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

August 2021

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☒ Endless Forms	☐ oVert	☒ TORCH
☒ ESB	☐ PCC	☒ TPT
☒ GLOBAL		

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

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CALIFORNIA PHENOLOGY TCN – QUARTERLY REPORT – AUGUST 2021

Assembled by Katie Pearson, 2 August 2021

PROGRESS IN DIGITIZATION EFFORTS

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

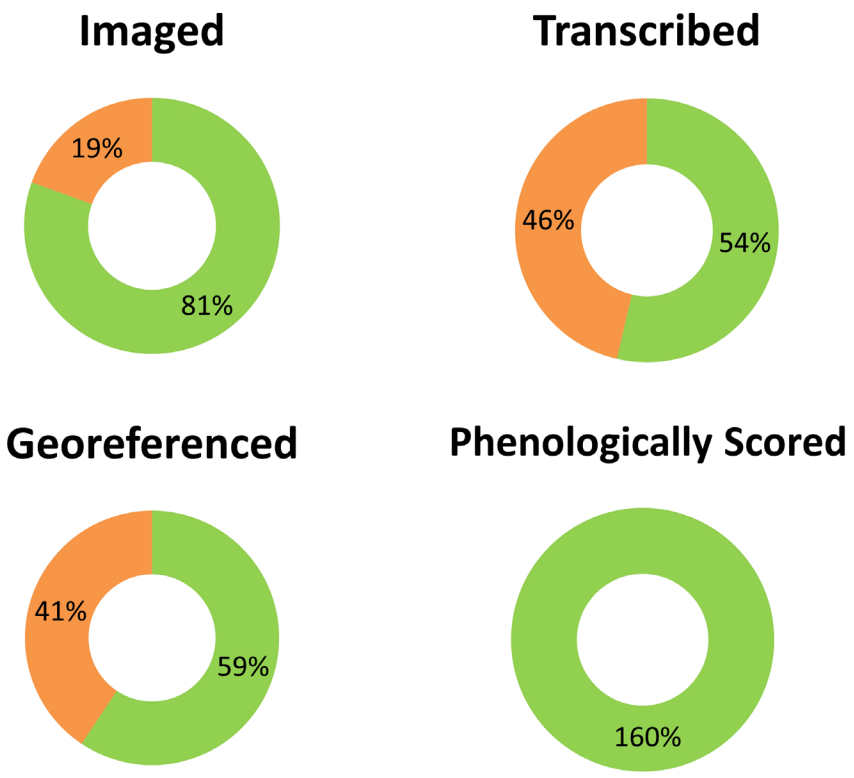

Figure 1. Progress in each of our four major digitization goals. Totals represent the original goals of the CAP grant: 902,400 specimens imaged and phenologically scored, and 300,000 transcribed and georeferenced. Additional specimens to be digitized by the PEN grant are tabulated in the PEN section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

TRANSCRIPTION

An estimated 161,000 specimen records have been transcribed across the CAP Network since the beginning of the project. This is approximately 54% of our goal.

Transcription has largely been accomplished by institutional volunteers and technicians in CCH2 and online volunteers in Notes from Nature.

GEOREFERENCING

We have georeferenced over 178,000 specimen records, which is 59% of our goal. Georeferencing is conducted by trained staff and students at HSC, OBI, and SD, by naturalist volunteers are part of the "100 Club," and by undergraduate students in the cross-institution herbarium digitization course led by Cal Poly. The CAP 100 Club currently has 28 active members who have collectively georeferenced over 8,000 specimens since September 2020. We have also continued to use the code we developed to convert township, range, section data into decimal coordinates to apply georeferences to specimens from other states, as they are transcribed.

IMAGING

Twelve of our 22 herbaria (55%) have accomplished their imaging goals (Figure 2). Of the remaining herbaria, seven have resumed imaging since the COVID-19 shutdowns. The other herbaria have used this time offsite to process images, georeference specimens, and transcribe specimens. Figure 2 shows the current state of CAP imaging as of July 2021.

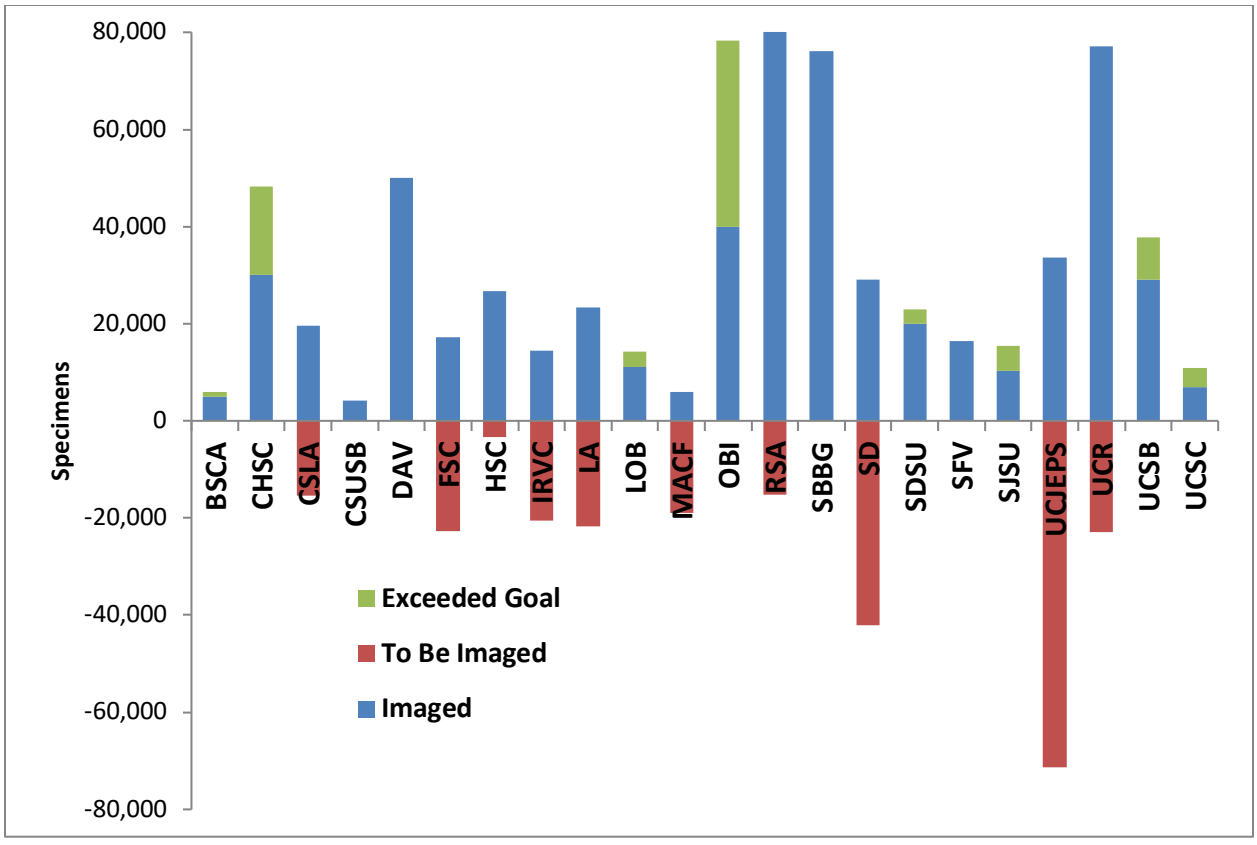

Figure 2. Herbarium specimen imaging progress. Blue portions represent the number of specimens that have been imaged, while green portions represent the number of specimens that have been imaged beyond the expected target specimens. Red bars below the zero line indicate the number of target specimens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

PEN PROGRESS

UNLV successfully completed their imaging goal and sent the equipment to SHTC. The CAP PM visited SHTC to train PI Gardner and a student technician in all steps of the digitization process. Imaging has begun at SHTC as of July 21st. Imaging has continued at SFSU and OSC, which have completed 7% and 41% of their goals, respectively. CDA is continuing to work on acquiring imaging equipment. Figure 3 shows the current imaging progress at PEN institutions.

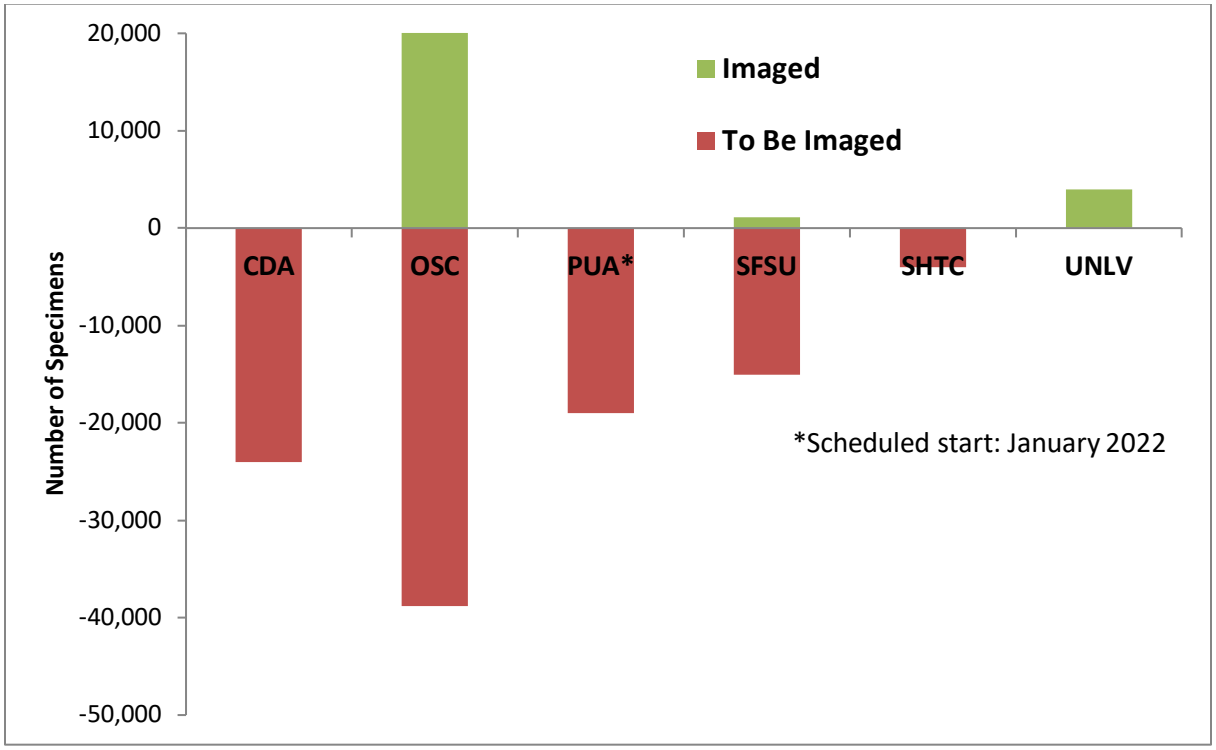

Figure 3. Herbarium specimen imaging progress for the seven PEN institutions. Green portions represent the number of specimens that have been imaged, while red bars below the zero line indicate the number of target specimens that have not yet been imaged. For SD, the total number of specimens to be imaged,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

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

We held a meeting of the data standards advisory committee to plan for forming a TDWG Task Group to develop a Plant Phenology Extension for the Darwin Core. We have drafted a Task Group charter and will submit it to TDWG leadership in the coming months.

After a process of gathering community statements, holding a community webinar, and discussion of the Admin Committee, the Consortium of California Herbaria moved to continue the data protection policy for sensitive taxa (e.g., threatened species). We will continue to publish all data openly, but community members may petition to protect data for specific taxa that may require protection due to poaching or other threats. In this situation, the petition will be considered by the CCH Admin Committee and potentially an assigned ad hoc committee of evaluators. Individual herbaria are free to redact data

on a specimen-by-specimen basis, but they are encouraged to discuss with the community prior to redacting data for an entire taxon from their dataset.

IDENTIFY GAPS IN DIGITIZATION AREAS AND TECHNOLOGY

We are developing a way to search for specimens based on taxon-level traits, such as CNPS rarity ranking.

Our community has expressed concern over the long-term sustainability and cost of storing image data. While some institutions have access to institutional cloud storage, others do not. Even those that do face an uncertain future that depends on the continued support by these cloud storage services, which has been liable to change with changes in the economy.

SHARE AND IDENTIFY OPPORTUNITIES TO ENHANCE TRAINING EFFORTS

In July 2021, the PM visited CSU Stanislaus to set up the imaging equipment and train the PI and a student technician in imaging and image processing protocols.

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.

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

As previously described, we are building a TDWG Task Force that involves phenological researches from multiple non-California institutions including Agrifood Canada, Florida Museum of Natural History, Yale, and others.

CCH2 data are now searchable on Calflora, a popular website for searching California plant occurrences. As per our recently improved memorandum of understanding with Calflora, these data will be continuously updated on their site, and users of Calflora will be directed to CCH2 to learn more or post comments on the specimen records.

PM Pearson continues to advise the new GLOBAL Lichens and Bryophytes TCN on matters of reporting, georeferencing, and other needs.

SHARE AND IDENTIFY OPPORTUNITIES AND STRATEGIES FOR SUSTAINABILITY:

We are prioritizing outreach within the California botanical community and beyond to publicize the resources that we have built. For example, we presented at the Digital Data in Biodiversity Research conference and the Botany 2021 conference and highlighted the use of our resources in each. We are also scheduled to present about the CCH2 at the Ecological Society of America 2021 meeting.

As previously described, we are also building a TDWG Task Force to develop a phenology extension for the Darwin Core. In this way, we hope to enable future collection and sharing of phenological data and ensure that the data we have created for this project will be available for research into the future.

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

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

Four blog posts were written and published to the CAP website: https://www.capturingcaliforniasflowers.org/blog-recap. Blog posts are publicized via Twitter and the "Herbarium Junkies" Facebook page.

Three Notes from Nature expeditions are ongoing, consisting of 5,943 specimens from Cal Poly, Cal State LA, and UC Los Angeles. Although volunteer activity has largely slowed in the summer, we expect to see an increase in traffic in late fall as we prepare for WeDigBio.

We concluded the spring 2021 quarter of the online digitization course in mid-June. This "advanced" session involved 16 students and 2 volunteers from seven institutions. The participants processed 543 specimens in 10 weeks and were able to georeference 485 specimens from Kern and Humboldt counties in California. We are currently recruiting for this course to run during the fall 2021 quarter.

PI Mazer also concluded the phenological research course at UCSB in the spring 2021 quarter. This course engaged 15 students and resulted in 15 posters that summarized the result of phenological analysis of herbarium specimens from CCH2. UCSB graduate student Tadeo Ramirez Parada worked with Mazer to improve the R code for analyses during the course, and throughout the summer, PM Pearson worked with Ramirez Parada to integrate the improved code into the published curriculum. An improved version of the curriculum, complete with coding demonstration and a simplified "students' code" was published on July 9 in QUBES (https://qubeshub.org/publications/1956/3).

We also developed a 3-hour workshop or lab version of the phenology research course in preparation for phenology workshops at UCSB. This version involved simplifying the analysis code, paring down and combining slides into a single presentation, and producing a "workshop packet" that leads participants through the process of conducting phenological analyses using herbarium specimens. We also prepared example datasets to streamline the technical part of the workshop. The workshop version is published on QUBES (https://qubeshub.org/publications/2476/1).

We gave oral presentations at the Digital Data in Biodiversity Research conference in June 2021 (https://youtu.be/xhETSXatHho) and at the Botany 2021 conference (https://youtu.be/guNGMmMupDc). In each of these talks, we highlighted the tools and resources developed by the CAP TCN and how they can be used by the community. In the Botany 2021 conference, we discussed research conducted by PIs Yost and Mazer, postdoc Love, graduate student Ramirez Parada, and PM Pearson to analyze the phenological sensitivity of the California poppy to climate change across the state. This research is currently in press in the journal *Madroño*. The PI at Fresno State

also presented a poster about digitization at her institution for annual conference of the Society for the Preservation of Natural History Collections (SPNHC).

WEBSITE AND PORTAL USAGE

Our project website (capturingcaliforniasflowers.org) has received 1,296 visits and 1,922 page views from May 1 to August 2, 2021. The data portal (cch2.org) has supported 23,889 sessions, 113,025 pageviews, and 12,252 users over the same time period.

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

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

Person Completing the Report (Libby Ellwood co-PI, Regina Wetzer, PI)

Share Progress in Digitization Efforts

ALMNH: Kevin Kocot: ALMNH has been working to digitize some historical marine invertebrate specimens. This involved a lot of research to decipher old numbering systems. We have figured a lot of these out and that will be very helpful moving forward. Our efforts this quarter have mostly been focused on material collected during our 2020 Antarctica research cruise. We are currently editing records to fix typos, etc. and aim to upload around 2500 Antarctic specimen records and their 'parts' this quarter. We have also been doing a lot of physical organization, cleaning, and triage of historical specimens in the collection.

AUMNH: Nusrat Noor: We have been working through material collected on previous Antarctic cruises that have been on backlog until now, along with setting up for the incoming material form the 2020 Antarctic cruise, and have 1,208 lots that are ready for digitization.

AMNH: Estefania Rodriguez, Lily Berniker: We continue to upload our scanned card catalog images (5,146), create skeletal catalog records and complete transcription of the information (4,931). We are doing quality control on our locality records (373 new; 553 updated) in preparation to submit these records for georeferencing. Taxon (945 new; 809 updated), party (160 new; 138 updated), and expedition (9 new; 3 updated) records are being created, updated and verified. Senior Personnel, Lily Berniker, is investigating, updating and creating previously undigitized accession records (167 new; 103 updated), as well as preparing cards of another group (Tunicates) for the volunteers and digitalizers to transcribe. We have finished imaging and databasing specimens onsite in the collection of uncatalogued Brachiopoda; imaging of dry crustacea is ongoing.

ANSP: Paul Callomon: 63 type lots retrieved, rehoused and researched. New entries created in the database.

BPBM: Holly Bolick: This quarter we pre-curated roughly 248 lots that are ready for digitization, we added an additional 232 new specimen records in the database; we now have 311 in situ invertebrate images organized (inventoried, categorized, relabeled) and moved from expedition folders into specimen image folders (by taxon) but not yet matched to specimen records; we added 505 specimen images (linked by catalog number) transferred from accession folders into specimen folders (by taxon and catalog number); we took 14 new specimen images for newly cataloged records.

CAS: Christina Piotrowski: Zooniverse, Notes from Nature Invertebrate Time Machine Project (NfN, ITM): Coll. staff have built a team of more than 1,896 volunteer transcribers, an estimated 900 of which transcribed records during this quarter. CAS staff trained and engaged these volunteers via more than 800 questions and comments by transcribers this quarter. Zooniverse Recent progress: this quarter ITM volunteers transcribed data for 4,320 catalog cards, each transcribed independently by 3 volunteers during 25,920 classifications (including 3 X duplicate transcriptions in two separate workflows). We continued preliminary QA/QC/reformatting of previously transcribed data to prepare it for ingestion, checking an equivalent of approximately 1000 records (data is QA/QC'd by field rather than by record). During in person workflow trials, our summer intern scanned 437 specimen labels, assigned unique identifiers, and entered skeletal collection object data. Coll. staff scanned content for 33 CAS Station List Files for efficient future reference during data capture, and to share with our TCN collaborators as appropriate. Some of this digitized content will eventually be made publically available via our Specimen Data portal to supplement specimen records.

