Species Status Assessments

SSA 200

Species Status Assessment

SPECIES' NEEDS

± Current Availability or Condition of those Needs

CURRENT SPECIES' CONDITION

± Future Availability or Condition of those Needs

FUTURE SPECIES' CONDITION

Objectives of this class

- Become familiar with common terminology and approaches used in population modeling including constraints, weaknesses, and underlying assumptions.
- Identify an appropriate analytical approach for assessing the status of a species given the available data.
- Communicate/understand relevant analytics and interpret population modeling results pertinent to an SSA.
- Communicate population modeling results to decision makers as part of SSA results.

“Models can do cool things for biologists and decision makers, and we want the biologists to think they’re cool–not voodoo.”

What this class is not:

- A class intended to teach technical skills in analysis or modeling
- A computer coding class to learn how to use R or some statistical program
- Etc…

Day 1

- Types of data typically available and used in SSAs and associated analyses
    - Descriptive data
    - Presence and presence/absence data
    - Count data over time and space
    - Demographic data (mark recapture, nest monitoring)

Day 1

- Analysis of existing data can give insight into:
  - Species ecological needs
    - Relating data on the species to environmental variables
  - Species current status
    - Current redundancy
    - Current resiliency

Day 2

- Projection models for each data type
  - Randomized categorical projections
  - Single-state and multistate occupancy modeling
  - Linear projection models, Poisson process projection models
  - Matrix population models, matrix state transition models

Day 2

- Projection models give insight into:
    - Future redundancy
    - Future resiliency
- Using the results of the current status and needs analysis to predict future redundancy and resiliency

Questions?

The purpose of modeling

- Statistical analysis of data
  - Assess and describe patterns
  - Estimate system or population **parameters**
  - Relate population parameters to ecological or environmental **variables**
  - Estimate and characterize variability in data
- Use statistical analysis to predict the future
  - Organize and structure your uncertainty/variability

