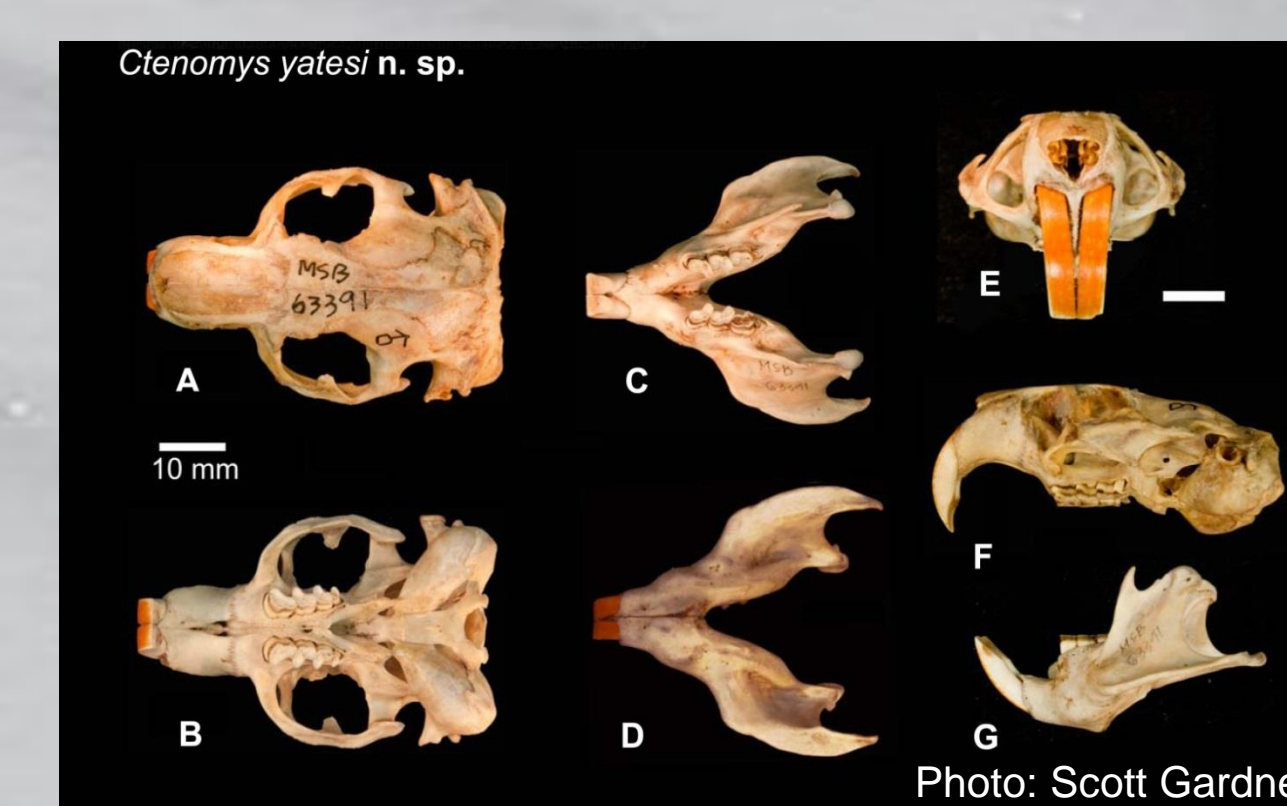
