LOGO

Digitization TCN: ESB: Mobilizing Millions of Marine Mollusks of the Eastern Seaboard

Project Start Date: 15 September 2020

Project period: 4 years

Project leads: Rüdiger Bieler & Petra Sierwald

VIRTUAL ADBC SUMMIT 2020

TCNs with molluscan component:

FOSSIL:

- 2012: (TCN) Digitizing Fossils to Enable New Syntheses in Biogeography- Creating a PALEONICHES (Paleoniches)

- 2015: (TCN) Documenting Fossil Marine Invertebrate Communities of the Eastern Pacific - Faunal Responses to Environmental Change over the last 66 million years (EPICC)

- 2016: (TCN): The Cretaceous World: Digitizing Fossils to Reconstruct Evolving Ecosystems in the Western Interior Seaway

EXTANT:

LAND AND FRESHWATER:

- 2014: (TCN) Documenting the Occurrence through Space and Time of Aquatic Non-indigenous Fish, Mollusks, Algae, and Plants Threatening North America's Great Lakes (GLI)

- 2014: (TCN) InvertEBase: Reaching Back to See the Future: Species-rich Invertebrate Faunas Document Causes and Consequences of Biodiversity Shifts (InvertEBase)

- 2019: (TCN) Enhancing Access to Taxonomic and Biogeographical Data to Stem the Tide of Extinction of the Highly Imperiled Pacific Island Land Snails: (PILSBRY)

MARINE: ?

