



**A Collaborative, Cost-Efficient
Solution for Managing and
Publishing Biodiversity Data in
Collections of all Sizes**

Carla Cicero, Link Olson, Joe Cook, Michelle Koo, Dusty McDonald, Gordon Jarrell

Website: <http://arctosdb.org>

Search: <http://arctos.database.museum>

Code: <https://code.google.com/p/arctos/>

Arctos is a robust, *collaborative* collection management system that *integrates* occurrence records, data management tools, and external resources on the web

in partnership with



TEXAS ADVANCED COMPUTING CENTER
Powering Discoveries That Change The World



Consortium of Pacific Northwest Herbaria
Providing access to specimen data and digital resources from herbaria throughout Pacific Northwest North America



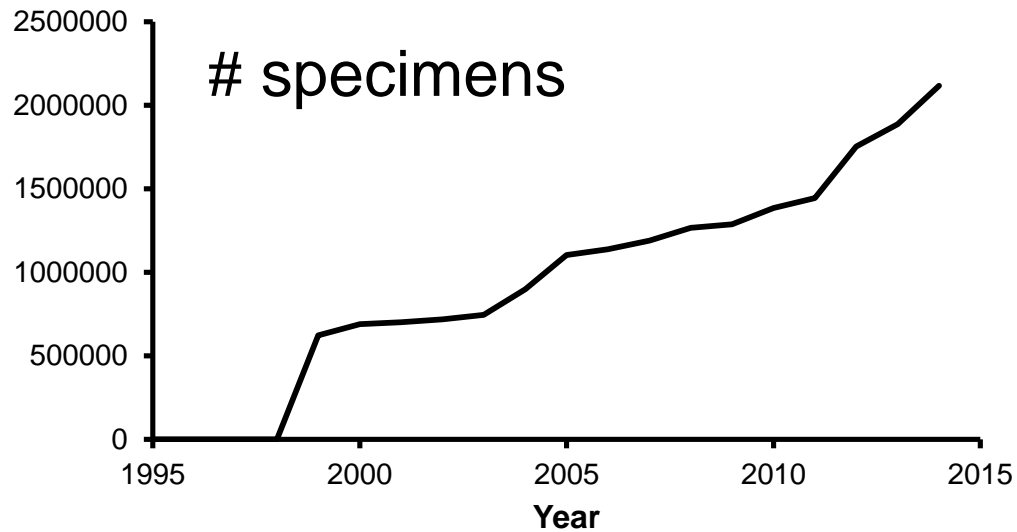
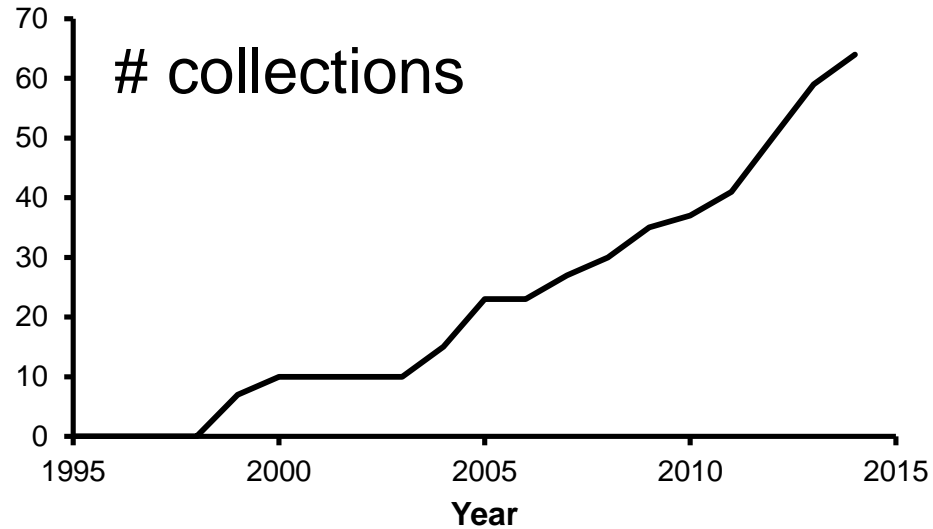
20 Year History