FWRI: Paul Larson: 115 records fully digitized & cataloged.

HBOM: Dennis Hanisak: We have set up our imaging station, have developed initial protocols for the work, and are training HBOM personnel using non-NSF samples and other funding so that we can maximize our use of our NSF funds for this project.

MCZ: Adam Baldinger: 546 uncataloged lots (mostly echinoderms) were databased this quarter from spreadsheet data; to date, 5,067 records in our database were cleaned/vetted for accuracy, and of these, 4,996 with verified georeferences. "Named Group" page developed in our database for public access to gather information about the grant, records/specimen lots associated with DigIn, including searchable links/breakdown of records by taxa, geography (i.e., by ocean, country, islands, etc.), images, collectors/agents; includes links to the DigIn web page and iDigBio (DigIn) pages. (https://mczbase.mcz.harvard.edu/grouping/showNamedCollection.cfm?underscore_collection_id=81)

NCSM-NMI: Megan McCuller: Currently slow due to working on outreach efforts for our museum summer camps.

NHMLA: Regina Wetzer: We have been working on building work flows, including purchasing equipment and supplies, creating mobile workstations, building data capture procedures and data structure to be able to incorporate collected data into existing databases.

NMNH: William Moser: Data captured 1,604 records and created 5,144 station data records

RSMAS: Nikki Traylor-Knowles: Scans: we finished scanning cards and books. I'm reporting by pages a total estimated (difficult estimation) of 3800. For data entry a total of 6733 Mollusca 5830, Cephalopod 150, Protozoa 51, Porifera 210, Hydrozoa 50, Scyphozoa 23, Alcyonaria 232, Zoantharia 187, TOTAL: 6733. We also have been scanning the cruise data: total 3149, April: 888, July: 2,261

SBNHM: Vanessa Delnavaz: We have cataloged 4,785 lots in Q3, and have added 5,214 images to our database (images not yet available online).

SIO-BIC: Charlotte Seid: Created 197 digital records, captured 8 images, created 16 locality records, and georeferenced 746 locality records as part of routine collection management.

SIO-PIC: Linsey Sala: Pre-curated ~1,500 specimens as part of our DigIn material assessment to create more efficient workflows for data capture, labeling, and sample organization.
UCM: Leanne Elder: We have digitized 329 specimen lots and imaged 170 lots.
UF: Gustav Paulay: See spreadsheet.
VIMS: Jennifer Dreyer: 551 records have been entered into Excel this quarter. I am working on finalizing the Specify forms in the database so data can be uploaded through the workbench.

NOTE that a selection of quantitative progress measures has also been reported:

	Grant proposal commitments		Commitments completed		Records ready to upload	Georeferencing			Curation	Specimen photography		Label or catalog data capture				Direct capture from specimens			Logs captured	
Institution	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 digitzation	Specimen images taken	Specimen images QCed and databased	Records imaged from ledgers, cards, or labels	Records OCRed or transcribed	Records QCed	Records databased	Specimen records directly captured from specimen labels	Specimen records QCed and databased	(If you have other quantities you're working on, add columns)	Field Notes and Station Files digitized	Comments
ALMNH	5,250	0																		
AMNH	56,708	7,000	0	0	0	926	0	0	0	1401	1101	5146	4869		4931*	0	0	0		*records transcribed from images directly into data
ANSP	22,060	1,600																		
AUMNH	10,000	5,000																		
BPBM	6,238	3,900			232				248	14	505									
CAS	59,616	3,500	0	0	0	0	0	0	0	11	0	471	4,320	1000	0	0	0		33	
FMNH	1,140	50																		
FWRI	33,582	150			115															
HBOM	10,000	0																		
MCZ	31,564	4,631	4,563	10	5,068*	4,996**		0	0	0	0	0	0	0	546	0	0	0		* all records vetted and can be or already are avail
NCSM-NMI	31,283	675																		
NHMLA	320,000	2,572	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0			
RSMAS	55,000	0	0	0	0	2261	0	0	0	0	0	3800	0	0	6733					
SBNHM	100,000	4,500	1,271	0	3,514	0	0	0	0	0	0	2,610	0	0	1,260	3,525	3,525			iDigBio IPT down since June, unable to upload nev
SIO-BIC	29,300	30,000	0	0	0	746	0	746	0	8	0	0	0	0	0	194	194			
SIO-PIC	34,371	0	0	0	0	0	0	0	1,500	NA	NA	0	0	0	0	0	0	0		
UCM	3,285	1,000	0	0	0	0	0	0	0	170	0	0	0	0	329	329	0		0	
UF	20,000	400,000	2214	8885	1269	0	0	15375	0	0	20000	0	0	0	0	2214	0	0		
VIMS	6,000	125	0	0	0	0	0	0	0	0	0	0	0	0	0	551	0			

The quantitative table can be accessed here:
https://docs.google.com/spreadsheets/d/14XQdodaJm8TJc9rTQEzuB1gRZNzQcROj_ABYYLaYLJQ/edit#gid=0

Share Best Practices, Standards, and Lessons Learned

AMNH: Estefania Rodriguez, Lily Berniker: When imaging material and labels we found it more efficient to work first with all the dry material and follow up with the wet material since imaging set up and protocols are very different for both kinds of material. Organizing and preparing information for volunteers and digitizers to work on without duplicating efforts has been a challenge; we found creating skeletal records with cards attached prior to adding any data is more efficient to avoid effort duplication.
AUMNH: Nusrat Noor: We have been taking notes on the recommendations/successes from the workflow working group to better create our workflow and adapt it to our specific needs.
BPBM: Holly Bolick: When running into "problem containers" or containers that do not fit into the normal workflow, these should be triaged in some standardized way to avoid disrupting the workflow; occurring mostly with wet specimens in jars with multiple vials; (e.g. uncataloged lots mixed in with cataloged specimens, dried/desiccated specimens, labels missing or with incomplete data).
CAS: Christina Piotrowski: Zooniverse: We continued to refine our specimen catalog card transcription project, sharing workflows and lessons learned from our project with an International community of Invertebrate Zoology collection staff (membership base of IZIG);

we shared progress and workflow innovations with the team from NHMLA as we both develop parallel workflows during informal meetings. NHMLA assisted us with troubleshooting and barcode formatting and we've each developed and shared our institution-appropriate solutions for implementing barcodes and QR codes during label digitization.

On site: CAS finalized a preliminary workflow to scan and transcribe label data from specimen jars. We have implemented temporary QR codes for file renaming and we drafted clear instructions and flow charts for documentation and training of workers. We set up a scanning workstation in our collection space and are in the process of building a second station for added efficiency. We continue to refine this preliminary workflow based on practiced time trials to create a more efficient process which we will further test next quarter using volunteers in advance of hiring grant staff.

HBOM: Dennis Hanisak: We have set up an immersion tank for imaging the wet samples to produce better images.

MCZ: Adam Baldinger: Permanent staff are involved in project working groups and participate in Steering, Expedition and Georeferencing committees/work groups. Information is then shared with others in MCZ's Invertebrate Zoology and Malacology departments, including those working on other TCN's (ESB and PILSBRy). Various staff members working on the project participate (via zoom) in DigIn monthly ESB general meetings and monitor communications shared on various Slack channels.

NCSM-NMI: Megan McCuller: Taking detailed notes on workflow are often not high on lists of priorities (at least from my experience). Doing so has been helpful for me to refer to, and I know this will be helpful when we hire our technician.

NHMLA: Regina Wetzer: Dissecting digitizing workflows into subunits such that others less experienced than senior collections staff can follow and quickly come up to speed. This is a slow, iterative, and at the beginning an extremely time consuming process.

NMNH William Moser Pivoted to scanning wet labels and imaging slides for remote data capture.

RSMAS: Nikki Traylor-Knowles: We have been focused on the scanning and data input. So far so good.

SBNHM: Vanessa Delnavaz: Construction is ongoing on the collection roof and HVAC system, which has lessened collection staff onsite at times (no ventilation, hot, noisy work conditions). Mixture of onsite and remote work.

UCM: Leanne Elder: Leanne Elder is on the following working groups: Best Practices, Specify and Workflows.

UF: Gustav Paulay: Continuing with existing practices and standards.

VIMS: Jennifer Dreyer: I am participating in the Specify, Workflow, and Georeferencing Working Groups to figure out what best practices will be for implementing efficient workflows that are consistent with other DigIn institutions.

Share Identified Gaps in Digitization Areas and Technology

AMNH: Estefania Rodriguez, Lily Berniker: We are still waiting for a copy-stand and lighting that are in backorder for improving our imaging workflow.

ANSP: Paul Callomon: Problems remain with duplicate numbers due to several catalogs having been created over the 200+ year history of the collection.

AUMNH: Nusrat Noor: While much of our existing data is already in excel, they are formatted incorrectly in a wide variety of ways, and we are still working on figuring out how to reformat them in large batches so as to be able to upload them faster but until then we have to do it individually which can be time consuming.

BPBM: Holly Bolick: The reporting function of our database is a bit clunky and not user friendly at the moment; working with database coordinator to fix this to make generating numbers and data for reports easier in the future; database link is still not functional for attaching images and other media but it is in the works.

CAS: Christina Piotrowski: CAS has technology gaps related to georeferencing (we have not implemented protocols for this process and our staff are not trained). One identified current roadblock is the ability to pull newly georeferenced records back into Specify. Similar challenges will be met as we share expedition data with our partner institutions to standardize and repatriate it. We will also be somewhat challenged as we ramp up our work by final tweaking of the data fields and protocols and while training ourselves on the use of our new Specify database.

HBOM: Dennis Hanisak: This quarter we addressed the gaps identified in the previous report (developing an image analysis station and barcoding the HBOM specimens): no new gaps identified.

MCZ: Adam Baldinger: macro-photography work-station for imaging now available for use.

NCSM-NMI: Megan McCuller: Document camera and photographing internal labels, some of which are faded and/or falling apart. Digitizing microscope slides. Working with database management at the institutional level is cumbersome.

NHMLA: Regina Wetzer: So far, we have had the needed technology available.

RSMAS: Nikki Traylor-Knowles: We need to get a website and a database management software chosen.

SBNHM: Vanessa Delnavaz: iDigBio IPT is down after massive system failure. Unable to upload data to iDigBio since the end of May.

SIO-BIC: Charlotte Seid: We were informed that our previously established data publication pipeline (via the VertNet IPT) has been discontinued, so along with other DigIn collections we will need to set up a new IPT.

SIO-PIC: Linsey Sala: same as SIO-BIC.

UCM: Leanne Elder: Specify database is not yet complete and likely needed for georeferencing.

VIMS: Jennifer Dreyer: There are still big gaps for me in learning Specify and using the workbench. I am participating in the Specify working group and attended the meeting with Specify principals to get answers for all of the Specify working group questions. I was waiting until this meeting was done to move forward with deciding on forms and taxon trees (via WoRMS). I have asked Specify to add a few new forms for verbatim locality and verbatim date. Once that is complete I will have to go back to card catalog cards and add that data to the records we currently have. I am still corresponding back and forth with Specify on the best way to move forward with the most recent WoRMS taxon tree. That is the last item before finalizing the database and move forward with uploading Excel records into Specify.

Share Opportunities to Enhance Training Efforts

AMNH: Estefania Rodriguez, Lily Berniker: We will be training an additional digitizer in August.

AUMNH: Nusrat Noor: We hired a grant-funded undergraduate student this quarter who we are currently training.

CAS: Christina Piotrowski: We have an opportunity for CAS to help advise potential users of Zooniverse - NfN for DigIn activity if funding can be secured for DigIn to use NfN services following on CAS's ""pro bono"" pilot project. Last quarter we shared our experiences on Zooniverse – Notes from Nature with our DigIn team members. This quarter we described workflows and shared strategies and lessons learned from our project with the International community of Invertebrate Zoology collection staff (membership base of IZIG [Invertebrate Zoology Interest Group).

During our Specify Working Group meetings we discussed best practices and met as a group with several staff members from Specify to ask questions and discuss our respective DigIn-related CMS needs. CAS programmer Jon Fong also participated in these working group discussions as a technical resource.

MCZ: Adam Baldinger: Various staff members participated in a workshop on imaging museum specimens.

NCSM-NMI: Megan McCuller: We are working on hiring our grant-funded technician position and they will need to be trained in all aspects of the digitization process.

NHMLA: Regina Wetzer: We will be training new data collection staff in early August. So far, we have no great insights into what works well and what will need modification.

NMNH: William Moser: Presentations at DigIn All-Hands meetings.

RSMAS: Nikki Traylor-Knowles: We have had two masters students working since March in the museum on digitizing and scanning the cards and books in our collection.

SBNHM: Vanessa Delnavaz: One of our curatorial assistants has left. We will rehire once roof construction is complete (fall) and training will be necessary at that time.

SIO-PIC: Linsey Sala: Initiating training of two undergraduate assistants in preparation for on-site digitization efforts.

UCM: Leanne Elder: Leanne Elder dresented at Workflows meeting on UCM protocol for epibiont cataloguing workflow using inselect.

VIMS: Jennifer Dreyer: I attended the Imaging Workshop: Specimen Photography in Museum Collections hosted by Paul Callomon of ANSP to learn about setting up an imaging station for specimens. While I am not sure we have the funds to purchase the equipment needed, it was very useful in describing the best way of capturing specimen images.

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

AMNH: Estefania Rodriguez, Lily Berniker: We established a new collaboration with University of Northern Iowa, acquiring a life-long research collection of crustaceans.

BPBM: Holly Bolick: We were able to incorporate 4 interns from an ongoing multi-year education grant (NSF's NHEP program) at the museum this summer; interns were trained in digitization and assisted with the project by cataloging specimens, imaging specimens, and sorting specimens (to prep for cataloging).

CAS: Christina Piotrowski: Our DigIn team as a whole, or CAS alone, collaborated with the ESB TCN; Zooniverse/Notes from Nature; and WoRMS (or taxonomic data downloads for standardizing/upgrading CAS taxon tree).

MCZ: Adam Baldinger: Information is shared among permanent MCZ staff working on other TCN's: ESB and PILSBRy, and an NSF CSBR cryogenic collections grant.

NCSM-NMI: Megan McCuller: I have participated in the Workflow Working Group, presented at the DigIn All-Hands Meeting, and helped identify possible social media strategies.

NHMLA: Regina Wetzer: In addition to the collaborations reported last quarter, we are also expanding our interactions and cooperation with non-DigIn funded institutions and collections both nationally and hopefully internationally at some point too. https://www.digin-tcn.org/partners.html

NMNH: William Moser: With Chrissy Piotrowski, invited international IZ Interest Group (IZIG) to DigIn communication and training.

RSMAS: Nikki Traylor-Knowles: We are working with UDelware on Molluscs (eastern seaboard)

SBNHM: Vanessa Delnavaz: Worked with California Department of Fish and Wildlife to obtain station records for several cephalopod specimens.

UF: Gustav Paulay: ESB, Pilsbry and DigIn collaborations.

Share Opportunities and Strategies for Sustainability

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

NHMLA: Regina Wetzer: This quarter, co-PI Libby Ellwood, led the development of a strategic plan for the DigIn project.
NMNH: William Moser: Scanning wet labels and imaging slides for remote data capture.
UF: Gustav Paulay: UF curation is sustainable.
VIMS: Jennifer Dreyer: While not part of the funding for DigIn, I have purchased new vials for part of the collection so we can transfer specimens at risk for desiccation due to leaking jar/vial caps. The long term care of the specimens will be much more sustainable with proper storage containers.

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

ALMNH: Kevin Kocot: We are developing a museum exhibit on the animal tree of life, taxonomy, and systematics. It will feature many different invertebrate specimens from our collections.
AMNH: Estefania Rodriguez, Lily Berniker: DigIn digitizer Gusmão gave a talk to summer camp children about invertebrate diversity and collections and our work on them. Rodriguez has scheduled an upcoming talk to the AMNH volunteers department to share about her marine invertebrates research and collections. Newly established collaboration with Iowa University provided the opportunity to expose and train undergraduate students in collection curation techniques; a blog about this experience has been posted on the university website.
ANSP: Paul Callomon: Various general-invertebrate-related posts to relevant Facebook groups (Natural History Collections etc.).
AUMNH: Nusrat Noor: We have done multiple tours for after-school programs as well as holding two, week-long summer camps.
BPBM: Holly Bolick: Four summer interns participated in the DigIn project and shared their experiences through presentations, video blogs, and educational outreach activities.
CAS: Christina Piotrowski: CAS hosted an undergraduate from Wake Forest University for 50 hours this quarter during a DigIn summer internship, where he practiced and helped troubleshoot our planned workflows for label imaging and skeletal specimen data capture. CAS also mobilized approximately 900 volunteer transcribers to crowdsource collections data this quarter (a total of 1896 transcribers since October). We have a number of students working on the project, as well as several docents who work on our museum's main floor engaging with the public. This quarter we received more than 802 questions and comments from our Zooniverse NfN ITM transcribers and CAS staff responded to hundreds of questions about label data that inspired transcribers' curiosity, provided content describing the value of historical marine collections data and engagement by describing captivating collections and collector ""stories"" in the collaborative Zooniverse Talk tool. Our transcribers researched and discussed historically significant collections, researched geography and taxonomy of highly diverse specimen records, and encountered and digitized data records for several extinct species this quarter.

NCSM-NMI: Megan McCuller: Have, and will continue, to assist lead PI with social media strategizing. E&O activities we are currently working on for NCSM summer camps—3D scanning and printing collection specimens—have been useful in developing a workflow for this process. 3D models have already been shown to be a hit with the public, as they make something traditionally untouchable (delicate/fluid-preserved specimens) something that can be physically interacted with.

NHMLA: Regina Wetzer: *The Dive Into Marine Biodiversity Workshop* was executed with great success, serving CSUDH STEM teachers and NHMLA Marine Teens interns. This also resulted in a series of Spanish language interviews aired on Univison34LA TV pieces which each aired multiple times. DISCO Week aired in four pieces early morning weekdays and on weekend Mujeres y Education. Also in internal NHM video and one to be produced by L.A. County will be forthcoming.

RSMAS: Nikki Traylor-Knowles: We have trained two masters students on scanning and digitization best practices.

SIO-BIC: Charlotte Seid: Conducted 4 E&O presentations (3 hrs) for elementary through graduate students, highlighting invertebrate biology and the value of digitized museum collections.

SIO-PIC: Linsey Sala: Conducted virtual collection tour for our Research Experience for Undergraduates summer program, completed virtual teaching assistance for graduate level course in Marine Zooplankton, working with resident artist at Scripps Birch Aquarium on plankton murals representing planktonic and pelagic fauna within our local marine protected areas, working with local author on children's book describing the importance of SoCA Bight fauna.

UCM: Leanne Elder: full day activity for Girls at the Museum Engaging in Science (GAMES) focused on Invertebrate collections and invertebrate parasites, as well as a DNA extraction activity.

UF: Gustav Paulay:Student mentoring at Friday Harbor Labs and UF in summer projects.

VIMS: Jennifer Dreyer: VIMS has remained closed to the public but will open back up in the Fall for public tours and outreach events. I anticipate that at that time there will be an increase in education and outreach events associated with the Invertebrate Collection.