U.S. Mollusk collections: 1973 baseline data

Published October 1975

- Analyzed data from 26 institutional collections with >5,000 lots

https://biodiversitylibrary.org/page/43040030

The Recent Mollusk Collection Resources of North America

A Report to the

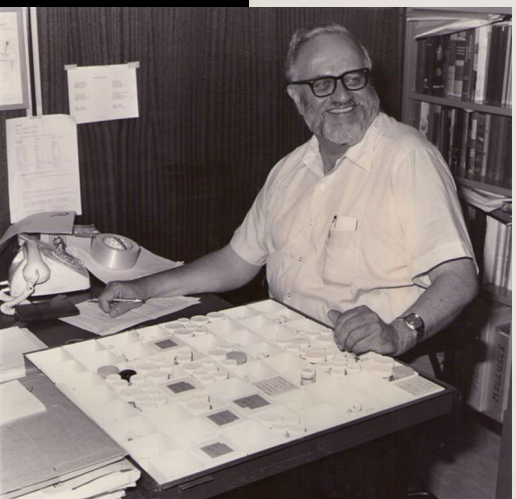
ASSOCIATION OF SYSTEMATICS COLLECTIONS

Compiled and Written by

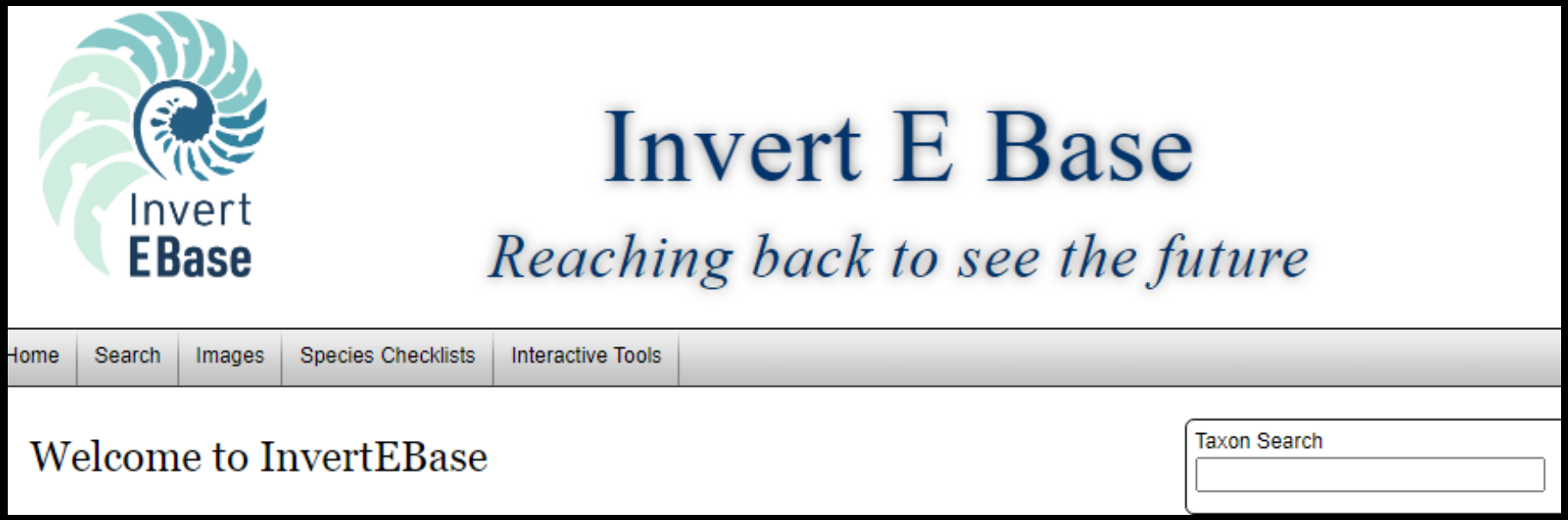
ALAN SOLEM

for the

COUNCIL OF SYSTEMATIC MALACOLOGISTS



invertebase.org



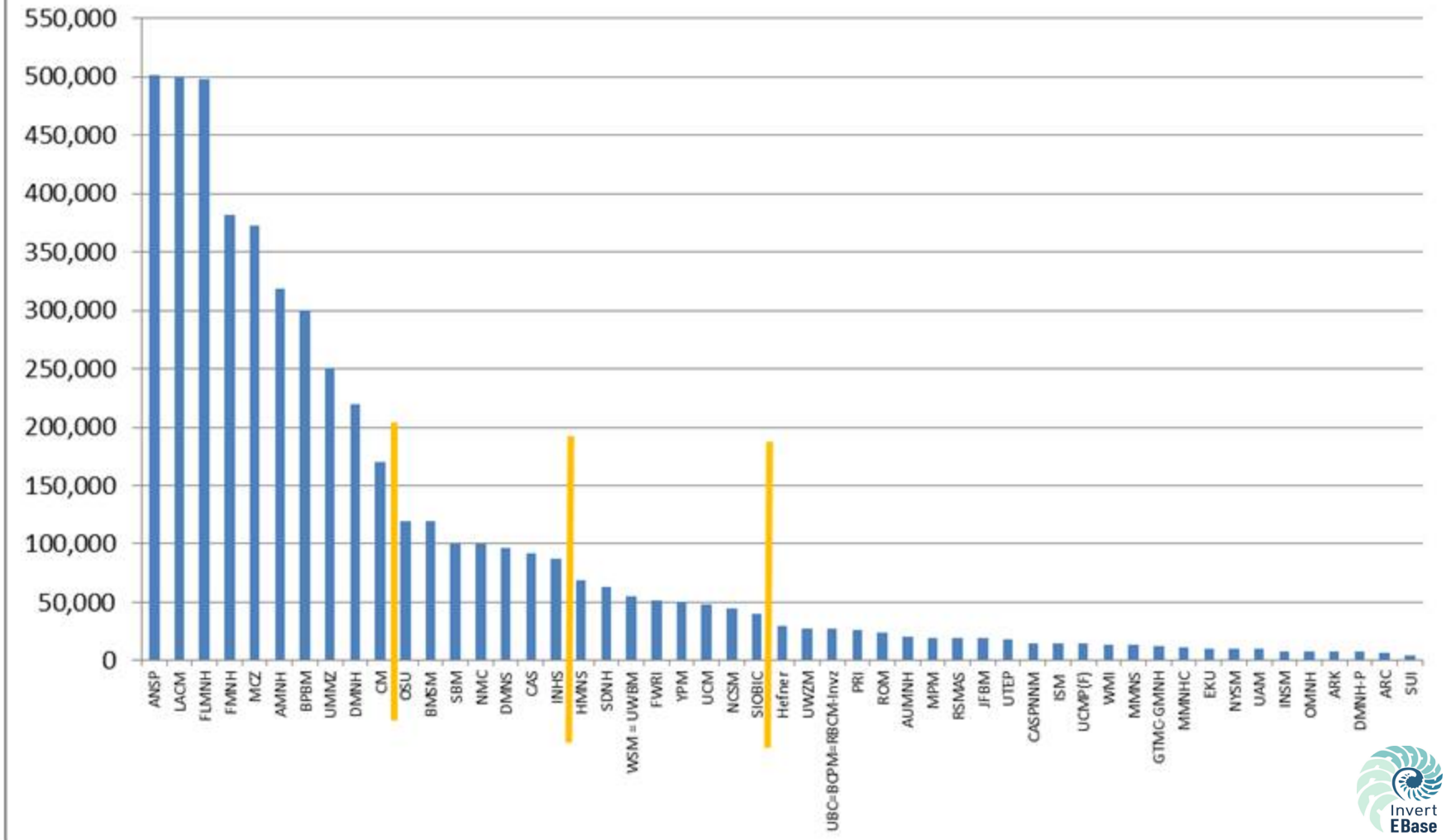
U.S. Mollusk collections: 2017 Survey

- Data from 85 institutional collections, including those identified by Solem (1975) and Cummings et al. (2009)
- 40 U.S. States/Territories, 4 Canadian provinces
- Analyzed data from all collections with >1,000 lots

Sierwald P, Bieler R, Shea EK, Rosenberg G (2018). Mobilizing mollusks: status update on mollusk collections in the U.S.A. and Canada. *American Malacological Bulletin* 36(2) [open access – BioOne]

Invert EBase

US and Canadian Mollusk Collections >5K lots



Invert EBase

When overall size does not matter: Freshwater mollusks

Collection	catalogued lots in 2017	freshwater
OSUM	120,180	104,280
USNM	1,000,000	95,000
UF	497,459	94,518
CM	170,000	92,350
UMMZ	251,000	87,850
ANSP	501,000	76,110
INHS	86,790	58,748
FMNH	382,000	57,300
MCZ	372,000	50,359
CMNML	100,000	47,500
		764,015

Mollusk lots in U.S. & Canada (2017)

Total: 8.4 million
Cataloged: 6.0 million
Digitized: 4.5 million
Georeferenced: 1.3 million
Mobilized (at least in part): 34 of 86 collections

