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Department of Defense Legacy II Initiative and Bat Conservation in Utah

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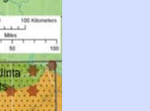
Legacy II (08-346): Data Analysis


Ryan Swan

BatBase allows for analysis of bat use across space and time within the State. DoD land managers use INRMPs to guide sustainable management practices to ensure that testing and training areas continue to function sustainably without restrictions. This regional approach to managing bats within Utah and specifically understanding regional trends and patterns on DoD lands directly supports stewardship objectives and goals fundamental to sound land management policies within the DoD.

Bat Occurrence

Methods

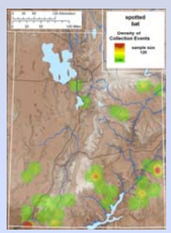
To evaluate occurrence of sensitive species, a frequency distribution was created across species using the number of capture events recorded in Utah by species and analyzed for 6 scales:

- Ecoregion
- Physiographic Province
- Land Cover Classification
- Land Owner
- UDWR Region
- County

Analysis was conducted using PROCFREQ in SAS® and visual analysis in Excel®. The occurrence data were then used to create a diversity analysis.

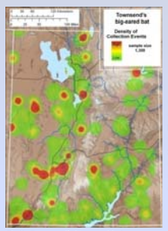
Results

Density of bat data collection events in Utah was calculated. Each data point has a 5 km radius of activity zone. A continuum of event densities from high (red) to low (green) areas indicates the magnitude of data collection.



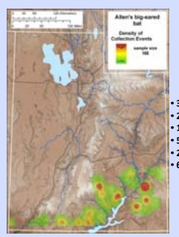
- 3 Ecoregions
- 3 Physiographic Provinces
- 23 Land Cover Classifications
- 6 Land Owners
- 4 UDWR Regions
- 12 Counties

Fig 7. Spotted bat.



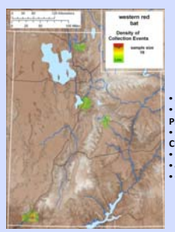
- 4 Ecoregions
- 4 Physiographic Provinces
- 44 Land Cover Classifications
- 11 Land Owners
- 5 UDWR Regions
- 27 Counties

Fig 8. Townsend's big-eared bat.



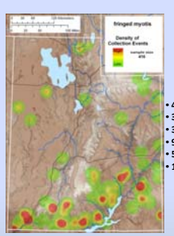
- 3 Ecoregions
- 2 Physiographic Provinces
- 18 Land Cover Classifications
- 5 Land Owners
- 2 UDWR Regions
- 6 Counties

Fig 9. Allen's big-eared bat.



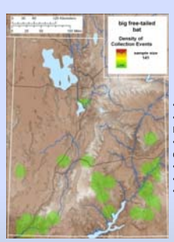
- 3 Ecoregions
- 3 Physiographic Provinces
- 2 Land Cover Classifications
- 2 Land Owners
- 4 UDWR Regions
- 6 Counties

Fig 10. Western red bat.



- 4 Ecoregions
- 3 Physiographic provinces
- 35 Land Cover Classifications
- 9 Land Owners
- 5 UDWR Regions
- 16 Counties

Fig 11. Fringed myotis.



- 4 Ecoregions
- 2 Physiographic Provinces
- 26 Land Cover Classifications
- 8 Land Owners
- 4 UDWR Regions
- 9 Counties

Fig 12. Big free-tailed bat.

Discussion

By defining the current status of bat distributions in Utah, a new stage in bat monitoring and research has begun. This data set provides a base for protocol development, species-specific habitat modeling, and sensitive species monitoring. Habitat associations are present with Utah sensitive species and was detected through this bat occurrence analysis.

Diversity

Methods

- Bat diversity was measured in two ways:
  1. Number of species events.
  2. A diversity and evenness index in each of the 6 scales (see list at left) and associated 116 classes (described below).
- Events: The number of times a species was captured within each of the scales and associated classes.
- Events were used to reduce the influence of 19 high magnitude capture events on species evenness.
- Six scales were analyzed using a frequency distribution across classes within scales. The Shannon-Weiner Diversity Index was used with each class across all scales. These classes were then compared within each of the six scales.
- Analysis was conducted with PROCFREQ in SAS® and Excel®.

Results

Ecoregion

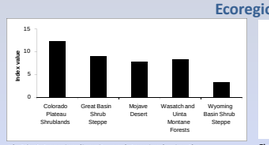


Fig 13. Bat species diversity, as determined using the Shannon-Weiner Diversity Index across Utah's Ecoregions.

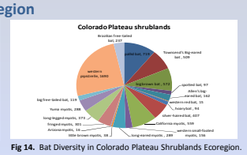


Fig 14. Bat Diversity in Colorado Plateau Shrublands Ecoregion.

Physiographic Province

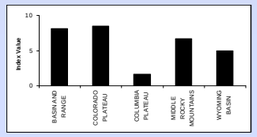


Fig 15. Bat species diversity, as determined using the Shannon-Weiner Diversity Index across Utah's Physiographic Provinces

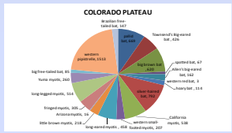


Fig 16. Bat Diversity in the Colorado Plateau.

Land Owner

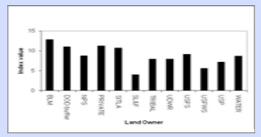


Fig 17. Bat species diversity, as determined using the Shannon-Weiner Diversity Index across Utah's land owner types

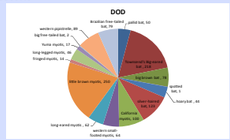


Fig 18. Bat Diversity on DoD Lands.

