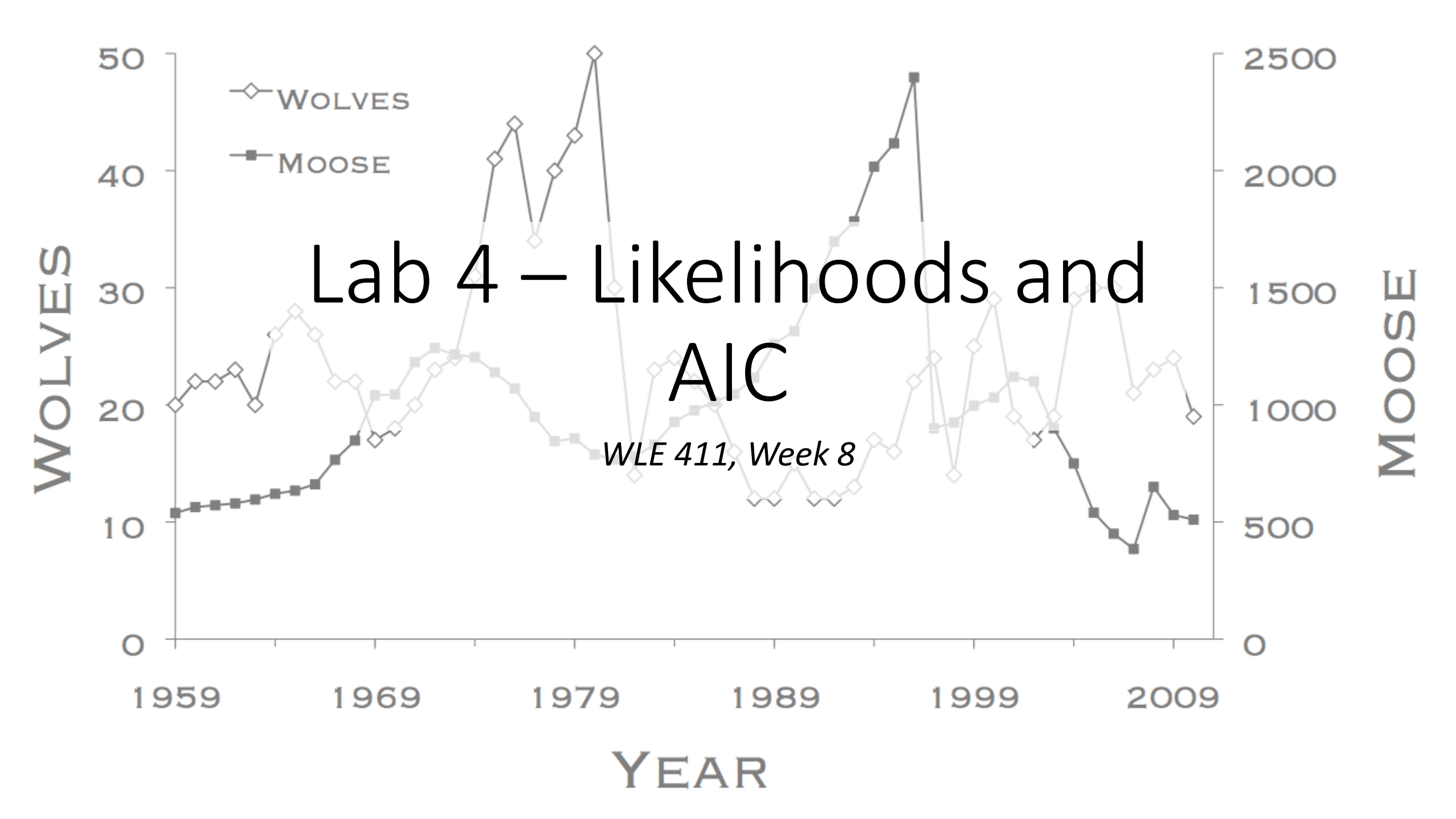
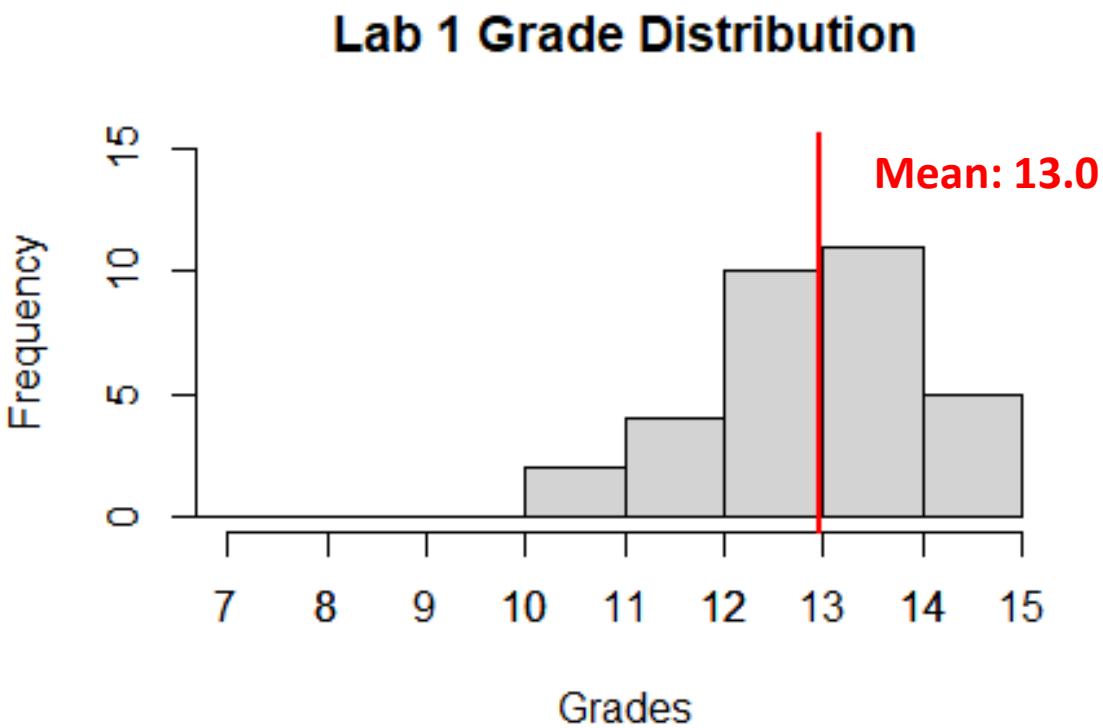