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George Box's Pipe

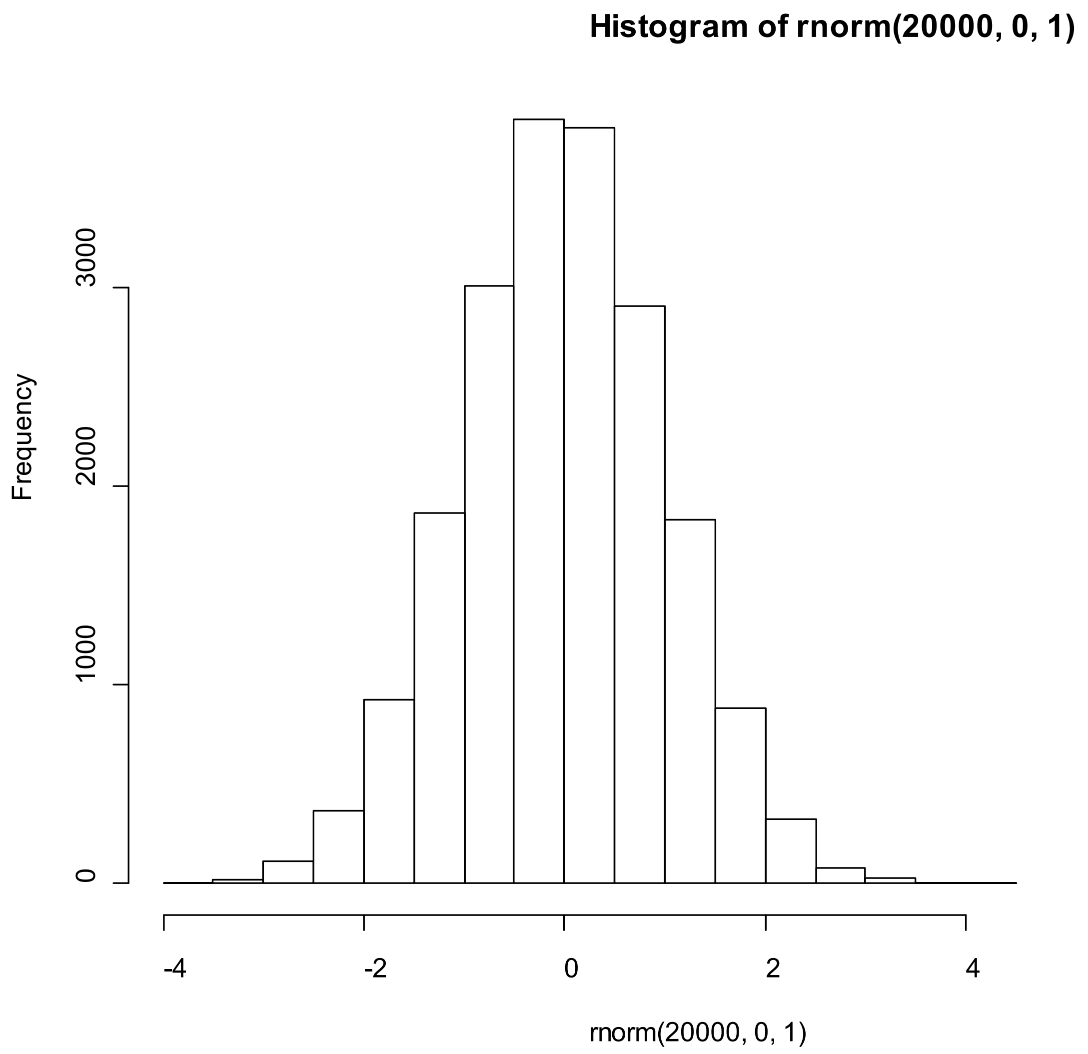
Forms of uncertainty

- Partial controllability
- Observational uncertainty