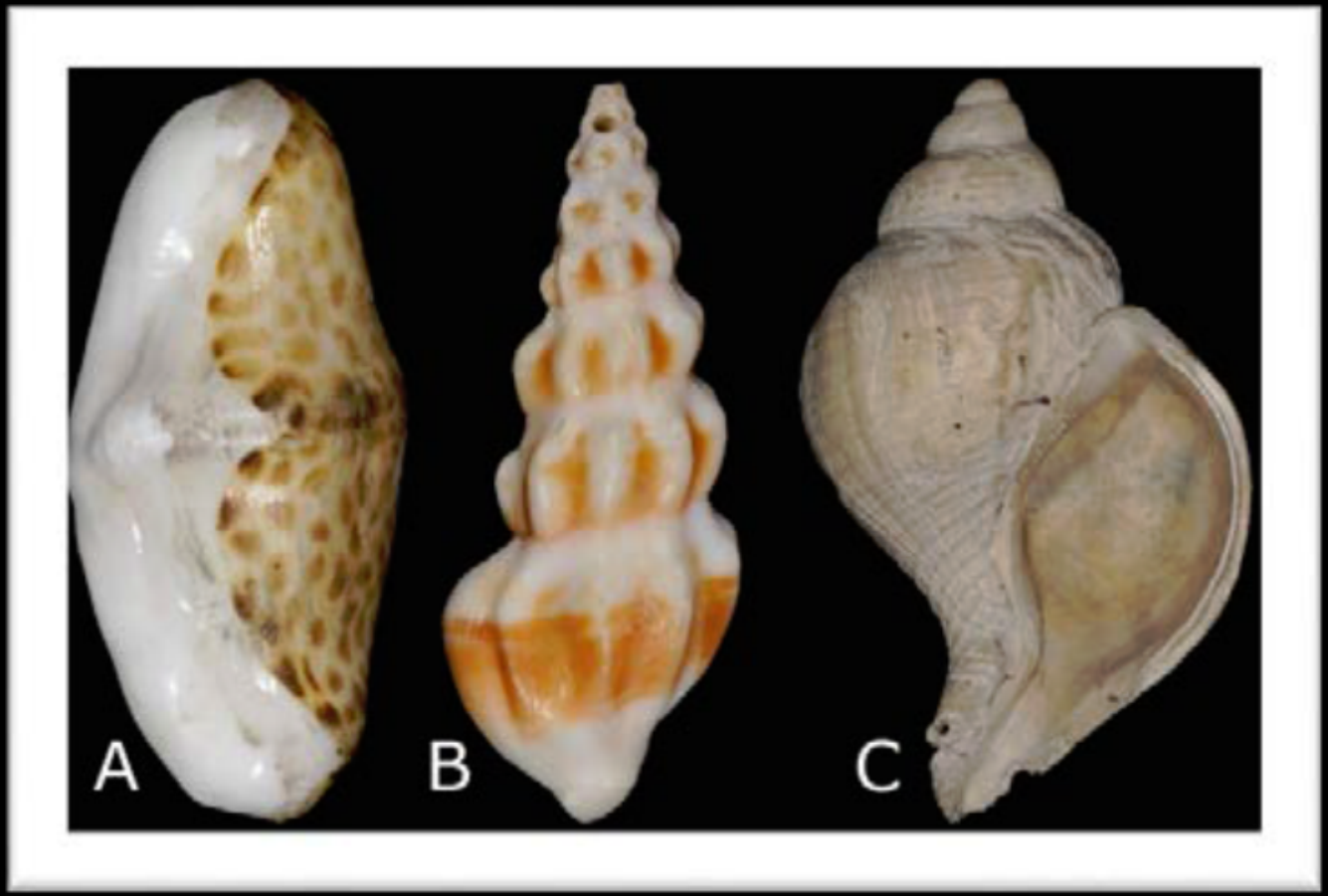
Collections community near-term goals

- Complete basic data entry
- Imaging of primary types
- Expanding MolluscaBase
- Collaborative georeferencing

Shea EK, Sierwald P, Bieler R, Rosenberg G (2018). Priorities and opportunities for digitizing mollusk collections. *American Malacological Bulletin* 36(2)

A Matter of Life and Death

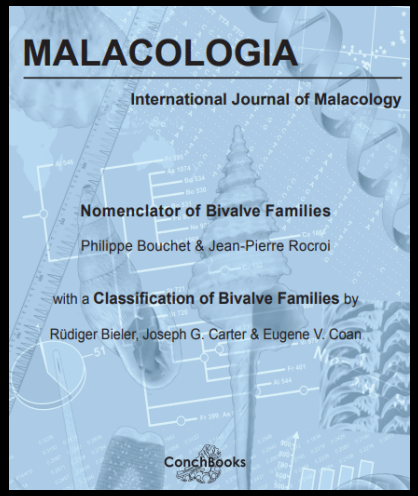
- Many shelled mollusks were dead-collected
- “Dead” records are problematic in meta analyses (poor data quality to address time & space questions)
- We have no community standards for the live/fresh/dead/subfossil spectrum
- We do not consistently flag this in our databases (EMu, Specify, Arctos, FileMaker)
- Aggregators cannot compile such data unless we provide them
- Some can be “automated” based on taxonomy or annotations