UDWR Region

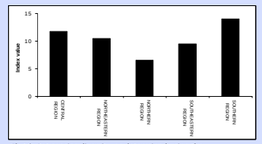


Fig 19. Bat species diversity, as determined using the Shannon-Weiner Diversity Index across Utah's UDWR Regions.

Fig 20. Bat Diversity in the Southern UDWR Region.

Discussion

- **Ecoregion:** The most diverse and evenly represented is the Colorado Plateau shrublands followed by the Great Basin Shrub Steppe; the Wyoming Basin is the least diverse.
- **Physiographic Province:** Trends mirror that of the ecoregion diversity.
- **Land Owner:** BLM managed lands account for more area than all other types and these lands are characterized by the high diversity land cover types discussed above. DoD had the second highest bat diversity though it has much less habitat diversity and land area than BLM lands.
- **UDWR Region:** The Southern region had the highest diversity index score followed by the Central, Northeastern, Southeastern, and Northern regions.
- **Land Cover:** Colorado Plateau Pinyon-Juniper Woodlands had the highest diversity score and Invasive Annual Forblands had the lowest.
- **County:** Garfield County had the highest diversity score. Its location in Wasatch and Uinta Montane Forests and Colorado Plateau ecoregions and the high diversity of land cover type in this county account for the high diversity. Kane County also had high diversity scores that is likely due to the Southern location and a mixing of ecoregions.
- **Project Deliverables**: Fact Sheet, Status of Bats Report, Utah Bat Conservation Plan, and Utah Bat Monitoring Protocol (a dynamic document). Copies are available from any POC listed under the title.

Elevational Associations

Methods

- To evaluate elevation as a total model, each bat event was categorized into one of six elevation classes: <1000 m, 1001-1500 m, 1501-2000 m, 2001-2500 m, 2501-3000 m, and >3000 m to represent variation on the landscape.
- A frequency analysis (PROCFREQ) was conducted in SAS® and Excel®.

Results

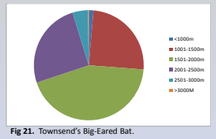


Fig 21. Townsend's Big-Eared Bat.

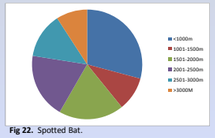


Fig 22. Spotted Bat.

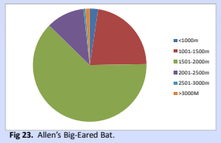


Fig 23. Allen's Big-Eared Bat.

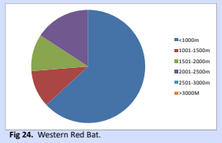


Fig 24. Western Red Bat.

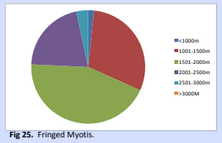


Fig 25. Fringed Myotis.

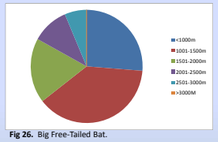


Fig 26. Big Free-Tailed Bat.

Discussion

- More species (19) were observed between 1501-2000 m elevation than all other elevations.
- 18 species at 2001-2500 m and 1001-1500 m (Arizona myotis was absent).
- 14 species at <1000 m (silver-haired bat, long-eared myotis, little brown myotis, Arizona myotis, and long-legged myotis were absent), and at 2501-3000 m (pallid bat, western red bat, Arizona myotis, western pipistrelle and Brazilian free-tailed bat were absent).
- 6 species were observed at >3000 m (spotted bat, Allen's big-eared bat, hoary bat, western small-footed myotis, long-eared myotis and long-legged myotis).

Utah Bat Monitoring Protocol

Introduction

- A landscape level bat monitoring protocol was developed to meet DoD and UDWR bat management goals (SIKES ACT, UDWR 2005; Oliver et al. 2009).
- Studies in Montana, Oregon, Washington, California, West Virginia, and Hawaii indicate that occupancy based models provided good estimates of bat species and community distribution.
- Studies such as these indicate that monitoring bats at a landscape level requires ecological stratification with at least 15 sample units per strata, and that using acoustic and mist netting methods in combination increases detection probabilities and the accuracy of occupancy estimates.

Methods

Protocol Designed to Determine the Status of Utah Bat Populations by Measuring:

- Geographic Extent, Species Distribution, Metapopulation Behavior, Species Richness, and Disease Movement.

Sampling Cell Selection

- 65 randomly selected 20 X 20 km hexagonal cells using Utah's existing Tesselated Grid allows for data comparison across other taxa monitoring programs (Fig 27).

Survey Site Selection

- Capture Survey (Primary Survey): Observer selected water site (within each sample cell) with 4 to 400 m^2 of standing or flowing water on less than a 4 degree slope.
- Acoustic Survey (Secondary Survey): Observer selected site greater than 500 m from the Primary Survey site.

Survey Schedule

- Three visits per sample cell per year (3 Acoustic and 3 Capture Surveys) encompassing reproductive conditions.
  - Gravid (May/June).
  - Lactating (June/July).
  - Volancy (July/August).
- Survey protocol repeats every three years (2009, 2012, etc...).

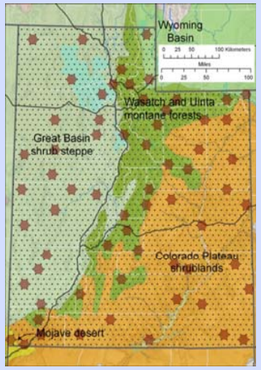


Fig 27. Sampling cell locations randomized throughout Utah using the existing Tesselated Grid and stratified by Utah's 5 ecoregions.

Ryan Swan