caphistory

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Using CJS and JS. JS -> for population estimates. CJS -> for time-dependent survival and recapture rates of a given species

library(marked)

## Loading required package: lme4

## Loading required package: Matrix

## Loading required package: parallel

## Warning in checkMatrixPackageVersion(): Package version inconsistency detected.  
## TMB was built with Matrix version 1.2.17  
## Current Matrix version is 1.2.15  
## Please re-install 'TMB' from source using install.packages('TMB', type = 'source') or ask CRAN for a binary version of 'TMB' matching CRAN's 'Matrix' package

## This is marked 1.2.1

library(RMark)

## This is RMark 2.2.6  
## Documentation available at http://www.phidot.org/software/mark/rmark/RMarkDocumentation.zip

##   
## Attaching package: 'RMark'

## The following objects are masked from 'package:marked':  
##   
## collapseCH, compute.real, create.model.list, make.design.data,  
## merge\_design.covariates, model.table, process.ch,  
## process.data, setup.model, setup.parameters, splitCH

library(ggplot2)

cap <- read.csv("capturehistory.csv", stringsAsFactors = F)  
str(cap)

## 'data.frame': 573 obs. of 17 variables:  
## $ location : chr "NMBS" "NMPN" "NMBN" "NMPN" ...  
## $ species : chr "CGrDar" "PaiSki" "PaiSki" "PaiSki" ...  
## $ sex : chr "m" "m" "m" "m" ...  
## $ mark.number : int 1 2 3 4 5 6 7 8 9 10 ...  
## $ Date.of.initial.capture: chr "2-May-18" "11-May-18" "11-May-18" "11-May-18" ...  
## $ c1 : int 1 1 1 1 1 1 1 1 1 1 ...  
## $ c2 : int 0 0 0 0 0 0 0 0 0 0 ...  
## $ c3 : int 0 0 0 0 0 0 0 0 0 0 ...  
## $ c4 : int 0 0 0 0 0 0 0 0 0 0 ...  
## $ c5 : int 0 0 0 0 0 0 0 0 0 0 ...  
## $ c6 : int 0 0 0 0 0 0 0 0 0 0 ...  
## $ c7 : int 0 0 0 0 0 0 0 0 0 0 ...  
## $ c8 : int 0 0 0 0 0 0 0 0 0 0 ...  
## $ c9 : int 0 0 0 0 0 0 0 0 0 0 ...  
## $ c10 : int 0 0 0 0 0 0 0 0 0 0 ...  
## $ c11 : int 0 0 0 0 0 0 0 0 0 0 ...  
## $ X : logi NA NA NA NA NA NA ...

print(cap)

