Using Online Natural History Databases to Support Innovation in Undergraduate Education

Tanya Dewey, Animal Diversity Web, University of Michigan Museum of Zoology
Tracy Barbaro, Encyclopedia of Life, Harvard Museum of Comparative Zoology

The Animal Diversity Web (animaldiversity.org, ADW) and Encyclopedia of Life (eol.org, EOL) work together to provide and disseminate natural history information useful in education.

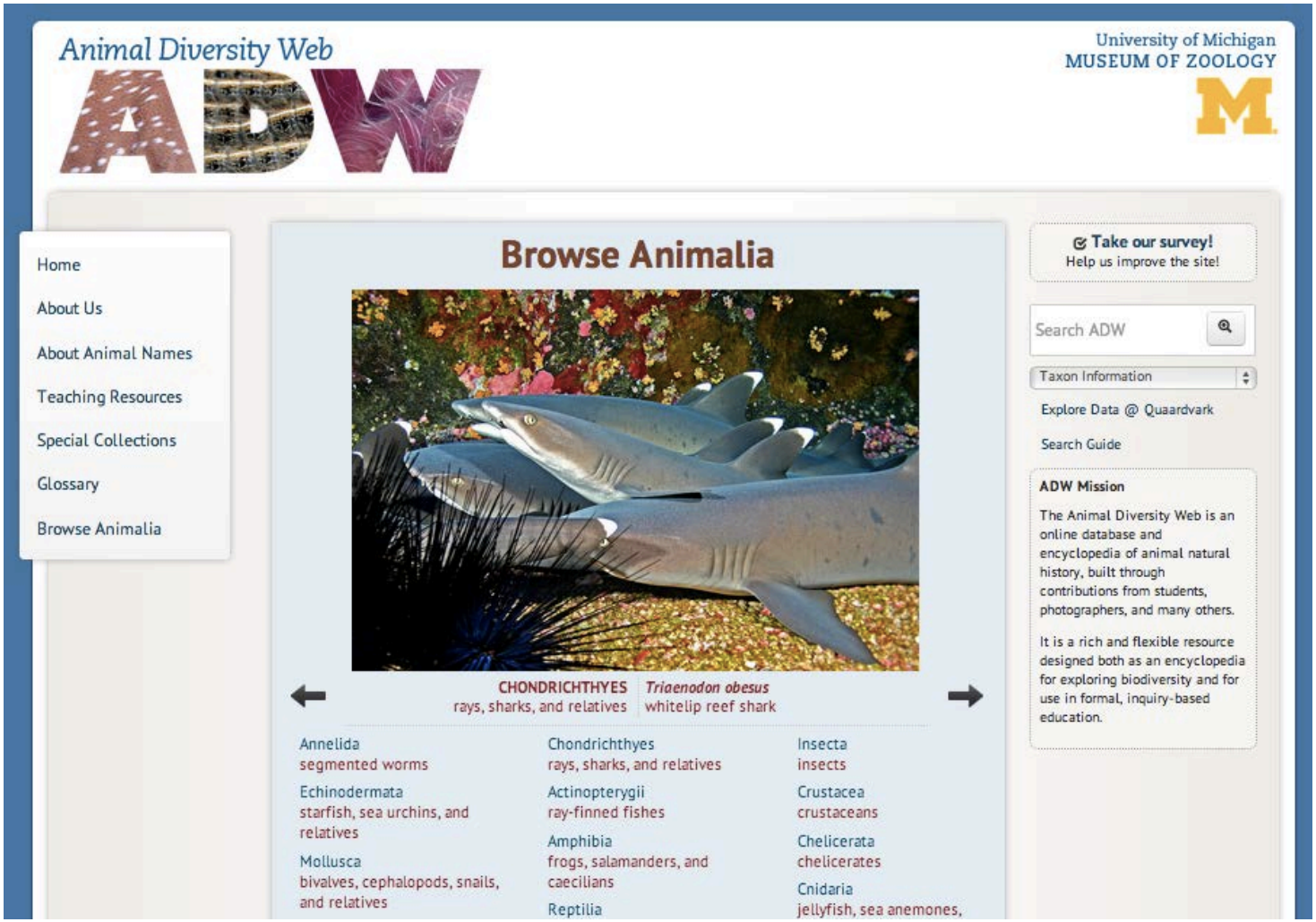
Long term collaboration: sharing data and ideas

- ADW is an EOL content partner
- EOL page re-directs on ADW
- Providing complementary resources:

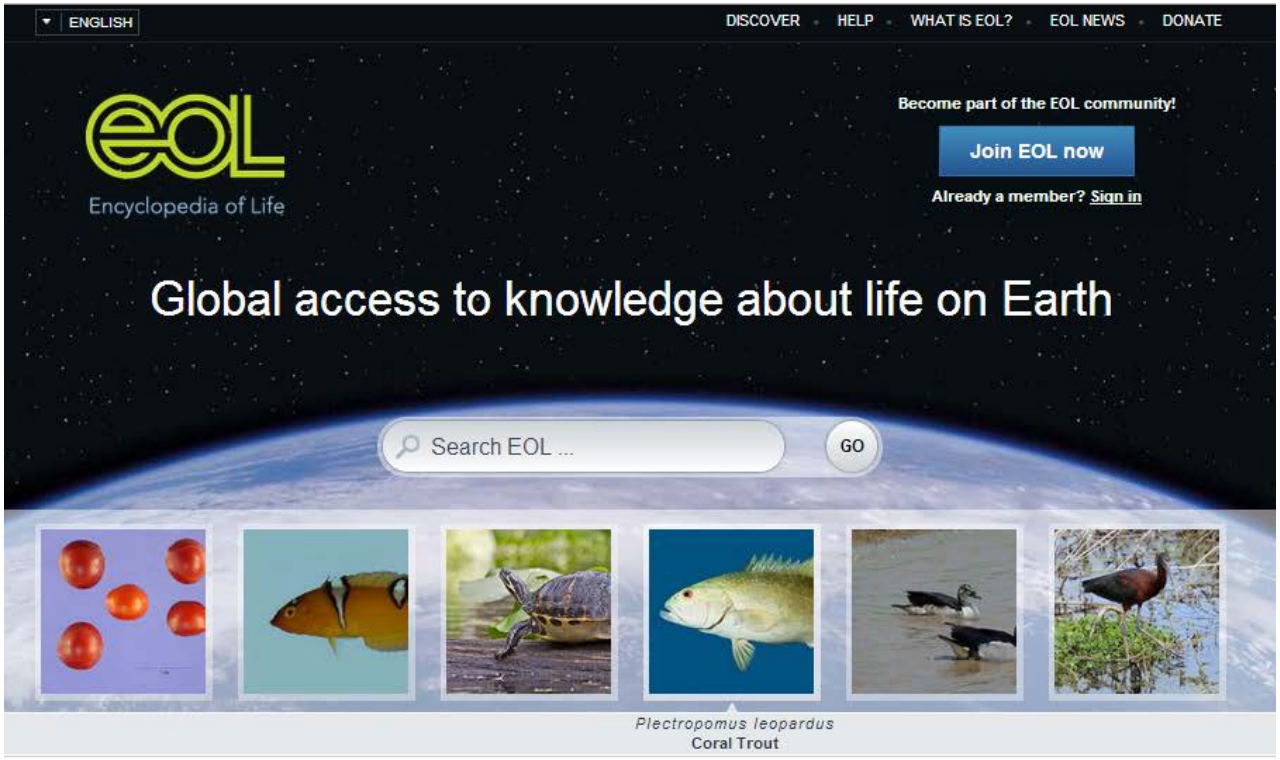
    Use of EOL tools in ADW/Center for Essential Science curriculum.

    ADW BioKIDS Critter Catalog provides kid-friendly content.

    Communicate about structuring student species account contributions.



