

# Evaluating the use of deuterium oxide dilution to determine body composition in the big brown bat, *Eptesicus fuscus*



Veterinary Research  
Scholars Program  
University of Missouri

Amanda N. Eshelman<sup>1</sup>, Sarah Hooper<sup>2</sup>, Sybill K. Amelon<sup>3</sup>

<sup>1</sup>College of Veterinary Medicine, <sup>2</sup>Department of Veterinary Pathobiology, University of Missouri, Columbia, MO;

<sup>3</sup>United States Department of Agriculture Forest Service, Northern Research Station, Columbia, MO



## Background

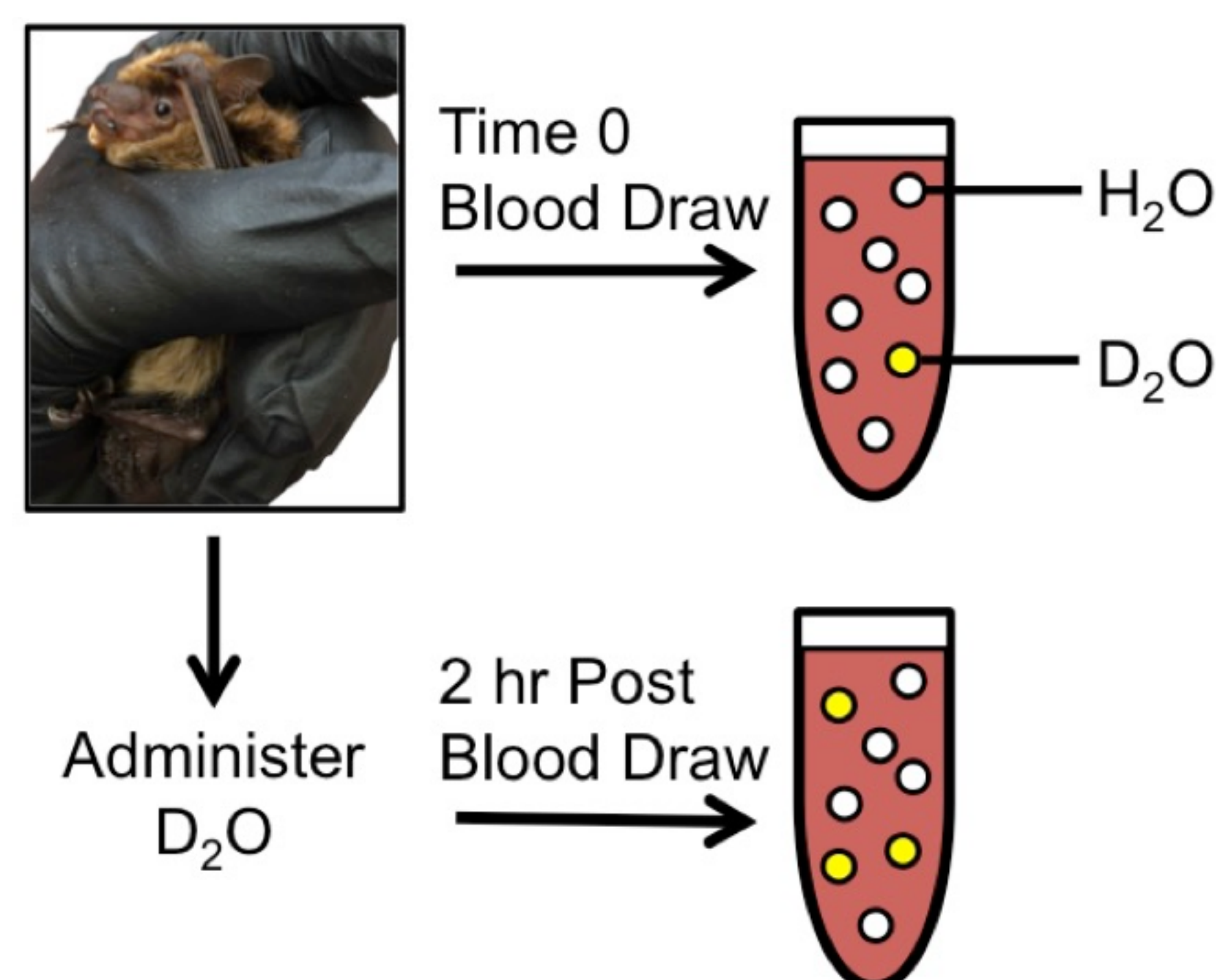
- Accurately evaluating body composition of wild and captive big brown bats as a proxy for fitness is imperative in research and conservation.
- Current methods including morphological indices and chemical extraction are inaccurate, time consuming, or require destruction of the animal.
- Use of dual-energy X-ray absorptiometry (DXA) yields accurate results but is expensive and requires transport of the animal from the site of capture.
- Deuterium oxide (D<sub>2</sub>O) dilution has been used to safely and rapidly determine body composition in humans and other animal species. In bats, this method could offer a low-stress and cost-effective method to evaluate body composition in the field.