Share Information About Your Website and/or Portal Usage

The skeletal project website is up at https://digin-tcn.org. The Symbiota-based InvertEBase is being prepared to receive records from DigIn, particularly for use as a georeferencing intermediate processing platform, but is not yet ready for broad-based data input.

Share Other Activities and/or Progress

BPBM: Holly Bolick: Due to the addition of the microscope camera and the extra help (4 summer interns) we were able to capture images of new specimens as soon as they were

cataloged, making a new workflow for imaging high priority or "quick and easy" specimens; taxonomic priority list is being created.

CAS: Christina Piotrowski: Current data/database: CAS has completed our CASIZ database migration from an aging CMS to a new customized Specify database and we are continuing to work towards data cleaning and standardization including Geography and Tree and Localities final cleaning/standardization that will benefit DigIn project data sharing.

FWRI: Paul Larson: Hired new staff member Austin Smith.

MCZ: Adam Baldinger: Part-time Curatorial Assistant has been hired; anticipated start date is July 26, 2021.

NCSM-NMI: Megan McCuller : We are in talks with another institution to acquire a sizable collection of dried marine specimens.

NHMLA: Regina Wetzer: Digitization Project Manager position is currently advertised and applications will be reviewed in early August.

NMNH: William Moser: Also digitizing invertebrates outside scope of DigIn (Mollusks and freshwater taxa).

SBNHM: Vanessa Delnavaz: Attachment server has been linked to our Specify database. Internally we are able to add images and other attachments. Further work to be done to make these available online.

SIO-BIC: Charlotte Seid: Recruited two graduate students to conduct digitization activities starting next quarter and initiated the hiring process.

SIO-PIC: Linsey Sala: Continuing to make progress on constructing our FMPro reference specimen database and capability to connect these with parent net tow event data with assistance from SIO's IT Dept. and SIO-BIC CM Charlotte Seid. This will include UUIDs necessary for iDigBio upload.

UF: Gustav Paulay: New collections from field work of NE Pacific fauna.

VIMS: Jennifer Dreyer: I installed the new Nikon microscope camera for imaging specimens so that it is set up and operational. The next step is to image specimens that are unique to our current research projects to help with lab identification guides but these images will also be uploaded and attached to the specimen record in Specify.

Additional costs due to COVID pandemic

AMNH: Estefania Rodriguez, Lily Berniker: We are on our way to purchase monitors for the volunteers working remotely to facilitate data entry ($400)

CAS: Christina Piotrowski: None large and direct, but indirectly:

1. We have incurred additional supplies expenses to support the remote scanning of cards and documents. For efficiency we'll require a second workstation which we will attempt to staff with volunteers since we have been unable to image a sufficient number of labels this FY due to not having staff on site (we currently have staff coverage less than 3 days per week on average).
2. Staff home internet bandwidth and data upgrades and equipment, etc. for remote work.

3. Staff remain unable to work on site so cannot physically prepare for workflow ramping up/hiring/training new staff. There is uncertainty re: the impact of COVID conditions on project budget over long term, however we're currently spending significant CAS staff time on "simple" student planned scanning grant work (by necessity to support transcription project) in the absence of student support, so will require proportionally more hours of more highly trained staff later in the funding period to complete less simple tasks. The current higher load of grant supporting activities also prevent staff from attending to non-grant related projects.

SBNHM: Vanessa Delnavaz: No direct costs, but there has been a 4 month backorder on glassware, which has caused us to shift to working in different areas of the collection.

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Key to Abbreviations

NHMLA	Natural History Museum of Los Angeles County (lead), Los Angeles, CA (R.Wetzer)
ANSP	Academy of Natural Sciences, Philadelphia, PA (P. Callomon)
AMNH	American Museum of Natural History, New York, NY (C.Johnson)
AUMNH	Auburn University, Auburn, AL – no submission
ASU	Arizona State University, Tempe, AZ [subaward]
BPBM	Bishop Museum, Honolulu, HI – no submission
CAS	California Academy of Sciences, San Francisco, CA (C.Piotrowski)
VIMS	College of William & Mary—Virginia Institute of Marine Science, Gloucester Point, VA (J.Dreyer)
FMNH	Field Museum of Natural History, Chicago, IL [subward]
HBOM	Florida Atlantic University, Fort Pierce, FL (D.Hanisak)
FWRI	Fish and Wildlife Research Institute, St. Petersburg, FL (P.Larson)
MCZ	Harvard University, Cambridge, MA (A.Baldinger)
NCSM-NMI	North Carolina Museum of Natural Sciences, Raleigh, NC (M.McCuller)
Q-Quatics	Q-Quatics, Laguna, Philippines [subaward]
SBNHM	Santa Barbara Museum of Natural History, Santa Barbara, CA (D.Geiger)
SIO-BIC	Scripps Institution of Oceanography, University of California San Diego, CA (C.Seid)
SIO-PIC	Scripps Institution of Oceanography, University of California San Diego, CA (L.Sala)
ALMNH	University of Alabama Tuscaloosa, AL (K.Kocot)
UCM	University of Colorado, Boulder, CO (L.Elder)
UF	University of Florida, Gainesville, FL (J.Slapcinsky)
RSMAS	University of Miami, Rosenstiel School of Marine & Atmospheric Science, Miami, FL (N.Traylor-Knowles)
YPM	Yale University Peabody Museum of Natural History, Boston, MA [subaward] (N.Rios)

NSF Project Reporting Format

This document has been developed to provide Principal Investigators (PIs), co-PIs, and research organizations with:

- a listing of the questions that will be asked in the new NSF project reporting format;
- assistance in planning for the submission of the report; and
- a tool to help PIs collaborate with other contributors in answering these questions, if needed.

The project reporting service on Research.gov and the associated help documentation provides more detailed instructions and contextual assistance.

Note: NSF project reports are not cumulative and should always be prepared for the specific project reporting period only.

PIs should NOT complete and upload this document to Research.gov in order to meet your reporting requirement. You are required to enter text in the text boxes available

Accomplishments

You have the option of selecting “nothing to report” in this section.

What are the major goals of the project?

Digitize and make publicly accessible online 2,000,000 collections of epiphytic, carnivorous, and succulent plants housed at 14 participating U.S. herbaria, universities, and botanical gardens. Engage with the hobbyist communities who have interests in these taxa. Train a diverse range of students in museum specimen digitization, and species conservation assessment. Engage the Natural History Community in a dialog about how location data of sensitive species are shared digitally.

What was accomplished under these goals (you must provide information for at least one of the 4 categories below)?

Major Activities:

-Major progress has been made with 91% of the promised specimens barcoded, 64% imaged, and 71% fully digitized.

-Eight institutions (53%) over delivered on barcoded/imaged/digitized specimens, i.e., they barcoded or imaged more specimen than promised.

-The majority of participants in the TCN (for the past year) are citizen scientists participating in specimen transcription via online transcription platforms. A few students were hired as interns, however COVID-19 significantly lessened the participation of interns.

-For the period of June 2020 - June 2021, there were 777 participants in Virtual Herbarium Expeditions featuring Endless Forms specimens on DIGIVOL & Notes from Nature. These volunteers contributed 58,535 full-classifications and assigned an additional 15,911 specimens to country.

-Several digital outreach events have taken place, in particular virtual transcription of specimen data by citizen scientists and hobbyists.

Specific Objectives:

SUMMARY FOR ALL INSTITUTIONS		
Items digitized	**Total Costs (year 3)**	**Average Cost/Specimen**
836,745	$462,827	$0.84

	ALL INSTITUTIONS, INDIVIDUAL		
Institution	**Items digitized**	**Total Costs ($) (Year 3)**	**Average Cost/Specimen ($)**
New York Botanical Garden	177918	49,232	0.43
Botanical Research Institute of Texas	18160	14,502	0.80
California Academy of Sciences	72348	110,692	1.53
Field Museum	120342	150,927	0.94
Harvard University	171231	20,551	2.47
Illinois Natural History Survey	38885	27,609	0.71
Marie Selby Botanical Garden	13692	No funds spent in year 3	
Missouri Botanical Garden	58,560	58,723	1.00
Philadelphia Academy of Science	33721	41,147	1.19
University of California	5244	2,622	0.50
University of Massachusetts	11305	11,727	0.96
University of Michigan	21989	15,180	0.69
University of Minnesota	16325	17,286	1.06
University of Texas	64639	No funds spent in year 3	
University of Wisconsin Madison	53515	53,321	0.96

SUMMARY FOR ALL INSTITUTIONS			
ACTIVITY	**OBJECTIVE**	**COMPLETED TO DATE**	**% TOTAL COMPLETED**
Imaging	1,424,936	915,459	64%
Bar coding	1,021,013	894,713	88%
Data Entry	1,160,560	836,745	71%
Geo-Ref	914,416	220,088	24%

	ALL INSTITUTIONS, INDIVIDUAL * = number delivered higher than objective											
Institution	Objective	to barcode	# barcoded	to image	# imaged	# data entry	to geo-ref	# geo-ref	% barcoded	% imaged	% data entry	%geo-ref
New York Botanical Garden	190892	166389	177918	190892	169691	114244	202689	23622	107 *	89	60	12
Botanical Research Institute of Texas	62796	43022	34697	43022	34697	50679	18009	12276	81	81	81	68
California Academy of Sciences	70000	70884	72348	83436	48372	72348	33582	10109	102 *	58	103 *	30
Field Museum	132620	132620	134453	132620	135298	120342	35000	39381	101 *	102 *	91	113 *
Harvard University	261403	261403	171231	276549	142438	171231	310541	9192	66	52	66	3
Illinois Natural History Survey	45981	45981	44542	45981	44535	38885	45981	11438	97	97	85	25
Marie Selby Botanical Garden	53455	18614	28731	49998	28731	13692	45137	10013	154 *	57	26	22
Missouri Botanical Garden	49088	49088	27324	302217	79571	27324	20103	7830	56	26	56	39
Philadelphia Academy of Science	35000	35000	34479	35000	34479	33721	35000	18422	99	99	96	53
University of California	85326	77022	10512	85326	9607	5244	4038	4038	14	11	6	100
University of Massachusetts	11788	7787	11305	7787	11154	11305	11778	8466	145 *	143 *	96	72
University of Michigan	69500	51100	51346	64700	51346	47887	57500	16142	100	79	69	28
University of Minnesota	10459	10459	10459	20679	16325	11689	15509	4902	100	79	112 *	32
University of Texas	49980	18476	26958	41414	53567	64639	40649	14978	146 *	129 *	129 *	37
University of Wisconsin Madison	46913	33168	58410	45315	55648	53515	38900	29279	176 *	123 *	114 *	75

Significant Results:

- 71% of the promised specimens were digitized within the first three years of this project across all institutions

-For the period of June 2020 - June 2021, there were 777 participants in Virtual Herbarium Expeditions featuring Endless Forms specimens on DIGIVOL & Notes from Nature. These volunteers contributed 58,535 full-classifications and assigned an additional 15,911 specimens to country.

-46% of institutions delivered more digitized specimens than initially promised.

Key outcomes or other achievements:

Digital tours, seminars, and workshops across the included institutions discussed or otherwise highlighted this TCN. The project was discussed in the context of national

digitization efforts, the conservation threats of the included species were presented, and engagement via potential volunteering was encouraged.

What opportunities for training and professional development has the project provided?

Very few student interns were trained on this grant over the past year due COVID-19 related shutdowns and related reductions in on-site staff access. Only a few students were trained, and they split their time between digital work and on-site imaging.

How have the results been disseminated to communities of interest?

Several partner institutions opened direct communications with hobbyist groups that focus on the included plant groups, to help spread awareness of the importance of natural history collections, and to help recruit volunteers to augment digitization efforts.

Partner institutions held digital tours and workshops that highlighted the groups featured in this TCN, and/or directly discussed this TCN directly.

This TCN and NSF support was discussed in detail during 2021 WeDigBio and Digivol public seminar series. The WeDigBio seminars focused on epiphytes and included epiphytic taxa/speakers who work on epiphytes and/or the Endless Forms TCN. These webinars were partial collaborations between the Pteridophyte and Endless Forms TCNS.

Many partner institutions held Zoom webinars, and/or WeDigBio webinars, and/or Notes from Nature and/or Digivol transcriptions expeditions focusing on the taxa included in this TCN, or the TCN itself.

In June, UC/JEPS PI Bruce Baldwin taught a four-hour virtual Jepson workshop to 100 enrolled students of diverse backgrounds on taxonomy, floristics, and phylogenetics. This workshop focused in part on the importance of herbaria collection databases and specimen images in general to biodiversity research and discovery.

Lead PI Pace participated in the California Phenology TCN panel discussion on best practices for displaying location information of California threatened species, providing information from a community wide survey originated through this award.

Additional photo-essay-style online exhibits will be put online in July/August 2021 showcasing Endless Forms specimens through a collaboration with Google Arts and Culture (BRIT).

What do you plan to do during the next reporting period to accomplish the goals?

Although this was the original final year of this award, the COVID-19 Coronavirus pandemic has significantly affected progress on this TCN for multiple participating institutions; may institutions are applying for / have received 1-year no cost extensions to complete deliverables. Several institutional participants had to stop work entirely for a portion of the last year due to shut-downs, loss of on-sight access, and/or loss of student interns due to HR hiring restrictions. Nearly all participating institutions experienced some sort of work activity shutdown or major reduction in staff numbers (e.g., student interns suddenly leaving campus, or staff hours being reduced to part time) or staff access (e.g., staff not being allowed on site at NYBG, Harvard, Field Museum, Missouri BG, University of Wisconsin, and many others). Imaging essentially stopped at most institutions due to these restrictions. As the spring and summer of 2021 advanced, most participating institutions were able to regain some level on on-site access, although reductions in staff density or the continued inability to hire student interns significantly affected imaging and transcription rates.

As campuses and museums continue to reopen, we anticipate workflows will still be interrupted due to reduced staff numbers, social distancing requirements, intermittent periods of working from home, and staggered work schedules. Fortunately, 88% of the specimens have been barcoded, 71% of specimens have been fully transcribed, and several of the biggest participating institutions have made significant progress in imaging prior to the shutdowns (e.g., NYBG, Harvard, Field Museum). Most participating institutions have requested no-cost extensions so as to meet project digitization and outreach goals.

We will continue to make inroads and form partnerships with hobbyist groups, via emails, digital tours, seminars, and transcription events.

Train any additional participants who may join the project.

NOTE: You may upload PDF files with images, tables, charts, or other graphics in support of the Accomplishments section. You may upload up to 4 PDF files with a maximum file size of 5 MB each.

Products

You have the option of selecting “nothing to report” in this section. There are no limitations to the number of entries you submit and you can also pull information directly from Thomson Search when using the online tool on Research.gov.

Within the Products section, you can list any products resulting from your project during the specified reporting period, such as:

Journals: Pace, M.C. 2021. *Spiranthes bightensis* (Orchidaceae), a New and Rare Cryptic Hybrid Species Endemic to the U. S. Mid-Atlantic Coast. Phytotaxa 498 (3): 159–176.

Books: nothing to report

Book Chapters: nothing to report

Thesis/Dissertations: nothing to report

Conference Papers and Presentations: Singer, R. A., R. K. Rabeler, E. M. Tucker, and G. Holman. 2020. Digital Workflows using Specify at the University of Michigan. SPNHC 2020 virtual meeting, June 11, 2020.

Other Publications:

Technologies or Techniques: nothing to report

Patents: nothing to report

Inventions: nothing to report

Licenses: nothing to report

Websites: Project Website: **http://sweetgum.nybg.org/science/projects/endlessforms/**

Li, Lin. 2020. Plant Inspired Innovations: *Nepenthes* and Slippery Liquid-Infused Porous Surfaces (SLIPS) Technology. The Hand Lens. http://sweetgum.nybg.org/science/the-hand-lens/explore/narratives-details/?irn=7458

Pace, M.C. 2021. Meet *Spiranthes bightensis*: A New Orchid in Our Own Backyard. The Hand Lens. http://sweetgum.nybg.org/science/the-hand-lens/explore/narratives-details/?irn=7532

Other Products:

NOTE: You may upload PDF files with images, tables, charts, or other graphics in support of the Products section. You may upload up to 4 PDF files with a maximum file size of 5 MB each.

What other organizations have been involved as partners?

The online service will also ask you for additional information such as:

- Type of Partner Organization
- Name
- Location
- Partner's contribution to the project

Have other collaborators or contacts been involved? No

Impacts

You have the option of selecting "nothing to report" in this section.

What is the impact on the development of the principal discipline(s) of the project?

nothing to report

What is the impact on other disciplines?

nothing to report

What is the impact on the development of human resources?

nothing to report

What is the impact on physical resources that form infrastructure?

nothing to report

What is the impact on institutional resources that form infrastructure?

nothing to report

What is the impact on information resources that form infrastructure?

nothing to report

What is the impact on technology transfer?

nothing to report

What is the impact on society beyond science and technology?

We have significantly increased the public's access to information related to rare and unusual plant species, communicating the importance of herbarium and other museum specimens in the consevration of these species.

Changes / Problems

If not previously reported in writing to the agency through other mechanisms, provide the following additional information or state, "Nothing to Report", if applicable.

Changes in approach and reason for change:

nothing to report

Actual or Anticipated problems or delays and actions or plans to resolve them:

Although this was the original final year of this award, the COVID-19 Coronavirus pandemic has significantly affected progress on this TCN for multiple participating institutions; may institutions are applying for / have received 1-year no cost extensions to complete deliverables. Several institutional participants had to stop work entirely for a portion of the last year due to shut-downs, loss of on-sight access, and/or loss of student interns due to HR hiring restrictions. Nearly all participating institutions experienced some sort of work activity shutdown or major reduction in staff numbers (e.g., student interns suddenly leaving campus, or staff hours being reduced to part time) or staff access (e.g., staff not being allowed on site at NYBG, Harvard, Field Museum, Missouri BG, University of Wisconsin, and many others). Imaging essentially stopped at most institutions due to these restrictions. As the spring and summer of 2021 advanced, most participating institutions were able to regain some level on on-site access, although reductions in staff density or the continued inability to hire student interns significantly affected imaging and transcription rates.

As campuses and museums continue to reopen, we anticipate workflows will still be interrupted due to reduced staff numbers, social distancing requirements, intermittent periods of working from home, and staggered work schedules. Fortunately, 87% of the specimens have been barcoded, 71% of specimens have been fully transcribed, and several of the biggest participating institutions have made significant progress in imaging prior to the shutdowns (e.g., NYBG, Harvard, Field Museum). Most participating institutions have requested no-cost extensions so as to meet project digitization and outreach goals.

Although we do not anticipate being able to return to pre-shut down imaging rates due to continued shutdowns, staff reductions, and social distancing requirements, we have taken the last year as an opportunity to shift our focus to data transcription and georeferncing, and many institutions also took this opportunity to greatly expanded virtual citizen science outreach and transcription through the Notes from Nature and DIGIVOL sites.

Changes that have a significant impact on expenditures:

Most organizations were not able to hire all of the participants/interns that were originally budgeted for

due to COVID-19 reductions in on-site staff access, or changes in HR hiring mandates.