- Online database focusing on animals, online since 1995.
- Structured content contribution model, undergraduate biology students write accounts, which are then edited for accuracy and completeness.
- 2 to 4 million pages served to 300,000 users monthly.
- 4000 taxon accounts, thousands of tagged images, including specimens and live animals.
- Majority education use.



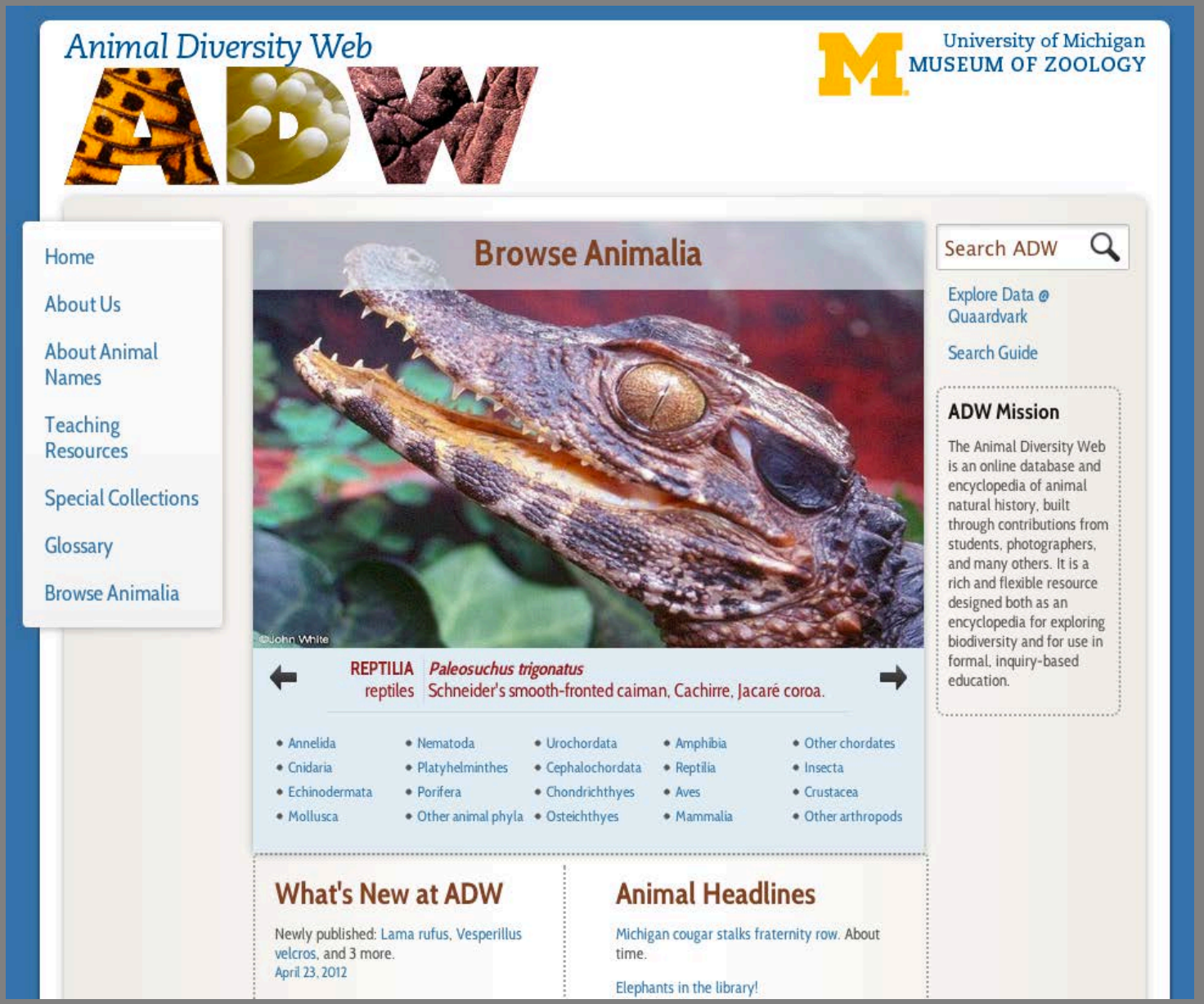
- Global, on-line resource—plants, animals, microorganisms
- Web pages for 1.9 million known species
- Plus millions more yet to be described
- Serves authoritative information as well as contributions from the general public.

Workshop Agenda

Introduction to ADW and Tools

Introduction to EOL and Tools

Wrap up and discussion



animaldiversity.org

One of the largest natural history databases online.
2 to 4 million pages to 300,000 users monthly.
Majority educational use.

- ADW History:
  - Nearly 4000 high quality, vetted, student-authored accounts.
  - Online since 1995, over 2 million pages served to 300,000 visitors monthly.
  - 20,000 tagged images.

- How is the database built?
  - Over 4000 students from 60 institutions have contributed.
  - Students contribute through an online template, resulting in a highly structured database.

- How is the database used?
  - Re-purpose data via presentation.
  - Mine the data for active inquiry in classrooms.
  - Connect to other databases via structure and tagging.

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Browse Animalia

Myotis lucifugus
little brown bat

By Aaron Havens

Additional Information
BioKIDS Critter Catalog
Encyclopedia of Life

Geographic Range

Little brown bats, *Myotis lucifugus*, are abundant in southern Alaska, Canada, across the United States from the Pacific to Atlantic coasts, and the higher elevation forested regions of Mexico. Although little brown bats are not found in northern Canada, individuals have been observed in Iceland and Kamchatka. Those outlying records are presumed to have been the result of accidental ship transportation by humans. Little brown bats are also absent from much of Florida, the southern Great Plains regions of the U.S., southern California, and parts of coast Virginia and the Carolinas. (Barbour and Davis, 1969; Fenton and Barclay, 1980a; Nowak, 1994)

Biogeographic Regions: nearctic (native)

Habitat

Myotis lucifugus occupies three types of roosts: day, night, and hibernation roosts. Locations of roosts are chosen based upon the presence of stable ambient temperatures. Day and night roosts are used by active bats and include, but are not li-

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Search ADW
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Pictures
Specimens
Classification

Classification

Kingdom
Animalia
animals

Phylum
Chordata
chordates

Subphylum
Vertebrata
vertebrates

Class
Mammalia
mammals

Order

Animal Diversity Web

ADW

University of Michigan
MUSEUM OF ZOOLOGY

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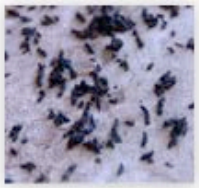
Encyclopedia of Life

Myotis lucifugus
little brown bat

Filter results by...

little brown bat
Myotis lucifugus

little brown bat
Myotis lucifugus



little brown bat
Myotis lucifugus

little brown bat
Myotis lucifugus

little brown bat
Myotis lucifugus

little brown bat
Myotis lucifugus

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Help us improve the site!

Search ADW

Myotis lucifugus
little brown bat

Filter results by...

Anatomy

Sexual (4)

Body Parts: Eyes (1)

Coloration/Patterning: Cryptic (1)

Body Parts (1)

Coloration/Patterning (1)

Life Stages And Gender

Adult/Sexually Mature (4)

Life Stages And Gender (4)

Subject

little brown bat
Myotis lucifugus

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Myotis lucifugus
little brown bat

Results refined by:

✖ Subject: Specimen: Skull: Dorsal View

little brown bat
Myotis lucifugus
Indiana bat
Myotis sodalis
northern
long-eared myotis

little brown bat
Myotis lucifugus

little brown bat
Myotis lucifugus

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Browse Animalia

Myotis lucifugus
little brown bat

Kingdom
Animalia
animals

Eumetazoa
metazoans

Bilateria
bilaterally symmetrical animals

Deuterostomia
deuterostomes

Phylum
Chordata
chordates

Craniata
craniates

Subphylum
Vertebrata
vertebrates

Superclass
Gnathostomata
jawed vertebrates

Euteleostomi
bony vertebrates

Class
Sarcopterygii
lobe-finned fishes and terrestrial vertebrates

Tetrapoda

Confused by a **class within a class** or an **order within an order**? Please see our **brief essay**.