- Environmental variation
- Ecological uncertainty
- Demographic stochasticity

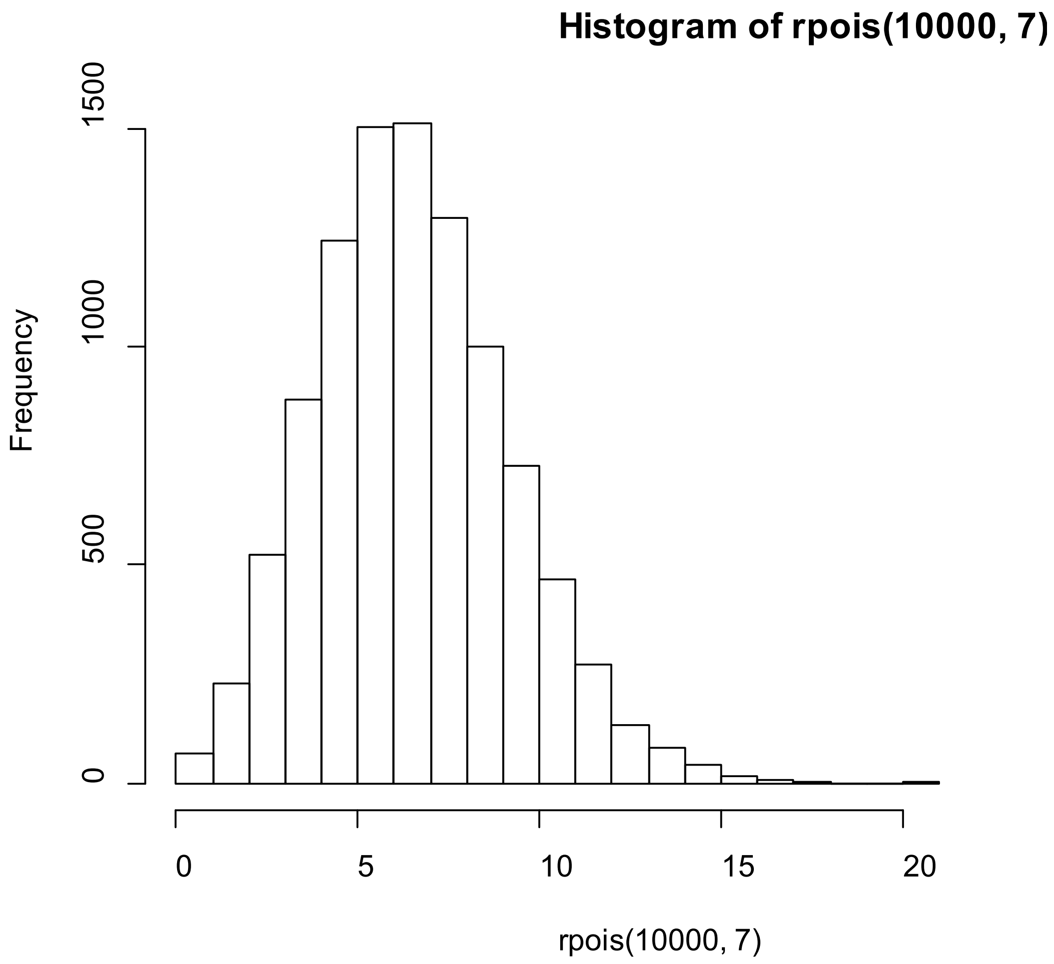
Statistical distributions characterize uncertainties