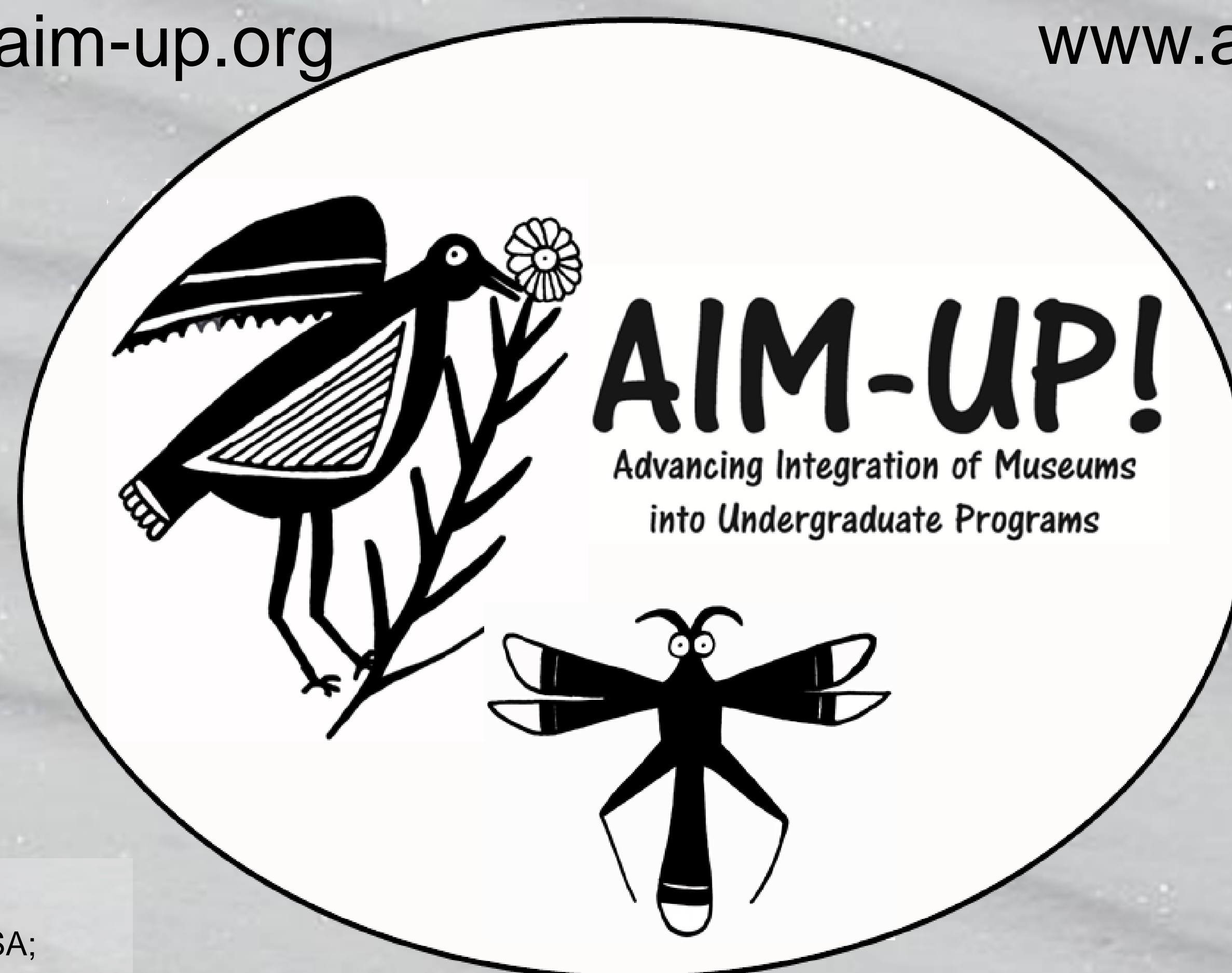