Additional Information

Encyclopedia of Life

Search ADW

Taxon Information

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Information
Pictures
Specimens

Classification

Classification

Kingdom
Animalia
animals

Phylum
Chordata
chordates

Subphylum
Vertebrata
vertebrates

Class
Mammalia
mammals

Order

- ADW History:
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- How is the database built?
  - Over 4000 students from 60 institutions have contributed.
  - Students contribute through an online template, resulting in a highly structured database.
  - Incorporate external data and add data to images.

- How is the database used?
  - Re-purpose data via presentation.
  - Mine the data for active inquiry in classrooms.
  - Connect to other databases via structure and tagging.

navigation

Switch to Contents view

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about

Created by
zookeeper

Species Taxon Account W2004

Last modified
2010-09-16 - 12:02

State
published

Species Myotis lucifugus

Discuss Species Taxon Account W2004

Mammalia

Geographic Range

Edit

Little brown bats, *Myotis lucifugus*, are abundant in southern Alaska, Canada, across the United States from the Pacific to Atlantic coasts, and the higher elevation forested regions of Mexico. Although little brown bats are not found in northern Canada, individuals have been observed in Iceland and Kamchatka. Those outlying records are presumed to have been the result of accidental ship transportation by humans. Little brown bats are also absent from much of Florida, the southern Great Plains regions of the U.S., southern California, and parts of coast Virginia and the Carolinas.

advanced

Barbour and Davis, 1969; Fenton and Barclay, 1980; Nowak, 1994

Little brown bats are found in most parts of North America. They are not found in the far north of Canada or in the far southern parts of the United States, except in the forested high mountains of Mexico. Some little brown bats have been observed in Iceland and Kamchatka, but those probably got there as the result of accidental ship transportation by people.

intermediate

Barbour and Davis, 1969; Fenton and Barclay, 1980; Nowak, 1994

Biogeographic Regions: Nearctic (Native).

Other Geographic Terms:

Habitat

Edit

Myotis lucifugus occupies three types of roosts: day, night, and hibernation roosts. Locations of roosts are chosen based upon the presence of stable ambient temperatures. Day and night roosts are used by active bats and include, but are not limited to, buildings, trees, under rocks, and in piles of wood. Day roosts have very little or no light, provide good shelter, and typically have southwestern exposures to provide heat for arousal from daily torpor.

Night roosts are selected for their confined spaces where large concentrations of bats can cluster together to increase the temperature in the roost. These roosts are primarily occupied when temperatures are below 15°C. Night roosts are usually away from day roosts; this may diminish the accumulation of feces at day roosts and avoid signaling predators. Day and night roosts are inhabited during spring, summer, and fall months, whereas during the winter, hibernacula sites are used.

identification | references | view | edit | contributors | properties | copyright release | help | state

Edit Species Taxon Account W2004

Discuss Species Taxon Account W2004

Reproduction: General Behavior

Use the text box to describe the reproductive cycle of this species. Be certain that you are reporting all of the important information relevant to reproduction. In the case of a mammal, this would include season of breeding, number of offspring per breeding season, gestation period, when weaning occurs, and age at sexual maturity. It might also include a description of any peculiarities of the system or anything that is notable or interesting. Examples might include descriptions of delayed implantation or fertilization, induced or spontaneous ovulation, or, in the case of hoofed mammals, whether the young are "followers" or "hiders."

Swarming at the hibernacula occurs during late summer and fall; activity decreases with lower temperatures. Swarming serves a prenuptial function, along with showing the young suitable hibernation roosts. During late July, bats arriving at the hibernacula are adult males and nonparous females; females and subadults appear in early August. Swarming <<M. lucifugus>> may travel large distances, causing mixing of populations from different areas. During the swarming period, little brown bats are receptive to calls of conspecifics.

☑ Advanced ☐ Intermediate

Please check the applicable references:

- ☐ Anthony and Kunz, 1977
- ☐ Barbour and Davis, 1969
- ☐ Bassett and Wiebers, 1979
- ☐ Belwood and Fenton, 1976
- ☐ Cockrum, 1956

Breeding interval

Describe how frequently, or at what intervals, individuals of this species breed. For example: "Wood frogs breed once yearly", or: "White-footed mice breed every 3 to 4 weeks during the warmer months and less frequently during winter".

Both sexes mate more than once per year and produce one yo

☑ Advanced ☑ Intermediate

Breeding season

Indicate the time of year (span of months usually) in which mating occurs. This should be the time when copulation occurs, not pair formation (which should be in 'Mating Systems'), and should not include the time when births occur (please describe that information in the 'General Behavior' text box).

Mating begins in mid-August during the active phase and conti

☑ Advanced ☑ Intermediate

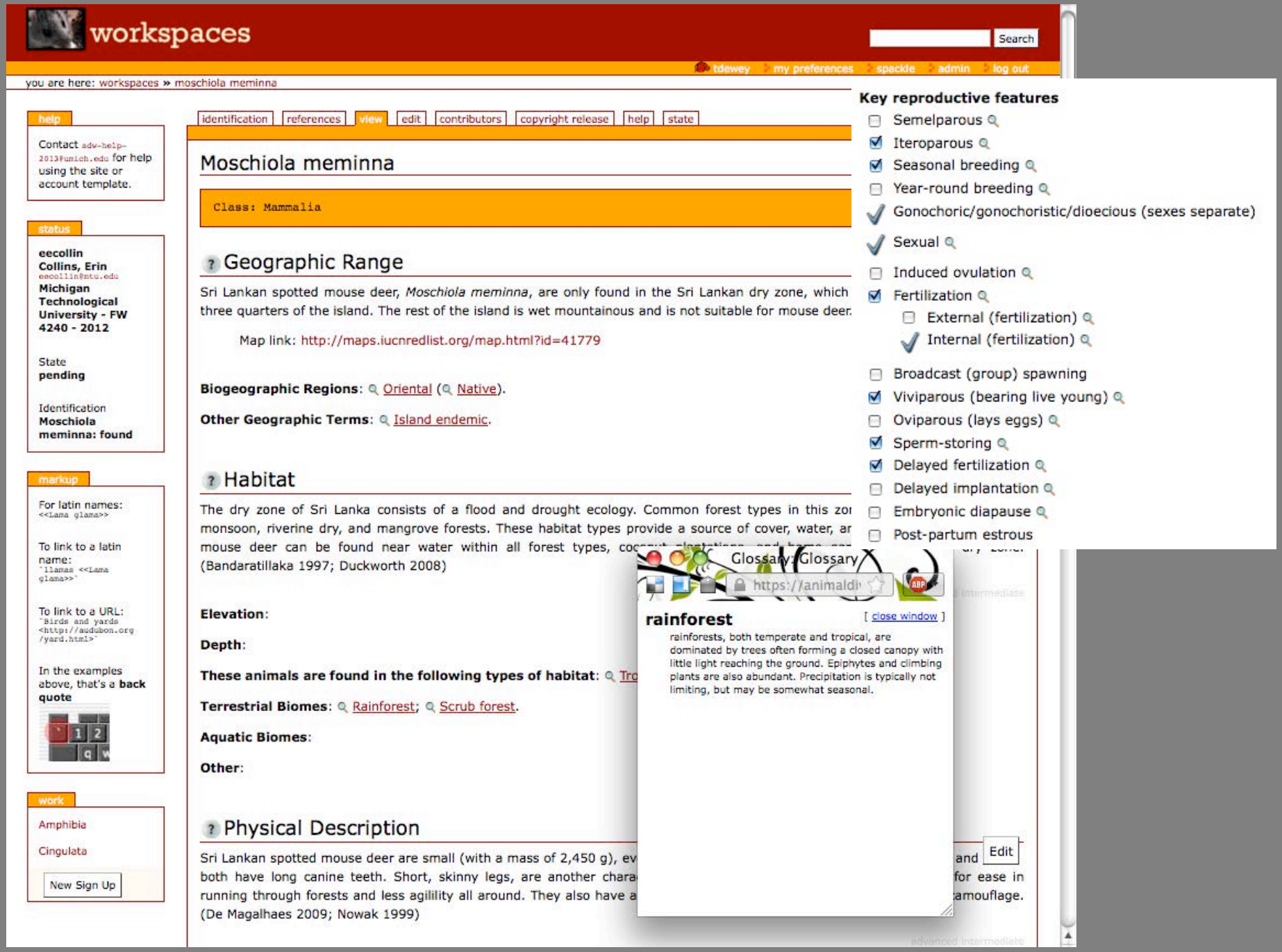
Use the fields provided to include information on number of offspring, time to hatching, time to independence, time to fledging, age at sexual maturity, etc. Be sure to select the correct units for those measurements. Please also describe these values in the Reproductive Behavior text box (above). Enter the typical lower and typical highest values as they are reported in the literature, only enter an average value if it is identified as an average in the literature (for example: average time to hatching is 12 days). Try to be as complete as possible in filling out this information and checking all keywords that apply to these animals.

