Ch1\_models\_Blackbear

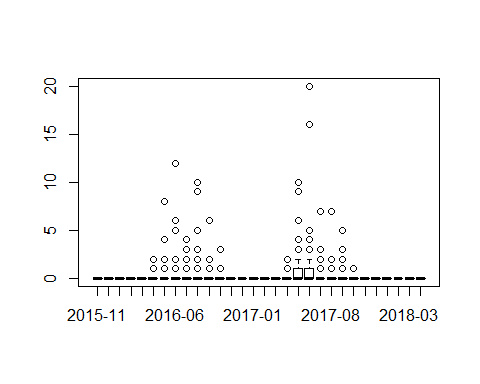
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Based on model selection comparison of underlying distributions and zero-inflation, I chose an nbinom2 distribution for black bear data, with zero-inflation and ActiveDays in the ZI model (see Ch1\_blackbear\_modelDistribution.Rmd). However, including ActiveDays in the ZI model resulted in model convergence problems. I will therefore include ActiveDays in the conditional model with a null ZI.

Here I will: 1. Double check random structure using all covariates 2. Build models with environmental covariates only  
3. Build hypothesis models with line covariates + environmental  
4. Perform model selection with AIC  
5. Calculate evidence ratios (AICwt of Best Model/ AICwt of other models)  
6. Checking residuals of Top Model 7. Model Averaging? 8. Standardize parameter estimates for easy interpretation  
Previous scale analysis showed lowland habitat and linear density measured at 1750m best explained caribou detections

## Select Active Months for Black bears

 ### 1. Random structure  
Random structure was previously assessed, but here I will confirm using all model covariates

## dLogLik dAIC df weight  
## r2 29.8 0.0 14 0.946   
## rSite 25.9 5.7 13 0.054   
## rMonth 1.7 54.2 13 <0.001  
## r0 0.0 55.5 12 <0.001

## Environmental models

|  |  |
| --- | --- |
| Model Name | Covariates |
| E1 | ActiveDays |
| E2 | ActiveDays + low500 + pSnow |
| E3 | ActiveDays + low500 |
| E4 | ActiveDays + pSnow |

## dLogLik dAIC df weight  
## E4 8.0 0.0 7 0.54   
## E2 8.8 0.4 8 0.46   
## E1 0.0 14.0 6 <0.001  
## E3 0.8 14.4 7 <0.001

As in the Wolf models, E4 and E2 perform very similarly, with the pSnow model coming out slightly on top. Model deviance is only ~1 unit separate and lowland does not appear to have much of an effect. However, perhaps lowland has an effect when adding other variables?  
Compare global models with and without lowland habitat.

## dLogLik dAIC df weight  
## woLow 0.0 0.0 13 0.65   
## wLow 0.4 1.2 14 0.35

As in the simpler models, the global model without lowland habitat has more model weight, but still within 2 AIC points. This provides more evidence that lowland habitat may just be a ‘pretending variable,’ and I will exclude it from further analysis.

## Line characteristics

|  |  |
| --- | --- |
| Model Name | Covariates |
| L1 | Treatment + pSnow + ActiveDays |
| L2 | VegHt + pSnow + ActiveDays |
| L3 | LD750 + pSnow + ActiveDays |
| L4 | LineWidth + pSnow + ActiveDays |
| L5 | Treatment + LineWidth + pSnow + ActiveDays |
| L6 | LineWidth + VegHt + pSnow + ActiveDays |
| L7 | Treatment + LD750 + pSnow + ActiveDays |
| L8 | LD750 + VegHt + pSnow + ActiveDays |
| L9 | Treatment + VegHt + pSnow + ActiveDays |
| L10 | Treatment + LineWidth + VegHt + pSnow + ActiveDays |
| L11 | Treatment + LineWidth + LD750 + pSnow + ActiveDays |
| L12 | Treatment + VegHt + LD750 + pSnow + ActiveDays |
| L13 | LineWidth + VegHt + LD750 + pSnow + ActiveDays |
| L14 | Treatment + LineWidth + LD750 + VegHt + pSnow + ActiveDays |

3 models within 2 dAIC points of each other, with model weights between 16 - 43%  
VegHt is present in top 5 models.