## Objective

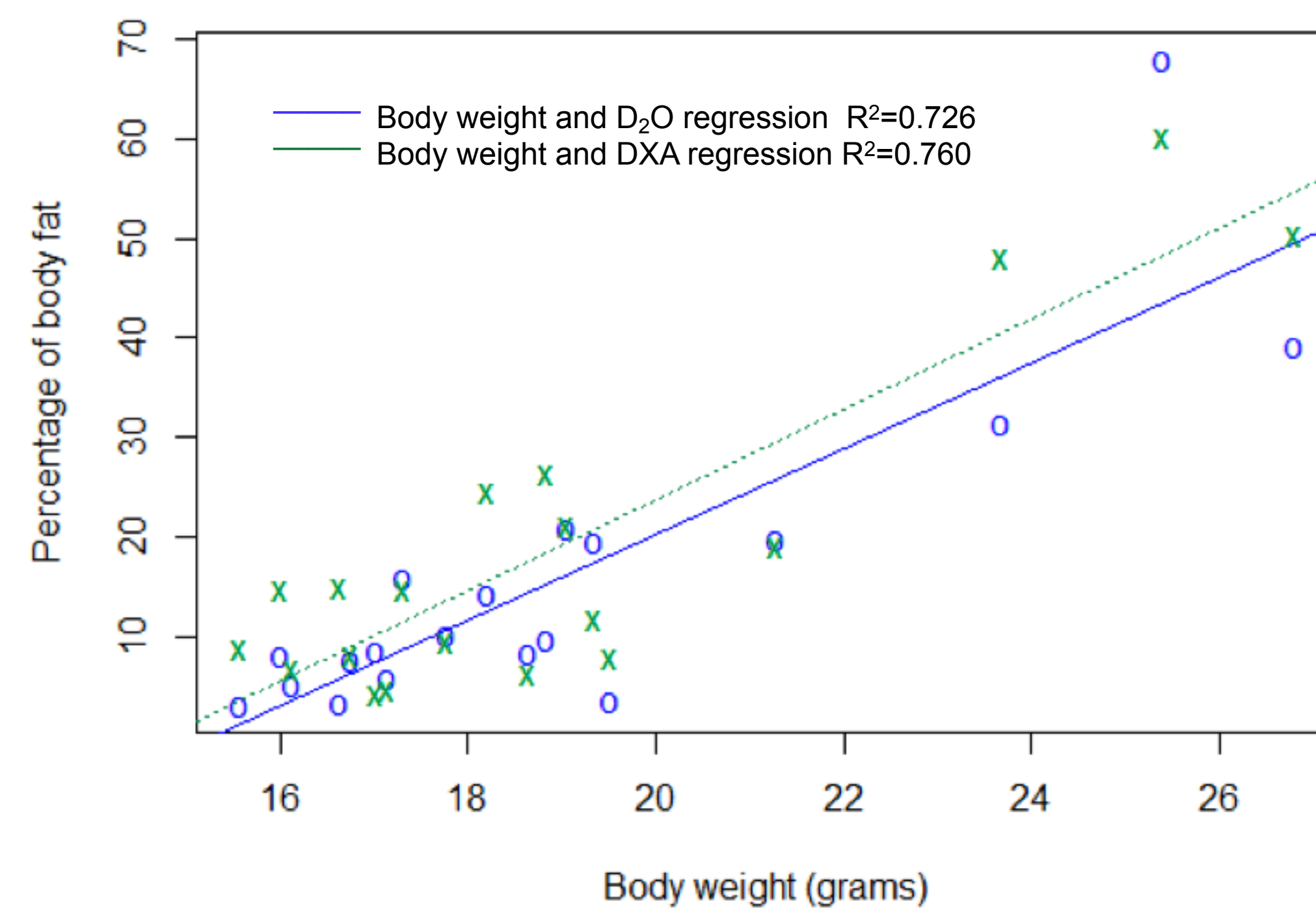
- The purpose of this study is to compare the use of DXA to D<sub>2</sub>O dilution in the evaluation of body fat mass in big brown bats