Number of offspring

Low:	1
High:	2
Average:	1

Gestation period

Low:	50
High:	60
Average:	55
Units:	days


workspaces
Search
tdewey
my preferences
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admin
log out
you are here: workspaces » moschiola meminna
help
Contact adw-help-2013@umich.edu for help using the site or account template.
status
eecollin
Collins, Erin
eecollin@mtu.edu
Michigan Technological University - FW 4240 - 2012
State
pending
Identification
Moschiola meminna: found
markup
For latin names:
<<Lama glama>>
To link to a latin name:
`llamas <<Lama glama>>`
To link to a URL:
`Birds and yards <http://audubon.org/yard.html>`
In the examples above, that's a back quote
work
Amphibia
Cingulata
New Sign Up
identification
references
view
edit
contributors
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state
Moschiola meminna
Class: Mammalia
Geographic Range
Sri Lankan spotted mouse deer, Moschiola meminna, are only found in the Sri Lankan dry zone, which
three quarters of the island. The rest of the island is wet mountainous and is not suitable for mouse deer.
Map link: http://maps.iucnredlist.org/map.html?id=41779
Biogeographic Regions: Oriental (Native).
Other Geographic Terms: Island endemic.
Habitat
The dry zone of Sri Lanka consists of a flood and drought ecology. Common forest types in this zo
monsoon, riverine dry, and mangrove forests. These habitat types provide a source of cover, water, ar
mouse deer can be found near water within all forest types,
(Bandaratillaka 1997; Duckworth 2008)
Elevation:
Depth:
These animals are found in the following types of habitat:
Terrestrial Biomes: Rainforest; Scrub forest.
Aquatic Biomes:
Other:
Physical Description
Sri Lankan spotted mouse deer are small (with a mass of 2,450 g), ev
both have long canine teeth. Short, skinny legs, are another chara
running through forests and less agilility all around. They also have a
(De Magalhaes 2009; Nowak 1999)
Edit
and
for ease in
camouflage.
Key reproductive features
Semelparous
Iteroparous
Seasonal breeding
Year-round breeding
Gonochoric/gonochoristic/dioecious (sexes separate)
Sexual
Induced ovulation
Fertilization
External (fertilization)
Internal (fertilization)
Broadcast (group) spawning
Viviparous (bearing live young)
Oviparous (lays eggs)
Sperm-storing
Delayed fertilization
Delayed implantation
Embryonic diapause
Post-partum estrous
Glossary: Glossary
https://animaldi
rainforest
[close window]
rainforests, both temperate and tropical, are dominated by trees often forming a closed canopy with little light reaching the ground. Epiphytes and climbing plants are also abundant. Precipitation is typically not limiting, but may be somewhat seasonal.

help

Contact adw-help-2013@umich.edu for help using the site or account template.

status

eecollin
Collins, Erin
eecollin@mtu.edu
Michigan Technological University - FW 4240 - 2012

State
pending

Identification
Moschiola meminna: found

markup

For latin names:
<<Lama glama>>

To link to a latin name:
"llamas <<Lama glama>>"

To link to a URL:
"Birds and yards <http://audubon.org/yard.html>"

In the examples above, that's a **back quote**

work

Amphibia

Cingulata

New Sign Up

identification | references | view | edit | contributors | copyright release | help | state

Moschiola meminna

Discuss

Class: Mammalia

Geographic Range

Edit

Sri Lankan spotted mouse deer, *Moschiola meminna*, are only found in the Sri Lankan dry zone, which is the northernmost three quarters of the island. The rest of the island is wet mountainous and is not suitable for mouse deer. (Duckworth 2008)

Map link: http://maps.iucnredlist.org/map.html?id=41779

advanced intermediate

Biogeographic Regions: Oriental (Native).

Other Geographic Terms: Island endemic.

Habitat

Edit

The dry zone of Sri Lanka consists of a flood and drought ecology. Common forest types in this zone are lowland rain, monsoon, riverine dry, and mangrove forests. These habitat types provide a source of cover, water, and food. Sri Lankan spotted mouse deer can be found near water within all forest types, coconut plantations, and home gardens within the dry zone. (Bandaratillaka 1997; Duckworth 2008)

advanced intermediate

Elevation:

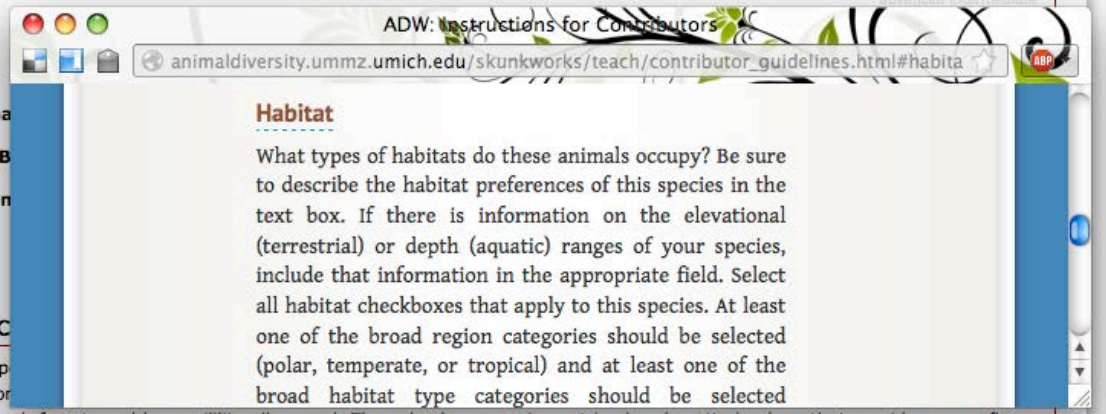
Depth:

These anima

Terrestrial B

Aquatic Bion

Other:



Physic

Sri Lankan sp
both have lor
running through forests and less agilility all around. They also have a unique striped and spotted pelage that provides camouflage. (De Magalhaes 2009; Nowak 1999)

advanced intermediate

Mass: Approximately 2,450 g (average)

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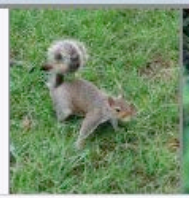
Kids' Inquiry of Diverse Species

CyberTracker Tools
ChangeThinking
Animal Diversity Web

myotis Search

Critter Catalog | Field Guides | Research | Resources

Critter Catalog

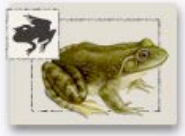



Welcome to the Critter Catalog!


mammals


birds


reptiles


amphibians

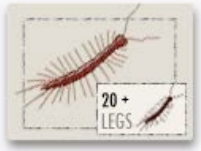

fish

annelids

mollusks

insects

arachnids



myriapods

crustaceans

invertebrates. Most of those invertebrates are insects. In comparison, the number of vertebrates is closer to tens of thousands.