- 1995 – Data model development (MVZ)
- 1997 – Partial desktop implementation (MVZ)
- 1998 – First collaboration (MVZ & UAM)
- 2002 – First web-based instance (UAM)
- 2003 – First multi-hosting instance (MSB joins UAM)
- 2005 – Additional instances (MVZ, MCZ)
- 2009 – Multi-hosting instance expands (MVZ joins)

... to present – continued growth and collaborations

Arctos Growth

(multi-hosted instance)

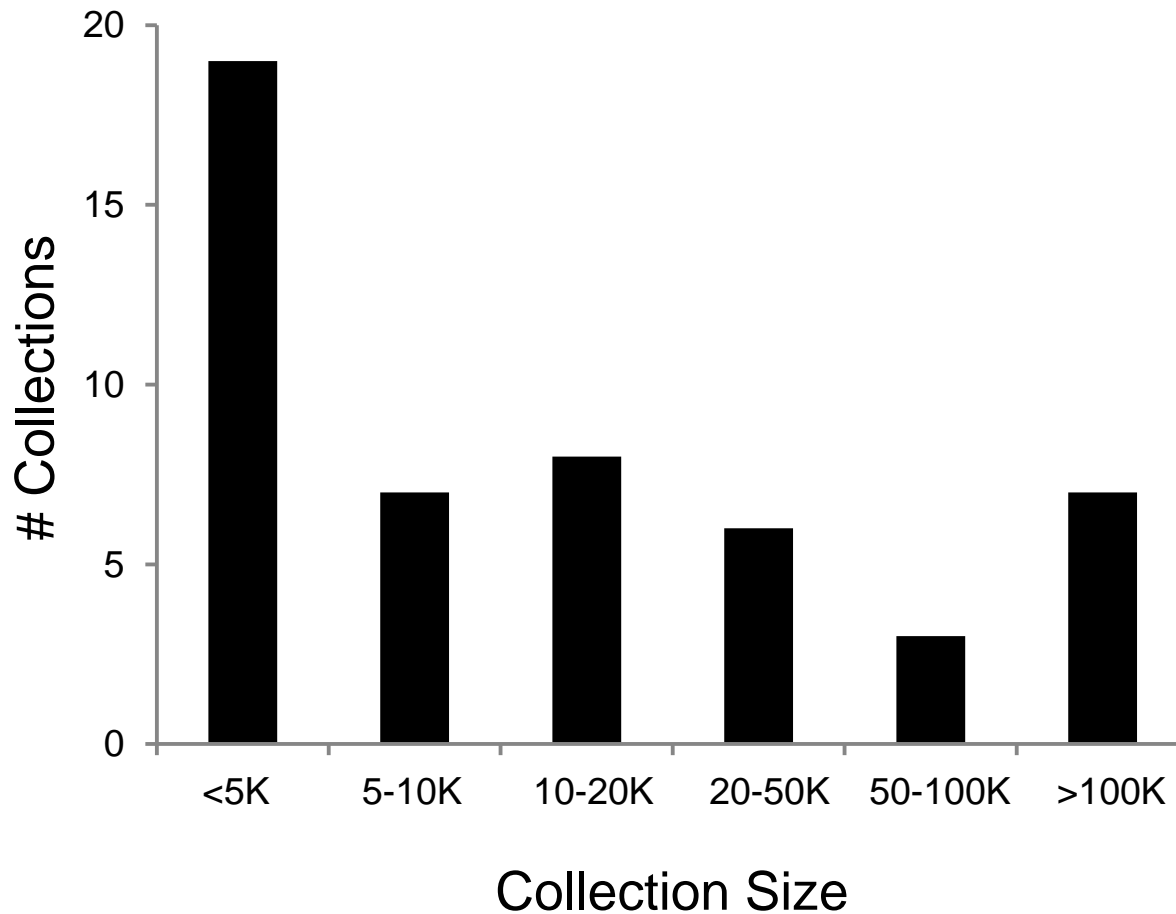


88 collections
25 institutions
3.9M records



1000 mi
1000 km

Arctos supports collections of *all* sizes



Breadth of Collections



Mammals



Birds



Herps



Plants



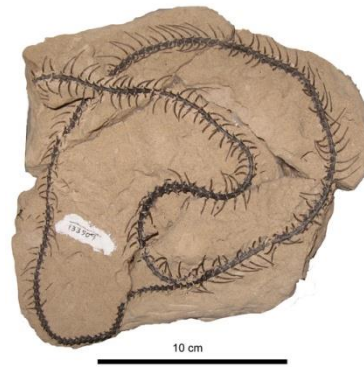
Culture



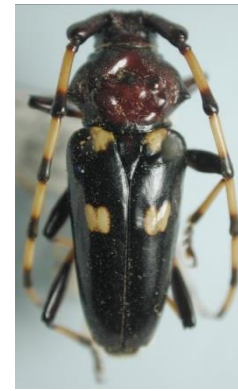
Eggs/Nests



Parasites



Fossils

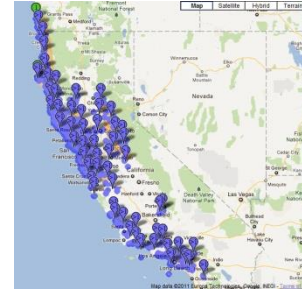
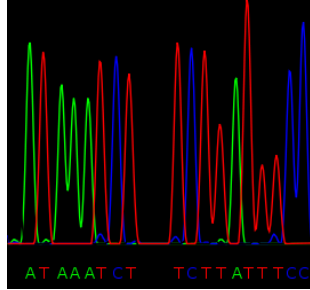


Insects



Fishes

Breadth of Data



REVISED DISTRIBUTION OF THE ALASKA MARMO, *ALOUATA BROTHERI*, AND CONSERVATION OF PARAPATRY WITH BROWN ELKHOUSES

John W. Storer, Robert S. Anderson, and David B. Clark

Journal of Field Ornithology, Volume 74, Number 1, 2003

Audio/Video

DNA

Relations

GIS

Projects/Pubs



SPECIMENS

