

## Beispiel 11.10. Ringfundanalysen zur Mortalitätsschätzung von juvenilen und adulten Stockenten (*Anas platyrhynchos*)

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Hier stellen wir einen Ringfund-Datensatz von Stockenten im San Luis Valley in Colorado vor. Beim diesem Datensatz werden Jung- und Alttiere unterschieden [Modell H1 von Brownie et al. (1985)]. Dazu nutzen wir den Datensatz von brownie, der im R-Paket RMark enthalten ist (Laake 2013). Erläuterungen finden sich in Laake und Rexstad (2013).

```
# check.packages function: install and load multiple R packages.
# Function from: https://gist.github.com/smithdanielle/9913897
check.packages <- function(pkg){
  new.pkg <- pkg[!(pkg %in% installed.packages()[, "Package"])]
  if (length(new.pkg))
    install.packages(new.pkg, dependencies = TRUE, type = "source")
  sapply(pkg, require, character.only = TRUE)
}

# benoetigte R pakete
pakete <- c("RMark", "ggplot2")

# Pruefe und installiere
check.packages(pakete)
```

```
## RMark ggplot2
## TRUE TRUE
```

Weitere Informationen zur Nutzung des Paketes finden sich hier:

<https://cran.r-project.org/web/packages/RMark/RMark.pdf>

Die Annahmen des Modells entsprechen denjenigen von Kap. 11.11 Modell 1, außer dass Jungvögel im ersten Lebensjahr und adulte Vögel eine unterschiedliche Überlebens- und Rückmelderate aufweisen. Damit kann dem Umstand Rechnung getragen werden, dass Jungvögel häufig eine erheblich höhere Mortalität aufweisen als Altvögel.

Der Datensatz ist im RMark-Paket (Laake 2013) als Beispiel integriert.

```
data("brownie")
head(brownie)
```

```
##           ch freq ReleaseAge
## 1 1000000000000000000000000 194      Adult
## 2 1100000000000000000000000  10      Adult
## 3 1001000000000000000000000  13      Adult
```

```
## 4 10000100000000000000 6 Adult
## 5 10000001000000000000 1 Adult
## 6 10000000010000000000 1 Adult
```

Die Standardsortierreihenfolge von RealeaseAge (also Alter der Beringung) ist alphabetisch, folglich: Adult, Young. Daher ist `initial.ages=c(1,0)`