For simplicity's sake, we have presented **six main groups of invertebrates**, distinguished

Kids' Inquiry of Diverse Species

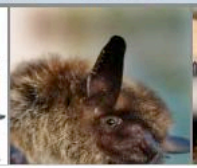
CyberTracker Tools
ChangeThinking
Animal Diversity Web

Search

Critter Catalog | Field Guides | Research | Resources | About Us | Glossary | Help

Critter Catalog






mammals
- bats
- vesper bats

mouse-eared bats, silver-haired bats, and wing-gland bats

Information
Pictures
Specimens
Classification

See also
Find little brown bat information at Animal Diversity Web

Little brown bat

Myotis lucifugus

What do they look like?

Little brown bats are appropriately named. Their fur is glossy, and can be dark-brown, golden-brown, reddish, or olive-brown. Albino individuals have also been observed. The fur on the belly is lighter than the fur on the back. Wings and membranes between the legs are dark brown or black, and have almost no hair. Little brown bats have small ears and large hind feet. The hind foot has hairs that extend past the toes.

Little brown bats are tiny, and weigh between 5 and 14 g. They are between 60 and 102 mm long, and have a wingspan between 222 and 269 mm. Females are larger than males, especially during the winter. Little brown bats fly at speeds as high as 35 km/hour and average 20 km/hour.

Mass
5 to 14 g; avg. 9.50 g
(0.18 to 0.49 oz; avg. 0.33 oz)

Length
60 to 102 mm; avg. 87 mm
(2.36 to 4.02 in; avg. 3.43 in)

Wingspan
222 to 269 mm
(8.74 to 10.59 in)

Some key physical features: endothermic; heterothermic.
Sexual dimorphism: female larger.

Animal Diversity Web
QUAARDVARK

University of Michigan
MUSEUM OF ZOOLOGY

animaldiversity.org/q

- Very large, structured database permits flexible querying so students can discover patterns in natural history. Ideally suited for active inquiry in a wide variety of organismal and introductory biology courses.

- Data available for queries includes geographic range, diet, size parameters, habitat, behaviors, and many other species-level characteristics.

- Queries of tagged specimen images illustrate morphological adaptations.

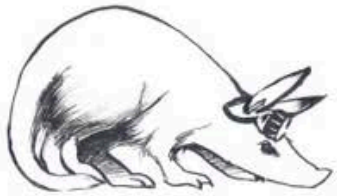
- Queries of live animal images illustrate life stages, anatomies, and behaviors.

Animal Diversity Web

QUAARDVARK

University of Michigan
MUSEUM OF ZOOLOGY

Welcome to Quaardvark



Welcome to **Quaardvark**, a tool for creating complex queries that allow you to dig through the underlying database of the Animal Diversity Web to discover ecological and evolutionary patterns in the natural world.

Quick Overview

- **Query and Report** takes you to the query tool, where you can search Animal Diversity Web data and create spreadsheet-like reports. You will need to be **registered** to download data or save work.
- For an explanation (including short screencasts) of how to set up queries and reports, see "**Using Quaardvark**".

Educators and Researchers

- To see how other educators have used Quaardvark, take a look at the set of **Sample Activities**.
- To explore the query tool without registering, select **Query and Report**. You will not be able to download data or save queries with this option, but you can access all search features and view reports within your browser.
- To save queries and download data, **register** for SAMPLE 999.
- To inquire about using Quaardvark in one of your courses, contact adw_quaardvark_help @ umich.edu.

Students

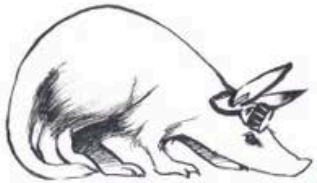
- If you're a student in a participating course, you must **register** as a member of the site. Don't forget to **select the course** that you're enrolled in, so your instructor will see your work!

Home
Using Quaardvark
Query & Report

Login
Register

Animal Diversity Web

Sample Activities



ADW project staff and collaborating faculty have created about 30 learning activities that use data from the Animal Diversity Web, extracted with Quaardvark. In each activity students construct their own searches, and extract data sets that are large enough for them to find patterns. Below is a full list of activities, and then shorter lists of activities suitable for different types of undergraduate classes. Activity titles link to individual pages with downloadable activity documents.

Full List of Activities

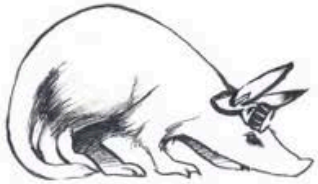
- *An Introduction to the Animal Diversity Web and Quaardvark*: This exercise serves as an introduction to the features of the Animal Diversity Web and the Quaardvark query tool by faculty collaborator Matthew Wund, The College of New Jersey.
- *Ecosystem Productivity and Resource Acquisition*: This exercise structures student exploration of the relationship between productivity in different kinds of habitats and aspects of life history that affect resource acquisition strategies, by faculty collaborator Matthew Wund, The College of New Jersey.
- *Life History Impacts on Number of Offspring*: An activity developed and implemented by Dr. Patricia Burrowes, University of Puerto Rico, for use in a General Zoology course. This activity explores the impact of various life history characteristics on the number of offspring in New World mice (Cricetidae).
- *Relating Natural History Traits to Basal Metabolic Rate*: This activity, designed by faculty participant Karen Francl, Radford University, has students explore the relationship between various natural history traits and basal metabolic rate.
- *Patterns in Life Histories and Conservation Risk*: These exercises explore conservation risk and its relationship with various life history characteristics, using several groups of mammals.
- *Reproductive Strategies in Metatherians and Eutherians*: This exercise explores the different reproductive investment strategies in metatherian and eutherian mammals, by faculty collaborator Jim Ryan, Hobart and William Smith Colleges.
- *Endangered Species Lab*: Students investigate a set of life history characteristics in a set of animal taxa to determine what most strongly influences conservation risk (by faculty collaborator Karen Francl, Radford University).
- *Primate Morphology Query*: This activity was specifically developed to demonstrate the ability of Quaardvark to query ADW images as well as text. Students explore several aspects of primate morphology, extracting and comparing images of skulls, other bones, and teeth. Topics include the association of binocular vision with life history and cranial structure, diet and dental morphology, and other patterns.
- *Generalized Sexual Dimorphism And Mating System Exercise*: Students test whether mating systems of different species correlate with size dimorphism between the sexes. Birds are the taxon specified in the example, but could easily use other groups. Uses Excel to graph data, doesn't include statistical tests, but could.

Home
Using Quaardvark
Query & Report

Login
Register

Animal Diversity Web

Help: How to use Quaardvark



Instructors! Do you want to see sample activities? They are on this page of examples.

For a quick overview of Quaardvark in action, **use these shortcuts to watch narrated screencasts**.

1. Query and Report overview
2. Save query to backpack
3. Download search results to desktop computer
4. Modify a query

If your class is using the discussion area, you may also want to view these two movies:

1. Participate in class discussion
2. Load query from discussion item

For more detail on any of these topics, read the sections below.