- We use statistical distributions to generate parameter values with some variation
- The distributions have some predefined properties that reflect our knowledge or data of how a parameter behaves
    - e.g., Mean and SD or variance

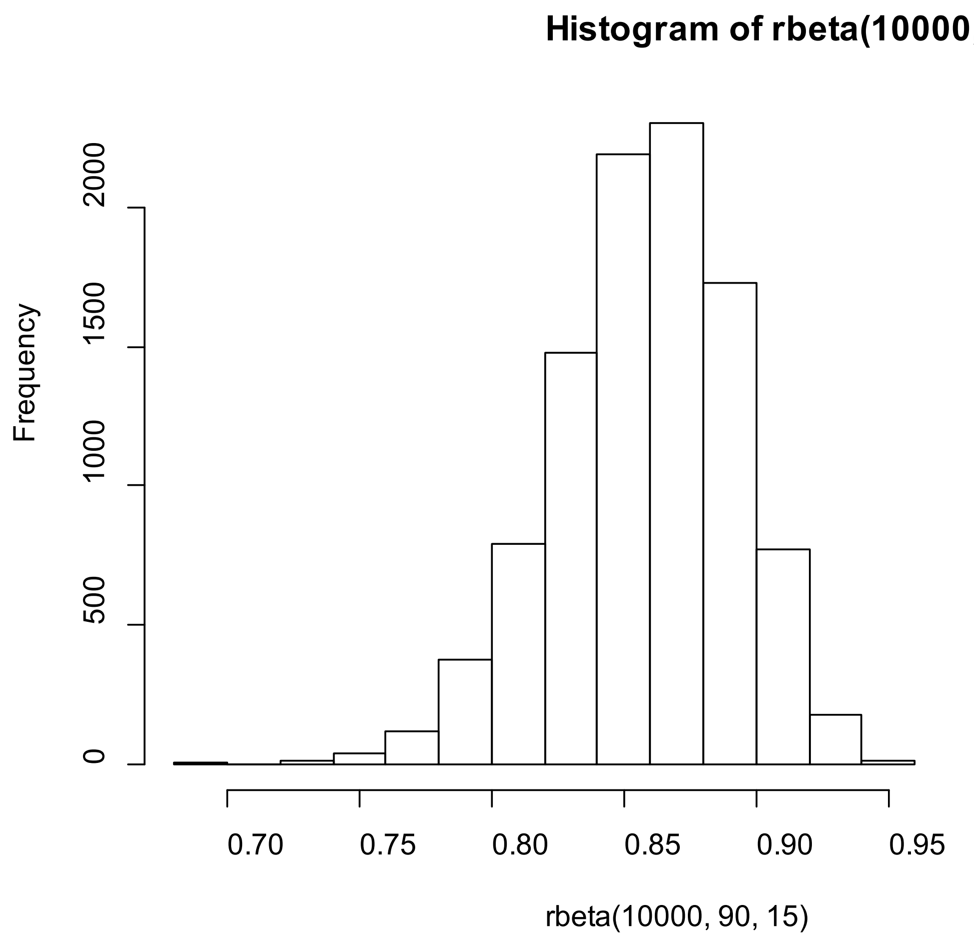
The normal distribution



The Poisson distribution



The beta distribution



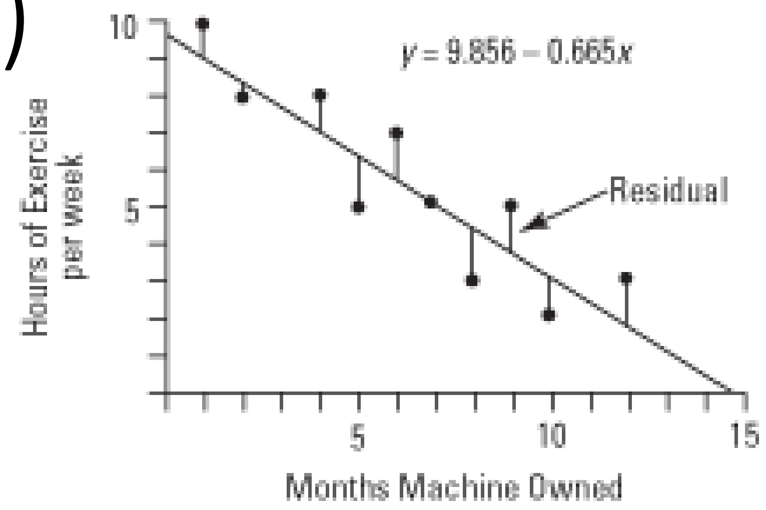
Application and use in the class and beyond

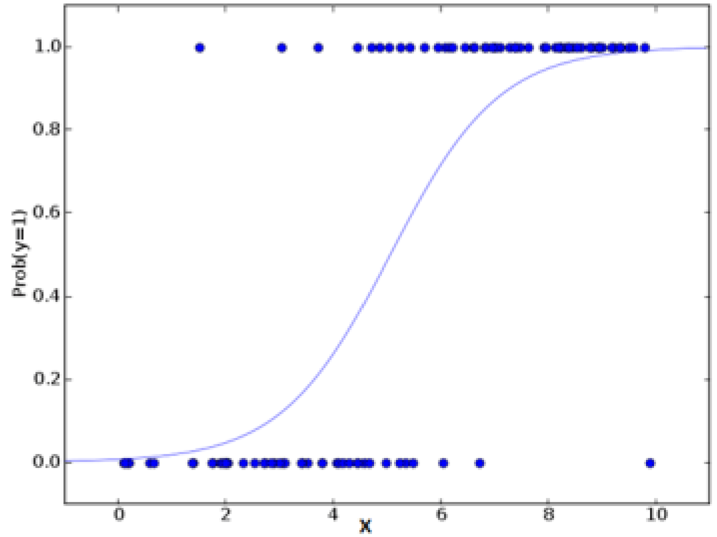
- The analysis tools and projection tools will refer to these statistical distributions
  - E.g., count data → Poisson distribution
- Simulation models will use these distributions to mimic variability in a virtual setting