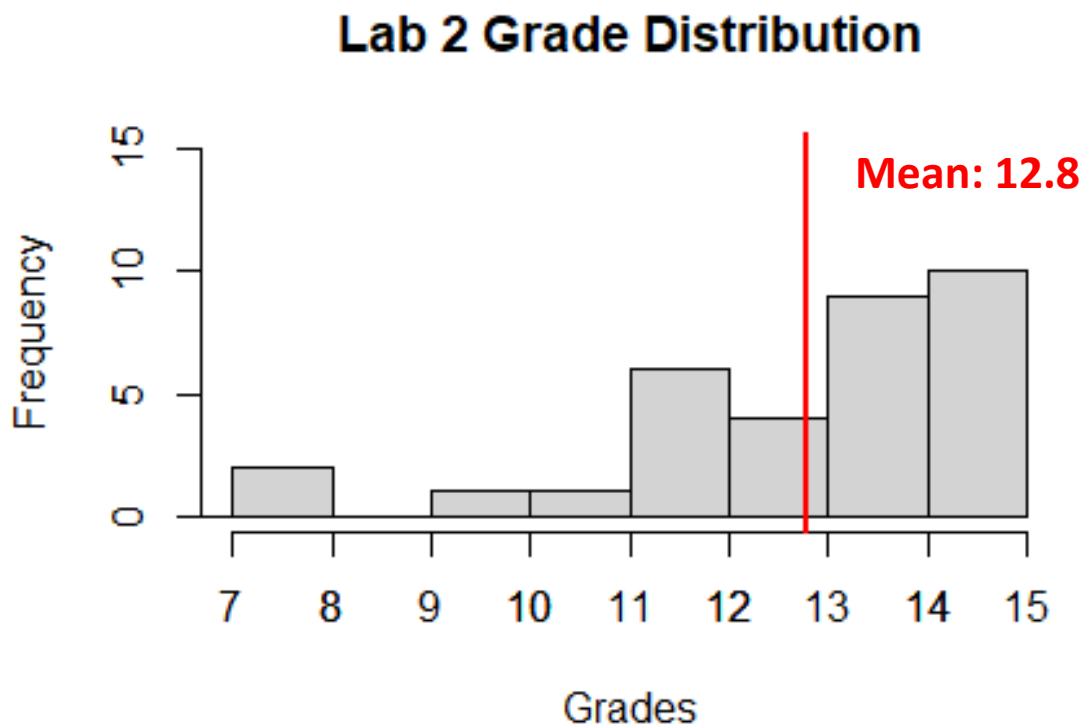