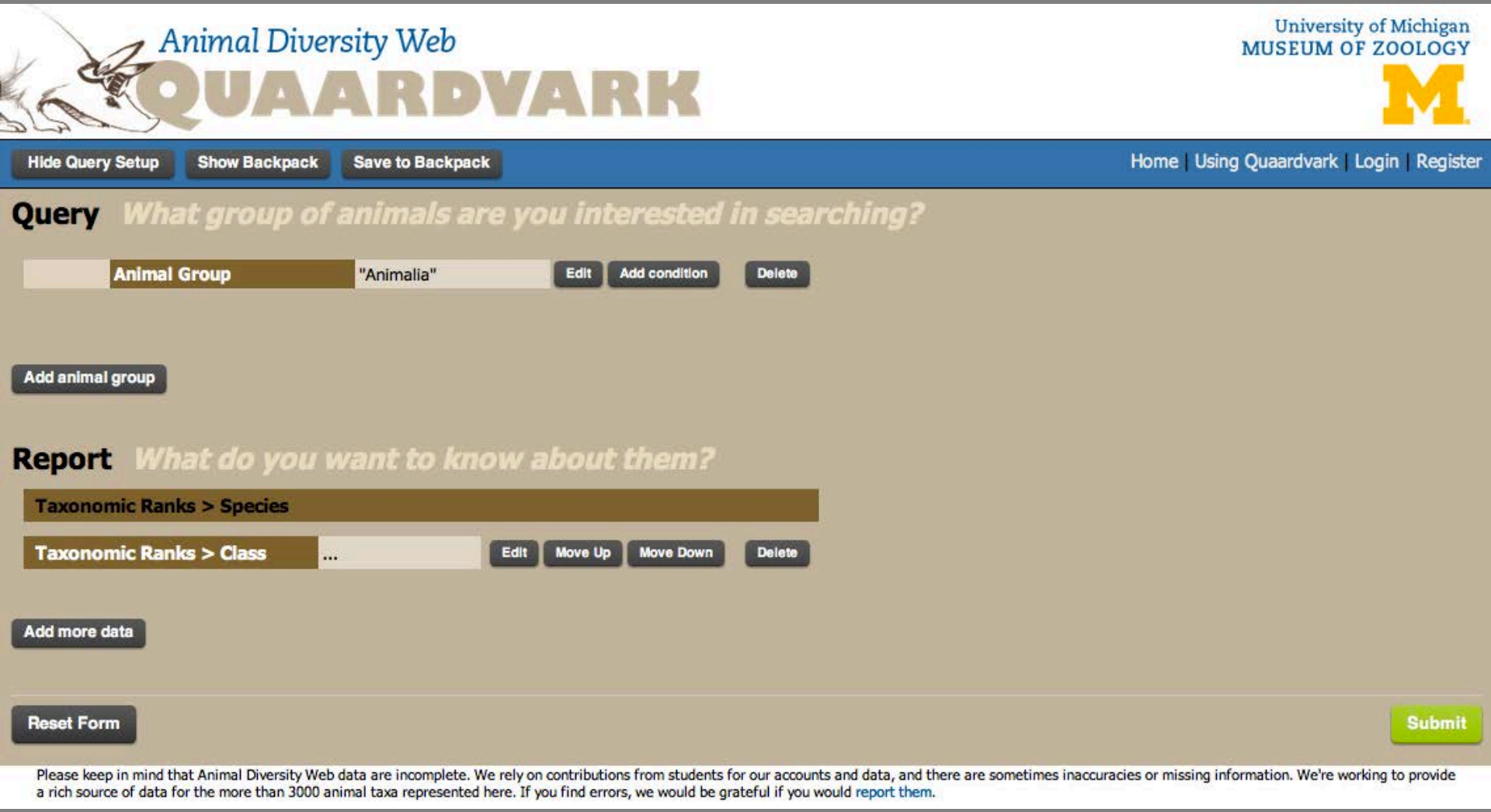
How do I use Query and Report?

Two questions underlie how you interact with Quaardvark:

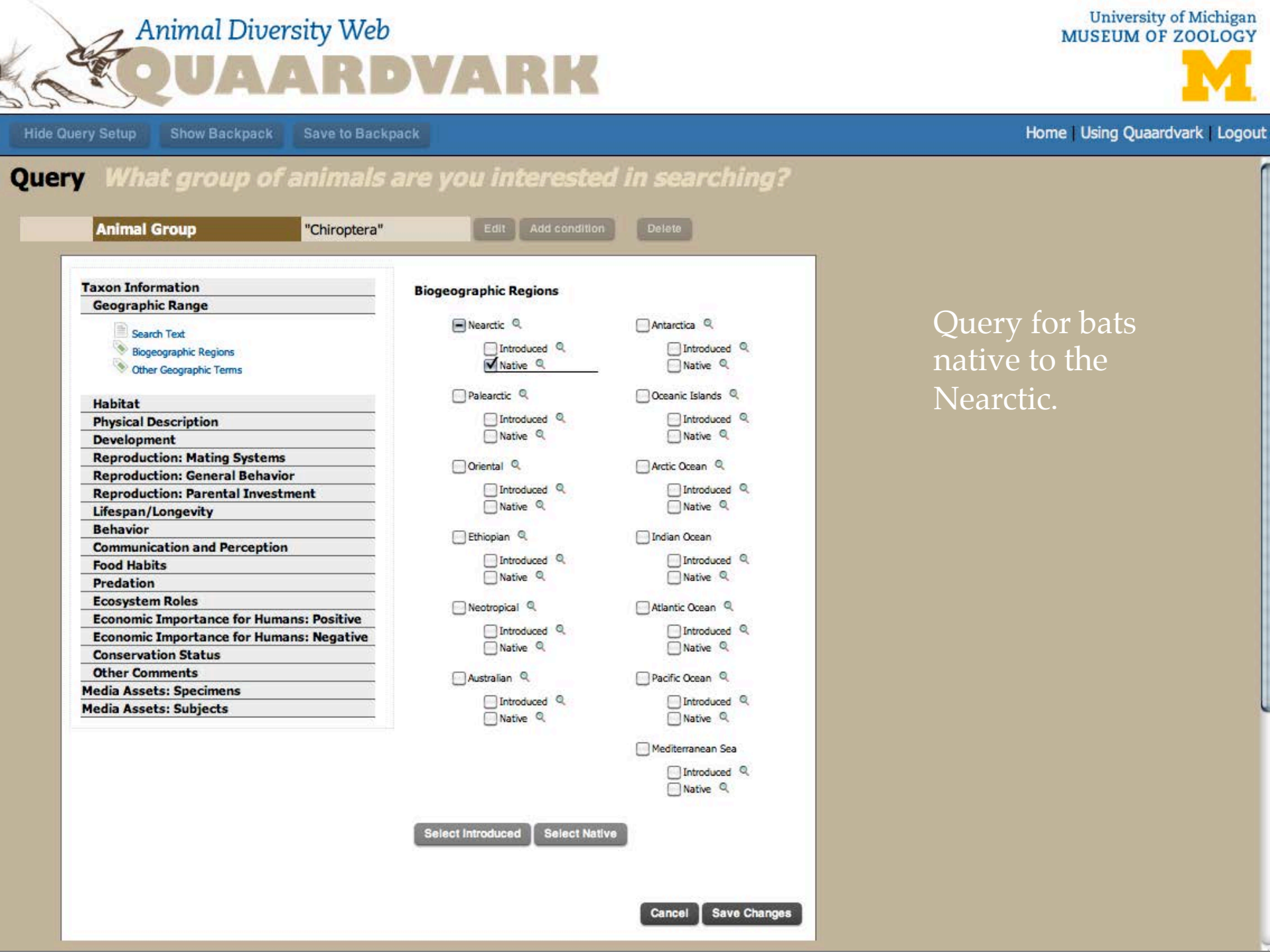
1. *What animals are you interested in?* This forms your **query** (search terms).
2. *What do you want to know about them?* This structures your **report**.

When you have specified both parts, we refer to that as a qu'ark. In the examples that follow, we are interested in *clutch size and conservation status for neotropical and ethiopian birds*.