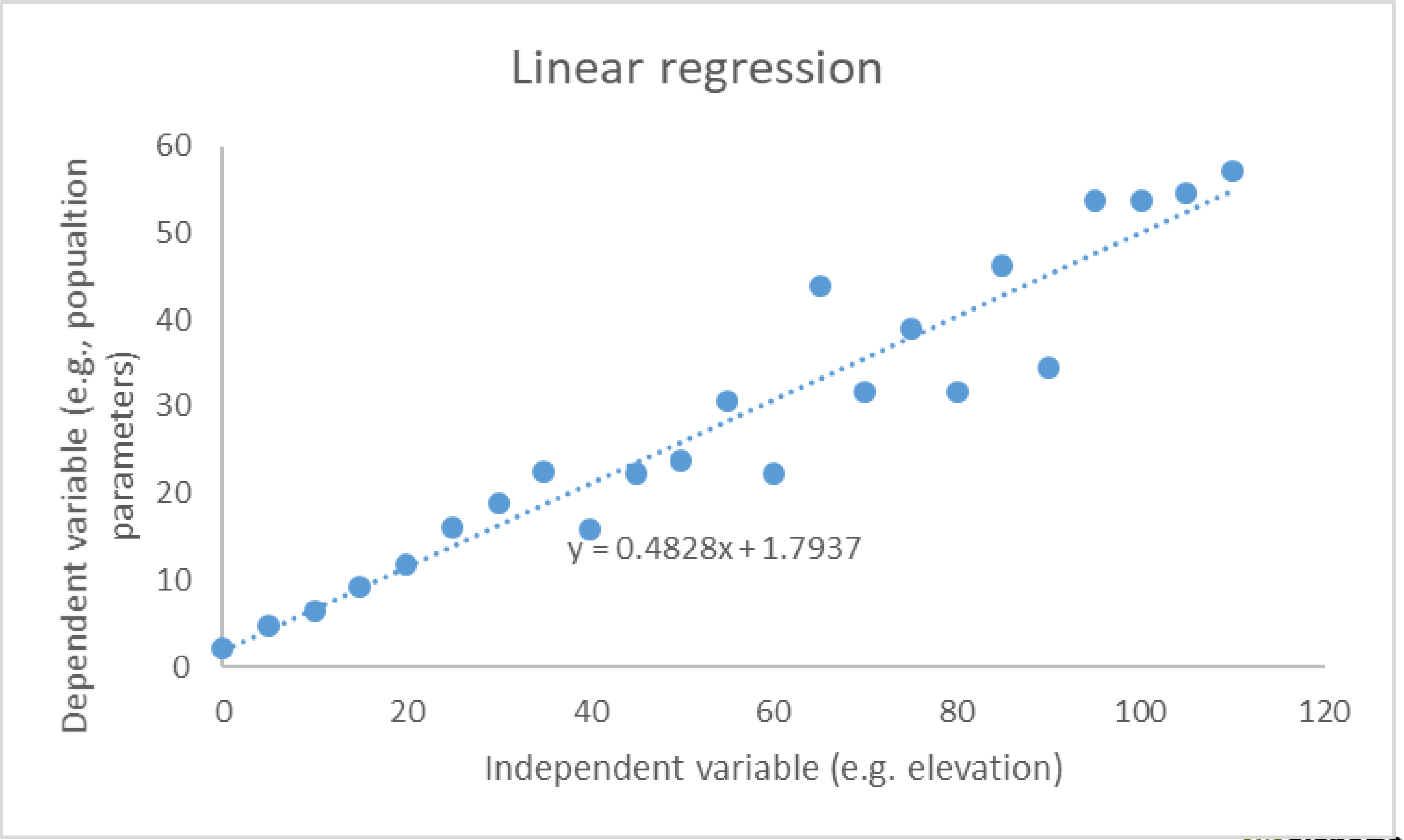
Generalized Linear Models (GLM)

- Regression modeling is the central premise for relating parameters to environmental variables

- Least squares regression – normal distribution
- GLMs use other underlying distributions
    - Poisson (Count data)
    - Binomial (Logistic regression)
    - Negative binomial (count data with lots of zero counts)







Linear regression
Dependent variable (e.g., popualtion parameters)
60
50
40
30
20
10
0
y = 0.4828x + 1.7937
0
20
40
60
80
100
120
Independent variable (e.g. elevation)