Lab 4 – Likelihoods and AIC

WLE 411, Week 8





Excluding zeros

Guidelines for submission

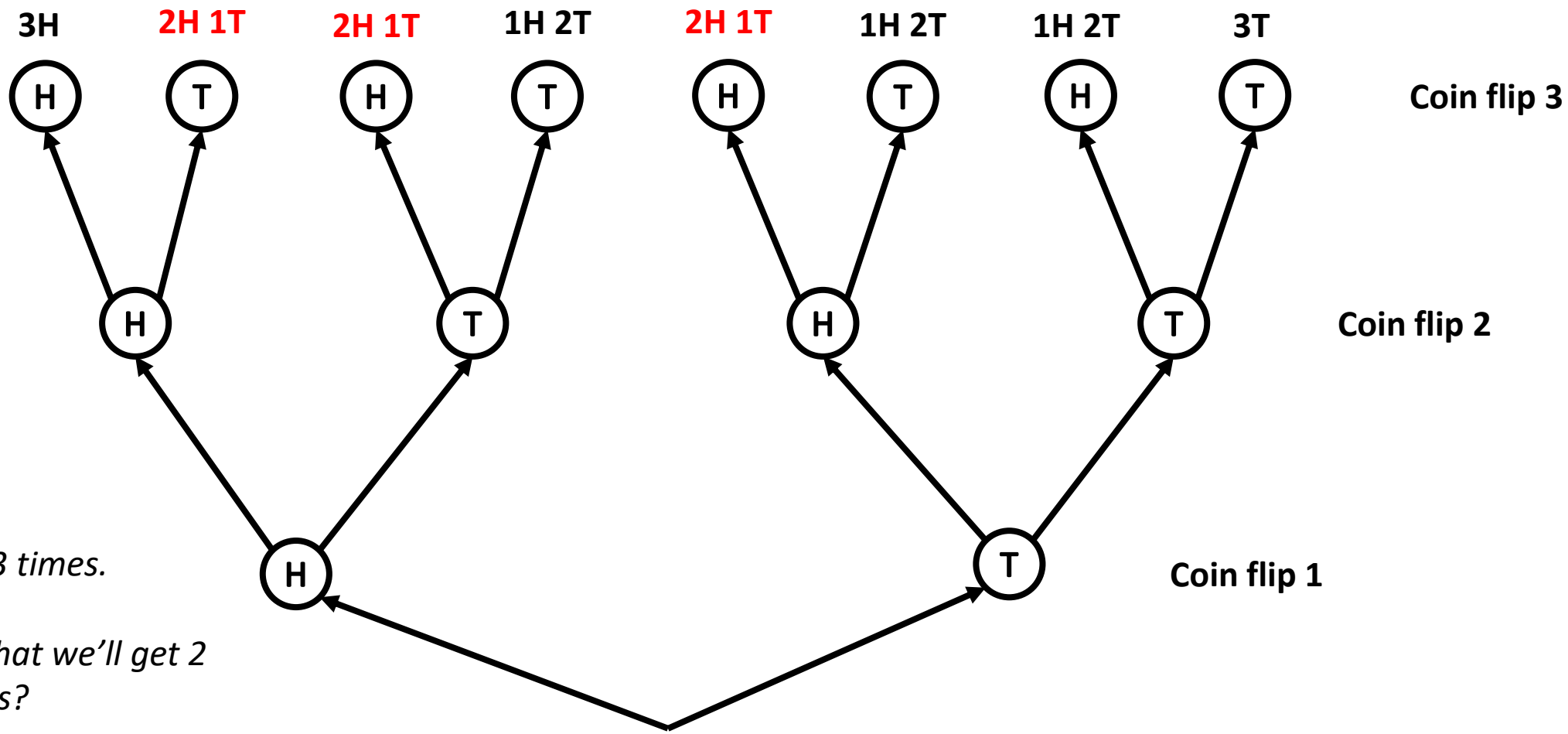
- Submit assignments using one of the following formats:
  - Word document: .doc/.docx
  - Excel document: .xls/.xlsx
  - R script: .R (NOT .RProj)