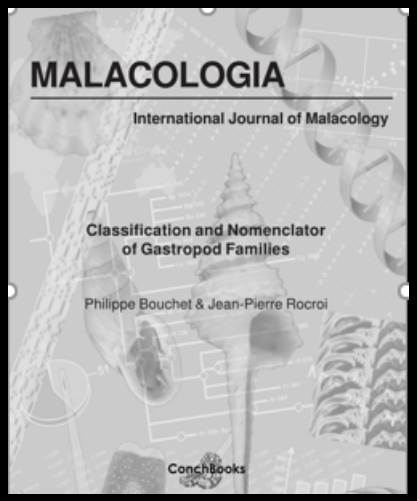


(A) The holotype of *Cyphoma mcgintyi* from Florida, clearly collected alive, with dried tissue visible on the shell. (B) A syntype of *Fenimorea halidorema* from Florida, clearly dead-collected with worn ribs and a hole in the spire. (C) A syntype of *Neptunea stonei*, with eroded shell layers and lacking pigment, an extinct species sometimes found on beaches in New Jersey.

Other molluscan infrastructure developments

- Authority files





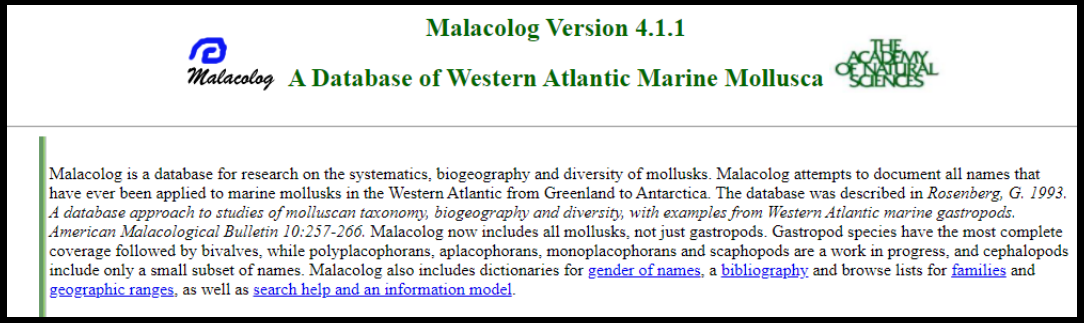
- MolluscaBase

WoRMS World Register of Marine Species

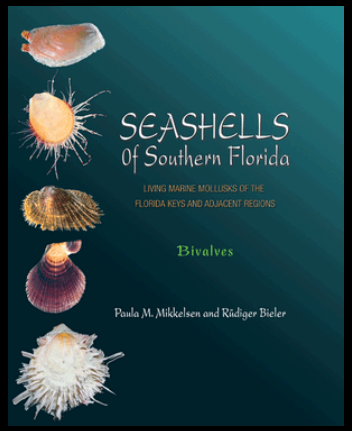
MOLLUSCABASE

Western Atlantic Focus

- Malacolog



- South Florida diversity



- Expanding online outreach

- Focus on East Coast
- From shore to edge of EEZ (200 nm)
- Coastline of 18 States
- Capture 85% of all ESB mollusks holdings in U.S. collections (add others via PENs)

ESB Collaborative 2020

Institution	Acronym	State	ESB lots	ESB specimens
Academy of Natural Sciences of Philadelphia (L)	ANSP	PA	44,385	498,000
Bailey-Matthews National Shell Museum (ML)	BMSM	FL	20,836	85,428
Carnegie Museum of Natural History (ML)	CM	PA	11,436	102,924
Delaware Museum of Natural History (L)	DMNH	DE	33,500	385,250
Field Museum of Natural History [Lead] (L)	FMNH	IL	68,500	660.000
Fish and Wildlife Research Institute (M)	FWRI	FL	51,551	[412,408]
Florida Museum of Natural History (L)	UF	FL	83,000	435,000
Harbor Branch Oceanographic Museum (S)	HBOM	FL	5,700	27,000
Houston Museum of Nature and Science (M)	HMNS	TX	18,400	368,387
Museum of Comparative Zoology (L)	MCZ	MA	82,775	710,000
National Museum of Natural History (L)	USNM	DC	63,000	570,000
Natural History Museum of Los Angeles Co. (L)	LACM	CA	6,675	53,550
North Carolina Museum of Natural Sciences (M)	NCSM	NC	20,000	60,000
Rosenstiel School of Marine and Atmospheric Science (S)	RSMAS	FL	20,000	100,000
University of Michigan Museum of Zoology (L)	UMMZ	MI	5,000	40,000

