Gaps in Digitization Areas and Technology

TPT network members continue to progress towards completing their digitization goals. Yale and the Ohio State Arthropod Lab (OSU) have already completed their digitization goals for the project and the Harold W. Mantor Parasitological Laboratory at the University of Nebraska State Museum has well exceeded their digitization goals and is still digitizing. Most of the remaining collections anticipate completing the project by the end of the 1st no-cost extension year (needed due to COVID-19 related impacts).

We hit a slight delay in completing our Symbiota2 Portal and Fieldbook applications due to loss of some skilled technological expertise. PI Zaspel and PM Tucker are working with both application PIs to resolve these issues and explore potential alternative avenues to accomplish our goals. PM Tucker has been instrumental in hiring the new engineer for the Symbiota Portal and continues to coordinate with the Symbiota2 portal working group and assist in project developer oversight.

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

## Share Opportunities to Enhance Training Efforts

**ANS** - Completed digitization of FMNH Phthiraptera slide collection. The spreadsheet for bulk upload of all records was reviewed and edited for consistency/import changes. Additional spreadsheets were further restructured and edited to enable bulk uploads at ANS, which added specimen data records for 52 hosts. ANS also completed and signed a memorandum of understanding (MOU) so that specimen lots in ethanol vials at -80°C with fully databased records that will be ported to public data repositories once transferred to Arctos.

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

**BYU -** 13 different students have been trained and working on the TPT project at BYU.

**FMNH -** Zoe Albion trained 2 new volunteers to work on the TPT project. Both Zoe Albion and Colin Bailey participated and presented at the ECN meeting in Vancouver. Additionally, 10k slides (122 boxes) were inventoried, 7k slides (84 boxes) were scanned, 10k inselect crops were created, and two new Notes from Nature expeditions (one mites and one fleas) were launched.

**HWML -** Gabor Racz & Scott Gardner have prepped and are data cleaning an additional 1000-2000 images and associated data to upload to Arctos.

**MPM -** CM Julia Colby is in the process of hiring someone to complete the project this spring.

**PSU -** Two undergraduates, Tara Presnall and Celia Graef, contributed to the TPT project this quarter totalling 8.75 people hours. During this time, 91 specimen labels were transcribed and 50 vials were rehoused with fresh 75% ethanol. All students working on the TPT project from last semester successfully obtained more permanent positions elsewhere in the scientific field. A new part-time staff member is anticipated to join the TPT team February 2023 and stay on through May.

**WIRC** - PI Brabant is in the process of interviewing new people to train and join the TPT project. WIRC is on track to complete their digitization goals by the end of 2023.

**UM** - CM anticipates hiring and training additional project help this coming quarter as the previous student Research Assistant on the project had class scheduling conflicts this semester.

**UNH -** Two students have been trained and are working on the TPT project. One student is digitizing/imaging mosquitoes and while the other student does CLSM on lice.

**UWSP -** Six students from PI Orlofske's Animal Parasitology Course participated in Course-Based Undergraduate research activities involving TPT. The group engaged in slide making activities of lice and analysis of historical trends in avian lice records from the collection. Students learned both hands-on specimen and data analysis techniques. Additionally, two new students are potentially starting work on TPT this spring after one of the students who intended to start in fall had health issues and could not participate. PI Orlofske took advantage of the gap in student help over the winter break to work on new cyber infrastructure for the TPT project including backups of materials on our Microsoft OneDrive account as well as Microsoft TEAMS. New students will be trained on the new workflow for backing up images and other related TPT data.

# 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 is also 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.

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

*Other TCNs & Grants.* TPT is collaborating with the **NSF TCN Big-Bee** group and the newly funded **NSF TCN iDigBees** digitization initiative by sharing workflows, digitization and project management insights, and technical expertise. In addition, members of TPT are lending expertise to the **USDA funded National Native Bee Monitoring RCN** and PM Tucker is co-organizing a data management workshop on topics relating to bee monitoring data preservation, management, best practices and standards, sharing, and contributor attribution. This will not only help develop better monitoring protocols, but also better standardize data collection methods which will hopefully lead to pre-digitization efforts and smoother incorporation of new collection data into both internal and shared databases.

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

resources. These tools and resources will well equip new managers and curators to care for and improve their collections.

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

## Share Opportunities and Strategies for Sustainability

Multiple TPT PIs are actively involved with and are collaborating on the BugFlow repository project. Workflows and tools developed by TPT have started to be added to the repository and continue to be added as each item is completed. Workflows and tools shared on this platform are available through the working side of GitHub (https://github.com/EntCollNet/BugFlow). In order to make the workflows more accessible to a broader audience, all workflows and information deposited on BugFlow are also available through a public facing webpage for those not comfortable using GitHub directly (https://entcollnet.github.io/BugFlow/). Many TPT providers are contributors of various modules, including slide imaging (both high and low resolution), papered specimen archival protocols, project management, curation, georeferencing, and data transcription.