## Seber Modell

Das Modell wird indiziert mit `model = "Recovery"` und geht auf Seber (1982) zurück. Details finden sich in Kapitel 11.11 des Buches.

```
br <- process.data(brownie,model="Recovery",groups="ReleaseAge",
  age.var=1,initial.ages=c(1,0))
br.ddl <- make.design.data(br,parameters=list(S=list(age.bins=c(0,1,10)),
  r=list(age.bins=c(0,1,10))),right=FALSE)
mod <- mark(br,br.ddl,
  model.parameters=list(S=list(formula=~-1+age:time,link="sin"),
  r=list(formula=~-1+age:time,link="sin")),delete=TRUE)
```

```
##
## Output summary for Recovery model
## Name : S(~-1 + age:time)r(~-1 + age:time)
##
## Npar : 36 (unadjusted=34)
## -2lnL: 20650.4
## AICc : 20722.57 (unadjusted=20718.554)
##
## Beta
##
## estimate se lcl ucl
## S:age[0,1]:time1 -0.0524435 0.1197357 -0.2871255 0.1822385
## S:age[1,10]:time1 0.1587899 0.2310334 -0.2940356 0.6116154
## S:age[0,1]:time2 0.0179440 0.1404892 -0.2574148 0.2933027
## S:age[1,10]:time2 0.2819125 0.1581181 -0.0279991 0.5918240
## S:age[0,1]:time3 0.1068975 0.1348959 -0.1574984 0.3712934
## S:age[1,10]:time3 0.2547029 0.1520851 -0.0433839 0.5527897
## S:age[0,1]:time4 0.1901296 0.1467227 -0.0974468 0.4777061
## S:age[1,10]:time4 0.8299081 0.3112308 0.2198957 1.4399205
## S:age[0,1]:time5 -0.0396188 0.1226789 -0.2800695 0.2008319
## S:age[1,10]:time5 0.3112348 0.1528207 0.0117062 0.6107635
## S:age[0,1]:time6 0.3152904 0.1527864 0.0158291 0.6147517
## S:age[1,10]:time6 0.1102404 0.1174259 -0.1199143 0.3403951
## S:age[0,1]:time7 -0.0661537 0.1368477 -0.3343753 0.2020679
## S:age[1,10]:time7 0.1528426 0.1352261 -0.1122006 0.4178857
## S:age[0,1]:time8 -0.1810578 0.2405948 -0.6526235 0.2905080
## S:age[1,10]:time8 0.1312937 0.2709547 -0.3997775 0.6623648
## S:age[0,1]:time9 -1.0075824 510.1421900 -1000.8863000 998.8711300
## S:age[1,10]:time9 0.6377650 0.0000000 0.6377650 0.6377650
## r:age[0,1]:time1 -0.7370080 0.0657532 -0.8658842 -0.6081317
## r:age[1,10]:time1 -0.9178819 0.1342330 -1.1809786 -0.6547852
## r:age[0,1]:time2 -0.4141179 0.1048336 -0.6195917 -0.2086440
## r:age[1,10]:time2 -0.5535656 0.1401768 -0.8283121 -0.2788191
## r:age[0,1]:time3 -0.7418327 0.0782931 -0.8952872 -0.5883782
## r:age[1,10]:time3 -0.7539209 0.1036718 -0.9571176 -0.5507243
## r:age[0,1]:time4 -0.3808190 0.1262969 -0.6283610 -0.1332770
```

```

## r:age[1,10]:time4  0.0278831  0.8753803  -1.6878623  1.7436286
## r:age[0,1):time5  -0.7078713  0.0662432  -0.8377079  -0.5780347
## r:age[1,10]:time5  -0.7753279  0.1108014  -0.9924985  -0.5581572
## r:age[0,1):time6  -0.4475538  0.1393154  -0.7206120  -0.1744955
## r:age[1,10]:time6  -0.7975263  0.0750975  -0.9447174  -0.6503351
## r:age[0,1):time7  -0.6293792  0.0755378  -0.7774333  -0.4813251
## r:age[1,10]:time7  -0.6785638  0.0940941  -0.8629881  -0.4941394
## r:age[0,1):time8  -0.7004678  0.1019667  -0.9003226  -0.5006129
## r:age[1,10]:time8  -0.6326277  0.1738161  -0.9733071  -0.2919482
## r:age[0,1):time9  -0.8736603  53.6321340  -105.9926500  104.2453200
## r:age[1,10]:time9  -0.3411521  0.0000000  -0.3411521  -0.3411521
##
##
## Real Parameter S
## Group:ReleaseAgeAdult
##      1      2      3      4      5      6      7      8      9
## 1 0.5790617 0.6390966 0.625979 0.8689347 0.6531172 0.5550086 0.5761241 0.5654584 0.7977006
## 2      0.6390966 0.625979 0.8689347 0.6531172 0.5550086 0.5761241 0.5654584 0.7977006
## 3      0.625979 0.8689347 0.6531172 0.5550086 0.5761241 0.5654584 0.7977006
## 4      0.8689347 0.6531172 0.5550086 0.5761241 0.5654584 0.7977006
## 5      0.6531172 0.5550086 0.5761241 0.5654584 0.7977006
## 6      0.5550086 0.5761241 0.5654584 0.7977006
## 7      0.5761241 0.5654584 0.7977006
## 8      0.5654584 0.7977006
## 9      0.7977006
##
## Group:ReleaseAgeYoung
##      1      2      3      4      5      6      7      8      9
## 1 0.4737903 0.6390966 0.625979 0.8689347 0.6531172 0.5550086 0.5761241 0.5654584 0.7977006
## 2      0.5089715 0.625979 0.8689347 0.6531172 0.5550086 0.5761241 0.5654584 0.7977006
## 3      0.553347 0.8689347 0.6531172 0.5550086 0.5761241 0.5654584 0.7977006
## 4      0.5944931 0.6531172 0.5550086 0.5761241 0.5654584 0.7977006
## 5      0.4801958 0.5550086 0.5761241 0.5654584 0.7977006
## 6      0.6550463 0.5761241 0.5654584 0.7977006
## 7      0.4669473 0.5654584 0.7977006
## 8      0.4099649 0.7977006
## 9      0.0772282
##
##
## Real Parameter r
## Group:ReleaseAgeAdult
##      1      2      3      4      5      6      7      8      9
## 1 0.1028417 0.2371382 0.1577488 0.5139398 0.1500249 0.1421848 0.1861622 0.204367 0.3327135
## 2      0.2371382 0.1577488 0.5139398 0.1500249 0.1421848 0.1861622 0.204367 0.3327135
## 3      0.1577488 0.5139398 0.1500249 0.1421848 0.1861622 0.204367 0.3327135
## 4      0.5139398 0.1500249 0.1421848 0.1861622 0.204367 0.3327135
## 5      0.1500249 0.1421848 0.1861622 0.204367 0.3327135
## 6      0.1421848 0.1861622 0.204367 0.3327135
## 7      0.1861622 0.204367 0.3327135
## 8      0.204367 0.3327135
## 9      0.3327135
##
## Group:ReleaseAgeYoung
##      1      2      3      4      5      6      7      8      9