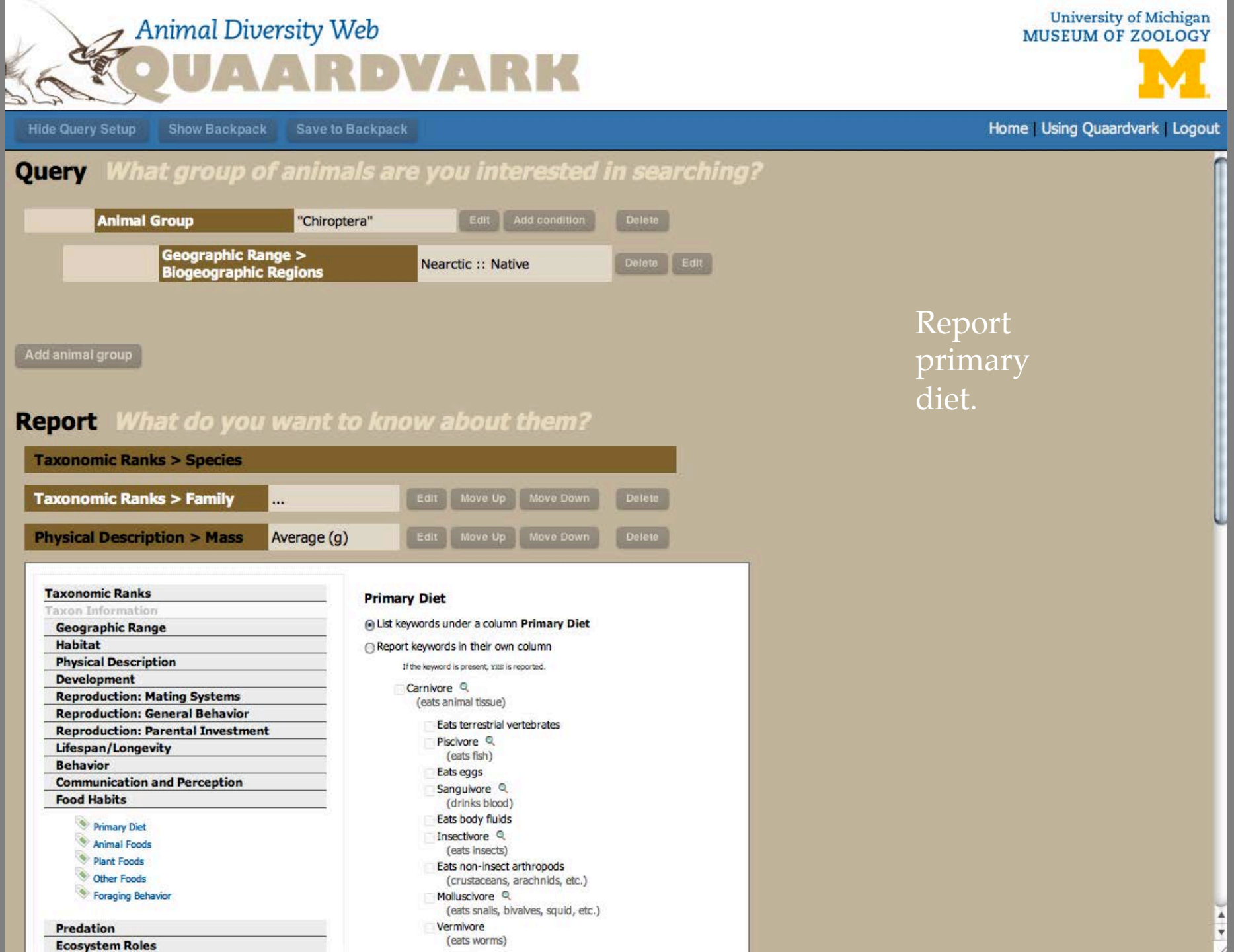
Step 1. What animals are you interested in? Specify your query. For this example, our animals of interest are: birds (Aves) in neotropical and ethiopian biogeographic regions. In the query area, start by editing the animal group to be the one we want (e.g. Aves). Next, add conditions to restrict the animal group (e.g. neotropical and ethiopian Aves).



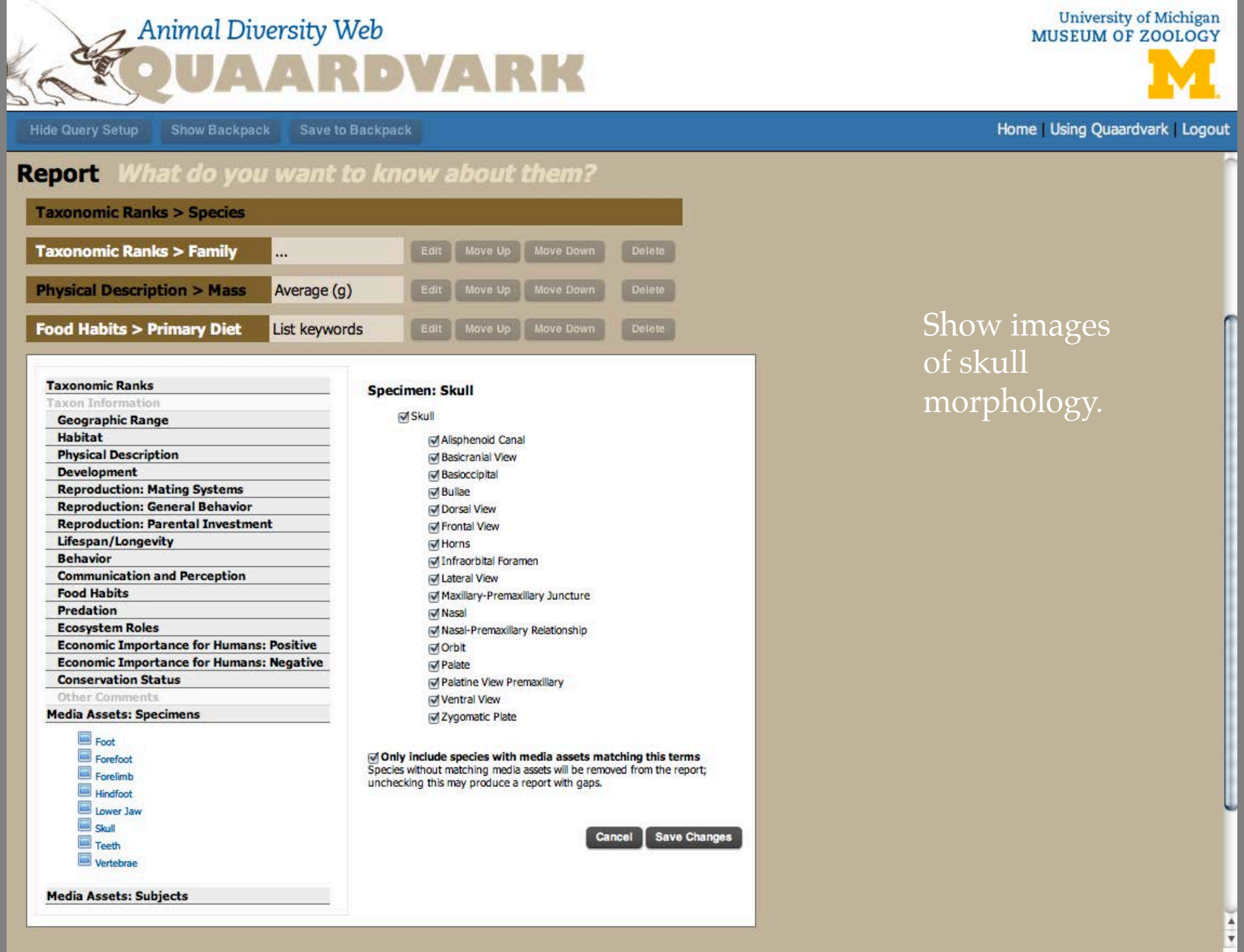
- ✧ Query section allows students to identify a group of animals that they want information on.
- ✧ Report section allows students to specify the information they want.
- ✧ An example query follows . . .



Query for bats native to the Nearctic.



Report primary diet.