The TPT group played an important role in the 2022 Entomological Collections Management Workshop (ECM). In addition to TPT members presenting at the workshop, and participating in the workshop, PI Zaspel (MPM) was 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). PI Zaspel is currently collaborating on organizing this year's 2023 ECM workshop as well. The ECM workshop is one of the most important collections training opportunities within the entomological community and offers an ideal 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 in obtaining funding for the new iDigBees TCN and will continue to offer expertise and support to the 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 and inter-institutional communication and collaboration between more experienced TCN participants and newer ones to facilitate sustainability, productivity, and reduce stress for everyone involved.

The TPT group continues to work closely with GloBI creator Jorrit Poelen on improving the "how-to" page (https://www.globalbioticinteractions.org/how-to) on GloBI. GloBI is an amazing resource for the scientific community, but it can often be a bit challenging to navigate and find a particular resource needed. The 'How-to' page on GloBI consolidates pre-existing, but disparate

GloBI instructional resources, as well as adds additional documentation for both new and existing methods that can be used for GloBI data. One of the new functions we developed and documented is a script that can query and download records for multiple taxa in a given list all at once. We believe usability of a given resource, such as GloBI, goes a long way in helping to sustain these types of resources in the long term.

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

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

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

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

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

As part of Entomological Collections Management workshop and to facilitate the remote attendees at the workshop, multiple TPT participants contributed to the creation of a website with a reusable lesson plan and hands-on activity examining species interaction data and interpretations. The goal of the website activity is to help data providers better understand the data they may come across in their collections, what it means, and how it may be used by future researchers downstream. Website and reusable/modifiable lesson/interactive activity, the Interaction Data Interpretation Workshop, are available online here: www.globalbioticinteractions.org/ecm-workshop.

## Share Information About Your Website and/or Portal Usage

To date, the TPT Notes from Nature project has completed **42 expeditions, 180,747 transcriptions** for 55,997 unique specimens, and provided learning experiences for **2,471 citizen**

**Scientists** and **volunteers**. TPT Notes from Nature statistics: https://www.zooniverse.org/projects/md68135/notes-from-nature-terrestrial-parasite-tracker.

The latest GloBI report included all TPT collections and collaborators indexed as of October 13, 2022. The total number of interactions included in this reporting period is **794,320** records (500,000 interactions was the overall goal for TPT). The full TPT biotic interaction dataset published on Zendo has been **viewed 1,045 times** and been **downloaded 396 times:** https://zenodo.org/record/7194486#.Y1wVtezMKjQ.

## Share Other Activities and/or Progress

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

Conferences, Presentations, & Symposia

***Annual Midwestern Conference of Parasitologists Meeting***

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

***Entomological Collections Network, Annual Meeting***

Many people involved in TPT attended the 2023 ECN annual meeting in Vancouver, BC (MPM, UMMZ….). The following groups also gave presentations:

- (**CU**): Deczynski, A., Caterino, M. Ferro, M.L. The Terrestrial Parasite Tracker project and beyond: A decade of digitization at the CUAC.
- (**FMNH**): Albion, Z., Bailey, C. Empowering volunteers in a large scale digitization effort; highlights from Field Museum's Terrestrial Parasite Tracker project.
- (**INHS**): Hart, L.V., Kohler, M., Mason, S., Struckhoff, E., McElrath, T. Got parasites? We do! The Illinois Natural History Survey's workflows for the Terrestrial Parasite Tracker TCN using TaxonWorks. *Poster*.
- (**MPM**): Caywood, A., Buntin, M., Julia, J., Tyrell, C., Zaspel, J. Show and tell: Finding other ways of knowing in digitized specimens. *Poster*.
- (**MPM**): Tucker, E., Zaspel, J. Terrestrial Parasite Tracker (TPT) Beyond the TCN: Project Sustainability.

**ANS** engaged and interacted with employees for a 1 hour presentation about TPT louse macropod images and the corresponding hosts.

Publications

- Poelen, Jorrit H., Seltmann, Katja C., Campbell, Mariel, Orlofske, Sarah A., Light, Jessica E., Tucker, Erika M., Demboski, John R, McElrath, Tommy, Grinter, Christopher C, Diaz-Bastin, Rachel, Bush, Sarah E, Delapena, Robin, Cook, Joseph, Gall, Lawrence F., Whiting, Michael F, Clark, Shawn M, Cameron, Stephen L, Replogle, Charla R, Rund, Samuel S.C., … Bailey, Colin. (2022). Terrestrial Parasite Tracker indexed biotic

interactions and review summary (0.7) [Data set]. Zenodo. https://doi.org/10.5281/zenodo.7194486

- Dr. Nicolas J. Dowdy, Dr. Erika M. Tucker, Jorrit Poelen, Dr. Vijay Barve, Teresa Mayfield-Meyer, Kathryn Sullivan, & Dr. Jennifer M. Zaspel. (2022). njdowdy/tpt-taxonomy: TPT Taxonomic Resource v2.0.0 (v2.0.0) [Data set]. Zenodo. https://doi.org/10.5281/zenodo.7215550