STAC Introduction
Presentation

-Andrew McGowan
Environmental Scientist
Delaware Center for the Inland Bays
About Me

• From Toms River, NJ
About Me

- B.S. Biology, East Stroudsburg University
About Me

• M.S. Applied Biology, Salisbury University
• Thesis work: “Bat Occurrence and Habitat Selection on the Delmarva Peninsula” with Dr. Aaron Hogue
Thesis

Goals:

• Document which species are present across the peninsula, in all habitat types

• Identify elements of the landscape important to local foraging bats
Driving Transects n = 280
Passive Monitoring Sites n = 24
Field Equipment
Spectrogram of Bat Call Sequence
Species Known to Occur on Delmarva

- **Red Bat**
  - www.nrri.umn.edu

- **Hoary Bat**
  - www.nrri.umn.edu

- **Tri-colored Bat**
  - www.pbase.com

- **Big Brown Bat**
  - http://www.fcps.edu/islandcreekes/ecology/big_brown_bat.htm

- **Evening Bat**
  - www.projectnoah.org

- **Silver-haired Bat**
  - www.ojibway.ca

- **Myotis spp.**
  - cdn-3.itsnature.org

Paradiso 1969; Fox 2007; Limpert et al. 2007; Johnson and Gates 2008; Wolcott and Vulinec 2012
Observed Species

Red Bat
815
www.nrri.umn.edu

Big Brown Bat
879
http://www.fcps.edu/islandcreekes/ecology/big_brown_bat.htm

Silver-haired Bat
542
www.ojibway.ca

Hoary Bat
75
www.nrri.umn.edu

Evening Bat
586
www.projectnoah.org

Tri-colored Bat
31
www.pbase.com

Myotis spp.
16
cdn-3.itsnature.org
Comparison of mean (SD) number of call sequences recorded for each species at sites with the indicated habitat variable on the local level. Asterisks represent a significant difference in median values (* = $P < 0.05$, ** = $P < 0.01$, *** = $P < 0.001$), as assessed by either a Kruskal Wallis and one-tailed Mann-Whitney U test ($\alpha = 0.05$) or Multiple Comparison Kruskal Wallis test with a Bonferroni correction.

<table>
<thead>
<tr>
<th>Comparison</th>
<th>n</th>
<th>Eastern Red Bat</th>
<th>Big Brown Bat</th>
<th>Evening Bat</th>
<th>Silver-haired Bat</th>
<th>Hoary Bat</th>
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</thead>
<tbody>
<tr>
<td>Forest edge</td>
<td>148</td>
<td>3.32 (12.73)***</td>
<td>3.14 (6.87)***</td>
<td>2.62 (4.94)***</td>
<td>1.87 (4.06)</td>
<td>0.14 (0.72)</td>
</tr>
<tr>
<td>Open</td>
<td>132</td>
<td>0.97 (4.11)</td>
<td>1.54 (5.33)</td>
<td>0.86 (3.29)</td>
<td>1.90 (3.64)</td>
<td>0.39 (1.28)*</td>
</tr>
<tr>
<td>Forest only$^a$</td>
<td>64</td>
<td>5.87 (18.93)*$^b$</td>
<td>3.28 (6.58)*$^b$</td>
<td>3.90 (6.30)*$^b$</td>
<td>1.50 (3.94)</td>
<td>0.25 (1.02)</td>
</tr>
<tr>
<td>Forest-open$^a$</td>
<td>84</td>
<td>1.38 (2.52)</td>
<td>3.03 (7.11)*$^c$</td>
<td>1.65 (3.28)*$^c$</td>
<td>2.15 (4.15)</td>
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<tr>
<td>Mixed only</td>
<td>40</td>
<td>6.65 (22.63)</td>
<td>3.70 (7.79)</td>
<td>4.62 (6.91)*</td>
<td>1.32 (2.77)*</td>
<td>0.40 (1.27)</td>
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<tr>
<td>Pine only</td>
<td>19</td>
<td>4.21 (10.89)</td>
<td>2.89 (4.21)</td>
<td>2.31 (4.71)</td>
<td>0.94 (2.99)</td>
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<td>Forest edge</td>
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<td>43.25 (61.53)*</td>
<td>35.75 (36.38)**</td>
<td>11.25 (12.44)**</td>
<td>1.50 (1.29)*</td>
<td>0.25 (0.50)</td>
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<tr>
<td>Forest interior</td>
<td>9</td>
<td>0.22 (0.66)</td>
<td>0.22 (0.66)</td>
<td>0.00 (0.00)</td>
<td>0.00 (0.00)</td>
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Asterisks represent a significant difference in median values (* = *P* < 0.05, ** = *P* < 0.01, *** = *P* < 0.001), as assessed by either a Kruskal Wallis and one-tailed Mann-Whitney U test (α = 0.05) or Multiple Comparison Kruskal Wallis test with a Bonferroni correction.
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Conclusions