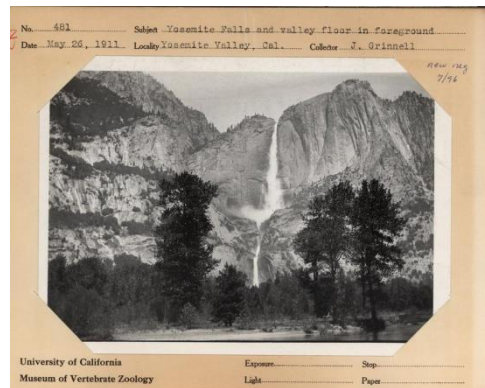
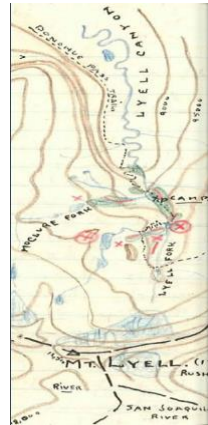
Small 1911 432

Yosemite Trip
May 22

From Merced to Merced Falls in San Joaquin Valley floor, somewhat rolling hilly, and have pastureland some along the river. Shortly above Merced Falls the foothills proper begin and with them, Blue Oaks, and a little farther up Sugar Pine. This association on Blue oak, Sugar Pine, and Tannerwood (*Abies* forestation) extend continuously all the long way, up to El Portal, the terminus of the railroad; but about a mile below this point a different becomes noticeable, especially on north slopes, of yellow pines and black oak. Here, in the steep, wooded canyon close around Hotel, reported to me are all of the above named plants, but yellow pine & black oak predominate. Birds noted here this morning, May 22, are: Spurred and Brown Towhees, Black headed Grosbeak, Black Phoebe, Western Tanager, Bush Tit, California Yellow Warbler, Red-shafted Flicker, Green-backed Goldfinch, Western Gnatcatcher, California Jay, Black-throated Gray Warbler and Nuttall Woodpecker. Mammals seen were Cottontail (abundant), and tracks of Skunk (*Mephitis*) in road.