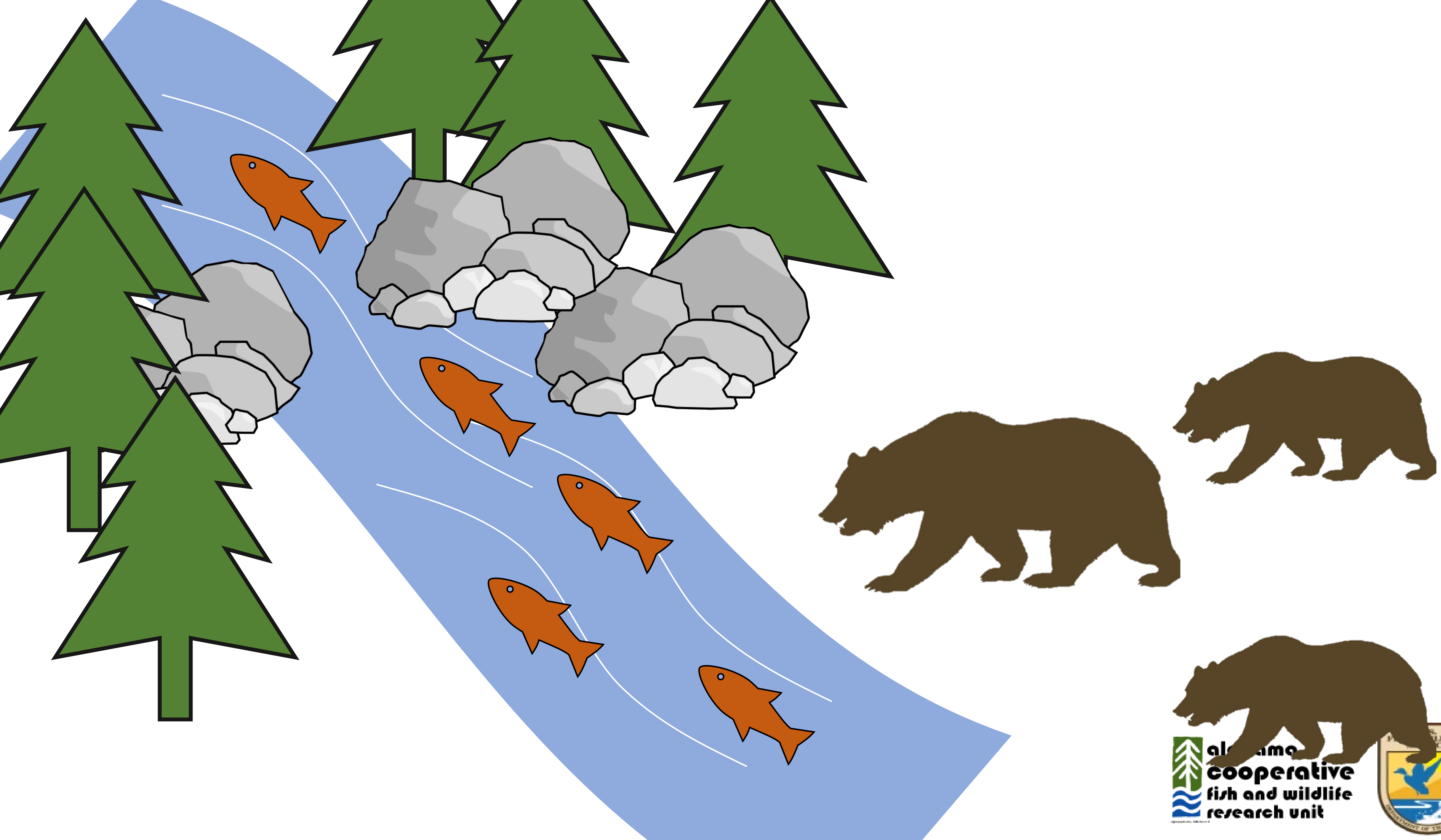
Multiple regression: relating parameters to multiple variables

$$y = b_1X + a$$

The parameter y is a function of X.

$$y = b_1X + b_2Z + b_3K + a$$

The parameter y is a function of X, Z, and K.



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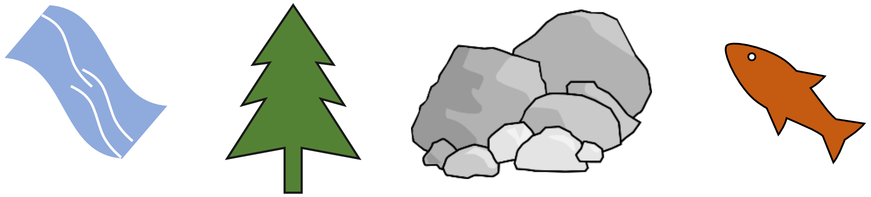
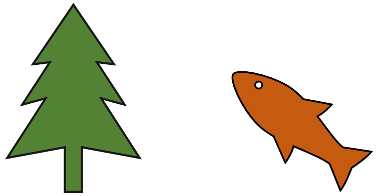
What variables best predict bear occurrence?

$$\boldsymbol{y = b_1 W + a}$$



$$\boldsymbol{y = b_1 W + b_2 T + b_3 R + b_4 S + a}$$



$$\boldsymbol{y = b_2 T + b_4 S + a}$$

None of the above

$$\boldsymbol{y = a}$$

How do we know which one is better??

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Comparing models using AIC

- AIC is a metric used to rank competing models that are fit with the same data
- Find the model that fits the best with the fewest number of parameters (parsimony)

Model	**Model fit**	**Number of parameters**	**AIC rank**
water	Not great	2	3
water + trees + rocks + salmon	Better	5	2
trees + salmon	Best	3	1
none of the above	Worst	1	4

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Questions?