Significant changes in use or care of human subjects:

nothing to report

Significant changes in use or care of vertebrate animals: nothing to report

Significant changes in use or care of biohazards: nothing to report

Special Requirements

This report section is only available when Special Requirements are specifically noted in the solicitation and approved by the Office of Management and Budget.

NOTE: You may upload PDF files in support of the Special Requirements section. You may upload PDF files with a maximum file size of 10 MB each. There is no limit to the number of files uploaded.

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.

COVID-19 restrictions continued to impact staff access to the collections and widespread hiring freezes for new staff caused unavoidable delays. However, where possible under the circumstances, work is underway. Members of the collaborative found creative ways to prepare for, and begin, digitization.

FMNH ESB**:** Collections staff tested the new, institution-wide database structure in anticipation of ESB data entry. COVID-delayed hires rescheduled for this fall.
FMNH ESB subaward **HMNS:** We have continued our efforts in digitizing ESB related specimens with 62 lots representing 351 specimens added to our database. These additions bring the total newly digitized records for this project to 124 lots that represent 912 specimens. To address the possibility of tracking specimens based off of live or dead collected a physical examination of specimens in the families Buccinidae, Melongenidae, Nassariidae, and Strombidae has been done. Of the specimens in HMNS holdings that are in these families and fall under the ESB project 499 lots representing 2,379 specimens have been identified as “live collected”, “dead collected”, or “live and dead collected”. While physically working through the

previous listed families, digital records for 746 lots representing 10,434 specimens have had updates/corrections made.
FMNH ESB subaward **FWRI:** ~~N~~nothing to report
FMNH ESB **s**ubaward **HBOM:** We have set up our imaging station, have developed initial protocols for the work, and are training HBOM personnel using non-NSF samples and other funding so that we can maximize our use of our NSF funds for this project.
ANSP ESB**:** nothing reported.
BMSM ESB**:** Cataloging was slow this quarter, due to the loss of our Collection Manager last February (we interviewed and will be hiring an ESB-funded incumbent on the week of August 2, 2021. Nonetheless, staff entered data for 226 ESB lots in the period, and cleaned 123 for accuracy.
CM ESB**:** nothing reported.
DMNH ESB**:** nothing reported.
DMNH ESB subaward **RSMAS:**Scans: we finished scanning cards and books. I'm reporting by pages a total estimated (difficult estimation) of 3800, for data entry: For data entry :Mollusca 5830 and Cephalopod 150.
MCZ ESB**:** no uncataloged lots/records were databased this quarter; to date, 6,980 records in our database were cleaned/vetted for accuracy, and of these, 6,962 with verified georeferences. 6,768 records are available on iDigBio (including 3 records with media/video).
LACM ESB**:** nothing reported.
NCSM ESB**:** nothing reported.
UF ESB**:** This quarter coordinates have been added or verified and datum and error radii recorded for 2834 (total 26,911) specimen lots of Eastern Seaboard mollusks at UF. We focused our efforts on georeferencing material from Florida and in particular data from the McGinty collection. This collection of mollusks from shallow to deepwater dredges and trawls off SE Florida includes well localized records, with depth and habitat information that is the source of several species described by H. Pilsbry and others. The collection includes field notebooks which we are using to improve our georeferencing efforts.
UMMZ ESB**:** 117 lots (Gastropoda: 115, Bivalvia: 2) including 1431 specimens records were entered including 2 bivalve paratype lots. Nova Scotia (1 lot), Massachusetts (1 lot), Connecticut (1 lot), New York (1 lot), Maryland (1 lot), Florida (100 lots), Alabama (6 lots), Mississippi (2 lots), Louisiana (2 lots), Texas (2 lots)

Share Best Practices, Standards, and Lessons Learned

Share information here. You can also embed graphics if desired.
FMNH ESB**:** nothing to report
FMNH ESB subaward **HMNS:**
FMNH ESB subaward **FWRI:** nothing to report
FMNH ESB **s**ubaward **HBOM:**We have set up an immersion tank for imaging the wet samples to produce better images.
ANSP ESB**:** nothing reported.

BMSM ESB**:** Staff participation in Steering, Outreach, and Live/Dead committees meetings. the PI and staff plan on hosting a short special session on ESB TCN in the upcoming Florida United Malacologists meeting (FUM, February 2022.)
CM ESB**:** nothing reported.
DMNH ESB**:** nothing reported.
DMNH ESB subaward **RSMAS:**We have been focused on the scanning and data input. So far so good.
MCZ ESB**:** Permanent staff involved in the project participate in Outreach, Steering, Expedition and Georeferencing committees/work groups. Information is then shared with others in MCZ's Malacology and Invertebrate Zoology departments, including those working on other TCN's (DigIn and PILSBRy). Various staff members working on the project participate (via zoom) in ESB monthly ESB general meetings and monitor communications shared on various Slack channels.
LACM ESB**:** nothing reported.
NCSM ESB**:** The Charleston Museum material has been databased completely. We are currently working on the Duke Marine Lab and The Institute of Marine Sciences. Most of the taxonomic names are out of date and have to be updated. I've learned that with all of the taxonomic name changes that it is easier to import the donors database and then code our database to show an error if all the complete scientific name does not connect to our taxonomic dictionary. This way you can't overlook it. Sometimes you get so focused on all the other information that you forget to check the scientific name.
UF ESB**:** nothing reported.
UMMZ 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
FMNH ESB subaward **HMNS:** Live/dead determinations have had to be listed in the notes field of our specimen records. Our version of EMu does not have a dedicated field assigned for the tracking of this information. It will need to be decided if one or more fields will be necessary to properly track these determinations.
FMNH ESB subaward **FWRI:**Nothing to report
FMNH ESB **s**ubaward **HBOM:**This quarter we addressed the gaps identified in the previous report (developing an image analysis station and barcoding the HBOM specimens}; no new gaps identified.
ANSP ESB**:** nothing reported.
BMSM ESB**:** After a long period without an incumbent, BMSM has selected and is ready to hire an ESB-dedicated cataloger/collection associate.
CM ESB**:** nothing reported.
DMNH ESB**:** nothing reported.
DMNH ESB subaward **RSMAS:**We need to get a website and a database management software chosen.

MCZ ESB**:** A new macrophotography work-station for imaging types is being set up and nearly ready for use.
LACM ESB**:** nothing reported.
NCSM ESB**:** nothing reported.
UF ESB**:** nothing to report
UMMZ 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
FMNH ESB subaward **HMNS:** nothing to report.
FMNH ESB subaward **FWRI:** nothing to report
FMNH ESB **s**ubaward **HBOM:** nothing to report.
ANSP ESB**:** nothing reported.
BMSM ESB**:** nothing to report
CM ESB**:** nothing reported.
DMNH ESB**:** nothing reported.
DMNH ESB subaward **RSMAS:** nothing to report
MCZ ESB**:** Various staff members participated in a workshop on imaging museum specimens.
LACM ESB**:** nothing reported.
NCSM ESB**:** nothing reported.
UF ESB**:** nothing to report
UMMZ ESB**:** nothing to report

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

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

Much effort has been spent to facilitate exchanges and avoid duplication with other relevant TCNs. InvertEBase is the main partner for our Symbiota portal – with close coordination with DigIn-TCN, PILSBRY-TCN, and Smithsonian's Panama project (which is also in the process of joining the InvertEBase platform). Shared working groups (with members of multiple TCNs) have been established and are meeting regularly. ESB and DigIn, in particular, share many upcoming needs in authority file development, georeferencing needs, and workflow development, and the two projects have a strong overlap in their steering committees to assure the best-possible flow of ideas and information.

FMNH ESB**:** Coordinating above efforts.
FMNH ESB subaward **HMNS:** ~~N~~nothing to report.
FMNH ESB subaward **FWRI:** ~~N~~nothing to report
FMNH ESB **s**ubaward **HBOM:** ~~N~~nothing to report.
ANSP ESB**:** nothing reported.
BMSM ESB**:** nothing to report.
CM ESB**:** nothing reported.
DMNH ESB**:** nothing reported.
DMNH ESB subaward **RSMAS:** nothing to report
MCZ ESB**:** Information is shared among permanent MCZ staff working on other TCN's: DigIn and PILSBRy, and an NSF CSBR cryogenic collections grant.
LACM ESB**:** nothing reported.
NCSM ESB**:** nothing reported.
UF ESB**:** nothing additional to report
UMMZ 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.
FMNH ESB subaward **HMNS:** nothing to report.
FMNH ESB subaward **FWRI:** nothing to report
FMNH ESB **s**ubaward **HBOM:** nothing new to report.
ANSP ESB**:** nothing reported.
BMSM ESB**:** Re: sustainability, after a difficult and protracted transition period, BMNSM recently hired a new executive director who is very aware of the value of institutional collections and committed to support the Museum's collection digitization and accessibility efforts. And this is great news from my end.
CM ESB**:** nothing reported.
DMNH ESB**:** nothing reported.
DMNH ESB subaward **RSMAS:**Honestly, we are still in survival mode. I do worry about the sustainability because we have very little money and we need to work fundraising to sustain the future of the collection and hire a full time director. However, we have not been able to do this yet.
MCZ ESB**:** nothing to report
LACM ESB**:** nothing reported.
NCSM ESB**:** nothing reported.
UF ESB**:** nothing to report
UMMZ ESB**:** nothing reported.

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

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

Our Social Media Committee (spearheaded by BMSM, with FMNH, MCZ, and FWRI) defined parameters and spearheaded creation of media resources for the project. ESB now has media presence on: Facebook https://www.facebook.com/groups/easternseaboardmollusks; Instagram @eastern_seaboard_mollusks; Twitter @EMollusks; iNaturalist https://inaturalist.org/projects/eastern-seaboard-mollusks

FMNH ESB**:** as above.
FMNH ESB subaward **HMNS:** In May a graduate student was hired with ESB funds to assist with the digitization of new records and updating existing records. So far during her time with us she has been able to assist us with updating/correcting 520 lots representing 7,598 ESB specimens and adding 48 new lots representing 246 ESB specimens. While assisting us in the Malacology collection our student was also able to learn proper specimen handling, proper storage techniques, specimen terminology specific to Malacology, and how to navigate, edit, and create records in our CMS, EMu.
FMNH ESB subaward **FWRI:** nothing to report
FMNH ESB **s**ubaward **HBOM:** nothing to report.
ANSP ESB**:** nothing reported.
BMSM ESB**:** In addition to activities in social media and the ESB Outreach Committee, BMNSM is currently presenting *In Focus*, a temporary exhibition of digital images initially created for our digital catalog (consequently also available via iDigBio and GBIF.) The vast majority of images on display consists of Florida/other ESB species.
CM ESB**:** nothing reported.
DMNH ESB**:** nothing reported.
DMNH ESB subaward **RSMAS:**We have trained two masters students on scanning and digitization best practices
MCZ ESB**:** our iNaturalist public portal keeps growing and now includes 39 members, 2,000 identifiers, 42,000 observations and 766 species.
https://www.inaturalist.org/projects/eastern-seaboard-mollusks
LACM ESB**:** nothing reported.
NCSM ESB**:** nothing reported.
UF ESB**:** Identified, added live dead attributes and posted observations on iNaturalist Eastern Seaboard Project. Highlighted Gulf of Mexico scallops on Wildlife Wednesday feature of Gainesville TV channel 20 https://www.wcjb.com/2021/07/07/wildlife-wednesday-scallops-florida/.
UMMZ 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**:** nothing to report.
FMNH ESB subaward **HMNS:** Nothing to report.
FMNH ESB subaward **FWRI:**Nothing to report
FMNH ESB **s**ubaward **HBOM:**Nothing to report.
ANSP ESB**:** nothing reported.
BMSM ESB**:** nothing to report
CM ESB**:** nothing reported.
DMNH ESB**:** nothing reported.
DMNH ESB subaward **RSMAS:** We are going to focus this next year on hiring a contractor to get our website up and going. We have a template started, but need to hire someone to devote time to finishing it and populating it.
MCZ ESB**:** "Named Group" page developed in our database for public access to gather information about the grant, records/specimen lots associated with ESB, including searchable links/breakdown of records by taxa, geography (ie. by ocean, country, islands), images, collectors/agents; includes links to iDigBio (ESB), MolluscaBase and iNaturalist pages. (https://mczbase.mcz.harvard.edu/grouping/showNamedCollection.cfm?underscore_collection_id=82
LACM ESB**:** nothing reported.
NCSM ESB**:** nothing reported.
UF ESB**:** nothing to report
UMMZ 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.

Communication infrastructure and file storage has been organized via a dedicated Slack workspace and file storage on Google Drive. We also are sharing relevant Slack channels with the DigIn TCN.
FMNH ESB**:** Coordination as described above. A new PEN (PRI) has been awarded.
FMNH ESB subaward **HMNS:** Nothing to report.
FMNH ESB subaward **FWRI:** - Staff has been identified and will begin in next quarter. Staging area has been prepped for workflow
FMNH ESB **s**ubaward **HBOM:**Nothing to report.
ANSP ESB**:** nothing reported.
BMSM ESB**:** nothing reported.
CM ESB**:** nothing reported.
DMNH ESB**:** nothing reported.

DMNH ESB subaward **RSMAS: We have also started working on the cruise data and have** scanned a total 3149 entries.
MCZ ESB**:** Part-time Curatorial Assistant has been hired; anticipated start date is August 4, 2021.
LACM ESB**:** nothing reported.
NCSM ESB**:** nothing reported.
UF ESB**:** nothing to report
UMMZ ESB**:** nothing to report

TCN Quarterly Progress Report

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

TCN Name

TCN iDigBio

Person Completing the Report

Nikki Traylor-Knowles, PI

Share Progress in Digitization Efforts

Scans: we finished scanning cards and books. I'm reporting by pages a total estimated (difficult estimation) of 3800.
For data entry a total of 6733
Molusca 5830
Cephalopod 150
Protozoa 51 Porifera 210
Hydrozoa 50
Scyphozoa 23
Alcyonaria 232
Zoantharia 187
TOTAL: 6733
We also have been scanning the cruise data:
total 3149
April 888
July 2,261

Share Best Practices, Standards, and Lessons Learned

We have been focused on the scanning and data input. So far so good

Share Identified Gaps in Digitization Areas and Technology

We need to get a website and a database management software chosen.

Share Opportunities to Enhance Training Efforts

We have had two masters students working since March in the museum on digitizing and scanning the cards and books in our collection.

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

We are working with UDelware on Molluscs (eastern seaboard)

Share Opportunities and Strategies for Sustainability

I think that we are still in survival mode. I do worry about the sustainability because we have very little money and we need to work fundraising to sustain the future of the collection and hire a full time director. However, we have not been able to do this yet.

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

We have trained two masters students on scanning and digitization best practices

Share Information About Your Website and/or Portal Usage

none

Share Other Activities and/or Progress

We also have been scanning the cruise data:
total 3149
April 888
July 2,261

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 April 1 – June 30, 2021.

Digitization progress at all GLOBAL institutions continued to be limited by COVID-19 constraints during much of 2021-Q2. However, restrictions began to ease in many areas during this period and some collaborators saw an increase in access, allowing more collections to begin some digitization activities. Four institutions are still waiting to start GLOBAL work until conditions are more favorable in fall 2021.

Imaging Equipment

Additional progress was reported in purchasing and setting up imaging equipment during 2021-Q2. BRY established its new lichen imaging station and CINC continued to improve its new bryophyte imaging station using already existing materials. COLO purchased some basic equipment (color square nano, blackout paper etc.) while using an existing lightbox, but will be replacing the camera and lens later in the GLOBAL project. With campus opening back up they are planning to purchase the computer and camera for the project in July. TENN finished purchasing the equipment for a second imaging station.

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

Workflow Development

Many institutions continued to spend time in 2021-Q2 drafting, updating, and refining their imaging workflows (CINC & MU, DUKE, MO, MSC, NY, TENN, WIS, YU). MO began barcoding and MSC was able to start imaging bryophyte specimens. CINC's imaging specialist is working on detailed imaging and image post-processing workflows. WIS continued to refine digitization protocol and review post-processing tasks. MSC prepared lichen specimens for digitization and went through an accession of lichens that have been sitting for several years, creating a spreadsheet that was used to print labels onto packets.

The GLOBAL Portal Manager (ASU), Georeferencing Manager (WIS), and Project Manager (TENN) met with additional collaborators to discuss centralized georeferencing and the flow of coordinate data between the portals and internal databases (ALA, ASU, BRY, CINC & MU, FLAS, MO, MSC, OSC, PH, UC, YU). WIS began creating data sets (by country) in the Collaborative Georeferencing interface (CoGe). This allows collection records to be directly downloaded from the Bryophyte and Lichen Portals for users to begin georeferencing. We are only able to use those records that are already transcribed with locality information so are limited by the slower than expected progress due to COVID-19 restrictions that institutions are under.

Personnel

FLAS lost the four student employees on this project to graduation in May. They advertised positions and hired two new students. One is cataloging remotely and one is carding specimens. Many respondents to the ad are interested in starting in August. ILLS hired a research assistant who imaged bryophyte specimens. MO began the process of hiring full-time a digitization technician. PH hired a full-time undergraduate co-op to begin imaging our bryophyte packets. TENN hired two undergraduate techs to work almost full-time on the project over the summer. YU hired a part-time undergraduate student worker to begin imaging bryophyte specimens.

Digitization

Fifteen institutions (BRY, CINC & MU, COLO, DUKE, F, FLAS, ILL & ILLS, LSU, MICH, MSC, NY, PH, TENN, WIS, and YU) reported progress on digitization deliverables, with a total of 42,637 specimens barcoded (20,223 bryophytes and 22,414 lichens), 25,613 labels imaged (18,100 bryophytes and 7,513 lichens), 29,716 specimens imaged (20,964 bryophytes and 8,752 lichens), 47,200 specimen records uploaded to the portal (16,054 bryophytes and 31,146 lichens), 31,735 skeletal records created (9,781 bryophytes and 21,954 lichens), 8,614 labels

fully transcribed (7,269 bryophytes and 1,345 lichens), and 31,268 specimens georeferenced (24,521 bryophytes and 6,747 lichens).