## Methods

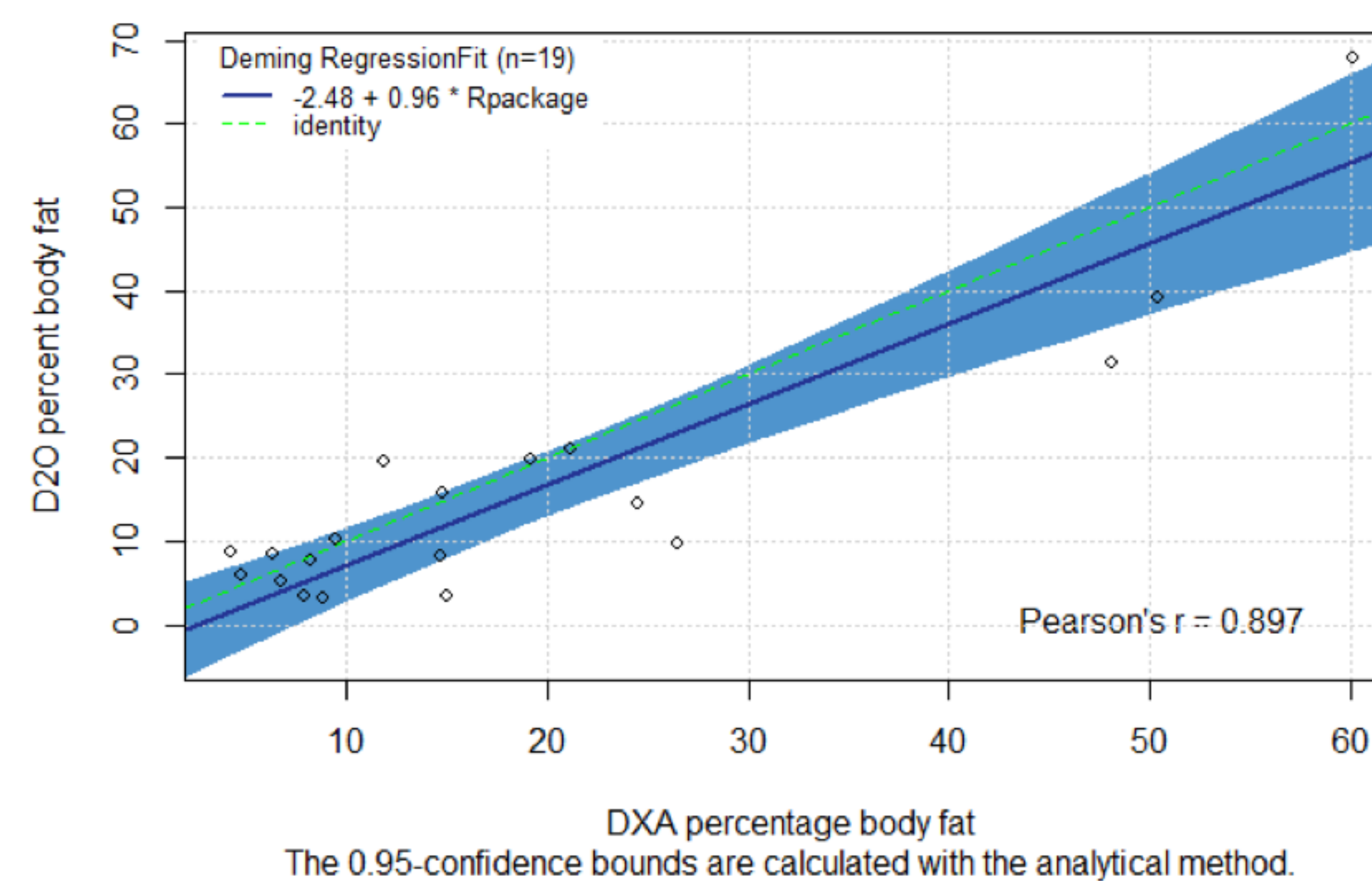
- Bats were anesthetized with isoflurane.
- Bats were scanned using a Hologic DXA machine calibrated for small rodents.
- 100 µL of blood was collected from each bat and D<sub>2</sub>O was administered subcutaneously at 0.7 to 0.75 g/kg.
- Two hours post-injection, 100 µL was collected from each bat.
- Blood sample D<sub>2</sub>O content was analyzed with infrared spectroscopy and used to calculate total body water, body lean mass, and body fat mass.