May 23

Came by stage from El Portal to Camp Curry, in Yosemite Valley, 7 to 11 a.m. The flora along the canyon gradually loses its Sierran complexion, and becomes more and more purely Sierran.



Fieldnotes, Maps, and Images

Arctos also includes observational data



Kenai National Wildlife Refuge



College of the Atlantic



Museum of Vertebrate Zoology

UNIVERSITY OF
ALASKA



Arctos Philosophy

- Maximize access to high quality information about collections on the web (*data strongly normalized*)
- Integrate different kinds of information into easily and visually retrievable records (*data immediately online*)
- Facilitate management of data by curators and collection managers (*collaboration is key to success*)
- Show value of specimens for scientific research to the public (*track usage through projects, publications, reciprocal linkages to GenBank, etc.*)

Arctos is...

- ***Versatile*** – handles everything you want to know about a record (customizable collection information, identification or georeferencing history, relationships, usage, barcodes, etc.)
- ***Secure*** – collections maintain control over data while sharing certain nodes (taxonomy, agents, geography)
- ***Modular*** – Easy to plug in new features (e.g., projects and publications, media, external web services, etc.)
- ***Open*** – code built upon community needs and input
- ***Economical*** – data and media hosted at TACC (no cost), shared programming and DBA costs

Who uses Arctos?

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



RCN-Undergraduate
Biology Education
(<http://www.aim-up.org/>)