Show images of skull morphology.

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Hide Query Setup | Show Backpack | Save to Backpack | Home | Using Quaardvark | Logout

Query *What group of animals are you interested in searching?*

	Animal Group	"Chiroptera"	Edit	Add condition	Delete

Add animal group

Report *What do you want to know about them?*

Taxonomic Ranks > Species					
Taxonomic Ranks > Family	...	Edit	Move Up	Move Down	Delete
Geographic Range > Biogeographic Regions	List keywords	Edit	Move Up	Move Down	Delete
Physical Description > Mass	Average (g)	Edit	Move Up	Move Down	Delete
Food Habits > Primary Diet	List keywords	Edit	Move Up	Move Down	Delete
Media Assets: Specimens > Specimen: Skull	Skull :: Ventral View	Edit	Move Up	Move Down	Delete

Add more data

Reset Form

Submit

Please keep in mind that Animal Diversity Web data are incomplete. We rely on contributions from students for our accounts and data, and there are sometimes inaccuracies or missing information. We're working to provide a rich source of data for the more than 3000 animal taxa represented here. If you find errors, we would be grateful if you would report them.

Select "submit."

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Show Query Setup | Show Backpack | Save to Backpack | Download | 38 matches | Home | Using Quaardvark | Logout

Image sizes: 1 2 3 4 | Hide selected | See selected | See all | Rotate Table

Species	Antrozous pallidus	Choeronycteris mexicana	Corynorhinus rafinesquii	Corynorhinus townsendii	Desmodus rotundus	Diphylla ecaudata	Eptesicus fuscus	Eumops pe
Family	Vespertilionidae	Phyllostomidae	Vespertilionidae	Vespertilionidae	Phyllostomidae	Phyllostomidae	Vespertilionidae	Molossidae
Mass - g	22.5	25	10	9	32.5	35	23	57
Primary Diet	• Carnivore • Carnivore :: Insectivore	• Herbivore • Herbivore :: Frugivore • Herbivore :: Nectarivore	• Carnivore • Carnivore :: Insectivore	• Carnivore • Carnivore :: Insectivore	• Carnivore • Carnivore :: Sanguivore		• Carnivore	• Carnivor • Carnivor
Skull :: Lateral View								
Skull :: Ventral View								

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Report is presented in the browser window and is downloadable.

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Image sizes: 1 2 3 4 | Hide selected | See selected | See all | Rotate Table

Backpack

Impact of Life History on Number of Offspring, Rodents (07/06/2012 - 23:34) Load Submit Delete

Bat Dietary Morphology (07/06/2012 - 23:20) Load Submit Delete

Use the backpack to save queries and reports for later review.

Species	Antrozous pallidus	Choeronycteris mexicana	Corynorhinus rafinesquii	Corynorhinus townsendii	Desmodus rotundus	Diphylla ecaudata	Eptesicus fuscus	Eumops pe
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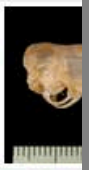
Mass - g	22.5	25	10	9	32.5	35	23	57
Primary Diet	• Carnivore • Carnivore :: Insectivore	• Herbivore • Herbivore :: Frugivore • Herbivore :: Nectarivore	• Carnivore • Carnivore :: Insectivore	• Carnivore • Carnivore :: Insectivore	• Carnivore • Carnivore :: Sanguivore		• Carnivore	• Carnivor • Carnivor
Skull :: Lateral View								
Skull :: Ventral View								

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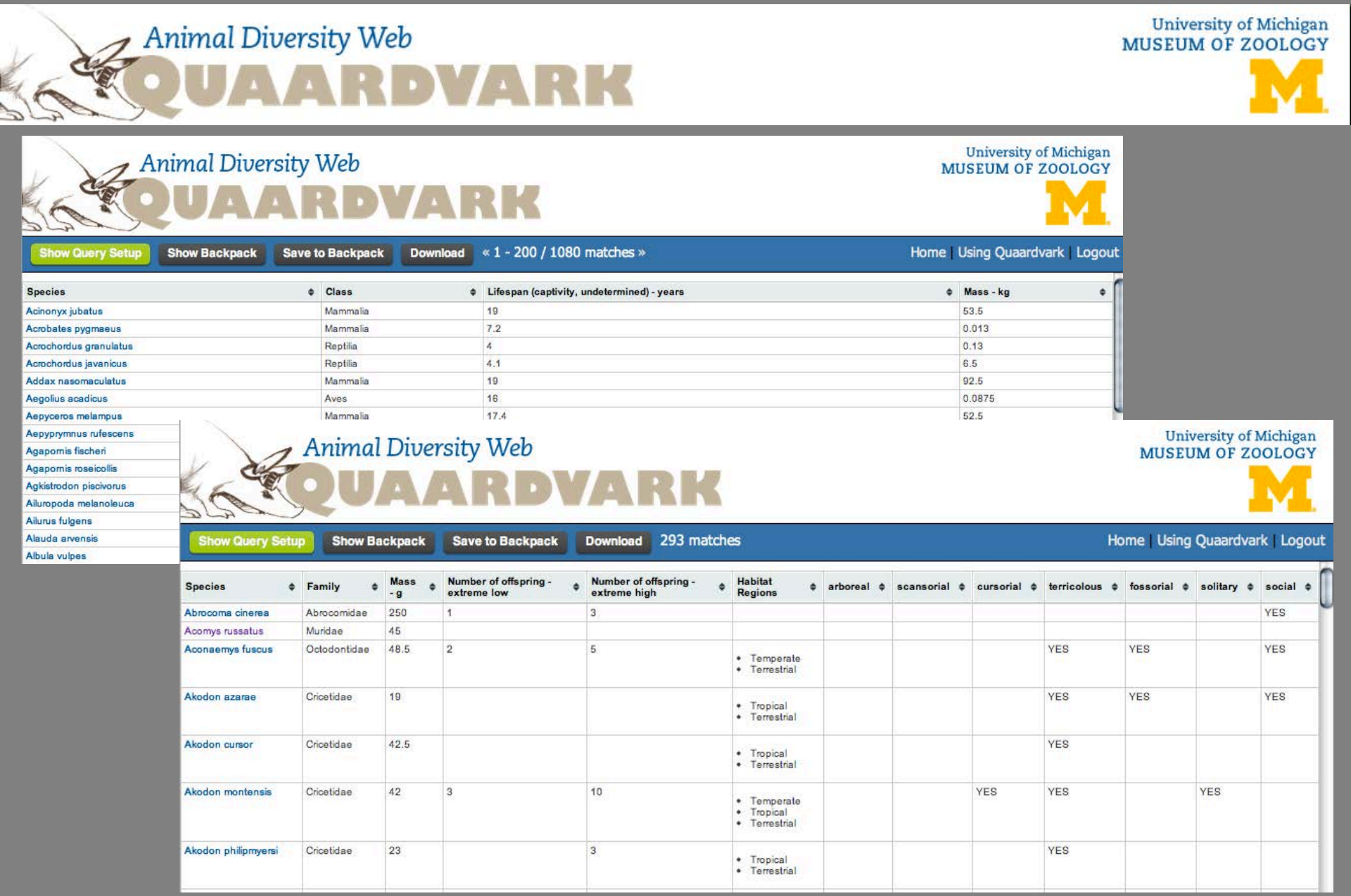
Registered users can save queries and results in their "backpack."



Possible queries are almost limitless.

- Instructors appreciate the opportunity to incorporate active inquiry into undergraduate biology classrooms.
- Students enjoy activities and report greater knowledge, skills, and confidence after query exercises.
- Implemented in over 20 undergraduate institutions and a wide variety of courses.
- Example activities are designed to be readily incorporated into introductory biology, zoology, behavior, and ecology courses.

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Give it a try!

animaldiversity.org/q

or

https://animaldiversity.ummz.umich.edu/quaardvark

or contact us at adw_staff@umich.edu