## Evidence Ratios and Cumulative model weight (calculating confidence intervals)

Calculating evidence ratios (AIC wt of best model/AIC weight of others) gives:

## ModelNames dLogLikelihood dAIC Modelweight CumulativeWeight  
## 1 L2 18.7334350 0.000000 4.344722e-01 0.4344722  
## 2 L6 18.7662726 1.934325 1.651691e-01 0.5996412  
## 3 L8 18.7528693 1.961131 1.629700e-01 0.7626113  
## 4 L9 20.0029144 3.461041 7.698506e-02 0.8395963  
## 5 L13 18.7923206 3.882229 6.236583e-02 0.9019621  
## 6 L12 20.0992260 5.268418 3.118456e-02 0.9331467  
## 7 L10 20.0149956 5.436879 2.866545e-02 0.9618121  
## 8 L4 15.8661504 5.734569 2.470109e-02 0.9865132  
## 9 L14 20.1052389 7.256392 1.154135e-02 0.9980546  
## 10 L5 15.9571820 11.552506 1.346999e-03 0.9994016  
## 11 L11 16.0428924 13.381085 5.398788e-04 0.9999415  
## 12 E4 7.9842058 19.498458 2.534694e-05 0.9999668  
## 13 E2 8.8081507 19.850569 2.125523e-05 0.9999881  
## 14 L3 8.0331223 21.400625 9.792086e-06 0.9999979  
## 15 L1 8.1638437 25.139182 1.510281e-06 0.9999994  
## 16 L7 8.2301970 27.006476 5.937181e-07 1.0000000  
## 17 E1 0.0000000 33.466870 2.348137e-08 1.0000000  
## 18 E3 0.7873106 33.892249 1.898251e-08 1.0000000  
## EvidenceRatio  
## 1   
## 2 2.63046962362898  
## 3 2.66596371358508  
## 4 5.64359080133565  
## 5 6.96650981140757  
## 6 13.932286393911  
## 7 15.1566496882572  
## 8 17.5891916210617  
## 9 37.6448463938006  
## 10 322.54830559344  
## 11 804.758723220105  
## 12 17141.0110761234  
## 13 20440.7199986927  
## 14 44369.725333337  
## 15 287676.317740112  
## 16 731781.983591669  
## 17 18502842.9798899  
## 18 22888024.090914

### Summary Output for Top Model

## Family: nbinom2 ( log )  
## Formula:   
## Blackbear ~ VegHt + ActiveDays + pSnow + (1 | Site) + (1 | Month)  
## Zero inflation: ~1  
## Data: det  
##   
## AIC BIC logLik deviance df.resid   
## 917.6 950.6 -450.8 901.6 447   
##   
## Random effects:  
##   
## Conditional model:  
## Groups Name Variance Std.Dev.  
## Site (Intercept) 1.02001 1.010   
## Month (Intercept) 0.08293 0.288   
## Number of obs: 455, groups: Site, 59; Month, 7  
##   
## Overdispersion parameter for nbinom2 family (): 1.59   
##   
## Conditional model:  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) -4.20877 1.05823 -3.977 6.97e-05 \*\*\*  
## VegHt 0.45741 0.17321 2.641 0.00827 \*\*   
## ActiveDays 0.09892 0.03300 2.998 0.00272 \*\*   
## pSnow -3.90616 0.97519 -4.006 6.19e-05 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Zero-inflation model:  
## Estimate Std. Error z value Pr(>|z|)  
## (Intercept) -17.96 4410.79 -0.004 0.997

### Plotting residuals against fitted values and predicted values for all covariates