## location species sex mark.number Date.of.initial.capture c1 c2 c3 c4  
## 1 NMBS CGrDar m 1 2-May-18 1 0 0 0  
## 2 NMPN PaiSki m 2 11-May-18 1 0 0 0  
## 3 NMBN PaiSki m 3 11-May-18 1 0 0 0  
## 4 NMPN PaiSki m 4 11-May-18 1 0 0 0  
## 5 HB CarSad m 5 12-May-18 1 0 0 0  
## 6 HB PaiSki m 6 12-May-18 1 0 0 0  
## 7 HB PaiSki m 7 12-May-18 1 0 0 0  
## 8 HB PaiSki m 8 12-May-18 1 0 0 0  
## 9 HB PaiSki m 9 12-May-18 1 0 0 0  
## 10 HB PaiSki m 10 12-May-18 1 0 0 0  
## 11 HB PaiSki m 11 12-May-18 1 0 0 0  
## 12 HB CarSad m 12 12-May-18 1 0 0 0  
## 13 HB PaiSki m 13 12-May-18 1 0 0 0  
## 14 HB PaiSki m 14 12-May-18 1 0 0 0  
## 15 HB CarSad m 15 12-May-18 1 0 0 0  
## 16 HB CarSad m 16 12-May-18 1 0 0 0  
## 17 HB CarSad m 17 12-May-18 1 0 0 0  
## 18 HB CarSad m 18 12-May-18 1 0 0 0  
## 19 NMPN PaiSki m 19 23-May-18 0 1 0 0  
## 20 NMPN PaiSki m 20 23-May-18 0 1 0 0  
## 21 NMPN PaiSki m 21 23-May-18 0 1 0 0  
## 22 NMPN PaiSki m 22 23-May-18 0 1 0 0  
## 23 HB CarSad m 23 24-May-18 0 1 0 0  
## 24 HB PaiSki m 24 24-May-18 0 1 0 0  
## 25 HB PaiSki m 25 24-May-18 0 1 0 0  
## 26 HB PaiSki m 26 24-May-18 0 1 0 0  
## 27 HB CarSad m 28 24-May-18 0 1 0 0  
## 28 HB PaiSki m 30 24-May-18 0 1 0 0  
## 29 HB ChFCor m 31 24-May-18 0 1 0 0  
## 30 HB PaiSki m 32 24-May-18 0 1 0 0  
## 31 HB CarSad m 34 24-May-18 0 1 0 0  
## 32 NMPS PaiSki m 35 25-May-18 1 0 0 0  
## 33 NMPS PaiSki m 36 25-May-18 1 0 0 0  
## 34 NMPS PaiSki m 37 25-May-18 1 0 0 0  
## 35 NMPS PaiSki m 38 25-May-18 1 0 0 0  
## 36 NMPS ChFCor f 39 25-May-18 1 0 0 0  
## 37 NMPS ChFCor m 40 25-May-18 1 0 0 0  
## 38 NMPS ComWhi m 41 25-May-18 1 0 0 0  
## 39 NMBS BeaBas m 42 25-May-18 0 1 0 0  
## 40 NMBS PaiSki m 43 25-May-18 0 1 0 0  
## 41 NMBS BeaBas m 44 25-May-18 0 1 0 0  
## 42 NMBS PaiSki m 45 25-May-18 0 1 0 0  
## 43 NMBS PaiSki m 46 25-May-18 0 1 0 0  
## 44 NMBS PaiSki m 47 25-May-18 0 1 0 0  
## 45 NMBS CarSad m 48 25-May-18 0 1 0 0  
## 46 NMBS PaiSki m 49 25-May-18 0 1 0 0  
## 47 NMBS PaiSki m 50 25-May-18 0 1 0 0  
## 48 NMBS PaiSki f 51 25-May-18 0 1 0 0  
## 49 NMBS PaiSki m 52 25-May-18 0 1 1 0  
## 50 NMBS PaiSki m 53 25-May-18 0 1 0 0  
## 51 NMBS PaiSki m 54 25-May-18 0 1 0 0  
## 52 NMBS PaiSki m 55 25-May-18 0 1 0 0  
## 53 NMBS PaiSki m 56 25-May-18 0 1 0 0  
## 54 NMBS PaiSki m 57 25-May-18 0 1 0 0  
## 55 NMBS CarSad m 58 25-May-18 0 1 0 0  
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## 58 NMBS BeaBas m 61 25-May-18 0 1 0 0  
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## 60 NMBS PaiSki m 63 25-May-18 0 1 0 0  
## 61 NMPS ComWhi m 64 25-May-18 1 0 0 0  
## 62 NMPS ChFCor f 65 25-May-18 1 0 0 0  
## 63 NMPS ComWhi m 66 25-May-18 1 0 0 0  
## 64 NMPS PaiSki m 67 25-May-18 1 0 0 0  
## 65 NCCP BeaBas m 68 25-May-18 1 0 0 0  
## 66 NCCP CGrDar m 69 25-May-18 1 0 0 0  
## 67 NCCP BeaBas m 70 25-May-18 1 0 0 0  
## 68 NCCP PaiSki m 71 25-May-18 1 0 0 0  
## 69 NCCP PaiSki m 72 25-May-18 1 0 0 0  
## 70 NCCP PaiSki m 73 25-May-18 1 0 0 0  
## 71 NCCB ComWhi m 74 25-May-18 1 0 0 0  
## 72 NCCB BeaBas m 75 25-May-18 1 0 0 0  
## 73 NCCB BeaBas m 76 25-May-18 1 0 0 0  
## 74 NCCB ComWhi m 77 25-May-18 1 0 0 0  
## 75 NCCB BeaBas m 78 25-May-18 1 0 0 0  
## 76 NCCB ComWhi m 79 25-May-18 1 0 0 0  
## 77 NCCB ChFCor m 80 25-May-18 1 0 0 0  
## 78 NCCB BeaBas m 81 25-May-18 1 0 0 0  
## 79 NCCB PaiSki m 82 25-May-18 1 0 0 0  
## 80 NCCP BeaBas m 83 25-May-18 1 0 0 0  
## 81 NCCP BeaBas m 84 25-May-18 1 0 0 0  
## 82 NCCP BeaBas m 85 25-May-18 1 0 0 0  
## 83 NCCP BeaBas m 86 25-May-18 1 0 0 0  
## 84 NCCP BeaBas m 87 25-May-18 1 0 0 0  
## 85 CT HudWhi m 88 28-May-18 1 0 0 0  
## 86 CT HudWhi m 89 28-May-18 1 1 1 0  
## 87 CT HudWhi m 90 28-May-18 1 0 0 0  
## 88 CT HudWhi m 91 28-May-18 1 0 0 0  
## 89 CT HudWhi m 92 28-May-18 1 0 1 0  
## 90 CT HudWhi m 93 28-May-18 1 1 1 0  
## 91 CT HudWhi m 94 28-May-18 1 0 0 0  
## 92 CT HudWhi m 95 28-May-18 1 0 1 0  
## 93 CT HudWhi m 96 28-May-18 1 0 0 0  
## 94 CT HudWhi m 97 28-May-18 1 0 0 0  
## 95 CT HudWhi m 98 28-May-18 1 0 0 0  
## 96 CT HudWhi m 99 28-May-18 1 0 1 1  
## 97 CT HudWhi m 100 28-May-18 1 0 0 0  
## 98 CT HudWhi m 101 28-May-18 1 0 1 0  
## 99 CT HudWhi m 102 28-May-18 1 0 1 0  
## 100 CT HudWhi m 103 28-May-18 1 0 1 0  
## 101 CT HudWhi m 104 28-May-18 1 0 0 0  
## 102 CT HudWhi m 105 28-May-18 1 0 0 0  
## 103 CT HudWhi f 106 28-May-18 1 0 0 0  
## 104 CT HudWhi m 107 28-May-18 1 0 0 0  
## 105 CT HudWhi m 108 28-May-18 1 0 0 0  
## 106 CT HudWhi m 109 28-May-18 1 0 0 0  
## 107 CT HudWhi m 110 28-May-18 1 0 0 0  
## 108 CT HudWhi m 111 28-May-18 1 0 0 0  
## 109 CT AmeEme m 112 28-May-18 1 0 0 0  
## 110 CT BeaBas m 113 28-May-18 1 0 0 0  
## 111 CT HudWhi m 114 28-May-18 1 0 0 0  
## 112 CT HudWhi m 115 28-May-18 1 0 1 0  
## 113 CT DtTWhi m 116 28-May-18 1 0 0 0  
## 114 CT HudWhi m 117 28-May-18 1 0 0 0  
## 115 CT HudWhi m 118 28-May-18 1 0 0 0  
## 116 CT HudWhi m 119 28-May-18 1 0 0 0  
## 117 HB CrRWhi f 120 28-May-18 0 0 1 0  
## 118 HB CrRWhi m 121 28-May-18 0 0 1 0  
## 119 HB AmeEme m 122 28-May-18 0 0 1 0  
## 120 HB CrRWhi m 123 28-May-18 0 0 1 0  
## 121 HB CrRWhi m 124 28-May-18 0 0 1 0  
## 122 HB CrRWhi f 125 28-May-18 0 0 1 0  
## 123 HB CrRWhi m 126 28-May-18 0 0 1 0  
## 124 HB CrRWhi m 127 28-May-18 0 0 1 0  
## 125 HB CrRWhi m 128 28-May-18 0 0 1 0  
## 126 HB CrRWhi f 129 28-May-18 0 0 1 0  
## 127 HB CrRWhi m 130 28-May-18 0 0 1 0  
## 128 HB CrRWhi m 131 28-May-18 0 0 1 0  
## 129 HB CrRWhi f 132 28-May-18 0 0 1 0  
## 130 HB CrRWhi m 133 28-May-18 0 0 1 0  
## 131 HB CrRWhi m 134 28-May-18 0 0 1 0  
## 132 HB CrRWhi m 135 28-May-18 0 0 1 0  
## 133 HB CrRWhi f 136 28-May-18 0 0 1 0  
## 134 HB CrRWhi m 137 28-May-18 0 0 1 0  
## 135 HB CrRWhi m 138 28-May-18 0 0 1 0  
## 136 HB CrRWhi f 139 28-May-18 0 0 1 0  
## 137 HB CrRWhi m 140 28-May-18 0 0 1 0  
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## 139 HB CrRWhi m 142 28-May-18 0 0 1 0  