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"At this point, I wish to emphasize what I believe will ultimately prove to be the greatest value to our museum-and that is that the student of the future will have access to the original record of faunal conditions .... Right now are probably beginning changes to be wrought in the next few years vastly more conspicuous than those that have occurred in ten times that length of time preceding." -J. Grinnell (1912)



Kayce Bell<sup>1</sup>, Joseph A. Cook<sup>1</sup>, Eileen A. Lacey<sup>2</sup>

<sup>1</sup>Museum of Southwestern Biology, University of New Mexico, Albuquerque, NM 87131 USA;

<sup>2</sup>Museum of Vertebrate Zoology, University of California, Berkeley, CA 94720 USA

### AIM-UP!

We are an NSF-funded research coordinating network (RCN) that aims to increase the integration of natural history collections into undergraduate education. Our goals are to:

1. Train undergraduates in museum-based research
2. Develop instructional tools that utilize museum specimens or databases
3. Introduce educators to the instructional power of museum collections and databases
4. Increase public awareness of the importance of natural history collections.

### The Challenge

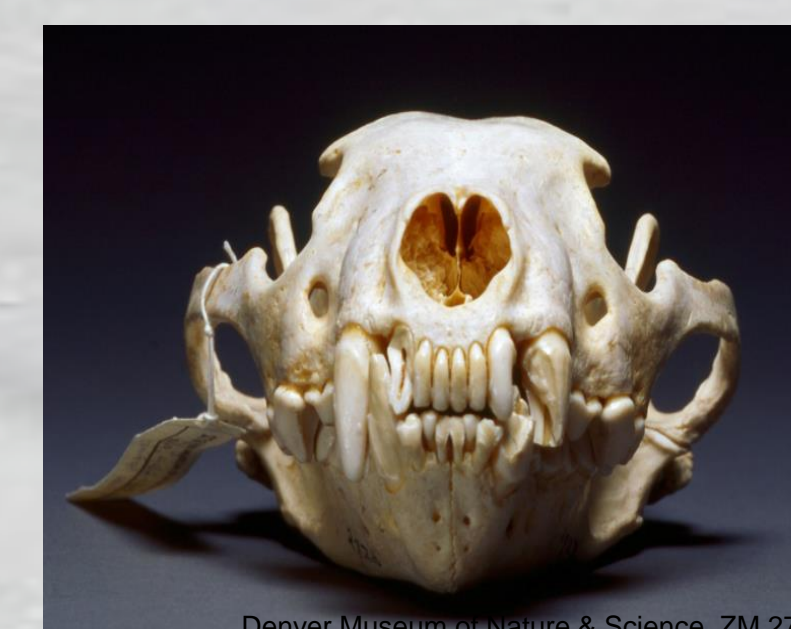
In general, few educators are aware of the potential of collections and associated databases to reshape undergraduate education. A substantial amount of museum data is now available on-line and a national digitization effort by NSF will soon increase access dramatically<sup>1</sup>. A significant challenge is to inform students and instructors about the potential role of collections in undergraduate teaching and research.

<sup>1</sup> <http://www.aibs.org/public-policy/biocollections.html>



### What do collections-based approaches offer undergraduate education?

- Scale
  - time and space
- Integration of Diverse Data
  - biotic and abiotic
  - genomic and organismal
- Complexity
- Web-based Discovery
- Educational Process
  - Experiential versus passive
  - Authentic and extensive biological data
  - Opportunities for inquire-based learning



### Exploring Collections Data in the Classroom

Many natural history collections, including mammal collections, are now accessible on-line providing opportunities for students to explore fundamental questions in biology using data that are associated with specimens, including georeferenced localities, habitat, morphology, DNA sequences, community associations, etc.

### UNM Mammalogy 2012

#### Assignment

Students in an upper-division mammalogy class were assigned a semester-long project intended to introduce them to on-line mammalian databases, such as GBIF, Arctos, & GenBank. Students developed their own research question related to mammalian biology and then used data from at least one natural history collection (often integrating across diverse databases) to address their question.

#### Diverse Projects and Research Questions

The research questions covered aspects of the evolution, ecology, and conservation of mammals, such as morphological variation across space, responses to climate change, and ecogeographic principles. Initially, students (n=19) explored on-line databases to evaluate the extent and limitations of available data, then refined their questions so that they could be realistically addressed using on-line resources. Types of data examined included information regarding phylogenetic relationships, species occurrence and distributional limits, body size change over latitude, projected conservation concerns, urban impact on species occurrences, and historic and contemporary shifts in distributions correlated with climate change.



