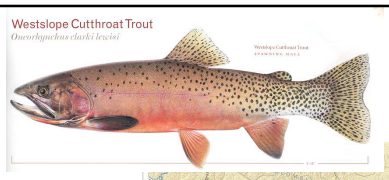
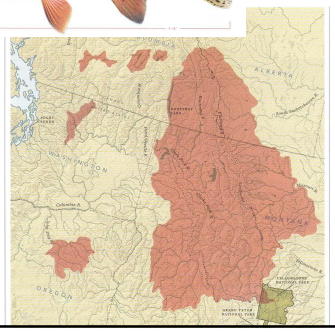
Methods for Estimating Distributions

- Static Distributions
  - Polygon
  - Grid
  - Habitat Mapping

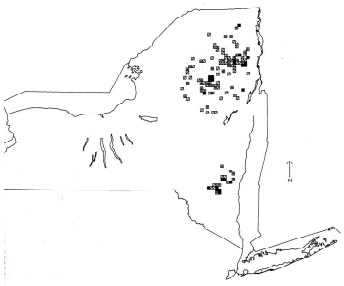


- Polygon Method
  - Relies on empirical knowledge of specialists
  - Likelihood of occurrence unspecified



Blackpoll Warbler Distribution in New York State

- "Grid" Method
  - Delineated by all subunits where presence in 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)

Dunham, J. B., B. E. Rieman, and J. T. Peterson. 2002. Patch-based models to predict species occurrence: lessons from salmonid fishes in streams. *In* Predicting Species Occurrences.

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

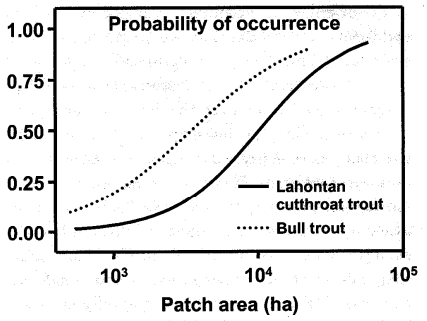


Figure 26.4. Predicted probability of occurrence in relation to patch size (area) for bull trout (*Salvelinus confluentus*) in the upper Boise River Basin and Lahontan cutthroat trout (*Oncorhynchus clarki henshawi*) in the eastern Lahontan Basin.

Distribution Evaluation

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

Actual Patch Status	Error (percent misclassified)
Occupied	27.6
Unoccupied	15.4
	19.7 (overall)

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 are 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

Patch Status	Mean Error (% misclassified)
Occupied	1 (range 0 – 12.1)
Unoccupied	33.3 (range 5.1 – 71.7)

Accuracy Dependent On…

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