

Colecciones científicas, bases de datos y cambio (climático)

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Universidad de Nuevo México,
EE.UU

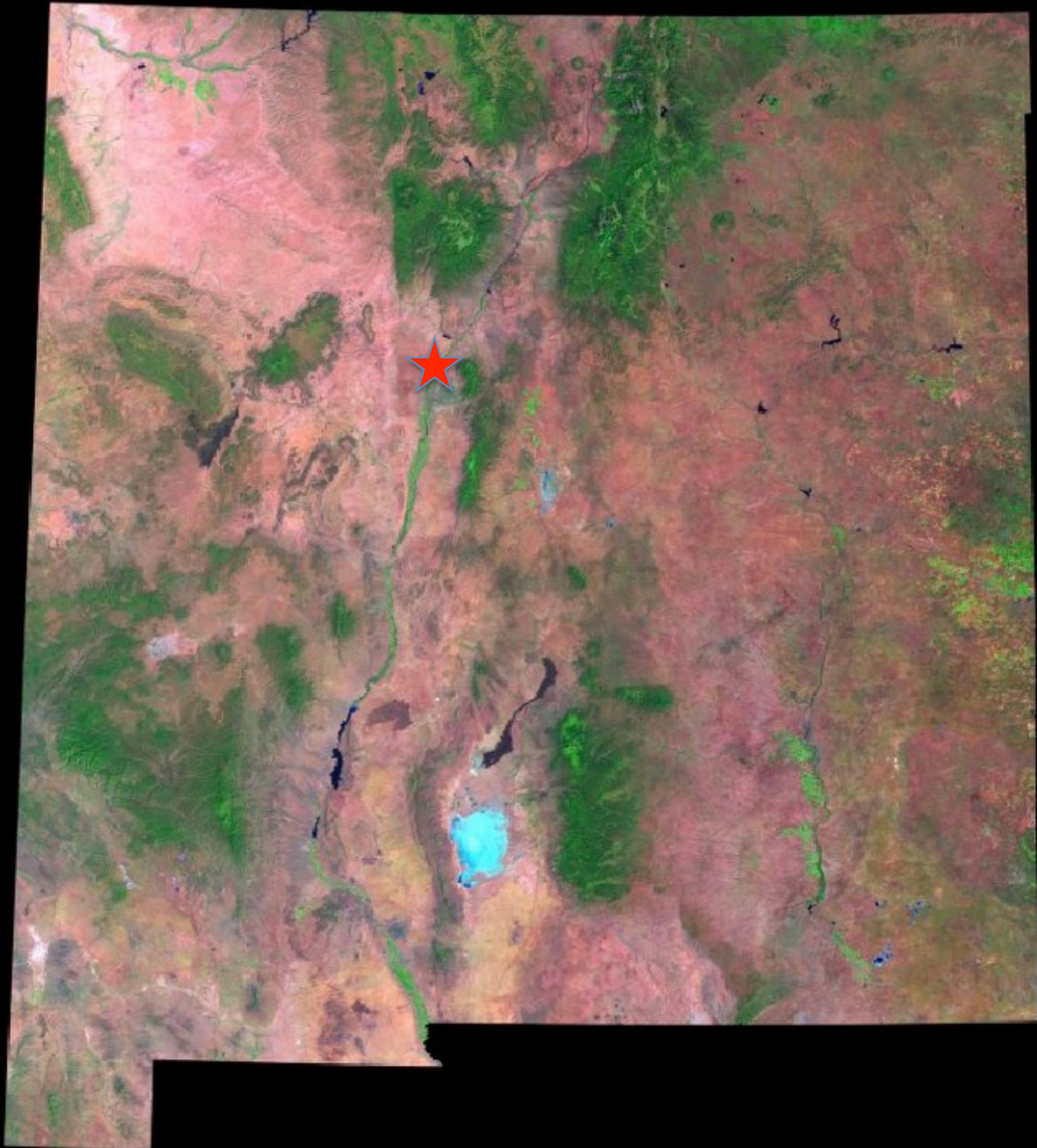


New Mexico



US Dept of State Geographer
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Data SIO, NOAA, U.S. Navy, NGA, GEBCO

GOO



Resumen de Curso

Lecturas y Discusión:

- Lunes 2, de 9 a 12 hs. y 14 a 17 hs
 - Museos, datos y web acceso, hoesped/parasito archivos
- Martes 3, de 9 a 12 hs. y 14 a 17 hs
 - 9-10 hs discusión de literatura
 - (Conroy et al 1999)
 - 10-12 hs Biología de islas,
14-15 hs discusión de la literatura
 - (Pyke and Ehrlich 2010)
 - 15-17 hs Museos y cambio de medio ambiente
- Viernes 6, de 9 a 13 hs., Salón de Seminarios II
 - Discusión de la Literatura, Presentación y Discusión de Proyectos
 - 9-10 hs discusión de la literatura
 - (Moritz et al., 2009; Hope et al., 2013)
 - 10-13 hs , Presentación y Discusión de Proyectos

Pero Primero Evaluación

- AIM-UP! perception of museums--pretest
- Despues de Island Module (Viernes)
 - module evaluación
 - y Fin de curso–post-test evaluación

Resumen de Tema de Colecciones

- Museos / research collections
 - Overview
 - Relevance today
- Web Interfaces
- Tema de Integración
- Linking “Big Data”
- Datos (y mas-muestras)
- New users



Museos (en general)

- Arte



museo**gurvich**®

Museos (en general)

- Arte
- Historia



Museo Histórico Nacional. Casa del Gral. Fructuoso Rivera

Museos (en general)

- Arte
- Historia
- Temas particulares



Museo del Mate



Museos (en general)

- Arte
- Historia
- Temas particulares
- **Museos de Historia Natural**



Museos (en general)

- Arte
- Historia
- Temas particulares
- Museos de Historia Natural
 - La Historia
 - Curiosities
 - First used to discover and describe novelties

Museos (en general)

From “Cabinets of Curiosity” in Renaissance Europe

- Unusual specimens
- One of a kind
- Displays-exhibits

Corals



Museos de Historia Natural

- Historia Natural
 - Exhibición—Este función bien conocido



Natural History Museums

- **Exhibits** play an important role in natural history & biodiversity education:
 - Highly visible/large visitor base
 - Informal education on the wonder of life
 - Build appreciation for natural world



Museos de Historia Natural

- Museos
 - Exhibición
 - Colecciones (especimenes)



How is the Role of NH Museums Changing?

- Are specimens only curiosities (unusual)?
- What are the other uses of specimens?
- How should collections change to meet new challenges in science, management, and education?