## 140 HB CrRWhi m 143 28-May-18 0 0 1 0  
## 141 HB CrRWhi m 144 28-May-18 0 0 1 0  
## 142 HB CrRWhi f 145 28-May-18 0 0 1 0  
## 143 HB CrRWhi m 146 28-May-18 0 0 1 0  
## 144 HB CrRWhi f 147 28-May-18 0 0 1 0  
## 145 HB CrRWhi m 148 28-May-18 0 0 1 0  
## 146 NMPS LanClu m 150 29-May-18 0 1 0 0  
## 147 NMBS ChFCor m 151 29-May-18 0 0 1 0  
## 148 NMBS ChFCor m 152 29-May-18 0 0 1 0  
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## 150 NMBS PaiSki m 154 29-May-18 0 0 1 0  
## 151 NMBS ChFCor m 155 29-May-18 0 0 1 0  
## 152 NMBS PaiSki m 156 29-May-18 0 0 1 0  
## 153 NMBS ComWhi m 157 29-May-18 0 0 1 0  
## 154 NMBS ChFCor m 158 29-May-18 0 0 1 0  
## 155 NMBS AmeEme m 160 29-May-18 0 0 1 0  
## 156 NMBS BeaBas m 161 29-May-18 0 0 1 0  
## 157 NMBS PaiSki m 163 29-May-18 0 0 1 0  
## 158 NMBS PaiSki m 164 29-May-18 0 0 1 0  
## 159 NMBS PaiSki m 165 29-May-18 0 0 1 0  
## 160 NMBS PaiSki m 167 29-May-18 0 0 1 0  
## 161 NMBS PaiSki m 168 29-May-18 0 0 1 0  
## 162 NMBS PaiSki m 169 29-May-18 0 0 1 0  
## 163 NMBS ChFCor m 170 29-May-18 0 0 1 0  
## 164 NMBS ComWhi m 171 29-May-18 0 0 1 0  
## 165 NMPN CrRWhi f 172 4-Jun-18 0 0 1 0  
## 166 NCCP ChFCor m 173 4-Jun-18 0 1 0 0  
## 167 NCCP ChFCor m 174 4-Jun-18 0 1 1 0  
## 168 NCCP ChFCor m 175 4-Jun-18 0 1 0 0  
## 169 NCCP ChFCor m 176 4-Jun-18 0 1 0 0  
## 170 NCCP ChFCor m 177 4-Jun-18 0 1 0 0  
## 171 NCCP ChFCor m 178 4-Jun-18 0 1 0 0  
## 172 NCCP DtTWhi m 179 4-Jun-18 0 1 0 0  
## 173 NCCP ChFCor m 180 4-Jun-18 0 1 0 0  
## 174 NCCP ChFCor m 181 4-Jun-18 0 1 0 0  
## 175 NCCP ChFCor m 182 4-Jun-18 0 1 0 0  
## 176 NCCP ChFCor f 183 4-Jun-18 0 1 0 0  
## 177 NCCP ChFCor m 184 4-Jun-18 0 1 0 0  
## 178 NCCP ChFCor m 185 4-Jun-18 0 1 0 0  
## 179 NCCP ChFCor m 186 4-Jun-18 0 1 0 0  
## 180 NCCP ComBas m 187 4-Jun-18 0 1 0 0  
## 181 NCCB DtTWhi m 188 4-Jun-18 0 1 0 0  
## 182 NCCB DtTWhi m 189 4-Jun-18 0 1 0 0  
## 183 NCCB DtTWhi m 190 4-Jun-18 0 1 0 0  
## 184 CT ChFCor m 191 4-Jun-18 0 1 1 0  
## 185 CLSA CrRWhi m 192 7-Jun-18 1 0 0 0  
## 186 CT HudWhi m 192 4-Jun-18 0 1 0 0  
## 187 CLSA PaiSki m 193 7-Jun-18 1 0 0 0  
## 188 CLSA ChFCor m 194 7-Jun-18 1 0 0 0  
## 189 HB AmeEme m 195 7-Jun-18 0 0 0 1  
## 190 HB CrRWhi m 196 7-Jun-18 0 0 0 1  
## 191 HB CrRWhi m 197 7-Jun-18 0 0 0 1  
## 192 HB CrRWhi m 198 7-Jun-18 0 0 0 1  
## 193 HB CrRWhi f 199 7-Jun-18 0 0 0 1  
## 194 HB CrRWhi m 200 7-Jun-18 0 0 0 1  
## 195 HB CrRWhi f 201 7-Jun-18 0 0 0 1  
## 196 HB CrRWhi m 202 7-Jun-18 0 0 0 1  
## 197 HB CrRWhi m 203 7-Jun-18 0 0 0 1  
## 198 HB CrRWhi f 204 7-Jun-18 0 0 0 1  
## 199 HB CrRWhi m 205 7-Jun-18 0 0 0 1  
## 200 HB CrRWhi f 206 7-Jun-18 0 0 0 1  
## 201 HB CrRWhi m 207 7-Jun-18 0 0 0 1  
## 202 HB CrRWhi m 208 7-Jun-18 0 0 0 1  
## 203 HB CrRWhi m 209 7-Jun-18 0 0 0 1  
## 204 HB ChFCor f 210 7-Jun-18 0 0 0 1  
## 205 HB CrRWhi m 212 7-Jun-18 0 0 0 1  
## 206 HB CrRWhi f 213 7-Jun-18 0 0 0 1  
## 207 HB CrRWhi m 215 7-Jun-18 0 0 0 1  
## 208 HB CrRWhi m 216 7-Jun-18 0 0 0 1  
## 209 HB CrRWhi m 222 7-Jun-18 0 0 0 1  
## 210 HB CrRWhi m 223 7-Jun-18 0 0 0 1  
## 211 HB ChFCor m 224 7-Jun-18 0 0 0 1  
## 212 HB CrRWhi m 226 7-Jun-18 0 0 0 1  
## 213 HB CrRWhi m 227 7-Jun-18 0 0 0 1  
## 214 HB CrRWhi m 228 7-Jun-18 0 0 0 1  
## 215 HB AmeEme m 229 7-Jun-18 0 0 0 1  
## 216 HB CrRWhi f 230 7-Jun-18 0 0 0 1  
## 217 HB CrRWhi f 231 7-Jun-18 0 0 0 1  
## 218 HB CrRWhi m 232 7-Jun-18 0 0 0 1  
## 219 HB CrRWhi m 233 7-Jun-18 0 0 0 1  
## 220 HB CrRWhi m 234 7-Jun-18 0 0 0 1  
## 221 HB CrRWhi m 235 7-Jun-18 0 0 0 1  
## 222 HB CrRWhi m 236 7-Jun-18 0 0 0 1  
## 223 HB CrRWhi m 237 7-Jun-18 0 0 0 1  
## 224 HB CrRWhi m 238 7-Jun-18 0 0 0 1  
## 225 HB CrRWhi m 239 7-Jun-18 0 0 0 1  
## 226 HB CrRWhi m 240 7-Jun-18 0 0 0 1  
## 227 HB CrRWhi m 241 7-Jun-18 0 0 0 1  
## 228 HB CrRWhi f 242 7-Jun-18 0 0 0 1  
## 229 HB CrRWhi f 244 7-Jun-18 0 0 0 1  
## 230 HB AmeEme m 245 7-Jun-18 0 0 0 1  
## 231 CLSA ChFCor m 246 7-Jun-18 1 0 0 0  
## 232 CLSA ChFCor m 247 7-Jun-18 1 0 0 0  
## 233 CLSA ChFCor m 248 7-Jun-18 1 0 0 0  
## 234 CLSA ChFCor m 249 7-Jun-18 1 0 0 0  
## 235 CLSA ChFCor f 250 7-Jun-18 1 0 0 0  
## 236 CLSA ChFCor m 251 7-Jun-18 1 1 0 0  
## 237 CLSA ChFCor m 252 7-Jun-18 1 0 0 0  
## 238 NMBS AmeEme m 253 7-Jun-18 0 0 0 1  
## 239 NMBS BeaBas m 254 7-Jun-18 0 0 0 1  
## 240 NMBS CrRWhi m 255 7-Jun-18 0 0 0 1  
## 241 NMBS AmeEme m 256 7-Jun-18 0 0 0 1  
## 242 NMBS DtTWhi m 257 7-Jun-18 0 0 0 1  
## 243 NMBS CrRWhi m 