Late penalties for partial assignments

- Lots of partial submissions in the past two weeks
  - No unified policy
- To ensure consistency in grading, we will follow this going forward:
  - Late penalty for the assignment is based on the day when the last portion of the assignment is turned in
  - Includes documents submitted in the wrong format

Bernoulli trials, or coin flips

3 out of 8 possible outcomes are 2H 1T



Let's flip a coin 3 times.

How likely is it that we'll get 2 heads and 1 tails?

Number of successes in a Bernoulli trial

We can get the same answer from this equation

N = number of trials
y = number of successes (heads)

$$\binom{N}{y} = \frac{N!}{y!\,(N-y)!}$$

$$\binom{3}{2} = \frac{3!}{2!\,(3-2)!}$$

$$\binom{3}{2} = \frac{3 * 2 * 1}{2 * 1 * 1} = 3$$

Parameter likelihoods

Likelihood- the accumulated evidence for a certain parameter value or model

$$L(p|N, y)$$

translates to

The likelihood of a certain value of *p* assuming observed values of *N* and *y*

Likelihood can also be used to compare models

$$L(\hat{\theta}|data)$$

translates to

The likelihood of a certain model
assuming the observed data

Parsimony: think-pair-share

$$Model\ A: Survival \sim time$$

$$L(Model\ A|data) = 0.2$$

$$Model\ B: Survival \sim time + age + sex$$

$$L(Model\ B|data) = 0.2$$

Models A and B have identical likelihoods: which is the better model?

AIC uses likelihood for model selection

Penalty for # of parameters (parsimony)

$$AIC = -2\ln\left(L(\hat{\theta}|data)\right) + 2K$$

Likelihood of the model

The best model is the one with the smallest AIC

Table 1. Model selection results of top 13 models from a set of 26 based on Akaike's Information Criterion using quasi-likelihood adjustments (QAIC; Burnham and Anderson 2002) to predict number of cougars killed/100 km^2, Oregon, USA, 1990–2009, where K = number of model parameters, ΔQAIC = difference in relation to best model within the set, and w = QAIC weight. Data included 400 county-year combinations; all models contained cougar population density as a fixed effect and county and year as random effects on the intercept.

Model		K	ΔQAIC	w
1	Cougar population density + cougar harvest density	5	0.00	0.46
2	Cougar population density + cougar harvest density + population proportion of juvenile male cougars	6	1.11	0.26
3	Cougar population density + cougar harvest density + population proportion of juvenile male cougars + proportion forest cover + human population density	8	4.53	0.05
4	Cougar population density	4	5.51	0.03
5	Cougar population density + cougar harvest density + population proportion of juvenile male cougars + beef cattle density + sheep density + deer relative density index + elk relative density index	10	5.83	0.02
6	Cougar population density + deer relative density index	5	5.86	0.02
7	Cougar population density + population proportion of juvenile male cougars	5	5.98	0.02
8	Cougar population density + proportion forest cover	5	6.44	0.02
9	Cougar population density + beef cattle density + sheep density	6	6.59	0.02
10	Cougar population density + beef cattle density + sheep density + deer relative density index	7	6.78	0.02
11	Cougar population density + human population density	5	7.43	0.01
12	Cougar population density + total annual snowfall	5	7.45	0.01
13	Cougar population density + mean minimum annual temperature	5	7.51	0.01