University of Alaska Museum



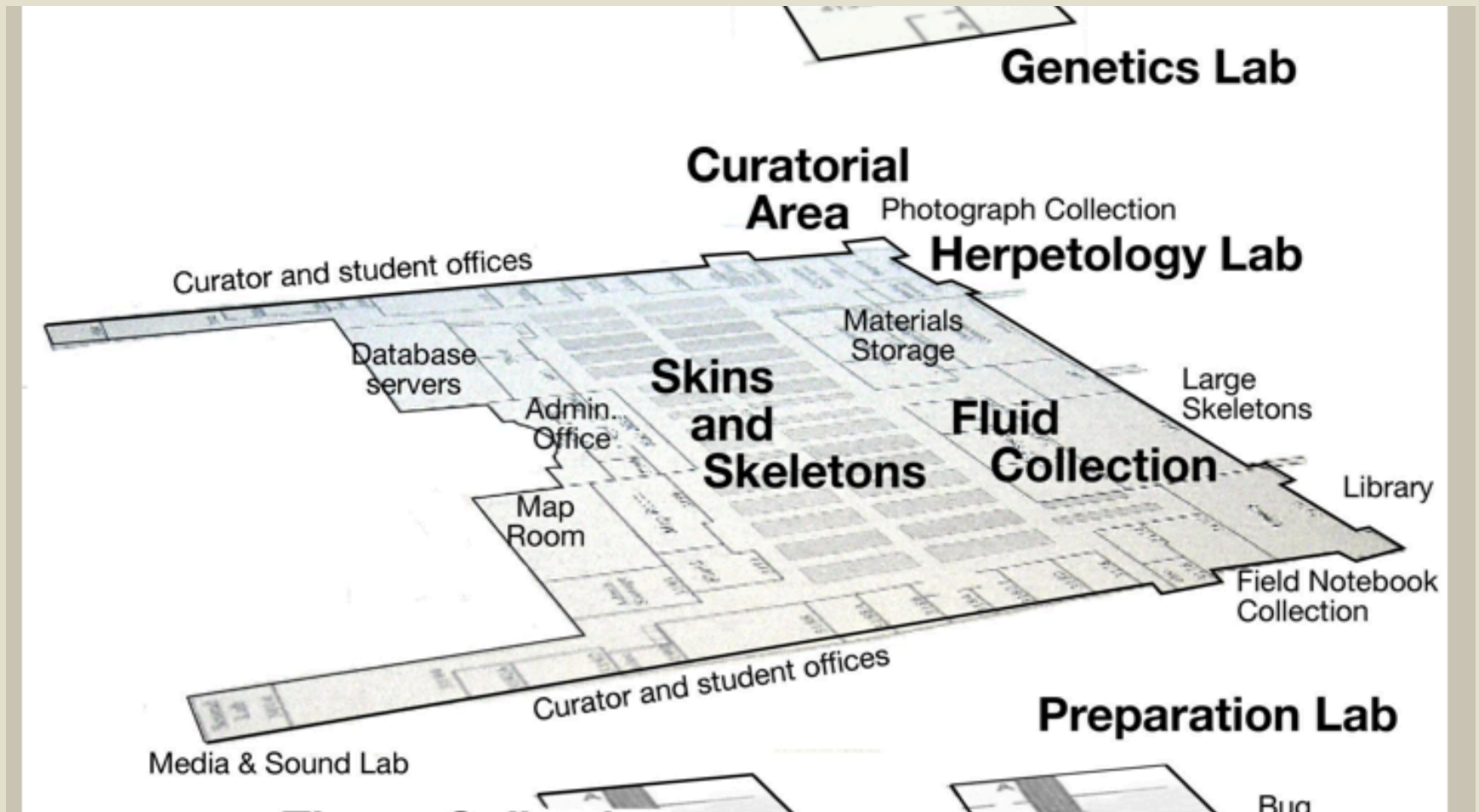


NEW YORK State Museum

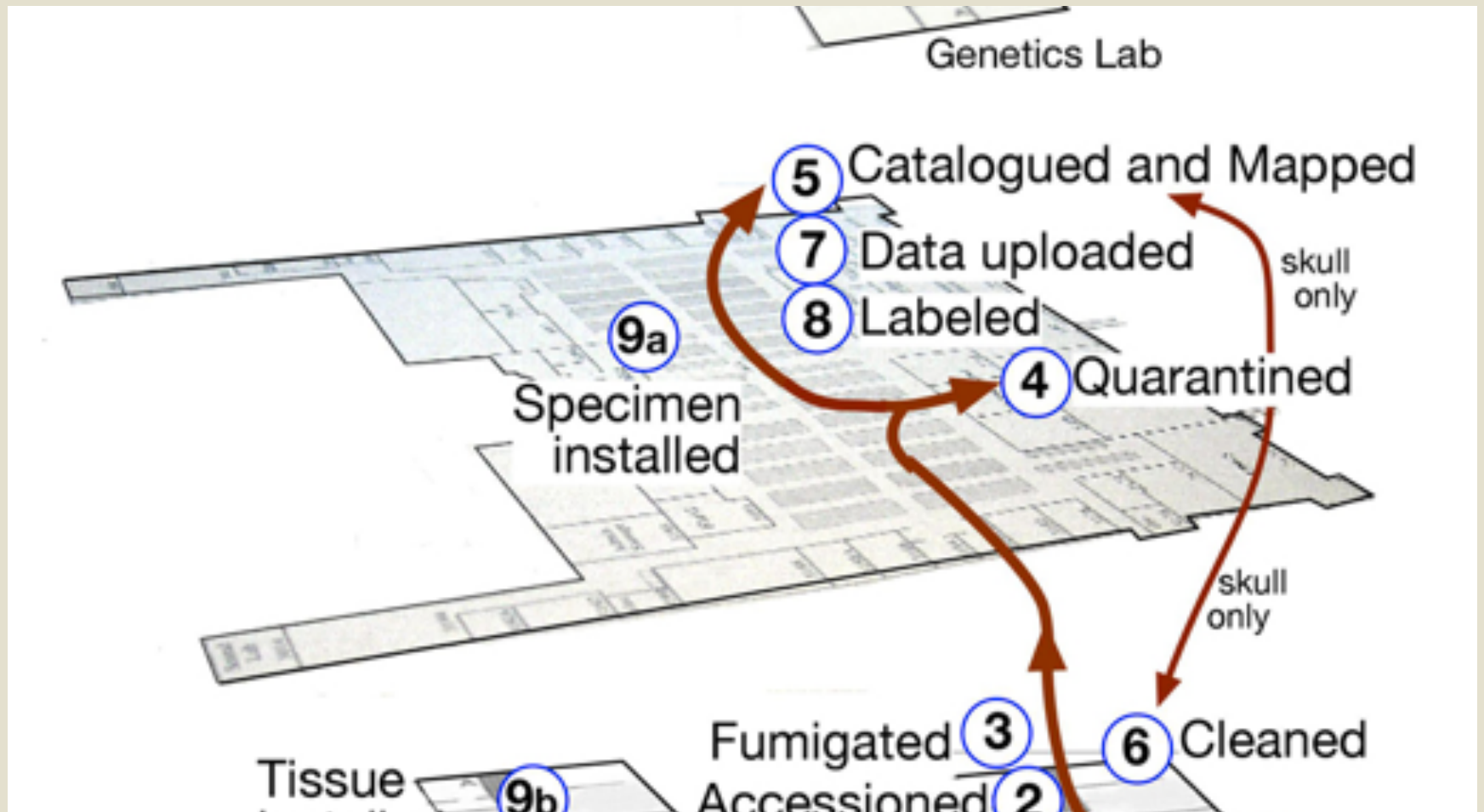
[http://www.youtube.com/watch?
v=KFms-9hy5KY](http://www.youtube.com/watch?v=KFms-9hy5KY)

[http://www.youtube.com/watch?
v=MyIT3EyVz0k](http://www.youtube.com/watch?v=MyIT3EyVz0k)

Colecciones



Ruta de una muestra



Colecciones de Museos de Historia Natural

- Museos de Historia Natural
 - Curiosities
 - New Species Descriptions

Ctenomys pearsoni Lessa & Langguth, 1983



- Fotografia: Marcelo Casacuberta

A few comments on biodiversity discovery

- About 54 new species of mammals described **annually** since 1980
- In last 40 years, number of amphibian species has increased > 35%
- Mega-diverse groups—(e.g., arthropods and nematodes) tremendous increase in species numbers

