Methods for Estimating Distributions

• Static Distributions
  – Polygon
  – Grid
  – Habitat Mapping

• Polygon Method
  – Relies on empirical knowledge of specialists
  – Likelihood of occurrence unspecified

Blackpoll Warbler Distribution in New York State

• “Grid” Method
  – Delineated by all subunits where presence is confirmed
  – Likelihood of occurrence unspecified
Habitat Mapping

- 2 Phases
  - Model occurrence-habitat relationship
  - Model distribution based on map of habitat

- Example bull trout in Nevada and southern Idaho (Dunham et al. 2002)


Goal: Predict occurrence of fish in patches of habitat suitable for local breeding populations

Possible Factors Affecting Bull Trout Distributions

- Natural and artificial dispersal barriers
- Water temperature
- Interactions with non-native salmonids and other fishes (brook trout)
- Human disturbance (road density)
- Geographic influences (‘patch size’, stream gradient and width)
Occurrence-Habitat Model

- Used logistic regression to model probability of occurrence based on various combinations of several factors
- Likely limiting factor for Nevada and southern Idaho was warm summer temps
  - Used elevation as surrogate for water temp. to delineate downstream distribution limit
- “Patch” size
  - Delineated upstream patch area as size of watershed upstream from lower limit

Distribution Evaluation

- Patches with >.5 probability-of-occurrence were predicted to be occupied
- Evaluation: Cross-validation

<table>
<thead>
<tr>
<th>Actual Patch Status</th>
<th>Error (percent misclassified)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupied</td>
<td>27.6</td>
</tr>
<tr>
<td>Unoccupied</td>
<td>15.4</td>
</tr>
<tr>
<td></td>
<td>19.7 (overall)</td>
</tr>
</tbody>
</table>
GAP Analysis

- GAP seeks to identify “gaps” that may be filled through establishment of new reserves or changes in land management
- Maps species distributions by combining habitat mapping method with known occurrence data

Required Information for GAP

- Digital map of vegetation, cover types, or habitat types
- Digital map of study area divided into geographic units (e.g., counties, grid)
- Database indicating presence/absence in each geographic unit
- Database predicting presence/absence in each vegetation or habitat type

Example: 100 Breeding birds in California (Garrison and Lupo 2002)

- Included habitats rated as Low, Medium or High by the California Wildlife Habitat Relationships (CWHR) system
- Map further refined by retaining habitat polygons in counties where species was known to breed
Distribution Evaluation

- Tested map predictions against Breeding Bird Survey records from 1977-1996

<table>
<thead>
<tr>
<th>Patch Status</th>
<th>Mean Error (% misclassified)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupied</td>
<td>1 (range 0 – 12.1)</td>
</tr>
<tr>
<td>Unoccupied</td>
<td>33.3 (range 5.1 – 71.7)</td>
</tr>
</tbody>
</table>

Accuracy Dependent On…

- Maps most accurate for species that were
  - Relatively abundant
  - Relatively large breeding ranges
  - Territorial
  - Associated with terrestrial habitats