Linear regression

$$y_i \sim Normal(\mu_i, \sigma^2)$$

$$\mu_i = ß_0 + ß_1 * x_i$$

Where,

y_i : response variable at site i

μ_i : mean of yi

σ^2 : variance of yi

$ß_0$: intercept

$ß_1$: slope

x_i : covariate value at site i

*this document was adapted from a course led by Richard Chandler and Bill DeLuca

Logistic regression

$$y_i \sim Binomial(\pi_i, N_i)$$

$$logit(\pi_i) = ß_0 + ß_1 * x_i$$

Where,

y_i : response variable (0 or 1) at site i

π_i : probability of observing a 1 at site i

N_i : number of trials (*eg*, coin tosses [=1 in typical logistic reg.])

$ß_0$: intercept – on logit scale

$ß_1$: slope – on logit scale

x_i : covariate value at site i

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Poisson regression

$$y_i \sim Poisson(\lambda_i)$$

$$log(\lambda_i) = ß_0 + ß_1 * x_i$$

Where,

y_i : response variable (integer value) at site i

λ_i : Poisson mean at site i

$ß_0$: intercept – on log scale

$ß_1$: slope – on log scale

x_i : covariate value at site i

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Single-season occupancy

$$y_{ij} \sim Binomial(p_{ij}, Z_i)$$

$$Z_i \sim Binomial(\psi_i, 1)$$

$$logit(p_{ij}) = ß_0 + ß_1 * x_{ij}$$

$$logit(\psi_i) = \alpha_0 + \alpha_1 * v_i$$

Where,

y_{ij} : observed presence/absence at site i on occasion j

Z_i : state variable: actual presence/absence at site i

p_{ij} : detection probability at site i on occasion j

ψ_i : probability of occurrence at site i

$ß_0$: intercept – on logit scale

$ß_1$: slope – on logit scale

x_{ij} : covariate value at site i on occasion j

α_0 : intercept – on logit scale

α_1 : slope – on logit scale

v_i : covariate value at site i

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N-mixture model (aka Binomial mixture model)

$$y_{ij} \sim Binomial(p_{ij}, N_i)$$

$$N_i \sim Poisson(\lambda_i)$$

$$logit(p_{ij}) = ß_0 + ß_1 * x_{ij}$$

$$log(\lambda_i) = \alpha_0 + \alpha_1 * v_i$$

Where,

y_{ij} : observed abundance at site i on occasion j

N_i : state variable: actual abundance at site i

p_{ij} : detection probability at site i on occasion j

λ_i : mean abundance at site i

$ß_0$: intercept – on logit scale

$ß_1$: slope – on logit scale

x_{ij} : covariate value at site i on occasion j

α_0 : intercept – on log scale

α_1 : slope – on log scale

v_i : covariate value at site i

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