258 7-Jun-18 0 0 0 1  
## 244 NMPS PaiSki f 259 9-Jun-18 0 0 1 0  
## 245 NMBS ChFCor m 262 9-Jun-18 0 0 0 0  
## 246 NMBS CrRWhi m 263 9-Jun-18 0 0 0 0  
## 247 NMBS DeSSpi m 264 9-Jun-18 0 0 0 0  
## 248 NMBS ChFCor m 265 9-Jun-18 0 0 0 0  
## 249 NMBS DeSSpi m 266 9-Jun-18 0 0 0 0  
## 250 NMBS AmeEme m 267 9-Jun-18 0 0 0 0  
## 251 NMBS ChFCor m 268 9-Jun-18 0 0 0 0  
## 252 NMBS AmeEme m 269 9-Jun-18 0 0 0 0  
## 253 NMBS CGrDar m 270 9-Jun-18 0 0 0 0  
## 254 NMBS ChFCor m 271 9-Jun-18 0 0 0 0  
## 255 NMBS AmeEme m 272 9-Jun-18 0 0 0 0  
## 256 NMBS AmeEme m 273 9-Jun-18 0 0 0 0  
## 257 NMBS CrRWhi m 274 9-Jun-18 0 0 0 0  
## 258 NMBS PaiSki m 275 9-Jun-18 0 0 0 0  
## 259 NMBS AmeEme m 276 9-Jun-18 0 0 0 0  
## 260 NMBS CrRWhi m 277 9-Jun-18 0 0 0 0  
## 261 NMBS ChFCor m 278 9-Jun-18 0 0 0 0  
## 262 NMBS CrRWhi m 279 9-Jun-18 0 0 0 0  
## 263 NMBS AmeEme m 280 9-Jun-18 0 0 0 0  
## 264 NMBS PaiSki m 281 9-Jun-18 0 0 0 0  
## 265 NMBS PaiSki m 282 9-Jun-18 0 0 0 0  
## 266 NMBS UniClu m 283 9-Jun-18 0 0 0 0  
## 267 NMBS CarSad f 284 9-Jun-18 0 0 0 0  
## 268 NMBS CarSad m 285 9-Jun-18 0 0 0 0  
## 269 NMBS CrRWhi m 286 9-Jun-18 0 0 0 0  
## 270 NMBS CrRWhi m 289 9-Jun-18 0 0 0 0  
## 271 NMBS HudWhi m 290 9-Jun-18 0 0 0 0  
## 272 NMBS PaiSki m 291 9-Jun-18 0 0 0 0  
## 273 NMBS LanClu m 292 9-Jun-18 0 0 0 0  
## 274 NMBS CrRWhi m 293 9-Jun-18 0 0 0 0  
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## 276 NMBS AmeEme m 295 9-Jun-18 0 0 0 0  
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## 279 NMBS ChFCor m 298 9-Jun-18 0 0 0 0  
## 280 NMBS AmeEme m 299 9-Jun-18 0 0 0 0  
## 281 NMBS AmeEme f 300 9-Jun-18 0 0 0 0  
## 282 NMBS BluDas m 301 9-Jun-18 0 0 0 0  
## 283 NMBS AmeEme m 302 9-Jun-18 0 0 0 0  
## 284 NMBS ComWhi m 303 9-Jun-18 0 0 0 0  
## 285 CT ChFCor m 304 12-Jun-18 0 0 1 1  
## 286 CT HudWhi f 305 12-Jun-18 0 0 1 0  
## 287 CT HudWhi f 306 12-Jun-18 0 0 1 0  
## 288 CT DtTWhi m 307 12-Jun-18 0 0 1 0  
## 289 CT HudWhi m 308 12-Jun-18 0 0 1 0  
## 290 CT HudWhi m 309 12-Jun-18 0 0 1 0  
## 291 CT SpaSki m 310 12-Jun-18 0 0 1 0  
## 292 CT DtTWhi m 311 12-Jun-18 0 0 1 0  
## 293 CT ComWhi m 312 12-Jun-18 0 0 1 0  
## 294 NCCP DtTWhi m 313 14-Jun-18 0 0 1 0  
## 295 NCCP ChFCor m 314 14-Jun-18 0 0 1 0  
## 296 NCCP ChFCor f 315 14-Jun-18 0 0 1 0  
## 297 NCCP AmeEme m 316 14-Jun-18 0 0 1 0  
## 298 NCCP DtTWhi m 317 14-Jun-18 0 0 1 0  
## 299 NCCP ChFCor m 318 14-Jun-18 0 0 1 0  
## 300 NCCP AmeEme m 319 14-Jun-18 0 0 1 0  
## 301 NCCP AmeEme m 320 14-Jun-18 0 0 1 0  
## 302 NCCP DtTWhi m 321 14-Jun-18 0 0 1 0  
## 303 NCCP ChFCor m 322 14-Jun-18 0 0 1 0  
## 304 NCCP AmeEme m 323 14-Jun-18 0 0 1 0  
## 305 NCCP AmeEme m 324 14-Jun-18 0 0 1 0  
## 306 NCCP AmeEme m 325 14-Jun-18 0 0 1 0  
## 307 NCCP AmeEme m 326 14-Jun-18 0 0 1 0  
## 308 NCCP AmeEme m 328 14-Jun-18 0 0 1 0  
## 309 NCCP ChFCor m 329 14-Jun-18 0 0 1 0  
## 310 NCCP ChFCor m 330 14-Jun-18 0 0 1 0  
## 311 NCCP AmeEme m 331 14-Jun-18 0 0 1 0  
## 312 NCCP ChFCor m 332 14-Jun-18 0 0 1 0  
## 313 NCCP AmeEme m 333 14-Jun-18 0 0 1 0  
## 314 NCCP AmeEme m 334 14-Jun-18 0 0 1 0  
## 315 NCCP AmeEme m 335 14-Jun-18 0 0 1 0  
## 316 NCCP AmeEme m 336 14-Jun-18 0 0 1 0  
## 317 NCCP AmeEme m 337 14-Jun-18 0 0 1 0  
## 318 NCCP UniClu m 339 14-Jun-18 0 0 1 0  
## 319 NCCP ChFCor m 340 14-Jun-18 0 0 1 0  
## 320 NCCP ChFCor m 341 14-Jun-18 0 0 1 0  
## 321 NCCP AmeEme m 342 14-Jun-18 0 0 1 0  
## 322 NCCB DtTWhi m 343 14-Jun-18 0 0 1 0  
## 323 NCCB DtTWhi m 344 14-Jun-18 0 0 1 0  
## 324 NCCB ChFCor m 346 14-Jun-18 0 0 1 0  
## 325 NCCB DtTWhi m 347 14-Jun-18 0 0 1 0  
## 326 NCCB ChFCor m 348 14-Jun-18 0 0 1 0  
## 327 NCCB UniClu m 349 14-Jun-18 0 0 1 0  
## 328 NMPN PaiSki m 350 14-Jun-18 0 0 0 1  
## 329 NMPN PaiSki m 351 14-Jun-18 0 0 0 1  
## 330 NMBN ChFCor m 352 14-Jun-18 0 1 0 0  
## 331 NMBN HudWhi m 353 14-Jun-18 0 1 0 0  
## 332 NMBN AmeEme m 354 14-Jun-18 0 1 0 0  
## 333 NMBS CrRWhi m 357 15-Jun-18 0 0 0 0  
## 334 NMBS ChFCor m 358 15-Jun-18 0 0 0 0  
## 335 NMBS ChFCor m 359 15-Jun-18 0 0 0 0  
## 336 NMBS ChFCor m 360 15-Jun-18 0 0 0 0  
## 337 NMBS CrRWhi m 361 15-Jun-18 0 0 0 0  
## 338 NMBS ChFCor m 362 15-Jun-18 0 0 0 0  
## 339 NMBS CrRWhi m 363 15-Jun-18 0 0 0 0  
## 340 NMBS CrRWhi m 364 15-Jun-18 0 0 0 0  
## 341 NMBS ChFCor m 365 15-Jun-18 0 0 0 0  
## 342 NMBS ComWhi m 366 15-Jun-18 0 0 0 0  
## 343 NMBS ChFCor m 368 15-Jun-18 0 0 0 0  
## 344 NMBS ChFCor m 369 15-Jun-18 0 0 0 0  
## 345 NMBS AmeEme m 370 15-Jun-18 0 0 0 0  
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## 347 NMBS AmeEme m 372 15-Jun-18 0 0 0 0  
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## 379 CLSA ComWhi m 408 15-Jun-18 0 1 0 0  
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## 393 HB CrRWhi f 422 16-Jun-18 0 0 0 0  
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## 406 CT DtTWhi m 436 18-Jun-18 0 0 0 1  
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## 408 CT HudWhi m 438 18-Jun-18 0 0 0 1  
## 409 CT TwSSki m 439 18-Jun-18 0 0 0 1  
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## 570 0 0 0 0 0 0 1 NA  
## 571 0 0 0 0 0 0 1 NA  
## 572 0 0 0 0 0 0 1 NA  
## 573 NA NA NA NA NA NA NA NA