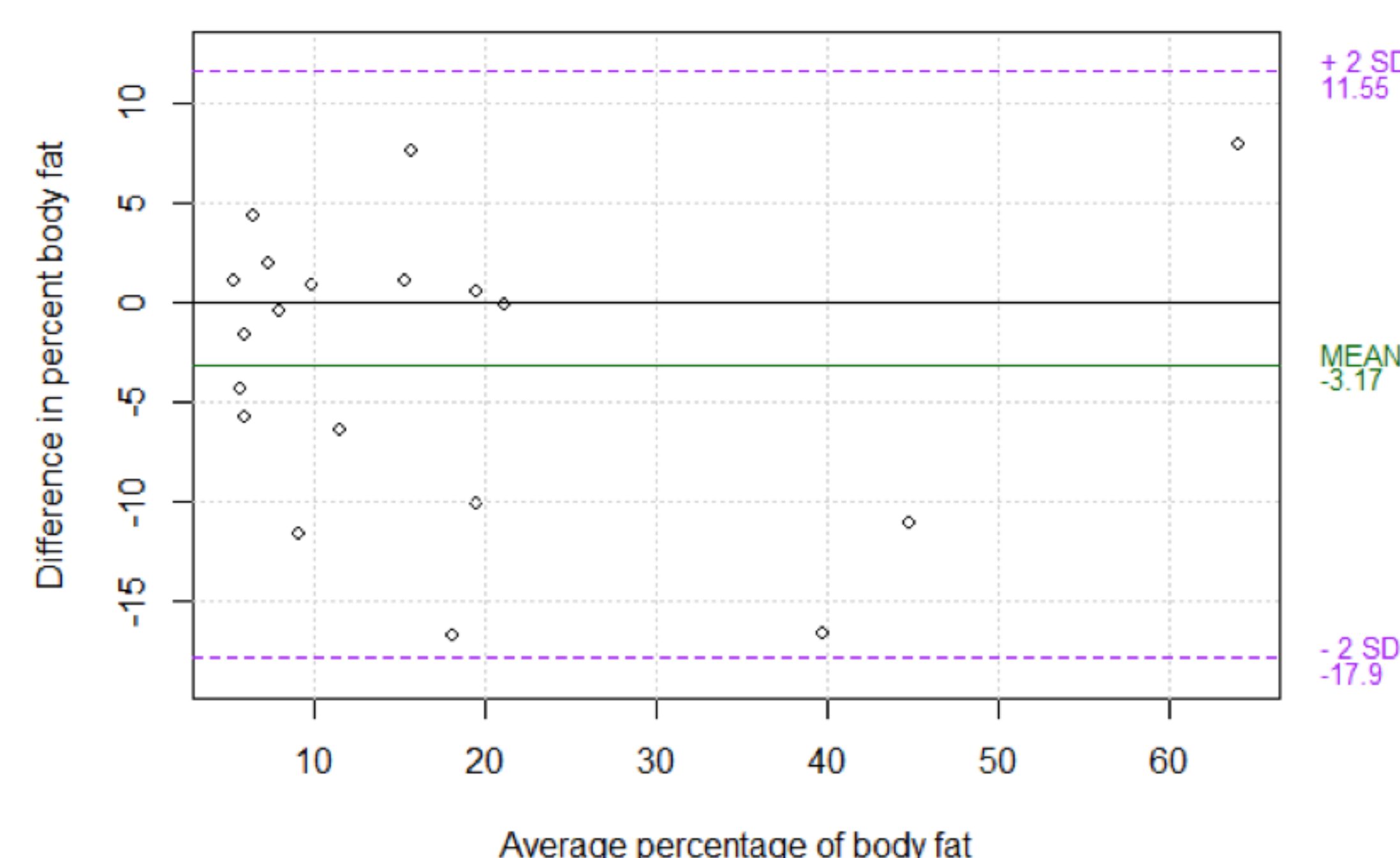
**Figure 1.** Schematic showing the deuterium oxide dilution technique.