Estimated Number of Species on Earth

Species	Earth		
	Catalogued	Predicted	±SE
Eukaryotes			
Animalia	953,434	7,770,000	958,000
Chromista	13,033	27,500	30,500
Fungi	43,271	611,000	297,000
Plantae	215,644	298,000	8,200
Protozoa	8,118	36,400	6,690
<i>Total</i>	1,233,500	8,740,000	1,300,000
Prokaryotes			
Archaea	502	455	160
Bacteria	10,358	9,680	3,470
<i>Total</i>	10,860	10,100	3,630
Grand Total	1,244,360	8,750,000	1,300,000

Mora, et al 2011. "How Many Species Are There on Earth and in the Ocean?".
PLoS Biology 9

Museos de Historia Natural

- Museos de Historia Natural
 - Curiosities
 - New Species Descriptions
 - Systematics
 - Species Distributions
 - “Natural History”
 - Y mas (otro usos nuevos)

Natural History Research Collections

- Research collections
 - Thousands of collections worldwide
 - (with >3 billion specimens)
 - Vast resources poorly known (public & scientists)
 - Out of the public eye and locked away
 - But now digitization of billions of specimens and data points on WWW



Specimens are Primary Biodiversity **Baselines**

- Porque baseline?

Specimens are Primary Biodiversity **Baselines**

- Geographic scale – locality
 - Precise georeference information (GPS)
- Temporal scale - collection date

SOCIEDAD
TAGUATÓ

MASTOZOLOGIA NO. 148

LOC. EST. DEL MEDIO LA PALOMA.-

DURAZ NO.-

FECHA 4/IV/58 SEXO

COL. R. SACCONNE.-

Specimens are Primary Biodiversity **Baselines**

- Geographic scale – locality
- Temporal scale - collection date

- What other information can we get from museum collections?

Specimens are Primary Biodiversity **Baselines**

- Geographic scale – locality
- Temporal scale - collection date
- Other information
 - Reproductive, natural history, ecological
 - Tissue/parasites/karyotypes



Significant questions are centered on our ability to assess **change**.

- Climate change



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- Climate change
- Habitat conversion



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- Habitat conversion
- Pollutants



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- Emerging pathogens



Significant questions are centered on our ability to assess **change**.

- Climate change
- Habitat conversion
- Pollutants
- Emerging pathogens
- Introduction of exotics



Significant questions are centered on our ability to assess **change**.

- Climate change
- Habitat conversion
- Pollutants
- Emerging pathogens
- Introduction of exotics
- Loss of biotic diversity



Significant questions are centered on our ability to assess **change**.

- Climate change
- Habitat conversion
- Pollutants
- Emerging pathogens
- Introduction of exotics
- Loss of biotic diversity
- All require **BASELINE DATA & SAMPLES**
 - Historic information is
 - New questions
 - New technology



How is a specimen prepared?

- <http://www.youtube.com/watch?v=azNkyFpPfGc>

1. Baselines

2: Integration

Across stakeholders

- Connect managers, scientists, general public through collaborations
- Make museum data electronically available through the web.
 - What data?
- One example:
- ARCTOS as an example (<http://arctosdb.org/>)
- Data are archived in ARCTOS; a web accessible relational database with samples

1. Baselines

2: Integration

Across stakeholders

Across scientists

- Connect Big Data
 - Cyberinfrastructure for Informatics
 - (GIS, GenBank, Isotopes, Pathogens, Toxins, Morphology, Ecology, etc)

1. Baselines

2: Integration

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- One example:
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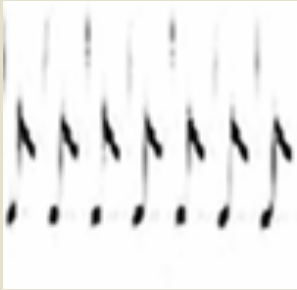
Arctos

A Database for Biodiversity
Researchers and Students

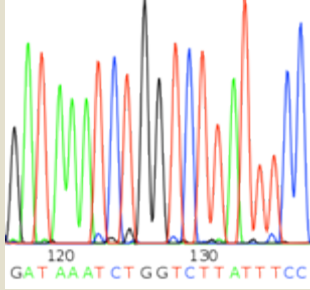
<http://arctos.database.museum>

- **ARCTOS a dynamic collaboration (>40 colecciones) integrating access to specimen data, collection-management tools, and external resources on the Web.**

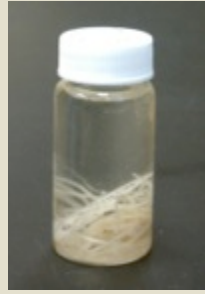
Breadth of Data in ARCTOS



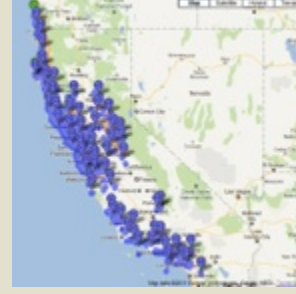
Audio



DNA



Relations



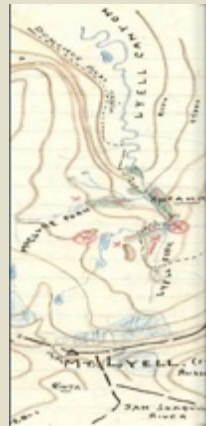
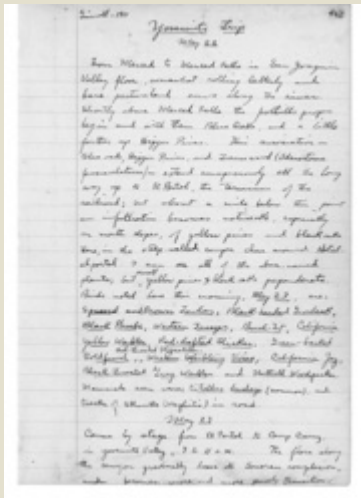
GIS



Projects/Pubs



SPECIMENS



Fieldnotes, Maps, and Images

Who Uses ARCTOS?

- Academics (students, postdocs, profs.)
- Museum curators and researchers
- Federal and state agencies
- Non-government organizations
- Environmental consultants
- K-12 educators
- Artists