Table 1: Digitization progress by GLOBAL collaborators in 2021-Q2, 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														
ASU														
BRY										300				
CINC & MU	49		40		40		9				2,844		11,330	3,359
COLO		1,595		1,595				1,595		1,595		722		
DUKE	1,019		1,341		879	3,829	2,212		1,066		21		1	837
F	7,500	1,032	2,838	1,032	9,737		9,737	915	5,116					
FLAS	2,180		414	197							57	387		
ILL & ILLS			1,627		1,627									
LSU	437	9	443	33			437	9	437	9	1	63		
MICH	1,883		2,789		73		367		652		1,231		42	
MIN														
MO														
MSC	891		891		891									
NY	63	19,728	365	4,465	365	4,465		28,305	63	19,728	699	22	441	30
OSC														
PH	3,535		3,535		3,535		298		298					
TENN	1,951		3,102		3,102		2,994		2,149		2,416	151	320	106
UC														
WIS		50		191		458		322		322			12,387	2,415
YU	715		715		715									
Totals	**20,223**	**22,414**	**18,100**	**7,513**	**20,964**	**8,752**	**16,054**	**31,146**	**9,781**	**21,954**	**7,269**	**1,345**	**24,521**	**6,747**
B+L Totals		**42,637**		**25,613**		**29,716**		**47,200**		**31,735**		**8,614**		**31,268**

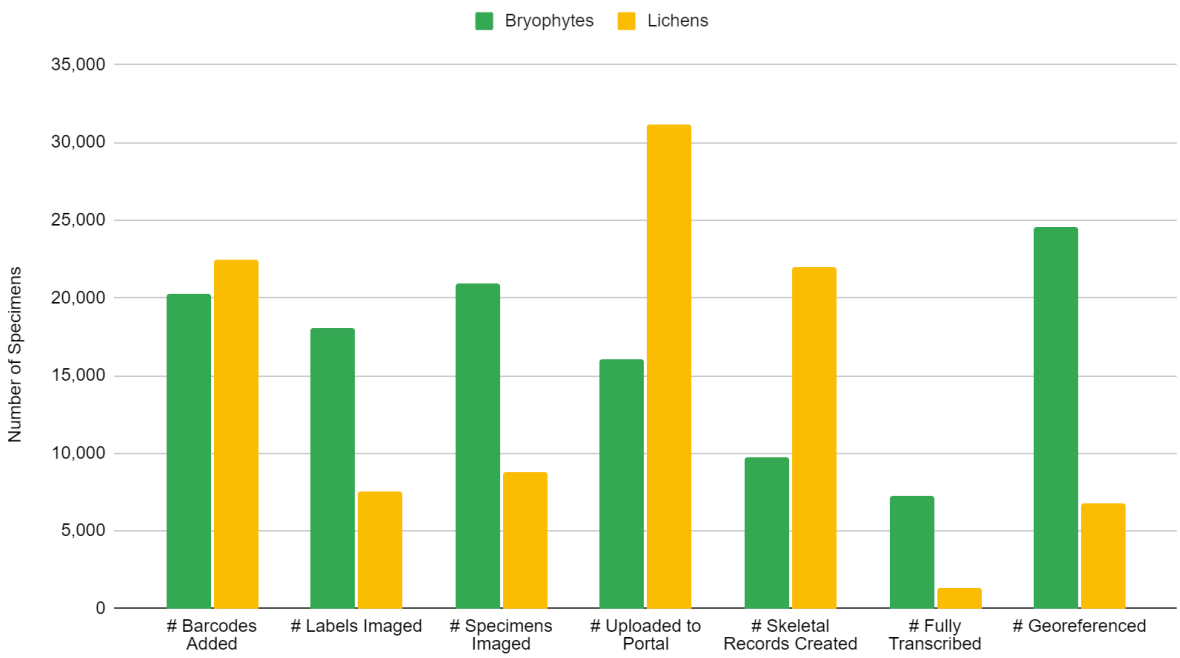


Figure 1: Digitization progress for the GLOBAL collaboration in 2021-Q2, separated by Bryophyte and Lichen specimens.

Share Best Practices, Standards, and Lessons Learned

Flexible Workflows

The GLOBAL teams continued to make use of flexible digitization workflows in 2021-Q1, including the use of remote imaging stations, virtual transcription work, and prioritizing label imaging. COVID-19 restrictions began to ease near the end of 2021-Q1 for some participants, allowing several collaborators to begin digitization activities and others to look forward to more standard workflows. As of mid-June several restrictions on access to the collection were relaxed at COLO. They expect to be able to get the project back on track and be able to have more students working in the collection at the same time. F began transitioning from remote imaging back to working on-site at the museum.

Collaboration

Team members continued to make use of Basecamp, Zoom, and email to communicate and collaborate during 2021-Q2. A Management Committee Meeting was held in May open to all GLOBAL team members to review quarterly and cumulative grant progress. The GLOBAL Project Manager (TENN) completed check-in meetings with most collaborators in April (ASU, CINC & MU, COLO, DUKE, F, ILL/ILLS, LSU, MICH, MO, PH, UC, WIS, NY) to discuss progress, concerns, and plans for the summer. She also met weekly with the Portal Manager (ASU) to coordinate project activities and needs. The GLOBAL IT Team convened in May to update progress and priorities. The GLOBAL Executive Committee met in June to discuss plans for the External Advisory Committee.

Duplicate Matching

The Portal Manager (ASU) and Georeferencing Manager (WIS) were able to clean duplicate georeferenced records and present files to the collection managers to review. These records were, or will be, uploaded to the portal and linked as duplicates. This was an effective way to reduce the workload for georeferencing the same locality multiple times. It was also a great chance to meet each of the managers and listen to their management styles and plans for the project.

Four additional international collections data were uploaded to the Bryophyte and Lichen Portals during 2021-Q2, including the Herbarium of the Muséum national d'Histoire Naturelle (Lichens), Ibaraki Nature Museum, Saitama Museum of Natural History, and National Museum of Nature and Science, Japan. This makes a total of 21 international collections, providing over 900,000 bryophyte and 900,000 lichen specimens as possible duplicates. These collections will not be permanently maintained in the portals, but will be available for all collections during the grant period.

Following the exsiccate list updates in the Bryophyte and Lichen Portals in 2021-Q1, additional progress was made to clean up records to add and correct exsiccate fields in individual collections (DUKE, TENN). DUKE Senior Personnel Aguero also cleaned about one fifth of the bryophyte exsiccatae library on the portal. ASU began establishing protocols for snapshot collections to upload their offline records using a unique exsiccatae identifier (ometid) as part of their data upload/update routine to the portals.

Data Usage Policies

Data usage policies were updated on both the Bryophyte and Lichen Portals, including a Spanish language translation. A disclaimer regarding sensitive and offensive language on labels was drafted and included with the usage policies.

Share Identified Gaps in Digitization Areas and Technology

Imaging Uploading

Image uploading to the portals was a major gap at the start of the GLOBAL project. The interim image uploading workflow made available to the GLOBAL team in 2021-Q1 transitioned to an official workflow in 2021-Q2. All collaborators now have access to this option for uploading images to the Bryophyte and Lichen Portals.

Barcode Renaming

Another challenge identified was renaming image files with the specimen barcode. Automated renaming is problematic for images taken inside a specimen packet, in which the barcode may not be visible. ASU continued working on a prototype version of “PhotoWatcher” that is currently being tested at TENN, COLO, F, and OSC. They worked on bug fixes and plan to share the official version with the entire community. They have also been fixing various bugs with “BarcodeRenamer.” The program now also reads barcodes from files with *.jpeg extension instead of just from *.jpg.

Taxonomic Filters

Specimen data outside of the Bryophyte and Lichen Portals offers the opportunity for additional information as well as possible duplicates to update incomplete records on existing specimens. One challenge is separating the particular records of interest from a larger collection of data. The GLOBAL Portal Manager and ASU team worked in 2021-Q1 to develop taxonomic filters to isolate bryophyte records from plant data and separate lichenized, lichenicolous and allied fungi from occurrence records of non-lichenized fungi. In 2021-Q2, ASU successfully applied the new lichen filter to the OSC collection, which now live-manages their data in CNALH, and the filter is in use for many imported collections.

Share Opportunities to Enhance Training Efforts

Digitization

DUKE held a Zoom training session organized with their undergraduate work study student to train him about what a specimen is, and what a protologue is, and what he should be photographing with regards to lichen type specimens.

FLAS started revamping the original bryophyte and lichen PEN website (https://www.floridamuseum.ufl.edu/mossesinflas/) to include new procedures, standards and help files for this TCN.

A dedicated "Student Group" was created on Basecamp in April 2021, to allow opportunities for communication, co-learning, and networking.

The GLOBAL TCN website (https://globaltcn.utk.edu) went live in 2021-Q2, which includes links to developed protocols and workflows.

Transcription

The GLOBAL Project Manager continued compiling transcription resources during 2021-Q2 to share on Basecamp and all resources were posted to the project website.

Georeferencing

WIS and ASU met with collaborators to plan centralized georeferencing workflow and data management. WIS also began reviewing georeferencing training materials for students that will be hired in the fall.

Symbiota

ASU created a YouTube video archive to store videos of informal workshops and meetings (example: OSC training on how to switch from managing data as a snapshot to now managing data live within the portal).

As part of our outreach to lichenologists from Latin America, ASU PI Bungartz organized a Symbiota workshop (in Spanish) for the Consorcio de Herbarios de Líquenes en América Latina during the 9th Symposium of the International Association for Lichenology, in Brazil August 1-6; the two day workshop is being planned as post-congress event: https://doity.com.br/ial9/blog/workshops.

Portal manager Katie Pearson is receiving training from developer Ed Gilbert on Symbiota development, particularly using GitHub to track new developments.

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

ASU PI Bungartz held Zoom meetings with Ecuadorian collaborators from the Instituto Nacional de Biodiversidad (INABIO) to set up a strategy on how to share data sets between the Ecuadorian National Biodiversity Data Portal and the Bryophyte and Lichen Portals.

The TCN's External Advisory Committee (EAC) was contacted to coordinate an initial meeting with the GLOBAL Executive Committee (F, NY, TENN, UC). EAC members include: Deborah Paul (University of Illinois Urbana-Champaign; TDWG), Joe Miller (GBIF), Rosa Scherson (University of Chile), Shelley James (Western Australian Herbarium; Australasian Herbarium Collections; SPNHC; TDWG), Shuo Shi (Hebei Normal University), and Terry Hedderson (University of Cape Town). The first meeting is scheduled for July.

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

Share Opportunities and Strategies for Sustainability

Portal Management

ASU portal management staff continued to facilitate the uploading of images into both portals, creation of new collections, and cleaning of datasets (including fixes to the import filter for lichen collections).

F coordinated an IPT update of both the lichen and bryophyte collections at the Field Museum so all the specimens we currently have in our internal database are reflected on the portals.

NY continued work to identify issues with their IPT to fully loan specimens and images to portals.

Back Ups

Raw images and JPGs at COLO are being uploaded to the University of Colorado Research Computing. These images are in addition to the local copies housed in the CU Herbarium. The hope is that these images will never need to be accessed, but to serve as a catastrophic backup if we have a computer or hard drive failure. Monthly backups of the COLO database in the Bryophyte and Lichen 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 we ever need a point in time backup of our data.

Taxonomy

ASU continued data maintenance of taxonomic thesaurus in the lichen consortium as part of regular database maintenance and updating routine.

MO PI Brinda conferred with Ed Gilbert (ASU) regarding issues with importing new Bryophyte nomenclatural thesaurus.

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

F and TENN successfully submitted an abstract (on behalf of all TCN participants and institutions) to the online conference: Bryophytes, lichens, and northern ecosystems in a changing world (BL2021; July 6-9, 2021). F PI Matt von Konrat presented the project to conference attendees from the four major bryological, lichenological and botanical societies: the International Association of Bryologists (IAB), the American Bryological and Lichenological Society (ABLS), the Canadian Botanical Association (CBA-ABC) and the Société québécoise de bryologie (SQB).

The GLOBAL TCN website (https://globaltcn.utk.edu) went live in April 2021, and includes links to developed protocols and workflows. Social media accounts belonging to collaborators began using #globalTCN as a way to share progress with the community.

ASU continued organizing a Symbiota workshop (in Spanish) for the Consorcio de Herbarios de Líquenes en América Latina during the 9th Symposium of the International Association for Lichenology, in Brazil August 1-6; the two day workshop is being planned as post-congress event: https://doity.com.br/ial9/blog/workshops.

Senior Personnel Aguero (DUKE) led a herbarium tour and biodiversity informatics presentation to PI Shaw's Plant Diversity class in Spring 2021.

DUKE Senior Personnel participated in a "LGBTQ leaders in STEM" panel discussion as part of June Pride Month talking about work on lichens.

FLAS started revamping the original LBCC PEN website (https://www.floridamuseum.ufl.edu/mossesinflas/) to include new procedures, standards and help files for the GLOBAL TCN.

LSU's GLOBAL results were exhibited in the biology building in a display case located in front of the herbarium which will be highly trafficked when students return in fall 2021. This display is targeted at visiting students and staff, and the public.

NY outreach products on the virtual herbarium website The Hand Lens (http://sweetgum.nybg.org/science/the-hand-lens/) are in progress.

PH led herbarium tours for young museum campers at PH on June 30, 2021 introduced many of them to bryophytes and lichens for the first time and showed them the digitization process.

Share Information About Your Website and/or Portal Usage

The GLOBAL project website, https://globaltcn.utk.edu, was launched publicly in April 2021. Google Analytics was set up on the site on April 29, 2021. 100 users accessed the project site during that short initial period (see Figure 2).

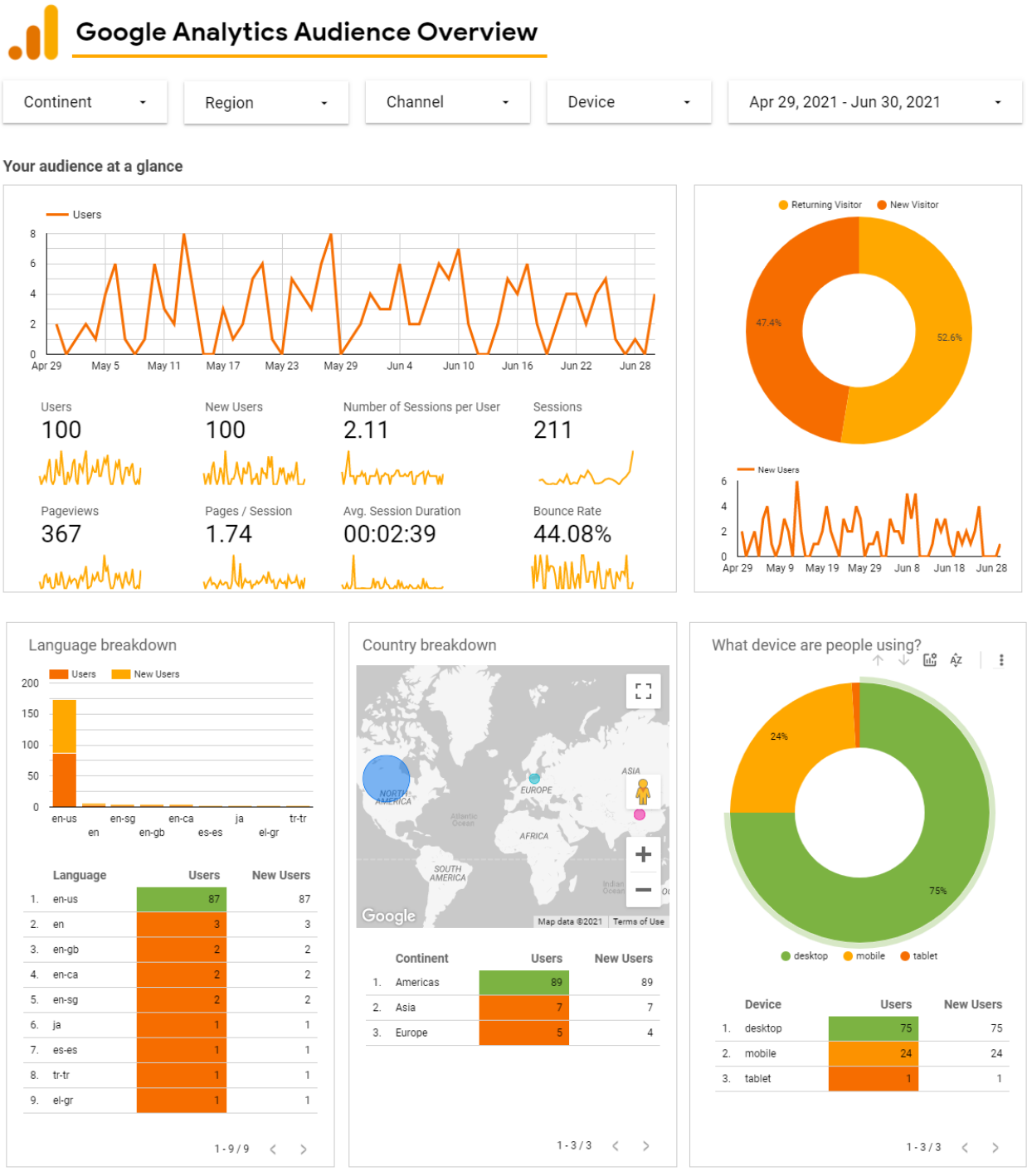


Figure 2: Use metrics for the GLOBAL project website (https://globaltcn.utk.edu) from April 29 – June 30, 2021.

The Bryophyte and Lichen Portals, created as part of the original LBCC grant, host new images and data produced by the GLOBAL collaborators. Over 2,400 users visited the Bryophyte Portal and over 13,800 users visited the Lichen Portal during 2021-Q2 (see Figures 3 & 4).

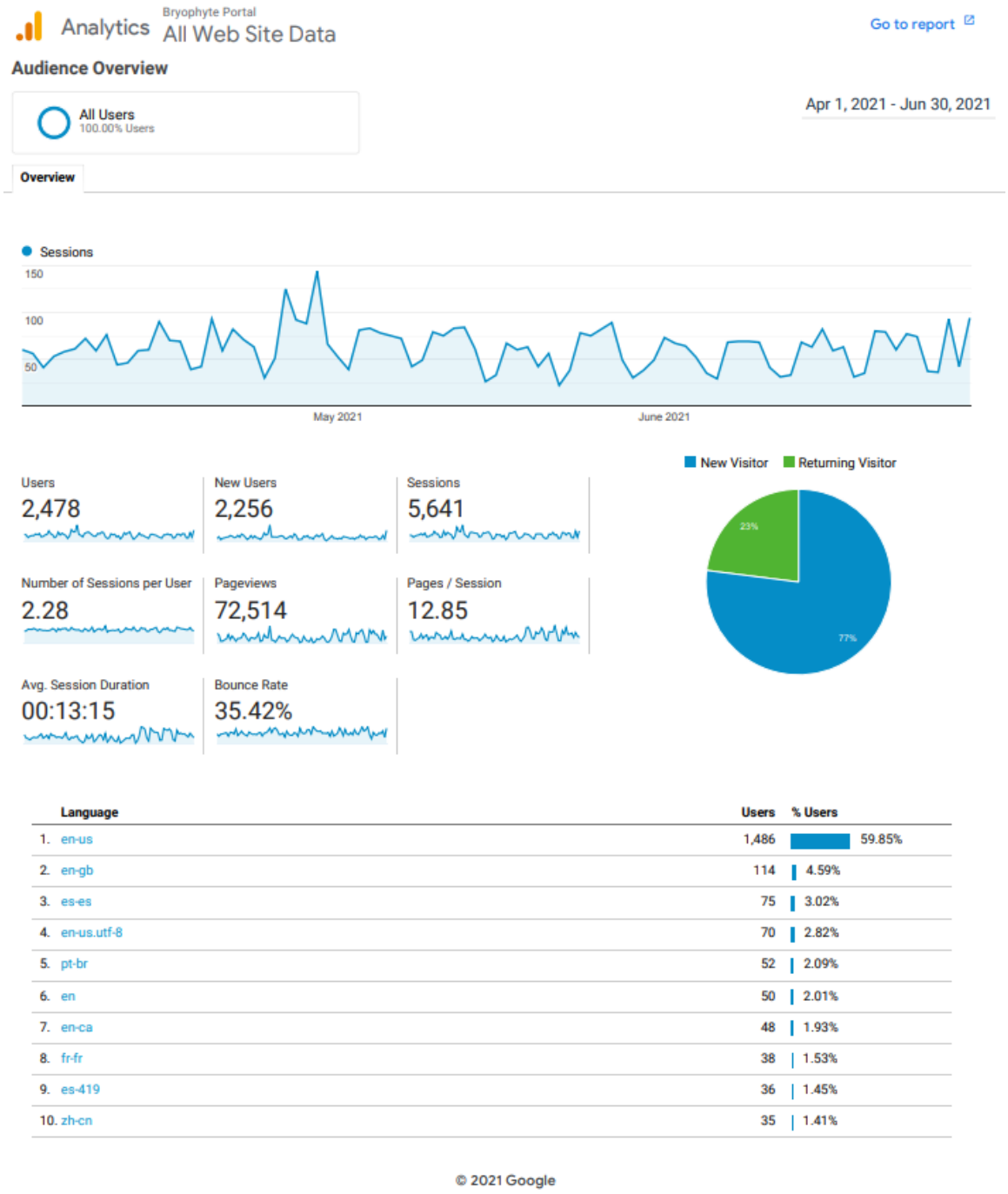


Figure 3: Use metrics for the Bryophyte Portal (https://bryophyteportal.org/portal/) from April 1 – June 30, 2021.