ESB Collaborative 2020

- **Delaware Museum of Natural History**
  DMNH/Greenville [Elizabeth Shea/Jean Woods]
  - **Rosenstiel School of Marine and Atmospheric Science**
    RSMAS/Miami, FL [Nikki Traylor-Knowles]
  - **GEOLocate**
    Yale University/New Haven, CT [Nelson Rios]
- **Field Museum of Natural History [lead]**
  FMNH/Chicago, IL [Rüdiger Bieler/ Petra Sierwald/ Jochen Gerber]
  - **Fish & Wildlife Research Institute**
    FWRI/St. Petersburg, FL [Paul Larson]
  - **Harbor Branch Oceanographic Museum**
    HBOM/Ft. Pierce, FL [Dennis Hanisak]
  - **Houston Museum of Nature and Science**
    HMNS/Houston, TX [Tina Petway/ Gary Kidder]
  - **BDI-Apps (Symbiota)**, ASU/Tempe, AZ [Edward Gilbert]
- **Academy of Natural Sciences of Philadelphia**
  ANSP/Philadelphia, PA [Gary Rosenberg]
- **Bailey-Matthews National Shell Museum**
  BMSM/Sanibel, FL [José Leal]
- **Carnegie Museum of Natural History**
  CM/Pittsburgh, PA [Timothy Pearce]
- **Florida Museum of Natural History**
  UF/Gainesville, FL [John Slapcinsky]
- **Museum of Comparative Zoology**
  MCZ/Cambridge, MA [Gonzalo Giribet/ Adam Baldinger]
- **Natural History Museum of Los Angeles County**
  LACM/CA [Jann Vendetti]
- **North Carolina Museum of Natural Sciences**
  NCSM/NC [Jamie Smith/ Arthur Bogan]
- **University of Michigan Museum of Zoology**
  UMMZ/MI [Thomas Duda/ Taehwan Lee]
- **National Museum of Natural History**
  USNM/Washington, DC [Ellen Strong]

Scope/Intellectual merit

- 14 institutions + Smithsonian
- 3,000 species, including numerous economically important taxa
- Mobilization of 4.5 million specimens
  - 1.1 million: de novo data entry
  - 3.4 million: improved data quality & access
- Georeferencing
  - Complete via CoGe (currently at 15%)
  - Add bathymetric data, benthic habitat, and marine conservation areas to GeoLocate
- Trait data linkages
  - Live vs. dead (address Darwin Core issues)
  - Epibiont data (learn from TPT)
  - Metadata from field books and expedition logs
- Temporal data (build agent authority files across institutions)
- Specimen images (types and verified exemplars)
- Integration of Malacolog
- Development of MolluscaBase

Broader Impacts

- Training of 44 undergrads and 8 grad students with strong recruitment efforts toward minority students
- Engagement of public (e.g., with online shell ID guides [BMSM, FMNH rapid Color Guides], tying common names to MolluscaBase)
- Involvement of avocational community (e.g., regional shell clubs)
- Updating Museum exhibitions (e.g., Carnegie, MCZ, HMNS)
- Strong social media presence (e.g., BMSM: eSeaboard Spotlight)
- Citizen Science projects (e.g., UF: iNaturalist Blast from the Past, LACM: SLIME)
- Brain Scoop Episode (FMNH – importance on citizen science involvement)
- Student workshops at annual Mollusca meetings focused on georeferenced biodiversity data
- Collaboration with RCN-UBE "BCEENET" (DMNH – use of natural history data in course-based undergraduate research experiences)