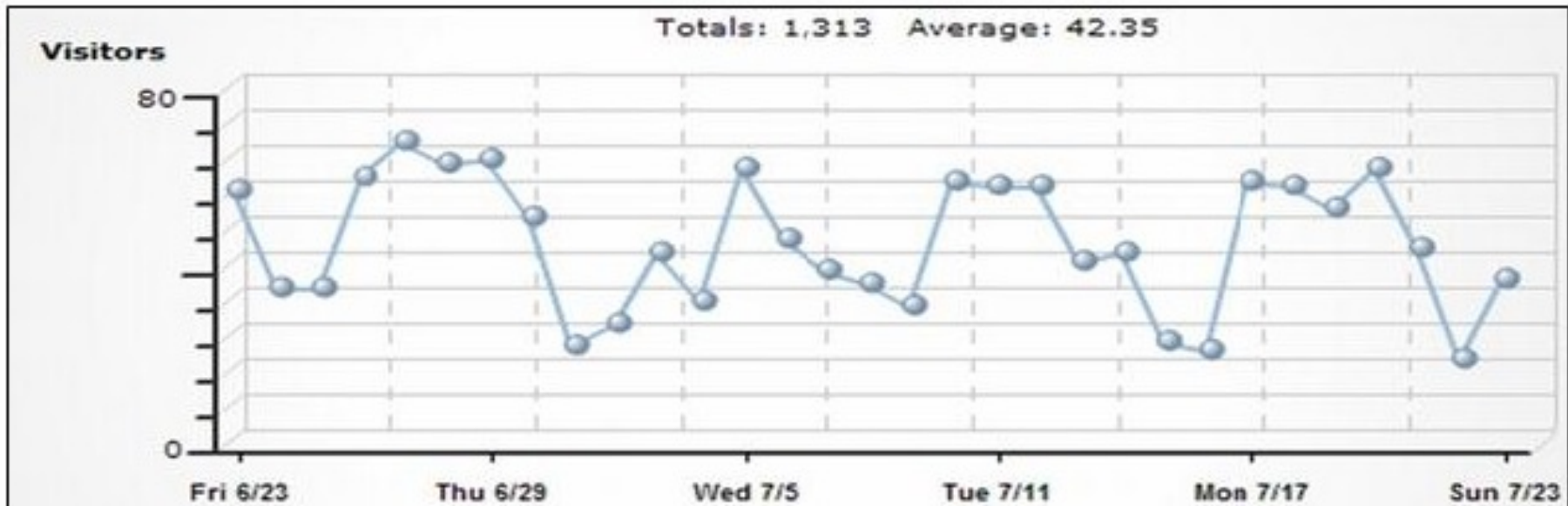
Network to

Increase Availability for---

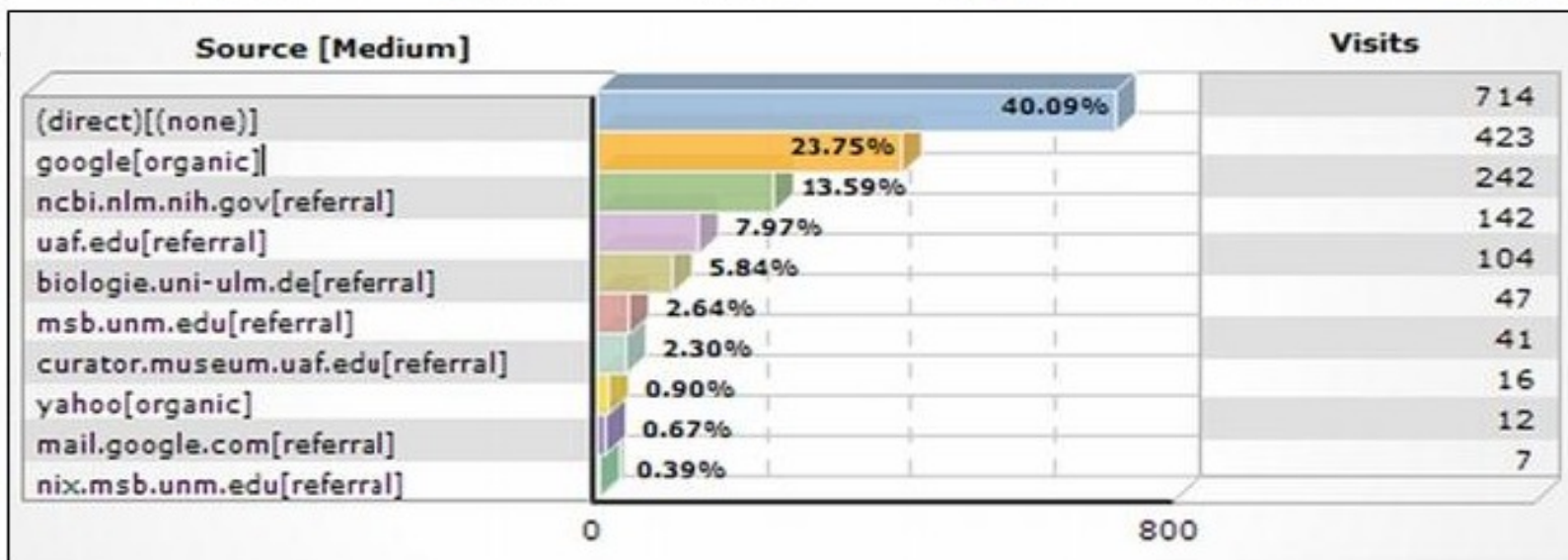
Managers, Scientists and the General Public

Fig. 6. ARCTOS data base visitor statistics. a). Visitors, b). Referring sources, c). Geographic origin of visitors.

a).



b).



c).



MVZ Mammals 183277

Punta Rasa
South America, Uruguay,
Departamento Maldonado
22 Nov 1994

tissue (95% ethanol); tissue extract (frozen); tissue
extract (frozen); whole organism (ethanol)



[\[Report Bad Data \]](#)
[MVZ Collections](#)

first prev next last
Record 36 of 59

[<< Return to results](#)

[Ctenomys pearsoni](#)

Animalia Chordata Mammalia Rodentia Ctenomyidae *Ctenomys pearsoni* Lessa and Langguth, 1983

Identified by Museum of Vertebrate Zoology, University of California, Berkeley on 1999-01-27

Nature of ID: legacy

Determination Type: accepted place of collection

assigned by Satya M. Witt on 2003-10-27

Higher Geography: South America, Uruguay, Departamento Maldonado

Specific Locality: Punta Rasa

Collecting Source: wild caught

Event Date: 22 Nov 1994

Verification Status: unverified

Coordinates: -34.9 / -55.23333

Verbatim Coordinates:
-34.9/-55.23333



Identifiers

collector number: 1363

Details

Part Name	Condition	Qty	Remarks
tissue (95% ethanol)	unchecked	1	
tissue extract (frozen)	unchecked	1	ground allozyme extract
tissue extract (frozen)	unchecked	1	ground allozyme extract
whole organism (ethanol)	unchecked	1	