1) All species except for *Myotis* spp. and Tri-colored bats seem to be doing well on the peninsula

2) Red bat, Big Brown bat, and Evening bats show strong preferences for forest edges

3) Silver-haired bats appear less specialized for edge habitat than expected

4) Hoary bats exhibited preference for open habitats as predicted

5) Forest interior habitat very unproductive for regional foraging bats
Maryland Department of Natural Resources Forestry Service

- Conducted inventory of Pocomoke State Forest
- Identified tree species at over 400 forest plots
- Measured tree diameter, number of bolts, merchantable height, insect damage, crown metrics
Maryland Coastal Bays
An NEP Program

• Scientific Intern performing data analysis on water quality data and bird data for DNR Wildlife and Heritage
Three approaches are recommended:

a. The use of reference streams or data percentiles

b. Predictive relationships (trophic classes, Redfield ratios, biocriteria)

c. Literature values for nutrient/algal thresholds
Choosing Reference Sites

1. Where the 75th PCT for all parameters is less than the 25th PCT of the entire data set.

Result: 2 streams, (both in the Chincoteage Bay)
- Purnell Bay UT
- Tanhouse Creek UT

2. Same as above except we ignore chlorophyll a values which exceed the 25th PCT.

Result: 8 streams, that are more representative of the entire watershed.
- Chincoteague:
  - Hancock Creek
  - Purnell Bay
  - Rowley Creek
  - Scarboro @ EA Vaughn
  - Tanhouse Creek

- Isle of Wight:
  - Jake Gut

- Newport:
  - Icehouse Branch

- Sinepuxent:
  - South Point

<table>
<thead>
<tr>
<th>Bay</th>
<th>Stream</th>
<th>CHLOR</th>
<th>TN_mgL</th>
<th>TP_mgL</th>
<th>DIN_mgL</th>
<th>DIP_mgL</th>
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<tbody>
<tr>
<td>Assawoman</td>
<td>Back Creek @ Caterpillar Lane</td>
<td>5.14</td>
<td>8.792</td>
<td>0.04</td>
<td>7.8274</td>
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<td>Assawoman</td>
<td>Drum Creek</td>
<td>6.34</td>
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<td>Chincoteague</td>
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<td>Isle of Wight</td>
<td>Jake Gut trib to Manklin</td>
<td>4.735</td>
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<td>1.16</td>
<td>0.04</td>
<td>0.03696</td>
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</tr>
</tbody>
</table>
Choosing Impacted Sites:

*25<sup>th</sup> percentile must exceed 75 percentile of all data, for multiple parameters*

Result: 10 streams representative of the entire watershed.

**Assawoman:**
- Back Creek

**Chincoteague:**
- Little Mill Run
- Powell Creek
- Riley Creek
- Sand Branch
- Waterworks Creek UT

**Newport:**
- Marshall Creek UT
- Massey Branch
- Poplartown Branch

**St Martin:**
- Church Branch B-8

<table>
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<th>Bay.</th>
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<tr>
<td>Assawoman</td>
<td>Back Creek @ Caterpillar Lane</td>
<td>7.34</td>
<td>7.79</td>
<td>0.009</td>
<td>0.039</td>
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<tr>
<td>Assawoman</td>
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<td>2.34932</td>
<td>3.044</td>
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<tr>
<td>Chincoteague Bay</td>
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<td>0.85</td>
<td>1.9495</td>
<td>0.03141</td>
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</tbody>
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Non log scaled:
- **Red** 75% = 2.05 mg/L
- **Blue** 25% = 0.19 mg/L
Delaware Center for the Inland Bays

Program Manager for:
• Inshore Fish Survey
• Horseshoe Crab Survey

Assist with:
• Long Term Salt Marsh Monitoring Program
• BioEnhancement of Dead-end Canals
• Data Analysis