Integrating museums and databases as tools in undergraduate curricula

Quick access to high quality data is crucial to documenting change

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

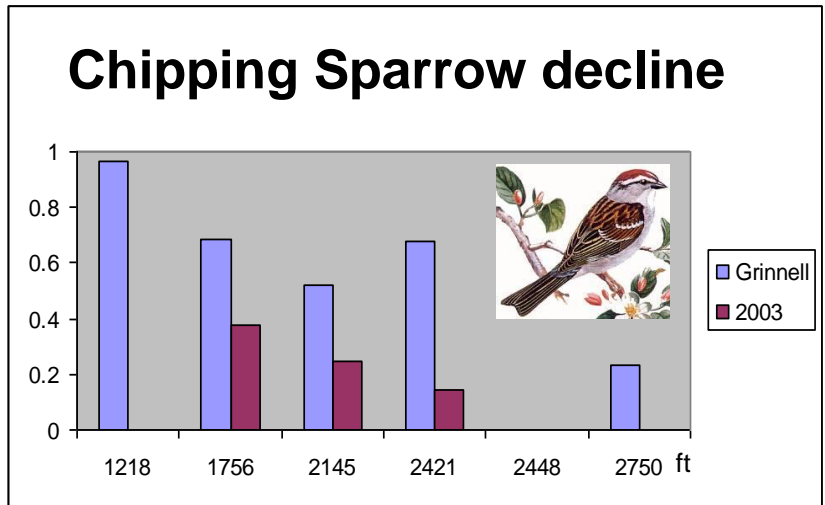
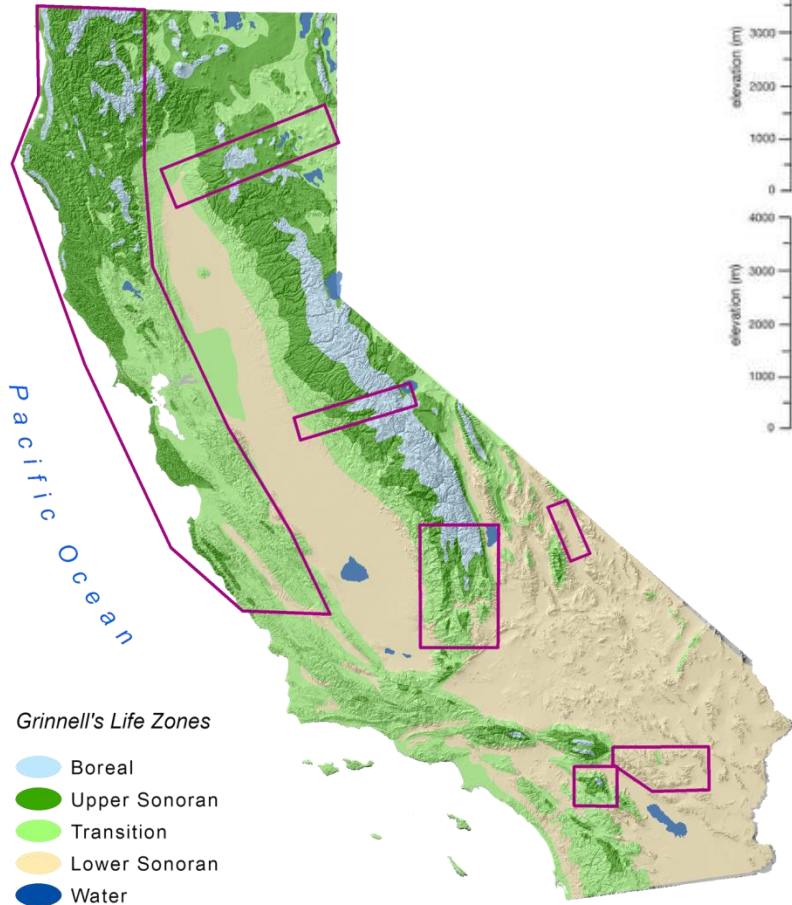
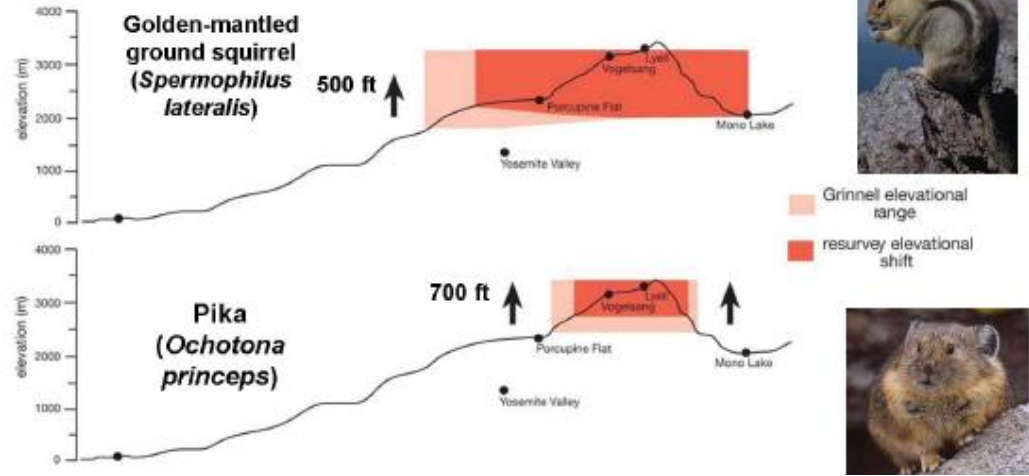


Lyell Glacier, Sierra Nevada, California



Projects: Grinnell Resurvey

Upward Range Retraction in High Elevation Species:



Linkages to Field Notes



Fieldnotes: Grinnell J. 1911 (part 1) - Section 2: Yosemite region, Calif.

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[PDF] [Media Details]

Grinnell - 1911 May 25 Yosemite 458

Black-headed Grosbeak (most noticeable bird around camp);
Western Chipping Sparrow (many along road and edges of
meadow); Pine Siskin (flock of 8 or 10 on meadow);
California Purple Finch (one pair); Sierra Junco (not
plentiful); Spurred Towhee (fairly common and surely
nesting); White-crowned Sparrow (one individual in a
willow thicket by the river may well have been a transient);
Western Flycatcher (several heard in cedar clumps on
valley floor); Trail Flycatcher (in full song in willow
thicket along river); Wright Flycatcher (several in song
on talus slopes among blackbark, ceanothos brush and
yellow pines); Western Wood Pewee (fairly common);
Luzon Bunting (several in full song); California
Woodpecker (one at top of lofty yellow pine);
Blue-fronted Jay (many); Spotted Sandpiper (a lively
pair on sandy beach of river and occasionally
flying out over adjacent meadow); Band-tailed
Pigeon (one flying along wall of valley)

664	Garter Snake	caught in meadow close to river
665	"	"
666	Thomomys ovalis	♂ Testes large 220x75x27
667	"	♀ 200x68x26
668	"	♀ < 4 large emb. 202x70x27

Create TAG type....