sex: male

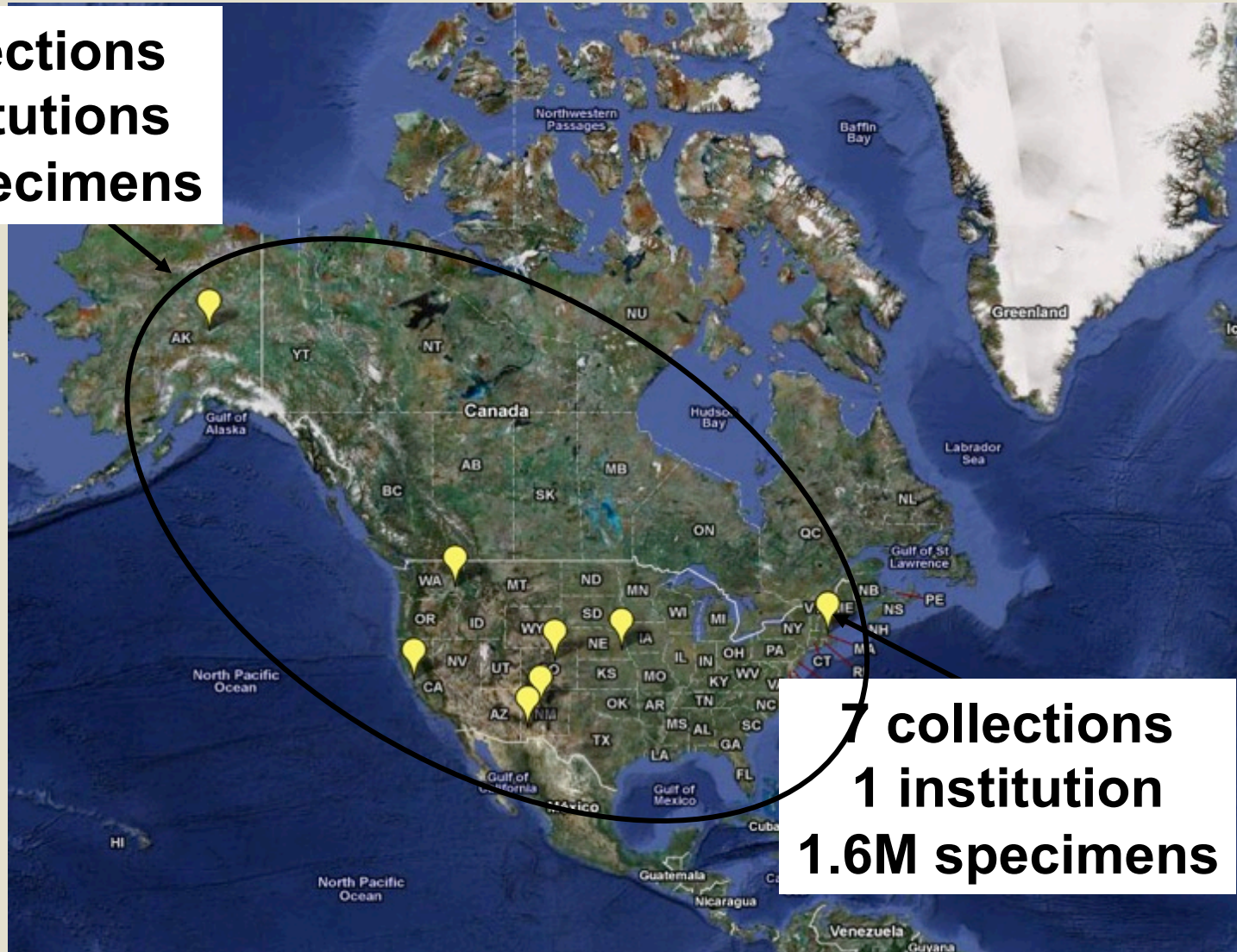
Museum of Vertebrate Zoology, University of California, Berkeley, 2005-11-01

Accession

13059

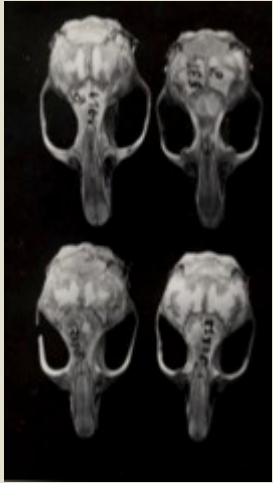
Two instances >3M total specimens

**50 collections
15 institutions
1.8 M specimens**



**7 collections
1 institution
1.6M specimens**

Collections- Taxonomic Integration



Mammals



Birds



Herps



Plants



Nematodes



Insects



Fishes

Collections- Integration of Science



Skins



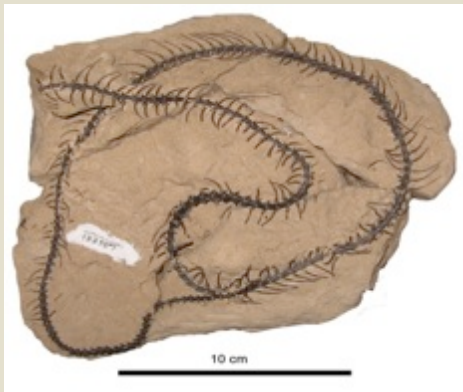
Tissues



Eggs



Nests



Fossils



Parasites



Skeletons

Ultra-frozen Tissues

- Multiple Kinds of Tissue
 - Heart
 - Kidney
 - Liver
 - Muscle
 - Spleen
 - other
 - Why?

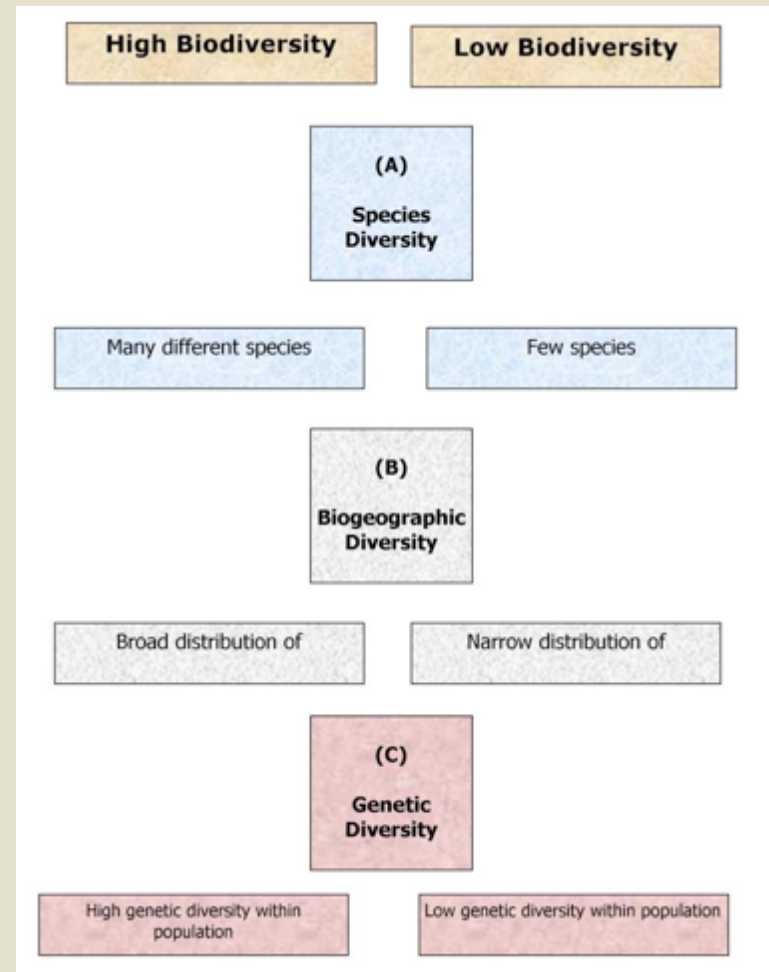


Arctos also includes observational data!