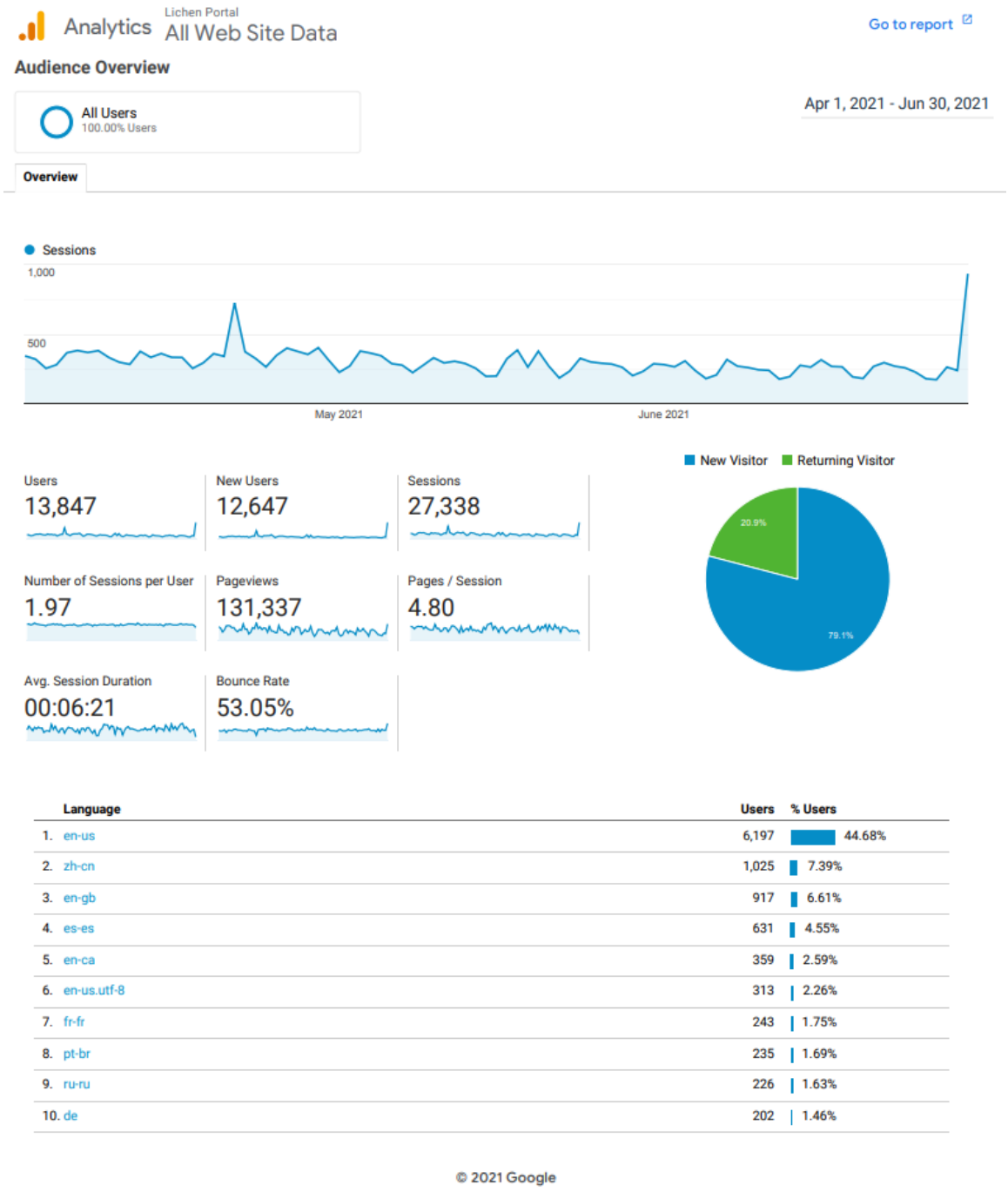


Figure 4: Use metrics for the Lichen Portal (https://lichenportal.org/cnalh/) from April 1 – June 30, 2021.

Share Other Activities and/or Progress

Imaging Tagging

ASU has now added a completely revised character set of secondary metabolites, integrated with a new program called Mytabolites, to the CNALH glossary. Revision of morpho-anatomical character matrix continues.

Bryophyte Packet Labels

ASU now has a beta version of lichen and bryophyte label format currently being tested. They are fixing several bugs mainly to make sure that packet folding marks are consistently printed at the same position.

NSF Annual Reporting

The Project Manager (TENN) created reporting templates for all GLOBAL institutions to facilitate Year 1 NSF Annual Reporting, which is scheduled for completion in 2021-Q3.

Lepidoptera of North America Network &
Symbiota Collections of Arthropods Network (SCAN)
Quarterly Report

August 2, 2021
Neil Cobb

Progress in Digitization Efforts:

This is a joint report for the two Thematic Collections Networks (TCNs) SCAN and LepNet. Many museums are involved in both SCAN and LepNet, including collections that have received funding from both TCNs, collections that are unfunded for one TCN and funded by the other, and some collections that are providing data to both and are unfunded by the ADBC program. Both TCNs share the same database https://scan-bugs.org/portal/, which depending on the context we refer to as the SCAN-LepNet database or the LepNet-SCAN database. We will also serve arthropod data for InverteBase and will serve Terrestrial Parasite Tracker TCN data when it becomes available (See TPT TCN report for details). Summary statistics presented here were compiled from data accessed on the SCAN portal, August 2, 2021. **Table 1** shows the key statistics of Lepidoptera (LepNet) and non-Lepidoptera (SCAN) records to date. These consist of all records and images, including records and images from data providers who have allowed us to post their data on the SCAN/LepNet portal. Providing data from these additional providers increases our ability to georeference, add to taxonomic tables, and more accurately assess the total digitization effort for any given taxon. We provide data specific to institutions that received direct funding from the NSF-ADBC program in the annual reports to NSF.

Table 1. Records in SCAN/LepNet database, "all data" reflects all arthropod taxa, "Non-Lep" includes all non-Lepidoptera arthropod data, and Lepidoptera includes only Lepidoptera taxa.

	All data	Non-Lep (SCAN)	Lepidoptera (All Leps)
Specimen Records	28,541,718	22,878,418	5,663,300
# Georeferenced	24,738,012	19,661,823	5,076,189
# Imaged	6,865,944	4,257,874	2,608,070
# Identified to species	17,706,630	12,243,223	5,463,407

The SCAN network started in 2012 and the TCN funding has ended, but SCAN continues to support PEN projects. The LepNet grant was initiated on July 1, 2016 and there are currently 27 ADBC funded museums and one non-funded museum (Oklahoma State University). The museums comprising the NSF-ADBC LepNet are all serving records and images on the LepNet Portal and are serving data directly to iDigBio via IPT or through DwC archives on the LepNet-SCAN portal. Twenty museums are serving DwC archives to iDigBio and six museums are serving data snapshots with the LepNet portal. We have set up the SCAN Portal to serve all arthropod data from North America as well as all data from North American arthropod collections where specimens were collected outside of North America.

LepNet - The LepNet ADBC-funded museums are still on target to meet goals for records and images. An additional 59 collaborators (non-ADBC funded museums that use our data portal to serve their data) have also provided additional records for Lepidoptera. There are 49 collections (referred to as added-value) that have allowed us to harvest their data via IPT to serve lepidopteran records. Although most of

the Lepidoptera imaged are from iNaturalist, 352,841 are specimen images **Table 2** shows the top 10 families of Lepidoptera in terms of total occurrences digitized.

What is most encouraging about the lepidopteran records is that 97% of the records are identified to species, which is higher than any of the other major orders. Thus, the primary factor limiting the production of "research-ready" data is due to georeferencing. For Lepidoptera 87% of the records are research-ready (i.e., identified to species and georeferenced) and by georeferencing existing records we should increase that percentage to 90% over the next three years. We realize that many records represent misidentified specimens and we also need to seek additional non-ADBC funding to review as many specimen identifications as possible. We are sponsoring three LepNet Partners to Existing Networks (PEN) grants (San Diego Natural History Museum, University of Wisconsin, and University of New Hampshire).

Table 2. The number of occurrence records for the top 10 families of Lepidoptera that have been digitized.

Family	Specimens	Georeferenced	Species ID	Georeferenced & Species ID
Nymphalidae	1,434,389	94%	99%	94%
Noctuidae	873,527	92%	97%	90%
Erebidae	742,934	87%	97%	84%
Geometridae	589,510	89%	96%	85%
Pieridae	512,908	86%	99%	85%
Hesperiidae	491,995	88%	98%	86%
Lycaenidae	403,585	94%	98%	93%
Papilionidae	284,263	88%	99%	88%
Crambidae	267,361	90%	97%	88%
Tortricidae	197,916	85%	95%	80%

Symbiota Collections of Arthropods Network (SCAN) - We have surpassed our overall TCN/PEN goals for the network and have been very successful in supporting data mobilization for unfunded museums and cooperation by larger collections that have allowed there data to be used to help mobilize data from other museums. We are sponsoring one SCAN PEN proposal, one through the American Museum of Natural History, focusing on several ground-dwelling families. **Table 3** shows data for the five major taxa we targeted in SCAN. All five groups have enough data to produce several papers, despite only 60% of the records with species-level identifications, accounting for 51% of the records being research-ready when you factor in percent records that are georeferenced.

Share and Identify Opportunities to Enhance Training Efforts: We are developing resources on the WordPress site http://www.scan-all-bugs.org/ .

Share and Identify Best Practices and Standards (including Lessons Learned):

Table 3 Number of records for the five focal SCAN taxa groups.

Taxa	# Specimen Records	# Georeferenced	# Specimen Identified to species	# Georeferenced & Ided to species
Formicidae	1,359,905	1,242,195	684,508	625,292
Carabidae	759,754	646,440	461,306	396,603
Acrididae	537,165	440,756	316,257	268,339
Araneae	487,356	463,247	444,927	326,775
Tenebrionidae	253,841	222,110	130,986	117,053

We share best practices on the SCAN/LepNet project website https://scan-all-bugs.org/ .

Images for Research - We developed a new and efficient process for uploading images to the database https://scan-bugs.org/portal/profile/index.php?refurl=/portal/imagelib/imagebatch.php? .We are participating in a TDWG-sponsored working group to develop standards for specimen images, including definition of morphological traits.

Identify Gaps in Digitization Areas and Technology: We are supporting the "LightingBug" project https://lightningbug.tech/, which will exponentially increase transcription rate of labels and produce specimen images comprising 360-degree image suites. The production of images will be transformational in terms of extending our capabilities to provide automated identifications and examine morphological traits.
We continue to seek out occurrence data to better understand the biogeography of the focal SCAN taxa and Lepidoptera. For most groups there is not enough data to talk about gaps. We are meeting this need by incorporating additional collections into the SCAN-LepNet database, and harvesting observational records from iNaturalist, Pollardbase, Buguide, LepSoc inventories, and smaller observation sets provided by individual lepidopterists.

Share and Identify Collaborations with other TCNs, Institutions, and Organizations:
We are currently only working with the Terrestrial Parasite Tracker TCN. We are also generally collaborating with a variety of individuals, projects and organizations to extend the ability to mobilize biodiversity data and promote the use of data in research. We are serving data from 246 collections, we continue to add one collection per month.

Share and Identify Opportunities and Strategies for Sustainability: Nothing to report

Other Progress (that doesn't fit into the above categories):

Focus on North American Arthropods We continue to provide North American data obtained from any credible sources to increase the quantity of data available to SCAN and LepNet users. We have added 29 new collections since the update.

GBIF Registration - There are 49 Live collections on SCAN that are now registered with GBIF and 93 other entomology collection datasets from the North America being served on GBIF for a total of 181 datasets. This leaves approximately 28 collections in North America that still need to register on GBIF.

Publications - We have published an overview of the LepNet project (Seltmann et al 2017), and several LepNet participants collaborated on a publication below (Belitz et al., 2018). Our review of North American entomology collections has been published in PeerJ. We are now developing a follow up review on completeness in bee data for the United States.

Belitz, M.W., Hendrick, L.K., Monfils, M.J., Cuthrell, D.L., Marshall, C.J., Kawahara, A.Y., Cobb, N.S., Zaspel, J.M., Horton, A.M., Huber, S.L. and Warren, A.D., 2018. Aggregated occurrence records of the federally endangered Poweshiek skipperling (*Oarisma poweshiek*). *Biodiversity data journal*, (6).

Cobb, N.S., L. Gall, J.M. Zaspel, L.M. McCabe, N.J. Dowdy. and A.Y. Kawahara. 2019 Assessment of North American Entomology Collections: Prospects and Challenges for Addressing Biodiversity Research. PeerJ, 7, p.e8086.

Google Analytics: Our Google Analytics data are dynamically shown https://datastudio.google.com/u/0/reporting/1VvEU4pM2LGqQXY0hVCTf98VvGmM7T_bu/page/cLZN for the SCAN portal, http://scan-bugs.org/portal/index.php .

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.

- All 6 collections are continuing to upload specimen records to the PILSBRy symbiota
- We've added another thousand names to the taxonomic authority file (5595 names)
- Hawaiian Island Gazetteer containing nearly 30,000 localities integrated with GEOLocate
- 5535 ledger pages linked to 275,122 specimen records(~95%)

Share Best Practices, Standards, and Lessons Learned
Share information here. You can also embed graphics if desired.

- We hosted an imaging workshop (86 participants) for museum specimens based on an associated guide.

Share Identified Gaps in Digitization Areas and Technology

Share information here. You can also embed graphics if desired.
COVID19 continues to impact access to collections and recruitment of staff and volunteers.

Share Opportunities to Enhance Training Efforts

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

- A silver lining to the COVID19 pandemic and restrictions was focusing attention to developing virtual educational and social media material to share with the research community and public. Social media such as Twitter, Facebook and YouTube is currently being used as platforms to share these data. The twitter page (@PacificSnail) currently has 150 followers with averages of 437 impressions (views) and 18 engagements (clicks) per tweet. Facebook (@Hawaiian.Land.Snails) currently has 1,332 followers with averages of 1,185 people reached and 60 clicks per post. YouTube is primarily used to host #collectionbattles and workshop recordings.

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

Share information here. You can also embed graphics if desired.
We are continuing to work with local conservation agencies to incorporate species data and GPS information. Additional geographic areas besides Hawaii are now parsed out to the various collections to start tackling GPS data.

Share Opportunities and Strategies for Sustainability

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

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

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

- We just ended YEAR2 of the TCN. Despite the COVID19 pandemic and lack of access into the various institutions, 26 students, volunteers and technicians were recruited in Year 2 and trained in digitization and enhancement of PILS records. There were 3 high school students, 15 undergraduates, 3 post-baccalaureate, 2 graduate student and 3 volunteers. Twenty-one participants are female and five are Pacific Islanders. A postdoctoral researcher was recruited at the beginning of Year 2 (September 2020). All participants are trained in museum studies, taxonomy, malacology, and science communication.

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

TCN Name

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

Reporting Period: May 1st, 2021 - July 31st, 2021

Assembled at BRIT on August 3rd, 2021, for August 4th IAC meeting

Person Completing the Report

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

Reporting Institutions

BAYLU –	Baylor University
BRIT –	Botanical Research Institute of Texas
HUH –	Harvard University
KANU –	University of Kansas
MO –	Missouri Botanical Garden
NOSU –	Northeastern State University
NY –	New York Botanical Garden
OKL –	University of Oklahoma
OKLA –	Oklahoma State University
SHST –	Sam Houston State University
TAES –	Texas A&M University-College Station
TAMUCC –	Texas A&M University-Corpus Christi
TEX/LL –	Plant Resources Center at the University of Texas at Austin [and subaward institutions]
TTC –	Texas Tech University
UTEP –	University of Texas at El Paso

Share Progress in Digitization Efforts

- Number of skeletal records created:

  BAYLU = 0

  BRIT = 0

  HUH = 45 new (1,874 cumulative)

KANU = 0

MO = 0

NOSU = 0

NY = 296 (project total: 29,378)

OKL = 0

OKLA = 0 (state only) (2,419 total)

SHST = 0

TAES = 0

TAMUCC = 13

TEX/LL & Subawards:

Plant Resources Center at UT-Austin (TEX/LL) =	3,237
Sul Ross State University (SRSC) =	0
Angelo State University (SAT) =	0
Texas State University (SWT) =	0
Howard Payne University (HPC) =	0
Our Lady of the Lake University (OLLU) =	0
University of Texas Rio Grande Valley-Edinburg (PAUH) =	0
Texas Lutheran University (TLU) =	0
University of Texas Rio Grande Valley-Brownsville (RUNYON) =	0
Lady Bird Johnson Wildflower Center (JWC) =	3,272
Fort Worth Nature Center (FWNC) = (finished earlier)	0
Saint Edwards University (SEU) =	2,258
Sub-Total =	8,767

TTC = 274

UTEP = 0

Total skeletal records created this quarter: 9,395

- Number of fully-transcribed records created:

BAYLU = 0

BRIT = 13,797 (8,941 staff & volunteer transcriptions + 4,856 community science Notes from Nature generated transcriptions; see below)

HUH = 2,377 new (42,109 cumulative)

KANU = 197 (total # fully transcribed records from OK & TX = 27,498)

MO = 199

NOSU = 0

NY = 6,885 (project total: 60,438)

OKL = 400

OKLA = 1,209 (53,481 total, including import from Oklahoma Vascular Plants Database)

SHST = 2,000

TAES = 0

TAMUCC = 0

TEX/LL & Subawards:

Plant Resources Center at UT-Austin (TEX/LL) =	1,186
Sul Ross State University (SRSC) =	554
Angelo State University (SAT) =	0
Texas State University (SWT) =	0
Howard Payne University (HPC) =	122
Our Lady of the Lake University (OLLU) =	0
University of Texas Rio Grande Valley-Edinburg (PAUH) =	0
Texas Lutheran University (TLU) =	673
University of Texas Rio Grande Valley-Brownsville (RUNYON) =	0
Lady Bird Johnson Wildflower Center (JWC) =	1,149
Fort Worth Nature Center (FWNC) = (finished earlier)	0
Saint Edwards University (SEU) =	570
Sub-Total =	4,254

TTC = 4

UTEP = 0

[***** Notes from Nature transcriptions: 11,205 subjects were uploaded into 11 Expeditions on BioSpex. Of these, 8,885 (79%) have been completely transcribed. Also: 9,981 transcriptions completed in the previous quarter were uploaded back into the TORCH Symbiota Portal for review by the respective collection managers.]

