



# Course review

- Only four labs left (including this one)
- Good time to check your grades
- If you have unsubmitted lab assignments, consider submitting them as revisions
- No lab next week

# Last week- CJS models

 $\Phi$ 

Apparent survival  
between intervals

 $p$ 

Detection/recapture  
probability in an  
interval

# This week- Known Fate models

$$S$$

Survival within each  
interval

# Features of Known Fate models

- Detection presumed to be perfect
- Animals can be found dead
- Examples:
  - Radio-tracked deer
  - Bird nests

# Differences in capture history format

	CJS								
Rows represent individuals	1	0	1	1	0	1	0	0	<i>1: Observed</i> <i>0: Unobserved</i>
	Columns represent capture intervals								

	Known Fate				
Rows represent individuals	<u>10</u>	<u>10</u>	<u>11</u>	<u>00</u>	<i>10: Alive during the interval</i> <i>11: Died during the interval</i> <i>00: Not tracked during the interval (censored)</i>
	Clusters of two represent capture intervals				

# Linear regression review

$$y = mx + b$$

$$y = \beta_1 x + \beta_0$$

Response  
(dependent)  
variable

$$y = mx + b$$
$$y = \beta_1 x + \beta_0$$

Predictor  
(independent)  
variable



Slope

$$y = mx + b$$
$$y = \beta_1 x + \beta_0$$

Y-intercept

How do we add parameters to describe  $S$ ?

$$\gamma = \beta_1 x + \beta_0$$

$$\textit{logit}(S) = \beta_{Sex} * Sex + \beta_0$$



Interval survival,  
transformed by a  
link function

How do we add parameters to describe  $S$ ?

$$\gamma = \beta_1 x + \beta_0$$

$$\textit{logit}(S) = \beta_{\textit{Sex}} * \textit{Sex} + \beta_0$$



Intercept (baseline  
survival)

How do we add parameters to describe  $S$ ?

$$\gamma = \beta_1 x + \beta_0$$

$$\textit{logit}(S) = \beta_{\textit{Sex}} * \textit{Sex} + \beta_0$$



Sex (categorical  
variables expressed  
as 0s and 1s)

How do we add parameters to describe  $S$ ?

$$\gamma = \beta_1 x + \beta_0$$

$$\textit{logit}(S) = \beta_{\textit{Sex}} * \textit{Sex} + \beta_0$$



Difference in  
survival between  
sexes

# Example survival calculation

Females (represented as 0):

$$\textit{logit}(S_{female}) = \beta_{sex} * 0 + \beta_0$$

$$\textit{logit}(S_{female}) = \beta_0$$

Males (represented as 1):

$$\textit{logit}(S_{male}) = \beta_{sex} * 1 + \beta_0$$

$$\textit{logit}(S_{male}) = \beta_{sex} + \beta_0$$

# General advice for this lab

- Link functions are a common sticking point
  - Converts results from a linear framework ( $y = mx + b$ ) into survival probabilities
- Take your time on the conceptual background
  - Dummy variables, multiple groups, etc.