Collections- Integration Across Levels of Biodiversidad

- **Genetic diversity**
- = within-species variability (reflects evolutionary history and future?)
- **Species diversity (richness)**
- **Ecosystem diversity**
- **Biogeographic**



Research Applications

Phylogenetics
Population Genetics
Genomics
Ecology
Biogeography
Behavior

Spatial Attributes

External Spatial Attributes:

Climate
Geology
Vegetation
other GIS

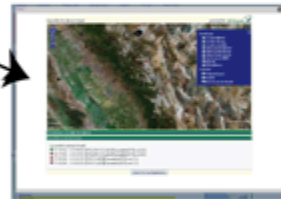
MVZ ARCTOS

• 710,000 Records of Birds, Mammals, Amphibian & Reptiles (Specimens & Observ.)
• Collecting Events and Spatial Coordinates
• Ancillary Data and Media Links to External Sources

Berkeley Mapper



GEOlocate



Mapping Tools

GenBank
links to
Publications

TACC
Web Archive

• Fieldnotes
• Images-fieldwork
• Images-specimens
• Archival Images
• Sound files

CalPhotos

• Images-habitat
• Images-specimens
• Images-fieldwork
• Images-animal and plant species

DigiMorph



External Database Links

Arctos Collection Management Functions:

- Search, enter, update data
- Georeference and map localities
- Manage transactions (projects, loans, accns, permits)
- Track specimen citations (pubs, GenBank)
- Track collection objects (e.g., tissue vial barcoding)
- Link to external web resources

Web Demo of Arctos

[Search](#)[My Stuff](#)[About Arctos](#)

Access to 1386256 records

[Holdings Details](#)

[Search](#)[Clear Form](#)[Use Last Values](#)

See results as: [Specimen Records](#)

Include Observations? Require Tissues? Require Media:

Identifiers

[Customize](#) [Show More Options](#)

Collection: [All](#) Number:

Identification and Taxonomy

[Show More Options](#)

Any Taxonomic Element:

Locality

[Show More Options](#)

Any Geographic Element:

[Select on Google Map](#)

Date/Collector

[Show More Options](#)

Help [Collector](#)

Biological Individual

[Show More Options](#)

Part Name: [Define](#) [Add = for exact match](#)

Usage

[Show More Options](#)

Basis of Citation: [Define](#)

[Search](#)[Clear Form](#)[Use Last Values](#)

See results as: [Specimen Records](#)



- [Data Providers](#)
- [Report a bug or request support](#)

Linking Big Data—Space, Time, Genetics

Firefox | MSB Mammals 234972: Galea musteloides


arctos.database.museum/guid/MSB:Mamm:234972

Search | Enter Data | Manage Data | Manage Arctos | Reports | Portals | My Stuff | About/Help

MSB Mammals 234972 17km by road S of Quine liver (frozen); heart, kidney (frozen); liver (frozen) sample
 NK: 22940 South America, Bolivia, Santa Cruz
Galea musteloides 04-Jun-1991
 << Return to results

[Report Bad Data]
 MSB Mammals

first prevnext last
 Record 16 of 37



Taxa | Accn | Locality | Agents | Relations | Parts | Part Locn. | Attributes | Other IDs | Media | Encumbrances

Galea musteloides
 Animalia Chordata Mammalia Rodentia Hystricognathi Caviidae Galea musteloides
 Identified by unknown on 2005-03-10
 Nature of ID: legacy

Galea musteloides
 Animalia Chordata Mammalia Rodentia Hystricognathi Caviidae Galea musteloides
 sensu **Dunnum and Salazar-Bravo 2010**
 Identified by Jon L. Dunnum, Jorge Salazar-Bravo
 Nature of ID: type specimen
 Remarks: ID from citation in Dunnum and Salazar-Bravo 2010.

Citations
 voucher of *Galea musteloides* in **Dunnum and Salazar-Bravo 2010**

Determination Type: accepted place of collection
 assigned by Jon L. Dunnum on 2011-04-07
 Higher Geography: South America, Bolivia, Santa Cruz
 Specific Locality: 17km by road S of Quine

Identifiers
 GenBank: [GU067519](#)
 NK: 22940
 institutional catalog number: AMNH M 264469
 preparator number: 786

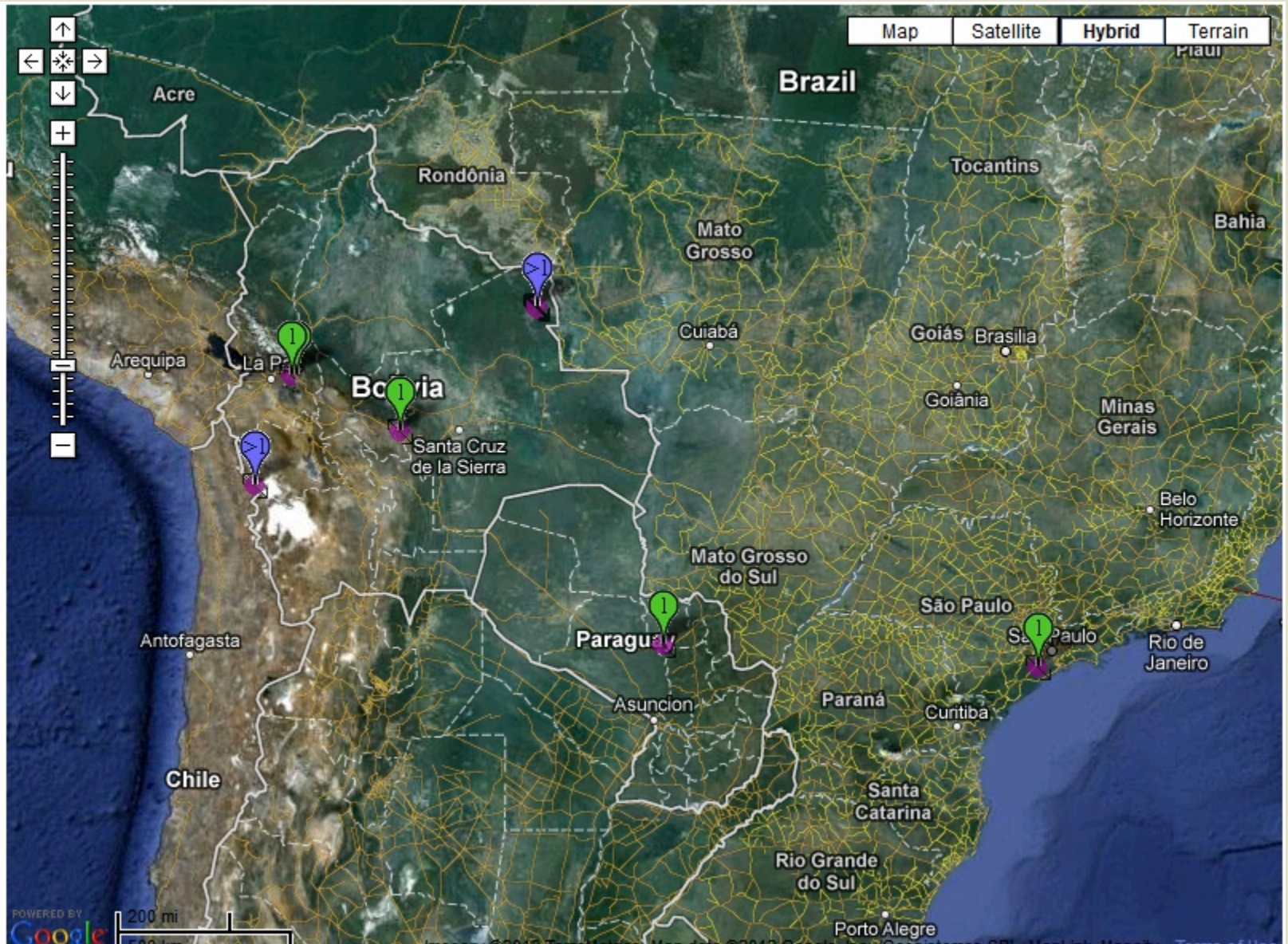
Part Name	Condition	Disposition	#	Label	Remarks
heart, kidney (frozen)	unchecked	unchecked	1		
liver (frozen)	unchecked	unchecked	1		
liver (frozen)	unchecked	on loan	1		

sex: male
 unknown, 2005-03-10

Remarks: 135.0g Trap# C-32; FlagOnRecord:: X; 135.0g Trap# C-32; FlagOnRecord:: X
 Entered By: Dusty L. McDonald on 2005-03-14