summary(cap)

## location species sex mark.number   
## Length:573 Length:573 Length:573 Min. : 1.0   
## Class :character Class :character Class :character 1st Qu.:146.8   
## Mode :character Mode :character Mode :character Median :305.5   
## Mean :307.7   
## 3rd Qu.:464.2   
## Max. :623.0   
## NA's :1   
## Date.of.initial.capture c1 c2   
## Length:573 Min. :0.0000 Min. :0.0000   
## Class :character 1st Qu.:0.0000 1st Qu.:0.0000   
## Mode :character Median :0.0000 Median :0.0000   
## Mean :0.1591 Mean :0.1171   
## 3rd Qu.:0.0000 3rd Qu.:0.0000   
## Max. :1.0000 Max. :1.0000   
## NA's :1 NA's :1   
## c3 c4 c5 c6   
## Min. :0.0000 Min. :0.0000 Min. :0.0000 Min. :0.0000   
## 1st Qu.:0.0000 1st Qu.:0.0000 1st Qu.:0.0000 1st Qu.:0.0000   
## Median :0.0000 Median :0.0000 Median :0.0000 Median :0.0000   
## Mean :0.1836 Mean :0.1696 Mean :0.1521 Mean :0.1171   
## 3rd Qu.:0.0000 3rd Qu.:0.0000 3rd Qu.:0.0000 3rd Qu.:0.0000   
## Max. :1.0000 Max. :1.0000 Max. :1.0000 Max. :1.0000   
## NA's :1 NA's :1 NA's :1 NA's :1   
## c7 c8 c9 c10   
## Min. :0.00000 Min. :0.00000 Min. :0.00000 Min. :0.00000   
## 1st Qu.:0.00000 1st Qu.:0.00000 1st Qu.:0.00000 1st Qu.:0.00000   
## Median :0.00000 Median :0.00000 Median :0.00000 Median :0.00000   
## Mean :0.04021 Mean :0.07168 Mean :0.03322 Mean :0.02273   
## 3rd Qu.:0.00000 3rd Qu.:0.00000 3rd Qu.:0.00000 3rd Qu.:0.00000   
## Max. :1.00000 Max. :1.00000 Max. :1.00000 Max. :1.00000   
## NA's :1 NA's :1 NA's :1 NA's :1   
## c11 X   
## Min. :0.000000 Mode:logical   
## 1st Qu.:0.000000 NA's:573   
## Median :0.000000   
## Mean :0.006993   
## 3rd Qu.:0.000000   
## Max. :1.000000   
## NA's :1

cap <- cap[which(!is.na(cap$c1)), ]  
summary(cap)

## location species sex mark.number   
## Length:572 Length:572 Length:572 Min. : 1.0   
## Class :character Class :character Class :character 1st Qu.:146.8   
## Mode :character Mode :character Mode :character Median :305.5   
## Mean :307.7   
## 3rd Qu.:464.2   
## Max. :623.0   
## Date.of.initial.capture c1 c2   
## Length:572 Min. :0.0000 Min. :0.0000   
## Class :character 1st Qu.:0.0000 1st Qu.:0.0000   
## Mode :character Median :0.0000 Median :0.0000   
## Mean :0.1591 Mean :0.1171   
## 3rd Qu.:0.0000 3rd Qu.:0.0000   
## Max. :1.0000 Max. :1.0000   
## c3 c4 c5 c6   
## Min. :0.0000 Min. :0.0000 Min. :0.0000 Min. :0.0000   
## 1st Qu.:0.0000 1st Qu.:0.0000 1st Qu.:0.0000 1st Qu.:0.0000   
## Median :0.0000 Median :0.0000 Median :0.0000 Median :0.0000   
## Mean :0.1836 Mean :0.1696 Mean :0.1521 Mean :0.1171   
## 3rd Qu.:0.0000 3rd Qu.:0.0000 3rd Qu.:0.0000 3rd Qu.:0.0000   
## Max. :1.0000 Max. :1.0000 Max. :1.0000 Max. :1.0000   
## c7 c8 c9 c10   
## Min. :0.00000 Min. :0.00000 Min. :0.00000 Min. :0.00000   
## 1st Qu.:0.00000 1st Qu.:0.00000 1st Qu.:0.00000 1st Qu.:0.00000   
## Median :0.00000 Median :0.00000 Median :0.00000 Median :0.00000   
## Mean :0.04021 Mean :0.07168 Mean :0.03322 Mean :0.02273   
## 3rd Qu.:0.00000 3rd Qu.:0.00000 3rd Qu.:0.00000 3rd Qu.:0.00000   
## Max. :1.00000 Max. :1.00000 Max. :1.00000 Max. :1.00000   
## c11 X   
## Min. :0.000000 Mode:logical   
## 1st Qu.:0.000000 NA's:572   
## Median :0.000000   
## Mean :0.006993   
## 3rd Qu.:0.000000   
## Max. :1.000000

## Format data for MARK

library(reshape)  
  
# get data formatted for MARK/RMark  
cap$ch <- paste(cap$c1,  
 cap$c2,  
 cap$c3,  
 cap$c4,  
 cap$c5,  
 cap$c6,  
 cap$c7,  
 cap$c8,  
 cap$c9,  
 cap$c10,  
 cap$c11,  
 " ",  
 ";",  
 sep="")  
  
  
data=data.frame(cap)  
data  
transform=melt(cap, id.vars="mark.number")  
pivot=cast(transform, mark.number ~ value)  
pivot[is.na(pivot)]=0  
  
pivot[,2:ncol(pivot)][pivot[,2:ncol(pivot)] != 0] = 1  
lh <- 11;  
  
  
pivot$eh <- apply(pivot[2:lh],1,paste,collapse="") # concatenates encounter columns into eh  
pivot[2:lh] <- NULL # drops individual encounter columns  
# create commented tag  
pivot$mark.number <- paste("/\*", pivot$mark.number, "\*/", sep=" ")  
# sort by descending encounter histories  
pivot <- pivot[order(data$ch,decreasing=TRUE),]  
# tack on the frequency for the individual  
pivot$end <- "1;";  
# write out the input file  
write.table(pivot,file="cjs-pivot.inp",sep=" ",quote=F,col.names=F,row.names=F);  
  
pivot

## Format data for marked package

marked\_df <- cap  
  
marked\_df$ch <- paste0(cap$c1,  
 cap$c2,  
 cap$c3,  
 cap$c4,  
 cap$c5,  
 cap$c6,  
 cap$c7,  
 cap$c8,  
 cap$c9,  
 cap$c10,  
 cap$c11)  
   
model=crm(marked\_df)

## Model: CJS

## Processing data...

## 569 capture histories collapsed into 569

## Creating design data...

## Fitting model

## Computing initial parameter estimates

## Starting optimization for 2 parameters...

##   
 Number of evaluations: 100 -2lnl: 375.7430761  
## Elapsed time in minutes: 0.0153

model

##   
## crm Model Summary  
##   
## Npar : 2  
## -2lnL: 375.7431  
## AIC : 379.7431  
##   
## Beta  
## Estimate  
## Phi.(Intercept) -0.6325888  
## p.(Intercept) -1.8079899

model=cjs.hessian(model)  
model

##   
## crm Model Summary  
##   
## Npar : 2  
## -2lnL: 375.7431  
## AIC : 379.7431  
##   
## Beta  
## Estimate se lcl ucl  
## Phi.(Intercept) -0.6325888 0.2561815 -1.134705 -0.1304731  
## p.(Intercept) -1.8079899 0.3266494 -2.448223 -1.1677570

str(marked\_df)

## 'data.frame': 572 obs. of 18 variables:  
## $ location : chr "NMBS" "NMPN" "NMBN" "NMPN" ...  
## $ species : chr "CGrDar" "PaiSki" "PaiSki" "PaiSki" ...  
## $ sex : chr "m" "m" "m" "m" ...  
## $ mark.number : int 1 2 3 4 5 6 7 8 9 10 ...  
## $ Date.of.initial.capture: chr "2-May-18" "11-May-18" "11-May-18" "11-May-18" ...  
## $ c1 : int 1 1 1 1 1 1 1 1 1 1 ...  
## $ c2 : int 0 0 0 0 0 0 0 0 0 0 ...  
## $ c3 : int 0 0 0 0 0 0 0 0 0 0 ...  
## $ c4 : int 0 0 0 0 0 0 0 0 0 0 ...  
## $ c5 : int 0 0 0 0 0 0 0 0 0 0 ...  
## $ c6 : int 0 0 0 0 0 0 0 0 0 0 ...  
## $ c7 : int 0 0 0 0 0 0 0 0 0 0 ...  
## $ c8 : int 0 0 0 0 0 0 0 0 0 0 ...  
## $ c9 : int 0 0 0 0 0 0 0 0 0 0 ...  
## $ c10 : int 0 0 0 0 0 0 0 0 0 0 ...  
## $ c11 : int 0 0 0 0 0 0 0 0 0 0 ...  
## $ X : logi NA NA NA NA NA NA ...  
## $ ch : chr "10000000000" "10000000000" "10000000000" "10000000000" ...

marked\_df$sex.fac <- as.factor(marked\_df$sex)  
marked\_df$species.fac <- as.factor(marked\_df$species)  
mod <- crm(marked\_df,   
 model="JS",   
 groups = c("sex.fac"),   
 model.parameters=list(Phi = list(formula = ~sex.fac),   
 p = list(formula = ~1)))

## Model: JS

## Processing data...

## 572 capture histories collapsed into 572

## Creating design data...

## Fitting model

## Computing initial parameter estimates

## Starting optimization 5 parameters  
##   
 Number of evaluations: 100 -2lnl: -2543.864709  
 Number of evaluations: 200 -2lnl: -2550.100774  
 Number of evaluations: 300 -2lnl: -2550.458778  
 Number of evaluations: 400 -2lnl: -2550.615302  
## Elapsed time in minutes: 0.0463

mod$results$beta #found online but not sure how to use it

## $Phi  
## (Intercept) sex.facm   
## -9.570483 7.542591   
##   
## $p  
## (Intercept)   
## 2.350227   
##   
## $pent  
## (Intercept)   
## -0.6529087   
##   
## $N  
## (Intercept)   
## 2.746676

mod

##   
## crm Model Summary  
##   
## Npar : 5  
## -2lnL: 880.8185  
## AIC : 890.8185  
##   
## Beta  
## Estimate  
## Phi.(Intercept) -9.5704833  
## Phi.sex.facm 7.5425909  
## p.(Intercept) 2.3502269  
## pent.(Intercept) -0.6529087  
## N.(Intercept) 2.7466757

cjs.hessian(mod)