Total fully-transcribed records created this quarter: 31,322

- Number of specimens imaged:

BAYLU = 36,000

BRIT = 9,563

HUH = 41,477 cumulative (* Imaging is ongoing, but we are able to report only on total images that have also been databased; **+2,443 since Q2 report**)

KANU = 481 (total # imaged specimens from OK and TX = 23,992)

MO = 59

NOSU = 0

NY = 5,736 (project total: 35,196)

OKL = 2,321

OKLA = 6,060 (75,301 total)

SHST = 50

TAES = 20,000

TAMUCC = 1,125

TEX/LL & Subawards:

Plant Resources Center at UT-Austin (TEX/LL) =	3,237
Sul Ross State University (SRSC) =	554
Angelo State University (SAT) =	0

Texas State University (SWT) =	0
Howard Payne University (HPC) =	21
Our Lady of the Lake University (OLLU) =	0
University of Texas Rio Grande Valley-Edinburg (PAUH) =	0
Texas Lutheran University (TLU) =	0
University of Texas Rio Grande Valley-Brownsville (RUNYON) =	0
Lady Bird Johnson Wildflower Center (JWC) =	3,272
Fort Worth Nature Center (FWNC) = (finished earlier)	0
Saint Edwards University (SEU) =	2,258
Sub-Total =	9,342

TTC = 1,796
UTEP = 200

Total number of specimens imaged this quarter: 95,176

- Number of specimens georeferenced:

BAYLU = 0

BRIT = 0

HUH = **3,185 new**
8,173 cumulative georeferenced with coordinates.
10,493 cumulative have been reviewed, but **"skipped"** with a reason given **(1,294 new since last quarter)**.
ca. 22,000 remaining to be reviewed (of records that have been databased).

KANU = 197 (total # georeferenced from OK & TX = 27,282)

MO = 21
NOSU = 0

NY = 896 (project total: 58,399)

OKL = 2,274

OKLA = 0

SHST = 0

TAES = 0

TAMUCC = 1,125 (all specimens included in the digitization project have georefererenced metadata attached)

TEX/LL & Subawards:

Plant Resources Center at UT-Austin (TEX/LL) =	230
Sul Ross State University (SRSC) =	70
Angelo State University (SAT) =	0
Texas State University (SWT) =	0
Howard Payne University (HPC) =	5
Our Lady of the Lake University (OLLU) =	0
University of Texas Rio Grande Valley-Edinburg (PAUH) =	0
Texas Lutheran University (TLU) =	646
University of Texas Rio Grande Valley-Brownsville (RUNYON) =	0
Lady Bird Johnson Wildflower Center (JWC) =	360
Fort Worth Nature Center (FWNC) = (finished earlier)	0
Saint Edwards University (SEU) =	2
Sub-Total =	1,313

TTC = 0 (believed finished; see below)
UTEP = 0

Total number of specimens georeferenced this quarter: 10,305

- Other digitization or pre-digitization efforts:

BRIT:

Prioritized data cleaning of records generated from Notes from Nature, as well as data-cleaning of locality-related field in records in preparation for georeferencing.

Prioritized image processing (renaming to barcodes, image editing, and upload to TACC servers).

All specimens collected in Oklahoma in the BRIT/SMU collections have been identified and imaged.

We continue to physically locate project specimens in the NLU collection for transcription (most NLU specimens had already been imaged but not transcribed when they were accessioned at BRIT in 2017).

Located all project specimens filed out in BRIT collection (Oklahoma in BRIT/SMU North America folders).

We continue skeletal transcriptions of images from image sets containing a mix of project and non-project specimens (Texas and Oklahoma in VDB North America folders) in the VDB collection at BRIT in order to prioritize TORCH complete transcriptions. Utilizing the crowd sourcing module in Symbiota, providing training (outside of business hours) and ongoing support (via email, Zoom, and Google Docs) has resulted in 31,211 skeletal transcriptions (scientific name, country, state, county) this reporting period. These skeletal transcriptions have provided us with details to prioritize complete transcription of TORCH specimens.

Project staff retrieved the loan of 37 boxes of HSU specimens for digitization under the TORCH grant. As of July 28, approximately 60% of the specimens have been imaged and transcribed.

ACU herbarium loan of over 5,000 specimens was returned to the University.

GeoLocate CoGE feature in Symbiota has been activated for the TORCH portal and a preliminary set of specimen records has been ported to CoGe for georeferencing of Erath Co., Texas by Tarleton State University M.S. student, Bethany O'Neal.

A significant amount of time was spent processing TORCH specimen images and uploading these to the TACC server, then linking them to Symbiota records.

In June 2021, the UNT herbarium collection was completely transcribed, primarily by staff member Tessa Boucher.

KANU: We processed (mounted, barcoded, databased, and imaged) 80 unmounted specimens from TX.

NOSU: We have our lightbox and camera now. We are now waiting on some barcodes so we can begin imaging.

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

OKLA: Specimens repaired as needed (not using TORCH funds). Curation conducted as needed (not using TORCH funds).

SHST: 500 specimens have been barcoded. We have also made arrangements to send all the available captured label data to Discover Life, and it should be accessible there soon. We will provide a copy of these data in CDF format to BRIT in August, so it can be ingested into the TORCH Symbiota Portal.

TAMUCC: We have used the digitization process as an opportunity to refine the organization of specimens by family. They are imaged roughly in order by family, and reorganized by species before being returned to the cabinet space.

TEX/LL: At the Plant Resources Center (TEX/LL), we acquired another imaging station constructed by Jason Best at BRIT, but lost our oldest (pre-grant) imaging station because of electrical failure. We plan to have it rewired and install new light fixtures in the future using internal funds.

TTC: Began digitization of catalogs and journals for Guadalupe Mountains National Park (GUMO) specimens collected 1973-1976 by Burgess, Northington, and Green, for use in extended specimen records. We have also begun to digitize mounted but unrecorded specimens from this collection and organize them in a specific GUMO cabinet, per our repository agreement we have with GUMO.

- Comments about the digitization process:

HUH: Digitization staff are sharing time across multiple digitization projects. Staff resumed creating new records this quarter and are dividing time between new record creation and georeferencing. Georeferenced records currently reside in the GEOLocate website and are planned to be ingested back into our system (data to be subsequently shared via existing IPT).

KANU: All label data for our OK and TX specimens have now been transcribed (except for approximately 60 unmounted specimens and infrequent specimens discovered in the cases), and essentially all OK and TX specimens have been imaged. We are now checking each case to verify that all flagged specimens were imaged. We will begin processing all RAW images in Lightroom for uploading to our attachment server next week. Once on the attachment server, all records (including images) will be uploaded to GBIF and iDigBio during our scheduled uploads to those portals.

Approximately 340 database records are for seed packets and alcohol-preserved specimens that will not be imaged.

MO: The COVID-19 pandemic continued to severely impact our ability to conduct work on the TORCH TCN project during the period 1 May-31 July 2021. As of this reporting, access to our collections remains restricted to just our science staff, who are authorized to be on-site only a few days per week. Presently, there are no provisions for access to our facilities by students or volunteers. This has curtailed our ability to make the level of progress that we had anticipated for this project. During this quarter we have been unable to recruit any project participants. This has been our situation since the pandemic started in March 2020. We are hopeful that in the coming months this will change, but we have no sense of when that might happen. Recruiting participants will be a top priority and major concern when we return to some kind of "normalcy".

Also note: Jim Solomon, curator at MO during the first half of this project, officially retired on July 2nd. However, his replacement will not arrive for a couple more months, so he is remaining on board in the interim.

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

OKL: Three undergraduate students and one Masters student are being trained, so progress will increase now.

OKLA: There is a bottleneck getting images uploaded to the TACC image repository and then linked to the TORCH Symbiota Portal.

SHST: Progress has been slow due to unexpected technical difficulties but we have made steps to speed up the process. We had issues with quality of the lighting in our images, but we managed to fix it by enhancing the brightness in post-processing. We also had issues with the image quality but we found that the software we were using is very detrimental to image quality on default settings, so we changed them to suit our needs.

TAMUCC: At this point in the digitization process, we've refined our imaging methods and have gained confidence in our ability to produce quality images for the specimens located in the Ruth O'Brien Herbarium.

TEX/LL:

The Plant Resources Center completed efforts to pull our Oklahoma plants from the main collection for digitization and made in-roads into imaging and transcribing labels from these.

Our Lady of the Lake University is currently waiting on a mobile imaging station to begin processing specimens.

At St. Edwards University (SEU) (Austin, Texas), what we had been led to believe was a 3,000-specimen collection actually is closer to 8,000 sheets.

TTC: We believe georeferencing is complete for all Texas and Oklahoma specimens. Imaging has proceeded this summer with a graduate student working on a departmental RA position two days per week.

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

BAYLU = 0

BRIT (Searched all collections on 2021-07-28, without taxonomic constraints, collected in TX or OK):

BRIT-SMU-VDB-NLU =	178,594
TAC =	7,065
NTSC =	0
ACU =	0
HSU =	336

Sub-total for BRIT Lead = 185,995

HUH = 41,788 (* last ingested by iDigBio 2021-05-20)

KANU: A new instance of our database is uploaded to GBIF and iDigBio at the beginning of each month. This continues to be done for all transcribed records. New images will be begin uploading starting in August. [for this count, **assumed 27,498 as above**]

MO = 0

NOSU = 0

NY = 105,972 (also includes bryophytes and fungi)

OKL = 0

OKLA = 0

SHST = 0

TAES = 0

TAMUCC = 0

TEX/LL = 232,987

TTC = 0

UTEP = 82,383

Total number of records available in iDigBio portal (cumulative): 676,623

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

BAYLU = 14,000

BRIT (Searched all collections on 2021-07-28, without taxonomic constraints, collected in TX or OK):

BRIT-SMU-VDB-NLU =	187,825
TAC =	7,064
NTSC =	11,324
ACU =	3,745
HSU =	2,221

Sub-total for BRIT Lead = 212,179

HUH = 41,556

KANU: All KANU records uploaded to GBIF and iDigBio should be accessible via the TORCH portal. [for this count, **assumed 27,498 as above**]

MO = 0

NOSU = 0

NY = 87,315 (same as previous report – IPT has apparently not been updated)

OKL = 136,017

OKLA = 59,778

SHST = 0

TAES = 236,901

TAMUCC = 0

TEX/LL = 232,759

TTC = 21,171

UTEP = 85,504

Total number of records in TORCH Symbiota portal (cumulative): 1,154,678

Note: Above count **does not include 100,792 from TEX/LL subawards, present in Q2 report. If they were included, then this GRAND TOTAL = 1,255,470.**

Share Best Practices, Standards, and Lessons Learned

Best Practices and Standards (Lessons Learned):

SHST: We learned to ensure proper lighting for specimens and proper photo quality.

TAMUCC: It has been beneficial to us to create image number goals before each workday, so that we stay on track with imaging. While imaging, it is important to take breaks once the process begins to feel robotic. We've found that even a 1min break in between every 50 images or so can help ensure the quality of images produced during the session.

Share Identified Gaps in Digitization Areas and Technology

Identify Gaps in Digitization Areas and Technology (issues preventing progress):

BRIT: Staff time on TORCH projects was temporarily reduced to complete requirements on other projects (May-July) of full-time TORCH staff members Ashley Bordelon and Joe Lippert. It is expected they will resume their April 2021 hour contributions to the project in August 2021.

HUH: In the previous year, the COVID-19 pandemic caused the shutdown of many institutions, including the HUH. We closed mid-March of 2020 and remained closed for approximately 3 months, but were able to continue many digitization activities remotely. The HUH reopened under a low-density occupancy plan and continues to operate in that capacity. Fortunately, staff only need to return to the building once per week to image enough specimens to continue transcription work remotely, a significant advantage to staff health and safety. We did encounter technical setbacks to our infrastructure this fiscal year that were exacerbated by COVID-related staffing disruptions. This halted new record creation in Q1 and Q2, during which time staff were diverted to other projects without disruption to employment status, and technical issues were resolved at the start of Q3. The HUH will request a one-year no-cost extension to continue digitization activities delayed in FY2021.

NY: As of 19 July, McKenna Coyle (and all herbarium staff) are working onsite three days per week. We still have one internship on the TORCH grant, but due to Garden restrictions, we are not yet able to hire a second intern. At this point, all the work that an intern would normally do has been done, so we will probably use the intern funds to continue McKenna's employment a little longer (perhaps until the end of 2021).

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. Also, need workflow and personnel for uploading images to TACC and linking them to the TORCH Symbiota Portal.

SHST: The cameras' age makes it harder to acquire software for them, and upgrading our cameras could allow for better imaging.

TAMUCC: Lack of communication between Herbaria and somewhat difficult uploading process once images have been exported from the session.

TEX/LL: University of Texas Rio Grande Valley-Brownsville is on hold due to Brownsville planning on moving its collection to UT-Austin or to University of Texas Rio Grande Valley-Edinburg. University of Texas Rio Grande Valley-Edinburg is also on hold, following the retirement of the curator and the recent death of the Biology Department head. These situations will hopefully be resolved early in the Fall 2021 semester.

Share Opportunities to Enhance Training Efforts

Opportunities to Enhance Training Efforts; Training and Professional Development Opportunities you offered and/or participated in (e.g., webinars, student digitizer training, etc.):

BRIT: We continue to host weekly Zoom conversations with the Armchair Botanist program to engage Notes from Nature volunteers transcribing project specimens. Project Manager Diego Barroso had the opportunity to attend the 5th iDigBio Biodiversity Data Conference (June 7th – 9th, 2021), and the iDigBio Digitization Academy (July 12th – 15th, 2021).

HUH: The HUH employs a team of approximately 14 staff working on digitization in some capacity and Endless Forms project staff are able to receive assistance and expertise from senior HUH staff and other digitizers. This is observed in the HUH Slack instance where staff often receive help on difficult to read labels and obscure localities. The HUH digitization workflow is supported by in-house technical staff and university Research Computing. These additional staff resources are not expensed to the grant.

NOSU: Abby Moore and two students came to NOSU in June to help set up the camera and light box.

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

OKLA: Trained two new undergraduate assistants in image processing and transcription. Data Manager Clay Barrett attended the 5th iDigBio Biodiversity Data Conference (June 7th – 9th, 2021).

TAES: TAES student workers participated in the recent iDigBio Digitization Workshop, held July 12th through the 15th.

TAMUCC: Attended the New York Botanical Garden webinar, "Collectively saving plant and fungal biodiversity". We are also interested in attending other trainings and webinars, and we look out for these opportunities throughout the semester.

TEX/LL: At the Plant Resources Center, two students we hosted through the university's Bridging Disciplines Program completed internships that included modules on the three components of digitization using TORCH specimens. Additionally, we are hosting one doctoral student for a summer herbarium internship with a similar focus. Because so many of our existing student workers continued to work remotely during the pandemic, other training opportunities were minimal.

UTEP: Georeferencing training has been offered to several student volunteers.

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

Collaboration with other TCNs, Institutions, and Organizations:

The TORCH TCN Project held a virtual Executive Committee meeting (with 4 out of 5 lead PI's in attendance), on July 16th, 2021. An important agreement reached at this meeting is that we will plan for and carry out the TORCH TCN Summer Internship Program during the Summer of 2022, as outlined in the TCN's grant proposal. A collaborative space has been created online (Google Drive) for the different P.I.s and stakeholders to brainstorm and organize this internship. Also, now that institutions are starting to return to normal and hire digitizers, the TCN is planning to hold regular training sessions via Zoom, and to finalize our existing documentation to properly guide our users on recommended workflows. We will also begin to proactively push out data from the TORCH Portal to iDigBio and GBIF, helping those institutions who are not yet set up to publish to aggregators from the TORCH Portal.

BRIT:

With Project Manager Diego Barroso, on May 17th met with Steven Pennings from University of Houston Coastal Center (UHCC) to discuss the possibility of his institution joining the TORCH Portal, and having TORCH image ca. 1000 specimens from UHCC.

Also, a collaboration with Google Arts Culture allowed us access to a new platform for disseminating herbarium specimen stories and data. Project staff generated two "Stories" for the public, which are curated photo essays that have yet to be published online. The grant is credited for contributing to the digitization and mobilization of the specimen images and data shared.

HUH: See below.

OKL: Abby Moore and two students traveled to NOSU in June to help set up their camera and light box.

TAMUCC: We plan to work with student organizations come Fall semester to share with them the importance of Herbaria and vouchered specimens.

Share Opportunities and Strategies for Sustainability

Opportunities and Strategies for Sustainability:

KANU: We continue strategic curatorial and collection management work on specimens, especially those from OK and TX. This work is handled by the Collection Manager and/or a student employee not working on the TORCH grant. It has resulted in significant collateral collection improvements, such as replacing several thousand worn genus folders, refoldering specimens to reduce compaction, repairing damaged specimens, annotating specimens, and updating the Specify taxonomy tree.

TAMUCC: We no longer use disposable, single-use plastic coverings for quarantining plant specimens, instead we use reusable Ziploc containers and bags. We only use natural and earth-friendly cleaning products in the workspace. We make sure to turn off all equipment after a session. We keep back door closed at all times to ensure the humidity and temperature in the room do not fluctuate. on campus, to prevent any unnecessary waste of material.

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

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

HUH: See below.

TAMUCC: We are open for tours during university hours, and we present at conferences and symposiums when possible.

UTEP: Castner Range Flora Project has been presented at this summer's Botanical Society of America National Meeting.

Other Education and Outreach activities:

HUH: Davis is working with Harvard Natural Museums staff to open an exhibit titled *"In Search of Thoreau's Flowers"*, which is a partnership with artists that will feature digital specimen images alongside climate change research from the Davis lab. This has also developed into a phenology module for Massachusetts middle school standards that uses herbarium materials and Thoreau's journals to detect climate change response in plants. Finally, Davis presented in May to a group of high school biology teachers on related research as part of the Museums professional development for primary educators.