10:49 PM 7/12/2012

Mapping



Arctos is part of a broader data museum network community



Ver⁺Ne⁺



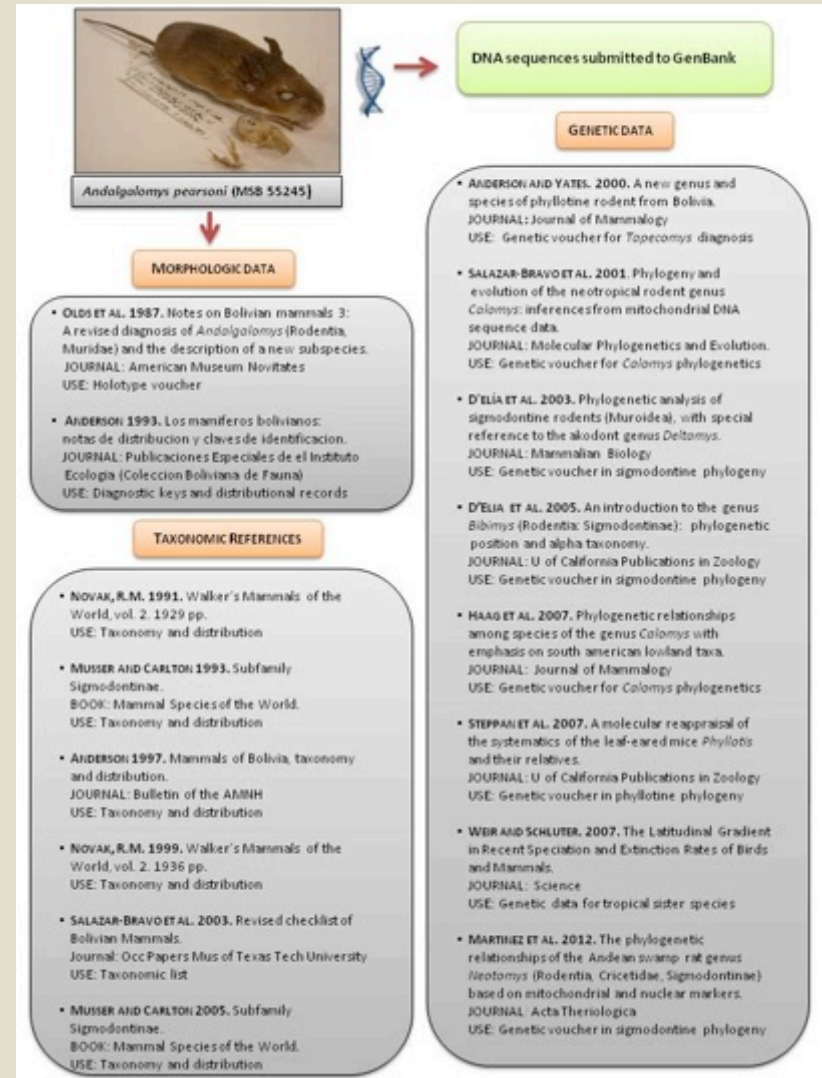
Overview of Web-accessible Databases

- **AmphibiaWeb** <http://amphibiaweb.org/>
- **Animal Diversity Web** <http://animaldiversity.ummz.umich.edu/site/index.html>
- **Arctos** <http://arctos.database.museum/home.cfm>
- **Barcode of Life** <http://www.boldsystems.org/views/login.php>
- **Encyclopedia of Life** <http://www.eol.org/>
- **Faunmap** <http://www.museum.state.il.us/research/faunmap/query/>
- **FishNET** <http://www.fishnet2.net/>
- **GenBank (National Center for Biotechnology Information)** <http://www.ncbi.nlm.nih.gov/>
- **Global Biodiversity Information Facility (GBIF)** <http://www.gbif.org/>
- **HerpNet** <http://www.herpnet.org/>
- **Host-Parasite Database**
<http://www.nhm.ac.uk/research-curation/research/projects/host-parasites/index.html>
- **IUCN Red List of Threatened Species** <http://www.iucnredlist.org>
- **Mammal Networked Information System (MaNIS)** <http://manisnet.org/>
- **National Parasite Collection (USDA)** <http://www.anri.barc.usda.gov/bnpcu/parasrch.asp>
- **NatureServ** <http://www.natureserve.org/getData/>
- **ORNIS** <http://www.ornisnet.org/>
- **Paleobotany Project** <http://www.paleobotanyproject.org/default.aspx>
- **TIGR Reptile Database** <http://www.reptile-database.org/>
- **Tree of Life** <http://tolweb.org/tree/>
- **VertNet** <http://vertnet.org/index.php>

Good science is testable and repeatable!

Specimens tie together research projects, track research and allow retesting of previous work and hypotheses

Scientific Process
(Replication
without vouchers is difficult)





Andalgalmys pearsoni (MSB 55245)



DNA sequences submitted to GenBank

GENETIC DATA

- **ANDERSON AND YATES. 2000.** A new genus and species of phyllotine rodent from Bolivia.
JOURNAL: Journal of Mammalogy
USE: Genetic voucher for *Tapecomys* diagnosis
- **SALAZAR-BRAVO ET AL. 2001.** Phylogeny and evolution of the neotropical rodent genus *Calomys*: inferences from mitochondrial DNA sequence data.
JOURNAL: Molecular Phylogenetics and Evolution.
USE: Genetic voucher for *Calomys* phylogenetics
- **D'ELIA ET AL. 2003.** Phylogenetic analysis of sigmodontine rodents (Muroidea), with special reference to the akodont genus *Deltamys*.
JOURNAL: Mammalian Biology
USE: Genetic voucher in sigmodontine phylogeny
- **D'ELIA ET AL. 2005.** An introduction to the genus *Bibimys* (Rodentia: Sigmodontinae): phylogenetic position and alpha taxonomy.
JOURNAL: U of California Publications in Zoology
USE: Genetic voucher in sigmodontine phylogeny
- **HAAG ET AL. 2007.** Phylogenetic relationships among species of the genus *Calomys* with emphasis on south american lowland taxa.
JOURNAL: Journal of Mammalogy
USE: Genetic voucher for *Calomys* phylogenetics
- **STEPHAN ET AL. 2007.** A molecular reappraisal of the systematics of the leaf-eared mice *Phyllotis* and their relatives.
JOURNAL: U of California Publications in Zoology
USE: Genetic voucher in phyllotine phylogeny
- **WEIR AND SCHLUTER. 2007.** The Latitudinal Gradient in Recent Speciation and Extinction Rates of Birds and Mammals.
JOURNAL: Science
USE: Genetic data for tropical sister species
- **MARTINEZ ET AL. 2012.** The phylogenetic relationships of the Andean swamp rat genus *Neotomys* (Rodentia, Cricetidae, Sigmodontinae) based on mitochondrial and nuclear markers.
JOURNAL: Acta Theriologica
USE: Genetic voucher in sigmodontine phylogeny

MORPHOLOGIC DATA

- **OLDS ET AL. 1987.** Notes on Bolivian mammals 3: A revised diagnosis of *Andalgalmys* (Rodentia, Muridae) and the description of a new subspecies.
JOURNAL: American Museum Novitates
USE: Holotype voucher
- **ANDERSON 1993.** Los mamíferos bolivianos: notas de distribución y claves de identificación.
JOURNAL: Publicaciones Especiales de el Instituto Ecología (Colección Boliviana de Fauna)
USE: Diagnostic keys and distributional records