## Warning in matrix(pbeta, ncol = nocc - 1, nrow = nrow(model\_data$p.dm)/  
## (nocc - : data length [6534] is not a sub-multiple or multiple of the  
## number of rows [653]  
  
## Warning in matrix(pbeta, ncol = nocc - 1, nrow = nrow(model\_data$p.dm)/  
## (nocc - : data length [6534] is not a sub-multiple or multiple of the  
## number of rows [653]  
  
## Warning in matrix(pbeta, ncol = nocc - 1, nrow = nrow(model\_data$p.dm)/  
## (nocc - : data length [6534] is not a sub-multiple or multiple of the  
## number of rows [653]  
  
## Warning in matrix(pbeta, ncol = nocc - 1, nrow = nrow(model\_data$p.dm)/  
## (nocc - : data length [6534] is not a sub-multiple or multiple of the  
## number of rows [653]  
  
## Warning in matrix(pbeta, ncol = nocc - 1, nrow = nrow(model\_data$p.dm)/  
## (nocc - : data length [6534] is not a sub-multiple or multiple of the  
## number of rows [653]  
  
## Warning in matrix(pbeta, ncol = nocc - 1, nrow = nrow(model\_data$p.dm)/  
## (nocc - : data length [6534] is not a sub-multiple or multiple of the  
## number of rows [653]  
  
## Warning in matrix(pbeta, ncol = nocc - 1, nrow = nrow(model\_data$p.dm)/  
## (nocc - : data length [6534] is not a sub-multiple or multiple of the  
## number of rows [653]  
  
## Warning in matrix(pbeta, ncol = nocc - 1, nrow = nrow(model\_data$p.dm)/  
## (nocc - : data length [6534] is not a sub-multiple or multiple of the  
## number of rows [653]  
  
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 Number of evaluations: 100 -2lnl: 482.4434459

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##   
## crm Model Summary  
##   
## Npar : 5  
## -2lnL: 880.8185  
## AIC : 890.8185  
##   
## Beta  
## Estimate se lcl ucl  
## Phi.(Intercept) -9.5704833 1.684776e+01 -4.259210e+01 2.345113e+01  
## Phi.sex.facm 7.5425909 1.684766e+01 -2.547882e+01 4.056400e+01  
## p.(Intercept) 2.3502269 1.700145e+00 -9.820579e-01 5.682512e+00  
## pent.(Intercept) -0.6529087 1.000000e+05 -1.960007e+05 1.959993e+05  
## N.(Intercept) 2.7466757 1.000000e+05 -1.959973e+05 1.960027e+05

str(mod)

## List of 5  
## $ model : chr "JS"  
## $ data :List of 12  
## ..$ data :'data.frame': 594 obs. of 17 variables:  
## .. ..$ ch : chr [1:594] "1,0,0,0,0,0,0,0,0,0,0" "1,0,0,0,0,0,0,0,0,0,0" "1,0,0,0,0,0,0,0,0,0,0" "1,0,0,0,0,0,0,0,0,0,0" ...  
## .. ..$ freq : num [1:594] 1 1 1 1 1 1 1 1 1 1 ...  
## .. ..$ group : Factor w/ 2 levels "1","2": 1 2 2 2 2 2 2 2 2 2 ...  
## .. ..$ mark.number: num [1:594] 250 194 246 247 248 249 251 252 404 405 ...  
## .. ..$ c1 : num [1:594] 1 1 1 1 1 1 1 1 0 0 ...  
## .. ..$ c2 : num [1:594] 0 0 0 0 0 0 1 0 1 1 ...  
## .. ..$ c3 : num [1:594] 0 0 0 0 0 0 0 0 0 0 ...  
## .. ..$ c4 : num [1:594] 0 0 0 0 0 0 0 0 0 0 ...  
## .. ..$ c5 : num [1:594] 0 0 0 0 0 0 0 0 0 0 ...  
## .. ..$ c6 : num [1:594] 0 0 0 0 0 0 0 0 0 0 ...  
## .. ..$ c7 : num [1:594] 0 0 0 0 0 0 0 0 0 0 ...  
## .. ..$ c8 : num [1:594] 0 0 0 0 0 0 0 0 0 0 ...  
## .. ..$ c9 : num [1:594] 0 0 0 0 0 0 0 0 0 0 ...  
## .. ..$ c10 : num [1:594] 0 0 0 0 0 0 0 0 0 0 ...  
## .. ..$ c11 : num [1:594] 0 0 0 0 0 0 0 0 0 0 ...  
## .. ..$ sex.fac : Factor w/ 2 levels "f","m": 1 2 2 2 2 2 2 2 2 2 ...  
## .. ..$ id : Factor w/ 594 levels "1","2","3","4",..: 1 2 3 4 5 6 7 8 9 10 ...  
## ..$ model : chr "JS"  
## ..$ mixtures : NULL  
## ..$ freq :'data.frame': 572 obs. of 2 variables:  
## .. ..$ sex.facf: num [1:572] 1 0 0 0 0 0 0 0 0 0 ...  
## .. ..$ sex.facm: num [1:572] 0 1 1 1 1 1 1 1 1 1 ...  
## ..$ nocc : num 11  
## ..$ nocc.secondary : NULL  
## ..$ time.intervals : num [1:10] 1 1 1 1 1 1 1 1 1 1  
## ..$ begin.time : num 1  
## ..$ initial.ages : NULL  
## ..$ group.covariates:'data.frame': 2 obs. of 1 variable:  
## .. ..$ sex.fac: Factor w/ 2 levels "f","m": 1 2  
## ..$ start : num [1:572, 1:2] NA NA NA NA NA NA NA NA NA NA ...  
## .. ..- attr(\*, "dimnames")=List of 2  
## .. .. ..$ : chr [1:572] "1,0,0,0,0,0,0,0,0,0,0" "1,0,0,0,0,0,0,0,0,0,0" "1,0,0,0,0,0,0,0,0,0,0" "1,0,0,0,0,0,0,0,0,0,0" ...  
## .. .. ..$ : NULL  
## ..$ ehmat : num [1:572, 1:11] 1 1 1 1 1 1 1 1 0 0 ...  
## $ model.parameters :List of 4  
## ..$ Phi :List of 14  
## .. ..$ formula :Class 'formula' language ~sex.fac  
## .. .. .. ..- attr(\*, ".Environment")=<environment: R\_GlobalEnv>   
## .. ..$ begin : num 0  
## .. ..$ num : num -1  
## .. ..$ default : num 1  
## .. ..$ type : chr "Square"  
## .. ..$ link : chr "logit"  
## .. ..$ bystratum : logi FALSE  
## .. ..$ tostrata : logi FALSE  
## .. ..$ cjs : logi FALSE  
## .. ..$ whichlevel : num 0  
## .. ..$ interval : logi TRUE  
## .. ..$ nointercept: logi FALSE  
## .. ..$ obs : logi FALSE  
## .. ..$ firstonly : chr "FALSE"  
## ..$ p :List of 14  
## .. ..$ formula :Class 'formula' language ~1  
## .. .. .. ..- attr(\*, ".Environment")=<environment: R\_GlobalEnv>   
## .. ..$ begin : num 0  
## .. ..$ num : num 0  
## .. ..$ default : num 0  
## .. ..$ type : chr "Square"  
## .. ..$ link : chr "logit"  
## .. ..$ bystratum : logi FALSE  
## .. ..$ tostrata : logi FALSE  
## .. ..$ cjs : logi FALSE  
## .. ..$ whichlevel : num 0  
## .. ..$ interval : logi FALSE  
## .. ..$ nointercept: logi FALSE  
## .. ..$ obs : logi FALSE  
## .. ..$ firstonly : chr "FALSE"  
## ..$ pent:List of 16  
## .. ..$ begin : num 1  
## .. ..$ num : num -1  
## .. ..$ default : num 0  
## .. ..$ type : chr "Square"  
## .. ..$ link : chr "mlogit"  
## .. ..$ formula :Class 'formula' language ~1  
## .. .. .. ..- attr(\*, ".Environment")=<environment: 0x000000001f2794b0>   
## .. ..$ bystratum : logi FALSE  
## .. ..$ tostrata : logi FALSE  
## .. ..$ cjs : logi FALSE  
## .. ..$ whichlevel : num 0  
## .. ..$ interval : logi FALSE  
## .. ..$ nointercept: logi FALSE  
## .. ..$ include : chr "time"  
## .. ..$ mlogit : chr "id"  
## .. ..$ obs : logi FALSE  
## .. ..$ firstonly : chr "FALSE"  
## ..$ N :List of 13  
## .. ..$ begin : num 0  
## .. ..$ num : num(0)   
## .. ..$ type : chr "Square"  
## .. ..$ link : chr "log"  
## .. ..$ formula :Class 'formula' language ~1  
## .. .. .. ..- attr(\*, ".Environment")=<environment: 0x000000001f2794b0>   
## .. ..$ bystratum : logi FALSE  
## .. ..$ tostrata : logi FALSE  
## .. ..$ cjs : logi FALSE  
## .. ..$ whichlevel : num 0  
## .. ..$ interval : logi FALSE  
## .. ..$ nointercept: logi FALSE  
## .. ..$ obs : logi FALSE  
## .. ..$ firstonly : chr "FALSE"  
## $ design.parameters: list()  
## $ results :List of 9  
## ..$ beta :List of 4  
## .. ..$ Phi : Named num [1:2] -9.57 7.54  
## .. .. ..- attr(\*, "names")= chr [1:2] "(Intercept)" "sex.facm"  
## .. ..$ p : Named num 2.35  
## .. .. ..- attr(\*, "names")= chr "(Intercept)"  
## .. ..$ pent: Named num -0.653  
## .. .. ..- attr(\*, "names")= chr "(Intercept)"  
## .. ..$ N : Named num 2.75  
## .. .. ..- attr(\*, "names")= chr "(Intercept)"  
## ..$ neg2lnl : num 881  
## ..$ AIC : num 891  
## ..$ convergence : num 0  
## ..$ optim.details:List of 13  
## .. ..$ p1 : num -9.57  
## .. ..$ p2 : num 7.54  
## .. ..$ p3 : num 2.35  
## .. ..$ p4 : num -0.653  
## .. ..$ p5 : num 2.75  
## .. ..$ value : num -1275  
## .. ..$ fevals : num 45  
## .. ..$ gevals : num 23  
## .. ..$ niter : num NA  
## .. ..$ convcode: num 0  
## .. ..$ kkt1 : logi TRUE  
## .. ..$ kkt2 : logi TRUE  
## .. ..$ xtime : num 1.07  
## .. ..- attr(\*, "details")=List of 5  
## .. .. ..$ method : chr "BFGS"  
## .. .. ..$ ngatend: num [1:5] 6.69e-05 -4.02e-03 4.18e-03 -6.03e-03 2.22e-03  
## .. .. ..$ nhatend: num [1:5, 1:5] 53.1 53.09 8.44 1.03 1.51 ...  
## .. .. ..$ hev : num [1:5] 1.09e+02 7.62e+01 6.28e+01 5.20 2.06e-03  
## .. .. ..$ message: chr "none"  
## .. ..- attr(\*, "maximize")= logi FALSE  
## .. ..- attr(\*, "npar")= int 5  
## ..$ model\_data :List of 9  
## .. ..$ Phi.dm : num [1:5940, 1:2] 1 1 1 1 1 1 1 1 1 1 ...  
## .. .. ..- attr(\*, "dimnames")=List of 2  
## .. .. .. ..$ : chr [1:5940] "1" "2" "3" "4" ...  
## .. .. .. ..$ : chr [1:2] "(Intercept)" "sex.facm"  
## .. ..$ p.dm : num [1:6534, 1] 1 1 1 1 1 1 1 1 1 1 ...  
## .. .. ..- attr(\*, "dimnames")=List of 2  
## .. .. .. ..$ : chr [1:6534] "1" "2" "3" "4" ...  
## .. .. .. ..$ : chr "(Intercept)"  
## .. ..$ pent.dm : num [1:5940, 1] 1 1 1 1 1 1 1 1 1 1 ...  
## .. .. ..- attr(\*, "dimnames")=List of 2  
## .. .. .. ..$ : chr [1:5940] "1" "2" "3" "4" ...  
## .. .. .. ..$ : chr "(Intercept)"  
## .. ..$ N.dm : num [1:2, 1] 1 1  
## .. .. ..- attr(\*, "dimnames")=List of 2  
## .. .. .. ..$ : chr [1:2] "1" "2"  
## .. .. .. ..$ : chr "(Intercept)"  
## .. ..$ imat :List of 11  
## .. .. ..$ nocc : int 11  
## .. .. ..$ freq : num [1:594] 1 1 1 1 1 1 1 1 1 1 ...  
## .. .. ..$ first: num [1:594] 1 1 1 1 1 1 1 1 2 2 ...  
## .. .. ..$ last : num [1:594] 1 1 1 1 1 1 2 1 2 2 ...  
## .. .. ..$ loc : num [1:594] 0 0 0 0 0 0 0 0 0 0 ...  
## .. .. ..$ chmat: num [1:594, 1:11] 1 1 1 1 1 1 1 1 0 0 ...  
## .. .. ..$ FtoL : num [1:594, 1:11] 0 0 0 0 0 0 0 0 0 0 ...  
## .. .. ..$ Fplus: num [1:594, 1:11] 0 0 0 0 0 0 0 0 0 0 ...  
## .. .. ..$ Lplus: num [1:594, 1:11] 0 0 0 0 0 0 0 0 0 0 ...  
## .. .. ..$ L : num [1:594, 1:11] 1 1 1 1 1 1 0 1 0 0 ...  
## .. .. ..$ First: num [1:594, 1:11] 1 1 1 1 1 1 1 1 0 0 ...  
## .. ..$ Phi.fixed : num [1, 1:3] -1 -1 0  
## .. ..$ p.fixed : num [1, 1:3] -1 -1 0  
## .. ..$ pent.fixed : num [1, 1:3] -1 -1 0  
## .. ..$ time.intervals: num [1:594, 1:10] 1 1 1 1 1 1 1 1 1 1 ...  
## ..$ ns : num [1:2(1d)] 55 517  
## .. ..- attr(\*, "dimnames")=List of 1  
## .. .. ..$ : chr [1:2] "1" "2"  
## ..$ options :List of 7  
## .. ..$ scale :List of 4  
## .. .. ..$ Phi : Named num [1:2] 1 1  
## .. .. .. ..- attr(\*, "names")= chr [1:2] "(Intercept)" "sex.facm"  
## .. .. ..$ p : Named num 1  
## .. .. .. ..- attr(\*, "names")= chr "(Intercept)"  
## .. .. ..$ pent: Named num 1  
## .. .. .. ..- attr(\*, "names")= chr "(Intercept)"  
## .. .. ..$ N : Named num 1  
## .. .. .. ..- attr(\*, "names")= chr "(Intercept)"  
## .. ..$ accumulate: logi FALSE  
## .. ..$ initial :List of 4  
## .. .. ..$ Phi : Named num [1:2] 0 0  
## .. .. .. ..- attr(\*, "names")= chr [1:2] "(Intercept)" "sex.facm"  
## .. .. ..$ p : Named num -0.887  
## .. .. .. ..- attr(\*, "names")= chr "(Intercept)"  
## .. .. ..$ pent: Named num 0  
## .. .. .. ..- attr(\*, "names")= chr "(Intercept)"  
## .. .. ..$ N : Named num 0  
## .. .. .. ..- attr(\*, "names")= chr "(Intercept)"  
## .. ..$ method : chr "BFGS"  
## .. ..$ chunk\_size: num 1e+07  
## .. ..$ itnmax : num 5000  
## .. ..$ control : list()  
## ..$ reals :List of 4  
## .. ..$ Phi :'data.frame': 2 obs. of 3 variables:  
## .. .. ..$ sex.fac : Factor w/ 2 levels "f","m": 1 2  
## .. .. ..$ occ : int [1:2] 1 1  
## .. .. ..$ estimate: num [1:2] 6.98e-05 1.16e-01  
## .. ..$ p :'data.frame': 1 obs. of 2 variables:  
## .. .. ..$ occ : int 1  
## .. .. ..$ estimate: num 0.913  
## .. ..$ pent:'data.frame': 10 obs. of 3 variables:  
## .. .. ..$ time : Factor w/ 10 levels "2","3","4","5",..: 1 2 3 4 5 6 7 8 9 10  
## .. .. ..$ occ : int [1:10] 2 3 4 5 6 7 8 9 10 11  
## .. .. ..$ estimate: num [1:10] 0.0839 0.0839 0.0839 0.0839 0.0839 ...  
## .. ..$ N :'data.frame': 1 obs. of 1 variable:  
## .. .. ..$ estimate: num 15.6  
## ..- attr(\*, "class")= chr [1:3] "crm" "mle" "js"  
## - attr(\*, "class")= chr [1:3] "crm" "mle" "js"