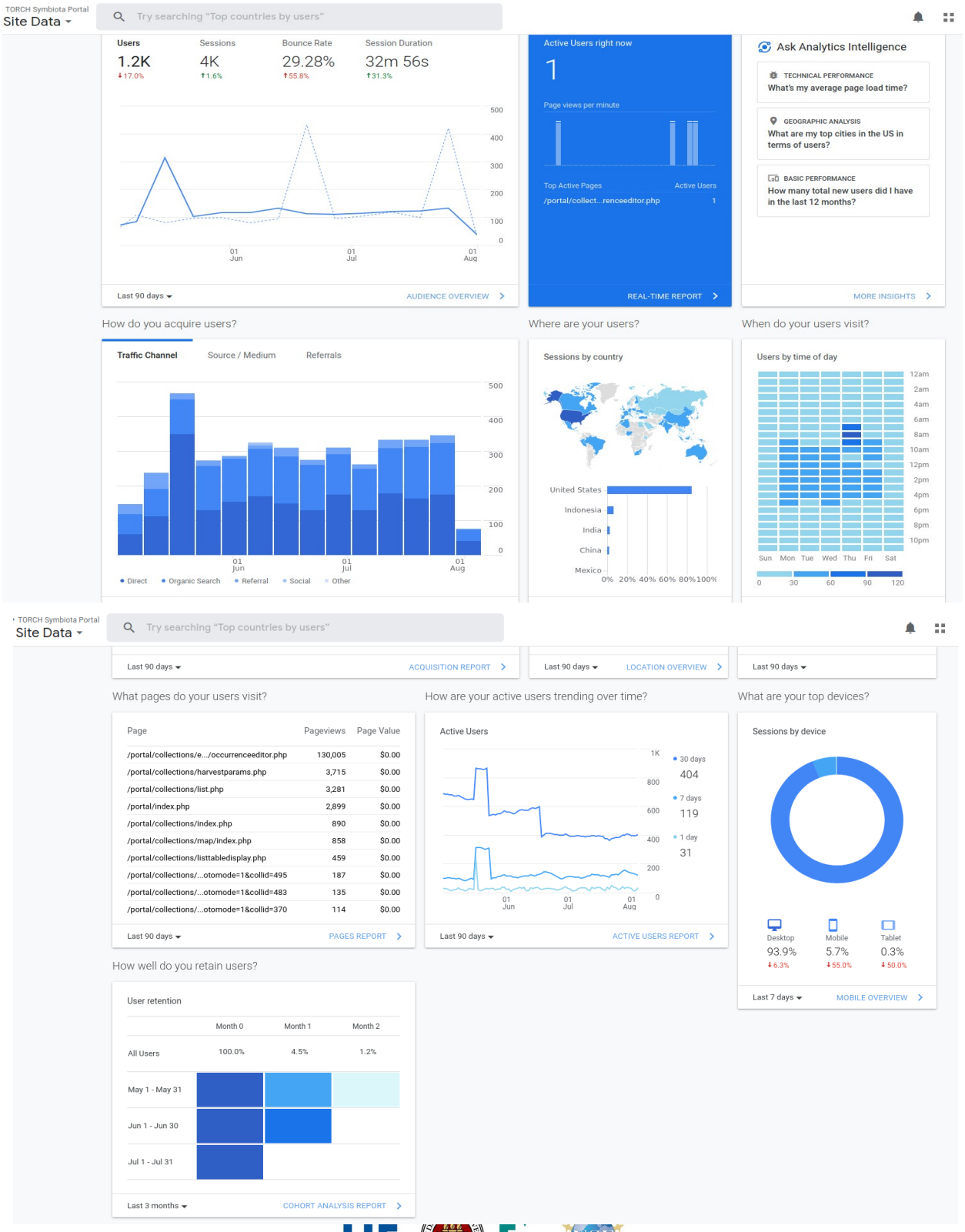
Chuck Davis gave lectures on these materials at Washington University, St. Louis, and North Carolina State University. Other scheduled talks (University of Minnesota, University of Michigan) were canceled on account of COVID.

OKLA: Outreach activities are documented by the New York Botanical Garden subaward.

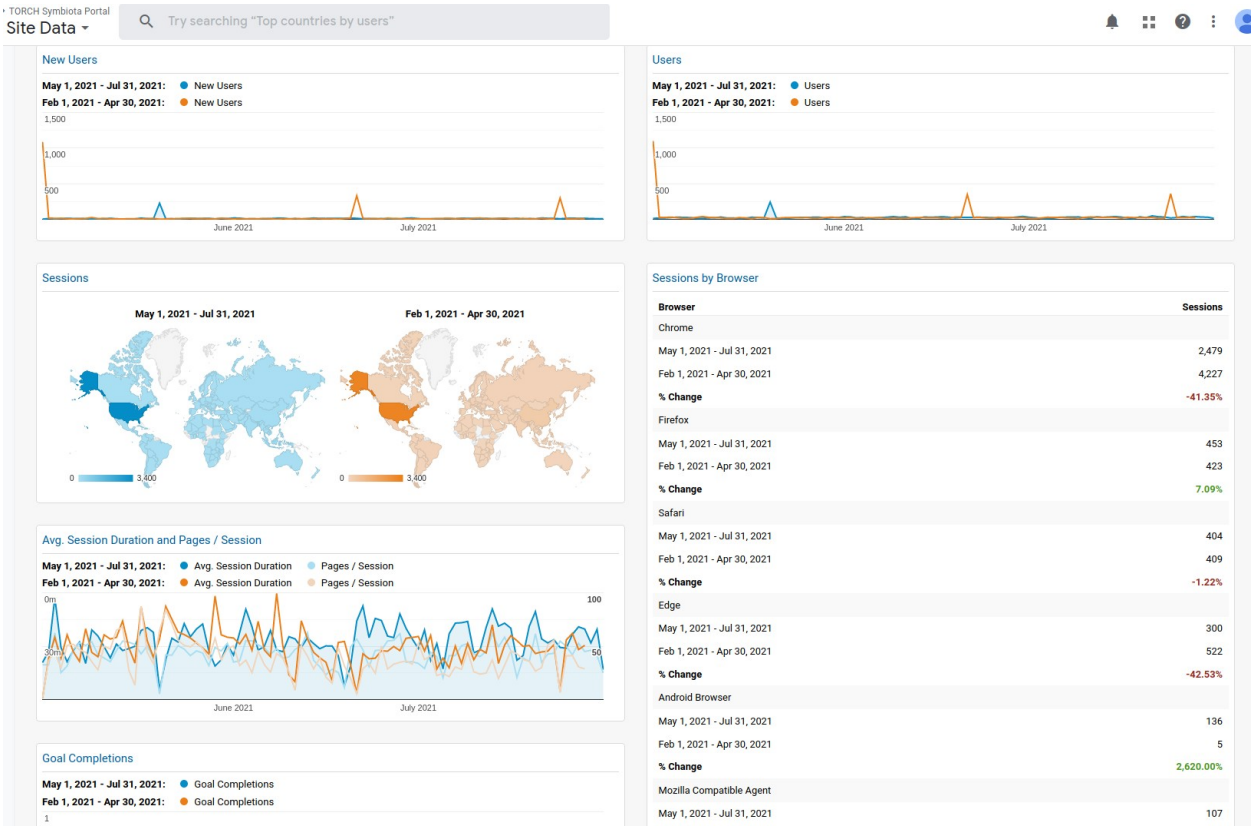
TAMUCC: We will continue to invite Biology and Ecology classes to utilize the herbarium for various projects and studies. Students exposed to the herbarium will gain knowledge on the function and purpose of herbaria through the process of collecting, pressing, and mounting plant specimens.

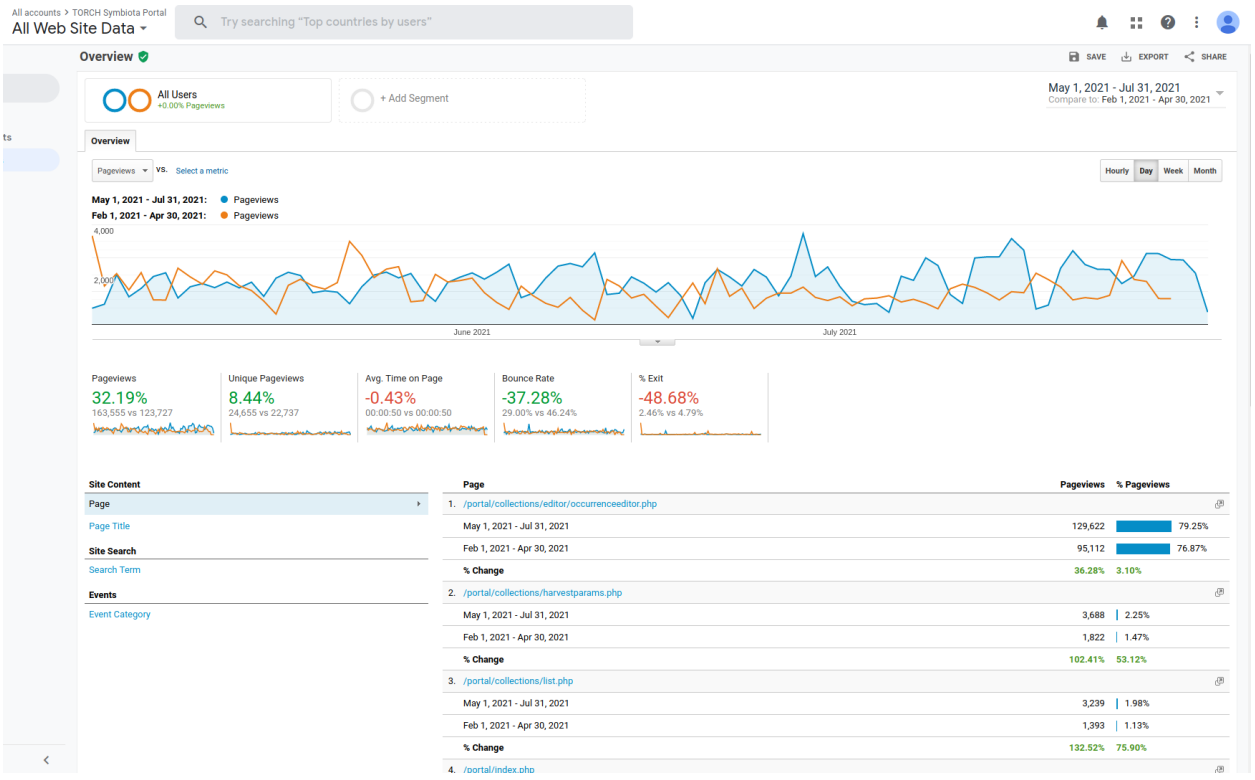
TEX/LL: The Plant Resources Center hosted three tours during the quarter to students and faculty from Texas Lutheran University and Trinity University (San Antonio, TX), as well as to staff and interns from the San Antonio Missions National Historical Site (National Park Service). These included discussions of our digitization programs and TORCH.

Share Information About Your Website and/or Portal Usage



iDigBio
Integrated Digitized Biocollections





UF UNIVERSITY of FLORIDA
FLORIDA STATE UNIVERSITY 1851
FM FLORIDA MUSEUM
NSF

Share Other Activities and/or Progress

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

HUH: Davis and members of this TCN have also participated or co-led in the publication of seven papers related to this effort, including: studies related to phenology (Park et al., 2020a), insect herbivory (Meineke et al., 2021), machine learning (Davis et al., 2020; Park et al., 2020b; Pearson et al., 2020), and the future of digitization (Hedrick et al., 2020). Most directly related this proposal was a paper describing a newly redesigned photostation for digitization efforts underway at the HUH (Davis et al., 2021).

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Davis CC, Champ J, Park DS, Breckheimer I, Lyra GM, Xie J, Joly A, Tarapore D, Ellison AM, Bonnet P. 2020. A new method for counting reproductive structures in digitized herbarium specimens using mask R-CNN. Frontiers in Plant Science 11(1129).

Davis CC, Kennedy JA, Grassa CJ. 2021. Back to the future: a refined single-user photostation for massively scaling herbarium digitization. Taxon n/a(n/a).

Hedrick BP, Heberling JM, Meineke EK, Turner KG, Grassa CJ, Park DS, Kennedy J, Clarke JA, Cook JA, Blackburn DC, et al. 2020. Digitization and the future of natural history collections. BioScience 70(3): 243-251.

Meineke EK, Davis CC, Davies TJ. 2021. Phenological sensitivity to temperature mediates herbivory. Global Change Biology 27(11): 2315-2327.

Park DS, Breckheimer IK, Ellison AM, Lyra GM, Davis CC. 2020a. Phenological displacement is uncommon among sympatric angiosperms. bioRxiv: 2020.2008.2004.236935.

Park DS, Willis CG, Xi Z, Kartesz JT, Davis CC, Worthington S. 2020b. Machine learning predicts large scale declines in native plant phylogenetic diversity. New Phytologist 227(5): 1544-1556.

Pearson KD, Nelson G, Aronson MFJ, Bonnet P, Brenskelle L, Davis CC, Denny EG, Ellwood ER, Goëau H, Heberling JM, et al. 2020. Machine learning using digitized herbarium specimens to advance phenological research. BioScience: biaa044.

TAES: A talk was given at Botany 2021: “Drivers of diversification and assembly are spatially structured”

TAMUCC: Herbarium Technician resources binder and Digitization Protocol.

TEX/LL: The Plant Resources Center presented the following poster at the Botany 2021 Virtual Conference in July 2021 (which cited NSF and the TORCH award, among other things):

Horning, Amber L., G. Yatskievych, and T. Urban. 2021. Digitizing large herbaria: history, progress, and challenges at the University of Texas at Austin. Poster presented at the Botany 2021 virtual conference, Biodiversity Informatics and Herbarium session.

TTC: Three student presentations by Texas Tech students at the Botany 2021 virtual conference involved TTC and TORCH specimen records and images:

Anukriti Dey* and Matt Johnson. Comparison of Machine Learning and Manual Approaches for Assessing Morphology in Herbarium Specimens [https://botanyconference.org/engine/search/index.php?func=detail&aid=498]

Jose Villeda*, Cassidy Coker*, Madeline Slimp*, Zachary Bailey*, Matt Johnson, and Nick Smith. Correlation of plant traits along a fast-slow continuum using 50 year-old herbarium specimens [https://botanyconference.org/engine/search/index.php?func=detail&aid=742]

Sherese Price*, Yanni Chen, Norm Douglas, Haley Hale, Eric LoPresti, Mike Moore, Sonia Nostranina, and Matt Johnson Reconstructing a phylogeny of sand verbenas (Abronia, Trypterocalyx) using Angiosperms353 [https://botanyconference.org/engine/search/index.php?func=detail&aid=293]

*Asterisks denote undergraduate students

New publication using DNA collected from digitized specimens of our Guadalupe Mountains National Park collection, with an undergraduate first-author:

Slimp, M*., L. D. Williams, H. Hale, and M. G. Johnson. 2021. On the potential of Angiosperms353 for population genomic studies. Applications in plant sciences.

*Asterisk denotes undergraduate student

<u>Participants (especially those who have newly joined the project)</u>:

BAYLU:

Albert Zertuche (technician)
Mykayla Oleson (student worker)
Isaac Montgomery (student volunteer)

BRIT:

Ashley Bordelon, Digitization Coordinator (virtual engagement); abordelon@brit.org
Joe Lippert, Digitization Coordinator (imaging and image processing); jlippert@brit.org
Diego Barroso, TORCH TCN Project Manager; dbarroso@brit.org
Tiana Rehman, Collections Manager/Institutional Rep; trehman@brit.org
Jason Best, Director of Biodiversity Informatics/Technovator; jbest@brit.org
Peter Fritsch, VP of Research/P.I.; pfritsch@brit.org
Jessica Lane, BRIT Herbarium Assistant; jlane@brit.org
Tessa Boucher, Digitization Technician, tboucher@brit.org
Rachel Carmickle, Herbarium Technician, rcarmickle@brit.org

HUH: Nothing new to report.

KANU: No new participants to report.

MO: Nothing new to report.

NOSU:

Lizz Waring, P.I.
Lorelei Burnside, Graduate Assistant
Emma Mills, Undergraduate Assistant
Jon Weeden, Undergraduate Assistant

NY:

McKenna Coyle, Lead Digitizer

OKL: Three new undergraduate students trained this summer, who will continue to work during the academic year: Michael Beck, Asim Ali, and Benjamin Conard. Michael Beck is paid off of herbarium funds, while Asim Ali and Benjamin Conard are paid off of the grant. Also, one new Masters student, Teraye Gillum, is being trained this summer and will manage the project and train undergraduates during the semesters that the other Masters student, Leann Monaghan, is working as a teaching assistant, thus allowing for uninterrupted progress.

OKLA: Three undergraduate workers (two new) continued image processing, and three began transcribing.

SHST: Four new students have joined the project and are helping with digitization efforts.

TAES: Digitization Technicians:
Ashish Nerlekar
Jennifer Deden
Daniel MacKenzie
Kelli Gartman

TAMUCC:
Barnabas H. Daru – project supervisor and PI
Jordan Rodriguez – Digitization Technician

TEX/LL: Jake Doyle (jakedoyle@utexas.edu), Undergraduate student, who has entered and edited records, and imaged specimens. Also, Saint Edward's University joined TORCH as a Data Provider.

TTC:

Graduate students: Yanni Chen, Sarah Vaca.
Undergraduate students: Madeline Slimp, Anukriti Dey

UTEP:
UTEP Undergraduates:
Mayra Madrid (NEW)
Muriel Normal (continuing, work-study student)
Alexis Vallejo (continuing)
Aparna Mangadu (continuing)

All georeferenced, trained and supervised by our collections manager, Mingna "Vicky" Zhuang.

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

BRIT: Jason Best, Director of Biodiversity Informatics at BRIT and Technological Innovator on the TORCH TCN Project, finalized the design of the lightboxes he created for the TORCH Project. The final cost for each lightbox and stand was determined to be $750 (not including the cost of the camera mount, labor, and shipping). Three lightboxes were delivered (one each to TEX, TAES, and OKL). Also, with Data Manager Clay Barrett at OKLA, work is ongoing on image-processing scripts, with notable bug fixes and enhancements this quarter.

NY:

Measures of progress (% done):

Skeletal records: We have essentially completed the barcoding of specimens and creation of skeletal records, though some will continue to be added (from new accessions, returned loans, etc.)

Specimens imaged: We have completed 35,196 (~62%) out of a promised 57,000; the actual number will be somewhat less than this estimate.

Full transcriptions: We have completed 60,438 (~78%) out of a promised 77,000.

Georeferences: We have completed 58,399 (~85%) out of a promised 68,267.

OKLA:

Subaward work at University of Kansas is almost complete.

Subaward work at New York Botanical Garden is on track to be completed by year's end.

Data Manager Clay Barrett and Technological Innovator Jason Best at BRIT continue to work on image-processing scripts, with notable bug fixes and enhancements this quarter. Data Manager Clay Barrett worked with BRIT Collection Manager Tiana Rehman to streamline the Notes from Nature workflow being used for TORCH TCN Expeditions.

TAES: We have received an additional two lightboxes, and our now putting together the rest of the digitization stations. We anticipate beginning to digitize records from TAMU-K beginning in the Fall.

Questions/comments:

NOSU: We are almost there for getting started! Next quarter I should have some numbers for you!

TAMUCC: We are loving all of our new, rubber-sealed cabinets!

TEX/LL:

We are still laboring under the cloud of the COVID-19 pandemic, which continues to have a negative impact on progress. The ca. five months that we lost in 2020 during the university shut down has not been recouped and, in fact, the slowness of the full reopening has continued to slow us down.

TTC:

Is TORCH prepared for the impending roll out of “Symbiota2” ?

Now that we have our collection georeferenced, we are interested in having our specimens “ingested” by other aggregators like iDigBio and GBIF, but are unsure about how to proceed. Is this something TORCH facilitates?

Will there be a TORCH meeting (in person or virtually) for participants this year? I feel like I’ve lost touch with the project due to the pandemic, and it would be great to reconnect!

I believe that TTC and BRIT representatives are still discussing the no-cost extension but it doesn’t seem like there will be any problem on our end; thanks for helping make that connection earlier!

UTEP: We are now mostly complete. There are a few odds and ends to clean up, but Oklahoma and Texas specimens are mostly included.