- Comment Only
- Cataloged Item
- Collecting Event
- Locality
- Agent

[Create TAG ~ Scroll to TAG](#)
[Cataloged Item](#)
[Collecting Event](#)
[Locality](#)
[Agent](#)

TAG Type: cataloged_item
Reference: MVZ:Herp:2488

[Edit TAG ~ Delete TAG ~ Scroll to TAG](#)
 TAG Type: cataloged_item
 Reference: MVZ:Mamm:12970

[Edit TAG ~ Delete TAG ~ Scroll to TAG](#)
 TAG Type: cataloged_item
 Reference: MVZ:Mamm:12971

[Edit TAG ~ Delete TAG ~ Scroll to TAG](#)
 TAG Type: cataloged_item
 Reference: MVZ:Mamm:12972



Collections Database
MUSEUM OF VERTEBRATE ZOOLOGY[Search](#) [Enter Data](#) [Manage Data](#) [Manage Arcots](#) [Reports](#) [Portals](#) [My Stuff](#) [About/Help](#)

MVZ Mammals 12971
collector number: 667
Thomomys bottae awahnee
[Return to results](#)
[get a DOI](#)

Yosemite Valley, Yosemite National Park
 North America, United States, California, Mariposa County
 25 May 1911

skull; study skin



[[Report Bad Data](#)]
[MVZ Collections](#)
 first prev next last
 Record 1 of 1

[Taxa](#) [Acch](#) [Locality](#) [Agents](#) [Parts](#) [Part Locn](#) [Attributes](#) [Other IDs](#) [Media](#) [Encumbrances](#)
Thomomys bottae awahnee

Animalia Chordata Mammalia Rodentia Geomyiidae Thomomys bottae awahnee

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 Tate S. Tunstall on 2000-03-17

Higher Geography: North America, United States, California, Mariposa County

Verbatim Locality: Yosemite Valley

Specific Locality: Yosemite Valley, Yosemite National Park

Locality Remarks: Checked by JLPatton (15 Jul 2008)

Collecting Source: wild caught

Event Date: 25 May 1911

Verification Status: verified by curator

Coordinates: 37.736686 / -119.598212

Verbatim Coordinates: 37.736686;-119.598212

Datum: North American Datum 1927

Error: 4 mi

Georeference Source: TopoScout 2.04 USGS 1:100000

Georeference Protocol: not recorded

Elevation 4030 to 4030 ft



Identifiers

collector number: 667

Part Name	Condition	Disposition	Qty	Label	Remarks
skull	unchecked	in collection	1	Museum of Vertebrate Zoology	
study skin	unchecked	in collection	1	Museum of Vertebrate Zoology	

sex: female

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

Entered By: unknown on 1999-02-04

Last Edited By: UAM on 2014-04-07

Accession

258

Usage

Contributed By/Project: **Historic Grinnell Survey: Yosemite Transect**

Tagged in Media

*from Merced
 Valley floor, on
 bare pasture
 shortly above
 begin and in:*

Collectors

Joseph Grinnell

Citizen Science (beta...future dev)

FromThePage

Transcribing the field notes of the Museum of Vertebrate Zoology — 1925: Joseph Grinnell's field notes

page transcribe versions

[Previous Page](#)

[Next Page](#)

[zoom in](#)

[too small?](#)

S2 Page 22

Collector: [Grinnell](#)-1925
Location: [Mineral](#), 4800 ft.
Date: [June 18](#)
Page Number: 2477