# get values on real scale and not logit or log scales  
mod$results$reals

## $Phi  
## sex.fac occ estimate  
## 1 f 1 0.0000697528  
## 2 m 1 0.1163053694  
##   
## $p  
## occ estimate  
## 1 1 0.9129523  
##   
## $pent  
## time occ estimate  
## 1 2 2 0.08388473  
## 2 3 3 0.08388473  
## 3 4 4 0.08388473  
## 4 5 5 0.08388473  
## 5 6 6 0.08388473  
## 6 7 7 0.08388473  
## 7 8 8 0.08388473  
## 8 9 9 0.08388473  
## 9 10 10 0.08388473  
## 10 11 11 0.08388473  
##   
## $N  
## estimate  
## 1 15.59072

mod <- crm(marked\_df,   
 model="JS",   
 groups = c("species.fac"),   
 model.parameters=list(Phi = list(formula = ~species.fac),   
 p = list(formula = ~species.fac)))

## Model: JS

## Processing data...

## 572 capture histories collapsed into 572

## Creating design data...

## Fitting model

## Computing initial parameter estimates

## Starting optimization 50 parameters

## Warning in max(logpar): no non-missing arguments to max; returning -Inf

## Warning in min(logpar): no non-missing arguments to min; returning Inf

##   
 Number of evaluations: 100 -2lnl: 265.4300543  
 Number of evaluations: 200 -2lnl: -91.2846988  
 Number of evaluations: 300 -2lnl: -145.8552291  
 Number of evaluations: 400 -2lnl: -178.1519929  
 Number of evaluations: 500 -2lnl: -193.5467715  
 Number of evaluations: 600 -2lnl: -228.7544936  
 Number of evaluations: 700 -2lnl: -343.8152087  
 Number of evaluations: 800 -2lnl: -366.9044407  
 Number of evaluations: 900 -2lnl: -383.2795115  
 Number of evaluations: 1000 -2lnl: -392.5418597  
 Number of evaluations: 1100 -2lnl: -394.1296606  
 Number of evaluations: 1200 -2lnl: -406.0698939  
 Number of evaluations: 1300 -2lnl: -407.8599747  
 Number of evaluations: 1400 -2lnl: -408.6041228  
 Number of evaluations: 1500 -2lnl: -408.6834355  
 Number of evaluations: 1600 -2lnl: -409.2266406  
 Number of evaluations: 1700 -2lnl: -409.5786542  
 Number of evaluations: 1800 -2lnl: -410.0662753  
 Number of evaluations: 1900 -2lnl: -410.4844576  
 Number of evaluations: 2000 -2lnl: -410.698991  
 Number of evaluations: 2100 -2lnl: -410.789236  
 Number of evaluations: 2200 -2lnl: -410.8403599  
 Number of evaluations: 2300 -2lnl: -410.8716464  
 Number of evaluations: 2400 -2lnl: -410.8852166  
 Number of evaluations: 2500 -2lnl: -410.892671  
 Number of evaluations: 2600 -2lnl: -410.896545  
 Number of evaluations: 2700 -2lnl: -410.8984871  
 Number of evaluations: 2800 -2lnl: -410.8994789  
 Number of evaluations: 2900 -2lnl: -410.8999856  
 Number of evaluations: 3000 -2lnl: -410.9002437  
 Number of evaluations: 3100 -2lnl: -410.9003761  
 Number of evaluations: 3200 -2lnl: -410.900443  
 Number of evaluations: 3300 -2lnl: -410.9004765  
 Number of evaluations: 3400 -2lnl: -410.9004789  
 Number of evaluations: 3500 -2lnl: -410.900486  
 Number of evaluations: 3600 -2lnl: -410.9005066  
 Number of evaluations: 3700 -2lnl: -409.2653265  
 Number of evaluations: 3800 -2lnl: -410.9005066  
 Number of evaluations: 3900 -2lnl: -410.9005066  
 Number of evaluations: 4000 -2lnl: -410.9005066  
 Number of evaluations: 4100 -2lnl: -410.9005066  
 Number of evaluations: 4200 -2lnl: -410.9005066  
 Number of evaluations: 4300 -2lnl: -409.1373257  
 Number of evaluations: 4400 -2lnl: -410.2442734  
 Number of evaluations: 4500 -2lnl: -410.9005066  
 Number of evaluations: 4600 -2lnl: -410.9005066  
 Number of evaluations: 4700 -2lnl: -410.9005066  
 Number of evaluations: 4800 -2lnl: -410.9005066  
 Number of evaluations: 4900 -2lnl: -401.5692203  
 Number of evaluations: 5000 -2lnl: -410.7741966  
 Number of evaluations: 5100 -2lnl: -409.2653265  
 Number of evaluations: 5200 -2lnl: -410.9005066  
 Number of evaluations: 5300 -2lnl: -410.9005066  
 Number of evaluations: 5400 -2lnl: -410.9005066  
 Number of evaluations: 5500 -2lnl: -410.9005066  
 Number of evaluations: 5600 -2lnl: -410.9005066  
 Number of evaluations: 5700 -2lnl: -405.7728827  
 Number of evaluations: 5800 -2lnl: -410.9005066  
 Number of evaluations: 5900 -2lnl: -410.9005066  
 Number of evaluations: 6000 -2lnl: -410.9005066  
 Number of evaluations: 6100 -2lnl: -410.9005066  
 Number of evaluations: 6200 -2lnl: -409.6426214  
 Number of evaluations: 6300 -2lnl: -385.3943429  
 Number of evaluations: 6400 -2lnl: -410.9005066  
 Number of evaluations: 6500 -2lnl: -409.2653265  
 Number of evaluations: 6600 -2lnl: -410.9005066  
 Number of evaluations: 6700 -2lnl: -409.2653265  
 Number of evaluations: 6800 -2lnl: -410.9005066  
 Number of evaluations: 6900 -2lnl: -410.9005066  
 Number of evaluations: 7000 -2lnl: -410.9005066  
 Number of evaluations: 7100 -2lnl: -410.9005066  
 Number of evaluations: 7200 -2lnl: -410.9005066  
 Number of evaluations: 7300 -2lnl: -410.9005066  
 Number of evaluations: 7400 -2lnl: -410.9005066  
 Number of evaluations: 7500 -2lnl: -405.7728827  
 Number of evaluations: 7600 -2lnl: -410.9005066  
 Number of evaluations: 7700 -2lnl: -410.9005066  
 Number of evaluations: 7800 -2lnl: -410.9005066  
 Number of evaluations: 7900 -2lnl: -410.9005066  
 Number of evaluations: 8000 -2lnl: -410.9005066  
 Number of evaluations: 8100 -2lnl: -410.9005066  
 Number of evaluations: 8200 -2lnl: -410.7807157  
 Number of evaluations: 8300 -2lnl: -408.534347  
 Number of evaluations: 8400 -2lnl: -410.7807157  
 Number of evaluations: 8500 -2lnl: -405.2435607  
 Number of evaluations: 8600 -2lnl: -410.6203235  
 Number of evaluations: 8700 -2lnl: -405.2435607  
 Number of evaluations: 8800 -2lnl: -410.7741966  
 Number of evaluations: 8900 -2lnl: -410.9005066  
 Number of evaluations: 9000 -2lnl: -410.6203235  
 Number of evaluations: 9100 -2lnl: -410.9005066  
 Number of evaluations: 9200 -2lnl: -409.6426214  
 Number of evaluations: 9300 -2lnl: -410.9005066  
 Number of evaluations: 9400 -2lnl: -410.9005066  
 Number of evaluations: 9500 -2lnl: -410.9005066  
 Number of evaluations: 9600 -2lnl: -410.9005066  
 Number of evaluations: 9700 -2lnl: -410.9005066  
 Number of evaluations: 9800 -2lnl: -410.9005066  
 Number of evaluations: 9900 -2lnl: -401.6808924  
 Number of evaluations: 10000 -2lnl: -410.4212392  
 Number of evaluations: 10100 -2lnl: -401.6808924  
 Number of evaluations: 10200 -2lnl: -410.4212392  
 Number of evaluations: 10300 -2lnl: -410.9005066  
 Number of evaluations: 10400 -2lnl: -409.6426214  
 Number of evaluations: 10500 -2lnl: -410.9005066  
 Number of evaluations: 10600 -2lnl: -410.6642112  
 Number of evaluations: 10700 -2lnl: -408.6816943  
 Number of evaluations: 10800 -2lnl: -410.5103381  
 Number of evaluations: 10900 -2lnl: -410.9005066  
 Number of evaluations: 11000 -2lnl: -410.9005066  
 Number of evaluations: 11100 -2lnl: -410.9005066  
 Number of evaluations: 11200 -2lnl: -410.9005066  
 Number of evaluations: 11300 -2lnl: -410.9005066  
 Number of evaluations: 11400 -2lnl: -410.9005066  
 Number of evaluations: 11500 -2lnl: -401.6808924  
 Number of evaluations: 11600 -2lnl: -410.9005066  
 Number of evaluations: 11700 -2lnl: -410.9005066  
 Number of evaluations: 11800 -2lnl: -410.7807157  
 Number of evaluations: 11900 -2lnl: -410.9005066  
 Number of evaluations: 12000 -2lnl: -410.9005066  
 Number of evaluations: 12100 -2lnl: -410.9005066  
 Number of evaluations: 12200 -2lnl: -410.4212392  
 Number of evaluations: 12300 -2lnl: -405.7728827  
 Number of evaluations: 12400 -2lnl: -410.9005066  
 Number of evaluations: 12500 -2lnl: -410.9005066  
 Number of evaluations: 12600 -2lnl: -410.9005066  
 Number of evaluations: 12700 -2lnl: -410.9005066  
 Number of evaluations: 12800 -2lnl: -410.9005066  
 Number of evaluations: 12900 -2lnl: -410.9005066  
 Number of evaluations: 13000 -2lnl: -410.8955697  
 Number of evaluations: 13100 -2lnl: -410.8210827  
 Number of evaluations: 13200 -2lnl: -410.8955697  
 Number of evaluations: 13300 -2lnl: -401.6207352  
 Number of evaluations: 13400 -2lnl: -410.9005066  
 Number of evaluations: 13500 -2lnl: -410.9005066  
 Number of evaluations: 13600 -2lnl: -410.9005066  
 Number of evaluations: 13700 -2lnl: -408.6816943  
 Number of evaluations: 13800 -2lnl: -410.9005066  
 Number of evaluations: 13900 -2lnl: -410.9005066  
 Number of evaluations: 14000 -2lnl: -410.9005066  
 Number of evaluations: 14100 -2lnl: -410.9005066  
## Elapsed time in minutes: 1.9727

mod$results$beta #found online but not sure how to use it

## $Phi  
## (Intercept) species.facBeaBas species.facBluDas species.facBWiSki   
## -17.3861682 -3.7972405 -3.8994319 -0.7712145   
## species.facCalPen species.facCarSad species.facCGrDar species.facChFCor   
## -2.3018725 -3.5722539 -2.4390061 15.2759549   
## species.facComBas species.facComWhi species.facCrRWhi species.facDeSSpi   
## -0.6267621 15.9045926 15.3050052 -1.7388402   
## species.facDtTWhi species.facEasPon species.facGrsDar species.facHudWhi   
## -3.9588782 -0.7712145 -1.0154739 16.8459329   
## species.facLanClu species.facPaiSki species.facRubMea species.facSlaSki   
## -2.0579053 14.5986784 -1.2775535 -0.8716625   
## species.facSpaSki species.facTwSSki species.facUniClu species.facWFaMea   
## -1.7250794 -3.2942624 -3.1787520 -0.7442033   
##   
## $p  
## (Intercept) species.facBeaBas species.facBluDas species.facBWiSki   
## 21.7869239 3.4587057 3.7180986 -0.2456497   
## species.facCalPen species.facCarSad species.facCGrDar species.facChFCor   
## 2.3417053 3.7150726 2.9545446 0.2869013   
## species.facComBas species.facComWhi species.facCrRWhi species.facDeSSpi   
## -0.2677599 -19.6654525 -18.5265913 1.8164567   
## species.facDtTWhi species.facEasPon species.facGrsDar species.facHudWhi   
## 3.6935192 -0.2456497 -0.2468494 -20.2122533   
## species.facLanClu species.facPaiSki species.facRubMea species.facSlaSki   
## 2.4129516 -18.3345523 1.0271194 -0.2373681   
## species.facSpaSki species.facTwSSki species.facUniClu species.facWFaMea   
## 1.8323524 3.3730686 3.3681552 -0.2519864   
##   
## $pent  
## (Intercept)   
## -0.6423892   
##   
## $N  
## (Intercept)   
## -33.38301