TAXONOMIC REFERENCES

- **NOVAK, R.M. 1991.** Walker's Mammals of the World, vol. 2. 1929 pp.
USE: Taxonomy and distribution
- **MUSSER AND CARLTON 1993.** Subfamily Sigmodontinae.
BOOK: Mammal Species of the World.
USE: Taxonomy and distribution
- **ANDERSON 1997.** Mammals of Bolivia, taxonomy and distribution.
JOURNAL: Bulletin of the AMNH
USE: Taxonomy and distribution
- **NOVAK, R.M. 1999.** Walker's Mammals of the World, vol. 2. 1936 pp.
USE: Taxonomy and distribution
- **SALAZAR-BRAVO ET AL. 2003.** Revised checklist of Bolivian Mammals.
Journal: Occ Papers Mus of Texas Tech University
USE: Taxonomic list
- **MUSSER AND CARLTON 2005.** Subfamily Sigmodontinae.
BOOK: Mammal Species of the World.
USE: Taxonomy and distribution

Animal Diversity Web

<http://animaldiversity.ummz.umich.edu/>

Animal Diversity Web



University of Michigan
MUSEUM OF ZOOLOGY



- Home
- About Us
- About Animal Names
- Teaching Resources
- Special Collections
- Glossary
- Browse Animalia

Browse Animalia



REPTILIA | *Phrynocephalus mystaceus*
turtles, snakes, lizards, and relatives | Secret Toadhead Anana



[Take our survey!](#)
Help us improve the site!

Search ADW



Taxon Information



[Explore Data @ Quardvark](#)

[Search Guide](#)

ADW Mission

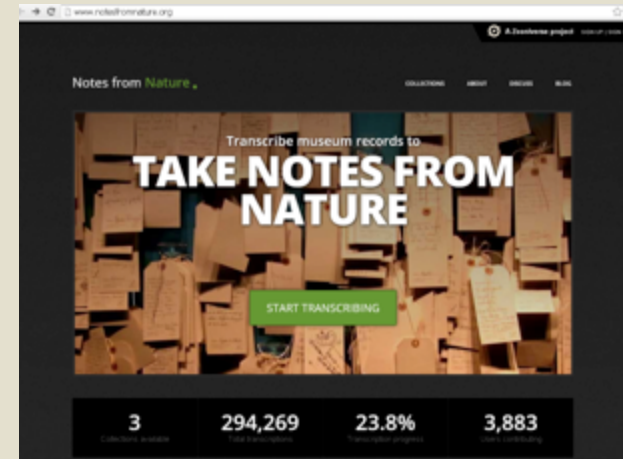
The Animal Diversity Web is an online database and encyclopedia of animal natural history, built through contributions from students, photographers, and many others.

It is a rich and flexible resource designed both as an encyclopedia for exploring biodiversity and for use in formal, inquiry-based education.

Public Contribution to Biodiversity Data

- Notes from Nature:

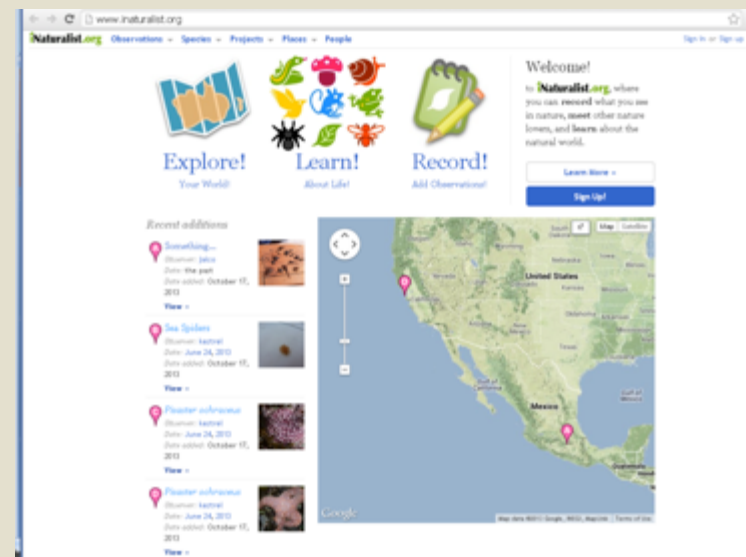
<http://www.notesfromnature.org/>



- iNaturalist:

<http://www.inaturalist.org/>

Citizen science: utilize the huge populace with interest in biodiversity issues



Map of Life

www.mappinglife.org

Search Go

Species Lists Radius 50 km Group Mammals

76 species of Mammals within 50 km of 0.747° S 123.003° E

List Images IUCN Download

Data type/source: Expert range map, IUCN Red List. All seasonalities.

Scientific Name	English Name	Order	Family	Rank	IUCN
▼ <i>Ailurops ursinus</i>	Bear Cuscus, Bear Phalanger, Sulawesi Bear Cuscus	Diprotodontia	Phalangeridae	16	VU
▼ <i>Strigocuscus celebensis</i>	Small Sulawesi Cuscus, Little Celebes Cuscus, Small Cuscus	Diprotodontia	Phalangeridae	16	VU
▼ <i>Strigocuscus pelengensis</i>	Peleng Cuscus	Diprotodontia	Phalangeridae	16	LC
▼ <i>Macaca tonkeana</i>	Tonkean Macaque, Tonkean Black Macaque	Primates	Cercopithecidae	53	VU
▼ <i>Tarsius dentatus</i>	Dian's Tarsier, Diana Tarsier	Primates	Tarsiidae	56	VU

Base Map: Basic Political Roadmap Terrain Satellite

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<http://tolweb.org>

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<http://www.iucnredlist.org/>



The IUCN Red List of Threatened Species™

2013.1

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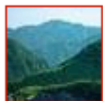
[A users' guide to The IUCN Red List web site](#)

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17 July 2013 - On a recent trip to Lang Co Lagoon in Thua Thien Hue Province, an MFF small grant project site, I met Nguyen Xuan Vinh who runs a local



MULANJE CEDAR
Widdringtonia whytei

© Russ Clare



Amazing Species

Big Data

Map of Life, Tree of Life, GBIF, GenBank, IUCN, GIS applications

Museum data need to be in a format that can be accessed and served by other databases.

Creating the linkages is critical.

What's Available from Uruguay?

- Argentina?
- Brasil?

New perspectives

- Making natural history collection available to non-traditional users
 - Especially non-systematists
- Artists provide not only new perspectives and criticality, but also are advocates for biodiversity issues

Gendron Jensen lithograph

Last brown bear taken from NM Pecos wilderness in 1917



Workshops & Seminars--Spring 2012



- 1) Fluid Taxonomy -- on the dynamic, ever shifting practice of classification
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<http://ae.unm.edu/>



Morphology and Evolution with Brian Conley



Novel perspectives are needed from museum specimens and data to unlock the answers to the current and future biodiversity crisis.



Natural History Collections in Education



- Train Future Investigators

.....to creatively explore, utilize and integrate these vast resources across disciplines and into critical science initiatives.



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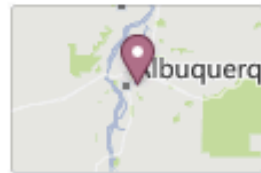
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