9:50 am -- Tolmie Warbler's nest, which [Dixon](#) has been photographing, and which Mrs. G & I found 3 days ago, then with four nearly fresh eggs in it. [But now incubated about 1/4]. Nest in scraggly, open growth of [ceanothus cordulatus](#), in dry ground, a small [yellow pine](#) within 10 feet, but site sunny during the hottest part of the day. Rim 190 mm. above ground surface, nest snugly resting among five dead twigs of the snow birch, with a slanting live stem of some 80 (unknown3) overhead. No single twig directly supporting nest, but compact structure of latter enables it to rest securely among the fine twiggy aforementioned. Female rather shy; sneaks off along ground and keeps quiet and out of sight. Male not noted in vicinity. Nest & eggs taken (1/4).
[6259](#) Sierra Grouse (male) nat. 13.8g. Iris hazel; toes and unfeathered portions of (unknown7), dull yellow; iris hazel. Taken yesterday (see p. 2475).
[6260](#) [Wright Flycatcher](#) (female) 12.2g. With set 1/4 (see p. 2476). Breast glandular.
[6261](#) [Gerrhonotus](#) found on the 16th squirming along (unknown6) stems under ceanothus near mom; Dixon has had it for photographing.
5:10 p.m. -- Fox Sparrow's nest with 3 fresh eggs -- complete set because same number on 16th when I first found it. Nest not on ground but up in ceanothus cordulatus bush, in large tract of same; rim 490 mm. above ground; two slanting green ceanothus stems partly shaded it from above, and a small dead pine stem stood up thru the tangle 10 inches away. Even though the outer portion of the nest is of very loose construction it was well supported by the close tangle of ceanothus twiggy

Notes

Grinnell-1925 Mineral, 4800 ft. June 18 2477

9:50 a.m. -- Tolmie Warbler's nest, which Dixon has been photographing, and which Mrs. G & I found 3 days ago, then with four nearly fresh eggs in it. [But now incubated about 1/4].

✓ Nest in scraggly, open growth of ceanothus cordulatus, on dry ground; a small yellow pine within 10 feet, but site sunny during the hottest part of the day.

Rim 190 mm. above ground surface; nest snugly resting among five dead twigs of the snow birch, with a slanting live stem of some 80 mm. overhead. No single twig directly supporting nest, but compact structure of latter enables it to rest securely among the fine twiggy aforementioned. Female rather shy; sneaks off along ground and keeps quiet and out of sight.

Male not noted in vicinity. Nest & eggs taken (1/4).

✓ 6259 Sierra Grouse ♂ nat. 13.8g. Iris hazel; toes and unfeathered portions of (unknown7), dull yellow; iris hazel. Taken yesterday (see p. 2475).

✓ 6260 Wright Flycatcher ♀ 12.2g. With set 1/4 (see p. 2476). Breast glandular on the 16th.

✓ 6261 Gerrhonotus found squirming along among stems under ceanothus near mom; Dixon has had it for photographing.

5:10 p.m. -- Fox Sparrow's nest with 3 fresh eggs -- complete set because same number on 16th when I first found it. Nest not on ground but up in ceanothus cordulatus bush, in large tract of same; rim 490 mm. above ground; two slanting green ceanothus stems partly shaded it from above, and a small dead pine stem stood up thru the tangle 10 inches away. Even though the outer portion of the nest is of very loose construction it was well supported by the close tangle of ceanothus twiggy

Transcribing the field notes of the Museum of Vertebrate Zoology

subject edit versions graph

[subjects](#)

Related Subjects Graph for *Mineral*



Subjects Mentioned Frequently With Mineral

[Read pages that mention *Mineral* in all works.](#)

The graph displays the other subjects mentioned on the same pages as the subject *Mineral*. If the same subject occurs a page with *Mineral* more than once, it appears closer to *Mineral* on the graph, and is colored in a darker shade. The closer a subject is to the center, the more "related" the subjects are.

Limit the graph to subjects in these categories:

- Author
- Common species names
 - Amphibians
 - Birds
 - Mammals
 - Plants
 - Reptiles
- Date
- Illustration
 - Map
- Locations
 - California
- Morphology
- People
- Scientific species names
 - Amphibians
 - Birds
 - Mammals
 - Plants
 - Reptiles

Show subjects that appear on at least pages in common with *Mineral*.