mod

##   
## crm Model Summary  
##   
## Npar : 50  
## -2lnL: 1456.97  
## AIC : 1556.97  
##   
## Beta  
## Estimate  
## Phi.(Intercept) -17.3861682  
## Phi.species.facBeaBas -3.7972405  
## Phi.species.facBluDas -3.8994319  
## Phi.species.facBWiSki -0.7712145  
## Phi.species.facCalPen -2.3018725  
## Phi.species.facCarSad -3.5722539  
## Phi.species.facCGrDar -2.4390061  
## Phi.species.facChFCor 15.2759549  
## Phi.species.facComBas -0.6267621  
## Phi.species.facComWhi 15.9045926  
## Phi.species.facCrRWhi 15.3050052  
## Phi.species.facDeSSpi -1.7388402  
## Phi.species.facDtTWhi -3.9588782  
## Phi.species.facEasPon -0.7712145  
## Phi.species.facGrsDar -1.0154739  
## Phi.species.facHudWhi 16.8459329  
## Phi.species.facLanClu -2.0579053  
## Phi.species.facPaiSki 14.5986784  
## Phi.species.facRubMea -1.2775535  
## Phi.species.facSlaSki -0.8716625  
## Phi.species.facSpaSki -1.7250794  
## Phi.species.facTwSSki -3.2942624  
## Phi.species.facUniClu -3.1787520  
## Phi.species.facWFaMea -0.7442033  
## p.(Intercept) 21.7869239  
## p.species.facBeaBas 3.4587057  
## p.species.facBluDas 3.7180986  
## p.species.facBWiSki -0.2456497  
## p.species.facCalPen 2.3417053  
## p.species.facCarSad 3.7150726  
## p.species.facCGrDar 2.9545446  
## p.species.facChFCor 0.2869013  
## p.species.facComBas -0.2677599  
## p.species.facComWhi -19.6654525  
## p.species.facCrRWhi -18.5265913  
## p.species.facDeSSpi 1.8164567  
## p.species.facDtTWhi 3.6935192  
## p.species.facEasPon -0.2456497  
## p.species.facGrsDar -0.2468494  
## p.species.facHudWhi -20.2122533  
## p.species.facLanClu 2.4129516  
## p.species.facPaiSki -18.3345523  
## p.species.facRubMea 1.0271194  
## p.species.facSlaSki -0.2373681  
## p.species.facSpaSki 1.8323524  
## p.species.facTwSSki 3.3730686  
## p.species.facUniClu 3.3681552  
## p.species.facWFaMea -0.2519864  
## pent.(Intercept) -0.6423892  
## N.(Intercept) -33.3830118

mod$results$reals

## $Phi  
## species.fac occ estimate  
## 1 ChFCor 1 1.081081e-01  
## 2 ComWhi 1 1.851896e-01  
## 3 CrRWhi 1 1.109412e-01  
## 4 PaiSki 1 5.800396e-02  
## 5 AmeEme 1 2.813734e-08  
## 6 BeaBas 1 6.311935e-10  
## 7 DtTWhi 1 5.369875e-10  
## 8 EasPon 1 1.301215e-08  
## 9 HudWhi 1 3.681329e-01  
## 10 SpaSki 1 5.012918e-09  
## 11 TwSSki 1 1.043766e-09  
## 12 CarSad 1 7.904474e-10  
## 13 BluDas 1 5.698773e-10  
## 14 UniClu 1 1.171571e-09  
## 15 WFaMea 1 1.336841e-08  
## 16 CGrDar 1 2.454913e-09  
## 17 ComBas 1 1.503432e-08  
## 18 LanClu 1 3.593736e-09  
## 19 RubMea 1 7.842394e-09  
## 20 CalPen 1 2.815740e-09  
## 21 DeSSpi 1 4.944409e-09  
## 22 GrsDar 1 1.019221e-08  
## 23 SlaSki 1 1.176860e-08  
## 24 BWiSki 1 1.301214e-08  
##   
## $p  
## species.fac occ estimate  
## 1 ChFCor 1 1.0000000  
## 2 ComWhi 1 0.8929726  
## 3 CrRWhi 1 0.9630426  
## 4 PaiSki 1 0.9693018  
## 5 AmeEme 1 1.0000000  
## 6 BeaBas 1 1.0000000  
## 7 DtTWhi 1 1.0000000  
## 8 EasPon 1 1.0000000  
## 9 HudWhi 1 0.8284484  
## 10 SpaSki 1 1.0000000  
## 11 TwSSki 1 1.0000000  
## 12 CarSad 1 1.0000000  
## 13 BluDas 1 1.0000000  
## 14 UniClu 1 1.0000000  
## 15 WFaMea 1 1.0000000  
## 16 CGrDar 1 1.0000000  
## 17 ComBas 1 1.0000000  
## 18 LanClu 1 1.0000000  
## 19 RubMea 1 1.0000000  
## 20 CalPen 1 1.0000000  
## 21 DeSSpi 1 1.0000000  
## 22 GrsDar 1 1.0000000  
## 23 SlaSki 1 1.0000000  
## 24 BWiSki 1 1.0000000  
##   
## $pent  
## time occ estimate  
## 1 2 2 0.08402643  
## 2 3 3 0.08402643  
## 3 4 4 0.08402643  
## 4 5 5 0.08402643  
## 5 6 6 0.08402643  
## 6 7 7 0.08402643  
## 7 8 8 0.08402643  
## 8 9 9 0.08402643  
## 9 10 10 0.08402643  
## 10 11 11 0.08402643  
##   
## $N  
## estimate  
## 1 3.176451e-15

# Run with RMark (need to download Program MARK in order for this to work)

MarkPath='C:/Program Files (x86)/MARK'  
mark(marked\_df, model.parameters=list(p=list(formula=~1)),output=FALSE)$results$beta

## estimate se lcl ucl  
## Phi:(Intercept) -0.6325888 0.2561814 -1.134704 -0.1304732  
## p:(Intercept) -1.8079899 0.3266493 -2.448223 -1.1677572

abundance/effort AIC vvvv

data <- read.csv("Dragonfly1718Abundance.csv", stringsAsFactors = F)  
  
### Each possible combination of variables needs to be analyzed. The lowest score (not counting the full model?) wins. #####  
mod1<-glm(data$adjusted.abundance~data$pH)  
mod2<-glm(data$adjusted.abundance~data$elevation)  
mod3<-glm(data$adjusted.abundance~data$fishpresence)  
mod4<-glm(data$adjusted.abundance~data$lenticlotic)   
mod5<-glm(data$adjusted.abundance~data$openwater)  
mod6<-glm(data$adjusted.abundance~data$pH\*data$elevation)  
mod7<-glm(data$adjusted.abundance~data$pH\*data$elevation\*data$fishpresence)  
mod8<-glm(data$adjusted.abundance~data$pH\*data$elevation\*data$fishpresence\*data$lenticlotic)  
mod9<-glm(data$adjusted.abundance~data$pH\*data$elevation\*data$fishpresence\*data$lenticlotic\*data$openwater)   
mod10<-glm(data$adjusted.abundance~data$elevation\*data$fishpresence)  
mod11<-glm(data$adjusted.abundance~data$elevation\*data$fishpresence\*data$lenticlotic)  
mod12<-glm(data$adjusted.abundance~data$elevation\*data$fishpresence\*data$lenticlotic\*data$openwater)  
mod13<-glm(data$adjusted.abundance~data$fishpresence\*data$lenticlotic)  
mod14<-glm(data$adjusted.abundance~data$fishpresence\*data$openwater) #### Chicken dinner #####  
mod15<-glm(data$adjusted.abundance~data$fishpresence\*data$lenticlotic\*data$openwater) #### Almost the same ####  
mod16<-glm(data$adjusted.abundance~data$lenticlotic\*data$openwater)  
  
  
  
AIC(mod1, k=2) ### k = 2 is the "penalty" for adding more factors #####

## [1] 217.9664

AIC(mod2, k=2)

## [1] 213.6784

AIC(mod3, k=2)

## [1] 217.9817

AIC(mod4, k=2)

## [1] 214.9074

AIC(mod5, k=2)

## [1] 212.3012

AIC(mod6, k=2)

## [1] 214.0008

AIC(mod7, k=2)

## [1] 215.5311

AIC(mod8, k=2)

## [1] 213.7232

AIC(mod9, k=2)

## [1] -1048.434

AIC(mod10, k=2)

## [1] 214.5525

AIC(mod11, k=2)

## [1] 220.7797

AIC(mod12, k=2)

## [1] 197.7667

AIC(mod13, k=2)

## [1] 218.3964

AIC(mod14, k=2) #### Chicken dinner #####

## [1] 196.2977

AIC(mod15, k=2) #### Almost the same, 0.1258 difference ####

## [1] 196.4235

AIC(mod16, k=2)

## [1] 214.1306

richness (jsut to see) vvvvv

### Each possible combination of variables needs to be analyzed. The lowest score (not counting the full model?) wins. #####  
mod1<-glm(data$Richness~data$pH)  
mod2<-glm(data$Richness~data$elevation)  
mod3<-glm(data$Richness~data$fishpresence)  
mod4<-glm(data$Richness~data$lenticlotic) #### Chicken dinner #####  
mod5<-glm(data$Richness~data$openwater)  
mod6<-glm(data$Richness~data$pH\*data$elevation)  
mod7<-glm(data$Richness~data$pH\*data$elevation\*data$fishpresence)  
mod8<-glm(data$Richness~data$pH\*data$elevation\*data$fishpresence\*data$lenticlotic)  
mod9<-glm(data$Richness~data$pH\*data$elevation\*data$fishpresence\*data$lenticlotic\*data$openwater)  
mod10<-glm(data$Richness~data$elevation\*data$fishpresence)  
mod11<-glm(data$Richness~data$elevation\*data$fishpresence\*data$lenticlotic)  
mod12<-glm(data$Richness~data$elevation\*data$fishpresence\*data$lenticlotic\*data$openwater)  
mod13<-glm(data$Richness~data$fishpresence\*data$lenticlotic)  
mod14<-glm(data$Richness~data$fishpresence\*data$openwater)  
mod15<-glm(data$Richness~data$fishpresence\*data$lenticlotic\*data$openwater)  
mod16<-glm(data$Richness~data$lenticlotic\*data$openwater)  
  
  
  
AIC(mod1, k=2) ### k = 2 is the "penalty" for adding more factors #####

## [1] 164.235

AIC(mod2, k=2)

## [1] 160.759

AIC(mod3, k=2)

## [1] 165.8397

AIC(mod4, k=2) #### Chicken dinner #####

## [1] 149.5434

AIC(mod5, k=2)

## [1] 163.4084

AIC(mod6, k=2)

## [1] 162.3076

AIC(mod7, k=2)

## [1] 165.6165

AIC(mod8, k=2)

## [1] 160.8072

AIC(mod9, k=2)

## [1] -1049.622

AIC(mod10, k=2)

## [1] 161.3178

AIC(mod11, k=2)

## [1] 155.129

AIC(mod12, k=2)

## [1] 151.3847

AIC(mod13, k=2)

## [1] 151.8263

AIC(mod14, k=2)

## [1] 166.4625

AIC(mod15, k=2)

## [1] 154.0367

AIC(mod16, k=2)

## [1] 150.7628