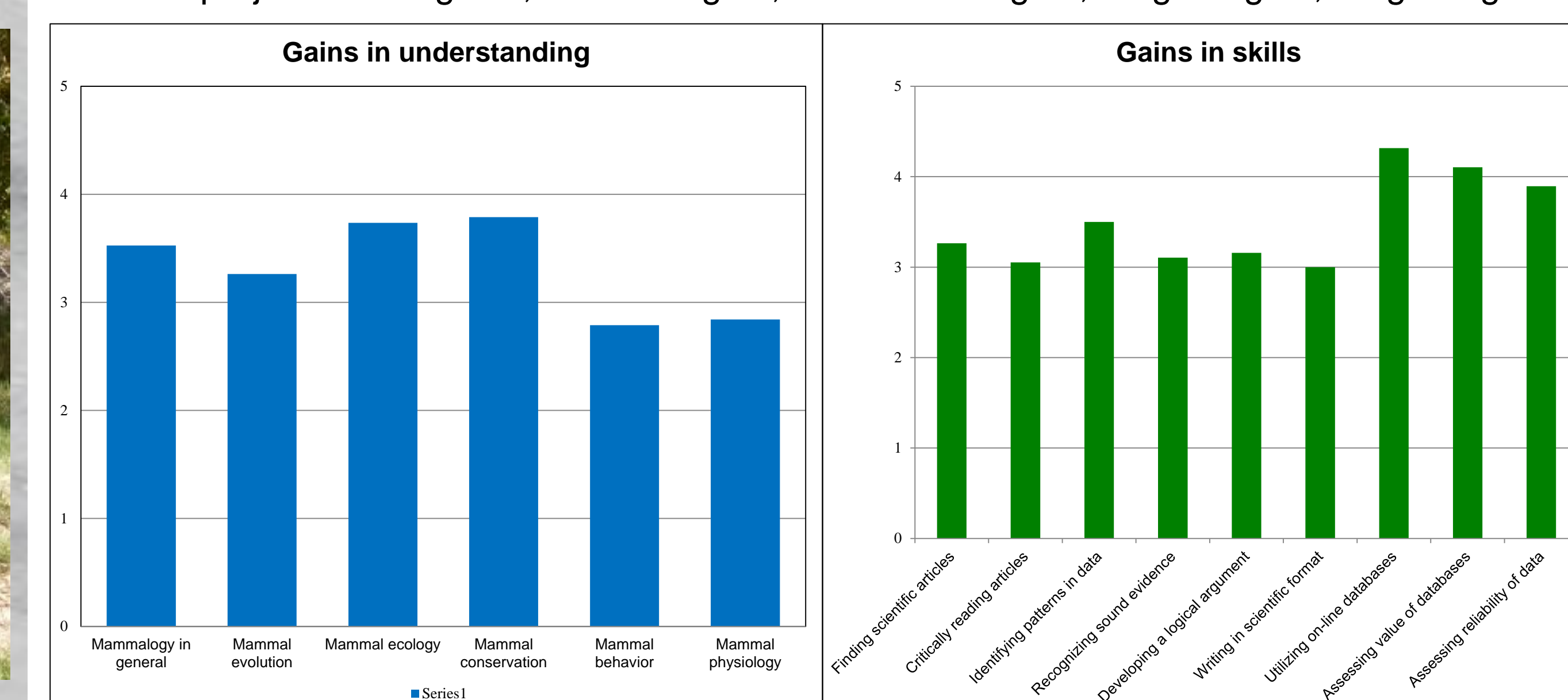
#### Project Evaluation

After completing the projects, students filled out an online survey using a Student Assessment of Learning Gains (SALG) framework. Here the SALG assessed the students' perceived learning gains as a direct result of the semester project.