Host-Parasite Integrations

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Arctos
Multi-Institution, Multi-Collection Museum Database

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Robert L. Rausch Necropsy Ledger

Page Previous 1187 (4 TAGs) Next of 4481

description: 17121
created by agent: Robert L. Rausch
derived from media: 10427164

[\[Media Details \]](#) [\[edit media \]](#) [\[download master \]](#)

MSB Ledger

No.	Host	Sex	Age	Locality	Weight	Cestode	Trematode	Nematode	Remarks
017121	horned lark	♀	June 9	Middleton I	Ad - S. int.	labelled			ovoid not enlarged ova up to 2mm TL-165
017122	fox sparrow	♀	"	"	Ad - S. int.		good known		broken egg in oviduct TL-185
017123	longspur	♂	"	"	Ad	labelled		Neg	TL-168 test. 12mm
017124	Parasit. Jaeger	♂	June 10	"	Ad.			Neg	TL-468 test. 15X7 TL-422
017125	b.f. Kittiwake	♀	"	"	Imm. pr.	Cestodes S.E.			
017126	Pallas murre	♂	"	"	Ad.		not ant.		TL-415 mm test. 38mm
017127	Winter wren	♂	"	"	Ad.		"		TL-100 test. 9mm
017128	Winter wren	♂	June 11	"	Ad			Neg	TL-113 test 8mm
017129	Yellow Warbler	♂	"	"	Ad			Neg	TL-125 test. 6mm
017130	Winter wren	♂	"	"					TL-93 test. 8mm

Create TAG type...

[Edit TAG ~ Delete TAG ~ Scroll to TAG](#)
TAG Type: cataloged_item
Reference: UAM:Bird:2877

[Edit TAG ~ Delete TAG ~ Scroll to TAG](#)
TAG Type: cataloged_item
Reference: MVZ:Bird:134762

[Edit TAG ~ Delete TAG ~ Scroll to TAG](#)
TAG Type: cataloged_item
Reference: MVZ:Bird:134755

[Edit TAG ~ Delete TAG ~ Scroll to TAG](#)
TAG Type: cataloged_item
Reference: UAM:Bird:2881

MVZ Specimen



Shared system fosters relationships between collections in different institutions

© Ondřej Zicha



MSB Parasites 1992
collector number: 17121
Cestoda

[<< Return to results](#)
[get a DOI](#)

Middleton Island
North America, Gulf of Alaska, United States, Alaska, Middleton Island Quad, Middleton Island
June 9 '56 (1956-06-09)

observation



[\[Report Bad Data \]](#)
[MSB Parasites](#)

Relationships

[Edit](#)

(parasite of) [MSB:Host:6746](#)

family@2014-05-23: Alaudidae

identification@2014-05-23: *Eremophila alpestris*

locality@2014-05-23: North America, Gulf of Alaska, United States, Alaska, Middleton Island Quad, Middleton Island: Middleton Island

(parasite of) [MVZ:Bird:134762](#)

family@2014-05-16: Alaudidae

identification@2014-05-16: *Eremophila alpestris arctica*

locality@2014-05-16: North America, United States, Alaska, Middleton Island: Middleton Island, Gulf of Alaska

Georeference Source: GeoLocate
Georeference Protocol: GeoLocate



Robert L. Rausch, 1956-06-09

verbatim host sex: female

Robert L. Rausch, 1956-06-09

location in host: small intestine

Robert L. Rausch, 1956-06-09

Remark: R. L. Rausch verbatim location: small intestine

Remarks: s. int.

Entered By: Mariel L. Campbell on 2012-10-04

Last Edited By: UAM on 2014-05-14

[Edit](#)

Collectors

Robert L. Rausch

[Edit](#)

Accession

2007.003.Para

[Edit](#)

Usage

Contributed By Project: [The Robert & Virginia Rausch Helminthological Studies](#)

Arctos for Small Collections

- Low cost and management overhead
- Reliable, scalable infrastructure
- Provides built-in “Data Management Plan”
- Flexible, dynamic, and responsive to user needs
- Collaborations and partnerships improve data quality, foster new capabilities, and build connections to “Big Data” in space and time

Teaching collections

Small regional collections

Field stations, refuges, parks



Hastings Reserve, Calif.

Questions?



Photo by J.L. Fiely

Email: ccicero@berkeley.edu