**Figure 2.** Graph comparing body weight in grams to percentage body fat calculated with DXA and D<sub>2</sub>O dilution.



**Figure 3.** Graph plotting percentage body fat calculated by DXA against percentage body fat calculated by D<sub>2</sub>O dilution.



**Figure 4.** Bland-Altman plot assessing the correlation between DXA and D<sub>2</sub>O as methods to evaluate percentage body fat.

Total body water calculations were performed using the equation from "Body composition, movement phenology, and habitat use of common eider along the southern New England coast" (Joshua M. Beuth, 2013).



## Conclusions

- Percentage body fat calculated by DXA and D<sub>2</sub>O dilution showed fair agreement. Differences are likely due in part to calculations of D<sub>2</sub>O content that did not account for age. Hydration may differ between juvenile and adult bats.
- Greater differences in results between the methods occurred in bats with higher than 60% body fat. This may indicate these bats require additional time for D<sub>2</sub>O to fully equilibrate with body water.
- There was poor correlation between actual body weight and percentage fat calculated both by DXA and by D<sub>2</sub>O dilution. This is likely due to the inclusion of captive bats, which are more likely to have increased body fat and decreased lean muscle compared to wild bats.
- Administration of the full D<sub>2</sub>O dose is critical. Partial loss of D<sub>2</sub>O during administration resulted in negative body fat values. These bats were excluded from analysis.

## Future Directions

- Perform carcass analysis to determine hydration and appropriate correction values for juvenile bats.
- Repeat D<sub>2</sub>O dilution technique with additional time points for bats with high body fat mass to allow full equilibration.
- Increase D<sub>2</sub>O dose to decrease the volume of blood required for smaller species.

## Acknowledgments

- Stipend supported by an endowment established by IDEXX-BioResearch.
- Project supported by USDA and Missouri Department of Conservation.
- Thank you to Dr. Backus for assistance with spectroscopy.