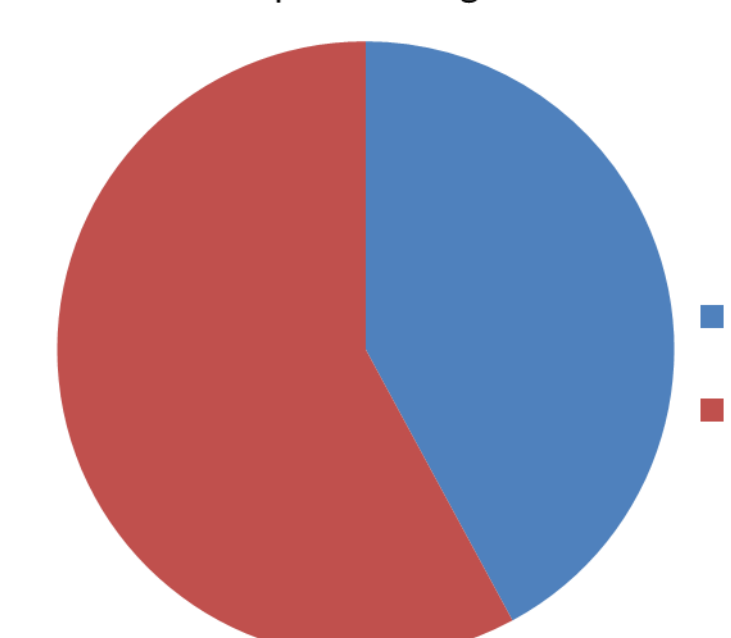
#### Conclusions

Planetary change is reconfiguring the field of mammalogy. Future biologists, managers, and policy makers will need to assimilate and assess data from diverse sources. Exercises such as this introduce students to valuable informatic methods. This exercise demonstrates the power of utilizing natural history data available on-line by allowing students to develop critical research skills related to mammalian biology while they explore questions. Importantly, educators without direct access to collections can make good use of collections based data as efforts to transform undergraduate education proceed.

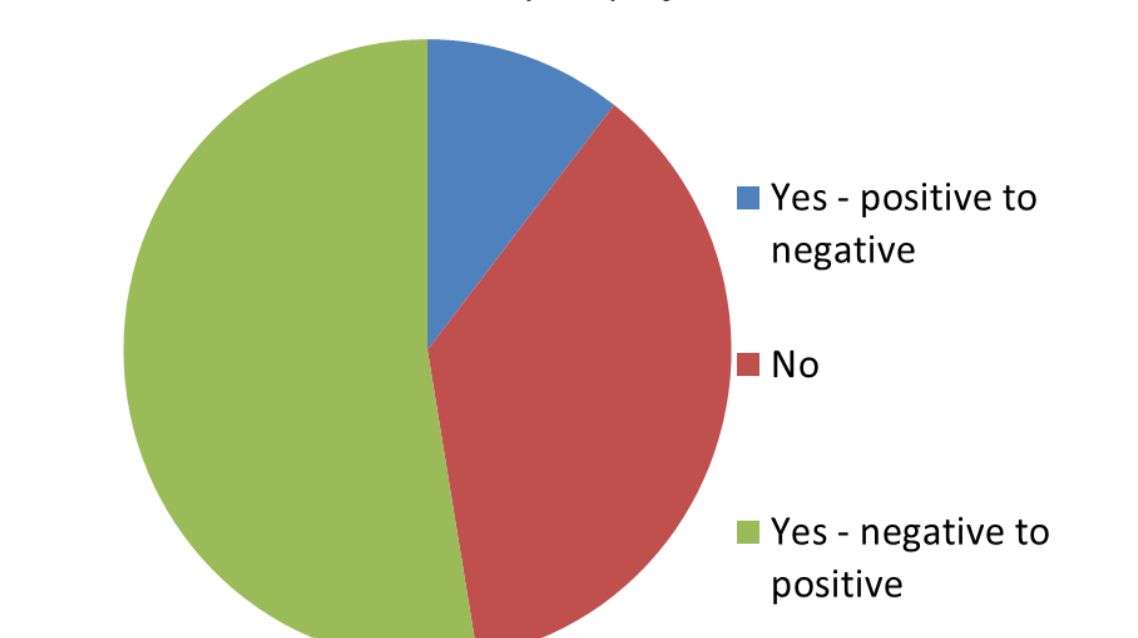
Average self-assessments of student learning gains in the areas listed on the x-axis after the semester project. 1= no gains, 2= a little gain, 3= moderate gain, 4= good gain, 5= great gain



Would you have preferred a more specific assignment?



Did your attitude about the assignment change while working on your project?



#### Interested?

We are recruiting educators and mammalogists to join the AIM-UP! network, test educational modules, and/or participate in one of our working groups: Bioinformatics & Web Presence, Outreach, Development & Design, Education, Network Evaluation

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