```

```
## 1 0.1639623 0.2371382 0.1577488 0.5139398 0.1500249 0.1421848 0.1861622 0.2043670 0.3327135
## 2          0.2988087 0.1577488 0.5139398 0.1500249 0.1421848 0.1861622 0.2043670 0.3327135
## 3          0.1621799 0.5139398 0.1500249 0.1421848 0.1861622 0.2043670 0.3327135
## 4          0.3141595 0.1500249 0.1421848 0.1861622 0.2043670 0.3327135
## 5          0.1748910 0.1421848 0.1861622 0.2043670 0.3327135
## 6          0.2836192 0.1861622 0.2043670 0.3327135
## 7          0.2056785 0.2043670 0.3327135
## 8          0.1777123 0.3327135
## 9          0.1166580
```

```
summary(mod)
```

```
## Output summary for Recovery model
## Name : S(~-1 + age:time)r(~-1 + age:time)
##
## Npar : 36 (unadjusted=34)
## -2lnL: 20650.4
## AICc : 20722.57 (unadjusted=20718.554)
##
## Beta
##          estimate      se      lcl      ucl
## S:age[0,1]:time1 -0.0524435 0.1197357 -0.2871255 0.1822385
## S:age[1,10]:time1 0.1587899 0.2310334 -0.2940356 0.6116154
## S:age[0,1]:time2 0.0179440 0.1404892 -0.2574148 0.2933027
## S:age[1,10]:time2 0.2819125 0.1581181 -0.0279991 0.5918240
## S:age[0,1]:time3 0.1068975 0.1348959 -0.1574984 0.3712934
## S:age[1,10]:time3 0.2547029 0.1520851 -0.0433839 0.5527897
## S:age[0,1]:time4 0.1901296 0.1467227 -0.0974468 0.4777061
## S:age[1,10]:time4 0.8299081 0.3112308 0.2198957 1.4399205
## S:age[0,1]:time5 -0.0396188 0.1226789 -0.2800695 0.2008319
## S:age[1,10]:time5 0.3112348 0.1528207 0.0117062 0.6107635
## S:age[0,1]:time6 0.3152904 0.1527864 0.0158291 0.6147517
## S:age[1,10]:time6 0.1102404 0.1174259 -0.1199143 0.3403951
## S:age[0,1]:time7 -0.0661537 0.1368477 -0.3343753 0.2020679
## S:age[1,10]:time7 0.1528426 0.1352261 -0.1122006 0.4178857
## S:age[0,1]:time8 -0.1810578 0.2405948 -0.6526235 0.2905080
## S:age[1,10]:time8 0.1312937 0.2709547 -0.3997775 0.6623648
## S:age[0,1]:time9 -1.0075824 510.1421900 -1000.8863000 998.8711300
## S:age[1,10]:time9 0.6377650 0.0000000 0.6377650 0.6377650
## r:age[0,1]:time1 -0.7370080 0.0657532 -0.8658842 -0.6081317
## r:age[1,10]:time1 -0.9178819 0.1342330 -1.1809786 -0.6547852
## r:age[0,1]:time2 -0.4141179 0.1048336 -0.6195917 -0.2086440
## r:age[1,10]:time2 -0.5535656 0.1401768 -0.8283121 -0.2788191
## r:age[0,1]:time3 -0.7418327 0.0782931 -0.8952872 -0.5883782
## r:age[1,10]:time3 -0.7539209 0.1036718 -0.9571176 -0.5507243
## r:age[0,1]:time4 -0.3808190 0.1262969 -0.6283610 -0.1332770
## r:age[1,10]:time4 0.0278831 0.8753803 -1.6878623 1.7436286
## r:age[0,1]:time5 -0.7078713 0.0662432 -0.8377079 -0.5780347
## r:age[1,10]:time5 -0.7753279 0.1108014 -0.9924985 -0.5581572
## r:age[0,1]:time6 -0.4475538 0.1393154 -0.7206120 -0.1744955
## r:age[1,10]:time6 -0.7975263 0.0750975 -0.9447174 -0.6503351
## r:age[0,1]:time7 -0.6293792 0.0755378 -0.7774333 -0.4813251
## r:age[1,10]:time7 -0.6785638 0.0940941 -0.8629881 -0.4941394
## r:age[0,1]:time8 -0.7004678 0.1019667 -0.9003226 -0.5006129
## r:age[1,10]:time8 -0.6326277 0.1738161 -0.9733071 -0.2919482
```

```

## r:age[0,1):time9 -0.8736603 53.6321340 -105.9926500 104.2453200
## r:age[1,10]:time9 -0.3411521 0.0000000 -0.3411521 -0.3411521
##
##
## Real Parameter S
## Group:ReleaseAgeAdult
##      1      2      3      4      5      6      7      8      9
## 1 0.5790617 0.6390966 0.625979 0.8689347 0.6531172 0.5550086 0.5761241 0.5654584 0.7977006
## 2      0.6390966 0.625979 0.8689347 0.6531172 0.5550086 0.5761241 0.5654584 0.7977006
## 3      0.625979 0.8689347 0.6531172 0.5550086 0.5761241 0.5654584 0.7977006
## 4      0.8689347 0.6531172 0.5550086 0.5761241 0.5654584 0.7977006
## 5      0.6531172 0.5550086 0.5761241 0.5654584 0.7977006
## 6      0.5550086 0.5761241 0.5654584 0.7977006
## 7      0.5761241 0.5654584 0.7977006
## 8      0.5654584 0.7977006
## 9      0.7977006
##
## Group:ReleaseAgeYoung
##      1      2      3      4      5      6      7      8      9
## 1 0.4737903 0.6390966 0.625979 0.8689347 0.6531172 0.5550086 0.5761241 0.5654584 0.7977006
## 2      0.5089715 0.625979 0.8689347 0.6531172 0.5550086 0.5761241 0.5654584 0.7977006
## 3      0.553347 0.8689347 0.6531172 0.5550086 0.5761241 0.5654584 0.7977006
## 4      0.5944931 0.6531172 0.5550086 0.5761241 0.5654584 0.7977006
## 5      0.4801958 0.5550086 0.5761241 0.5654584 0.7977006
## 6      0.6550463 0.5761241 0.5654584 0.7977006
## 7      0.4669473 0.5654584 0.7977006
## 8      0.4099649 0.7977006
## 9      0.0772282
##
##
## Real Parameter r
## Group:ReleaseAgeAdult
##      1      2      3      4      5      6      7      8      9
## 1 0.1028417 0.2371382 0.1577488 0.5139398 0.1500249 0.1421848 0.1861622 0.204367 0.3327135
## 2      0.2371382 0.1577488 0.5139398 0.1500249 0.1421848 0.1861622 0.204367 0.3327135
## 3      0.1577488 0.5139398 0.1500249 0.1421848 0.1861622 0.204367 0.3327135
## 4      0.5139398 0.1500249 0.1421848 0.1861622 0.204367 0.3327135
## 5      0.1500249 0.1421848 0.1861622 0.204367 0.3327135
## 6      0.1421848 0.1861622 0.204367 0.3327135
## 7      0.1861622 0.204367 0.3327135
## 8      0.204367 0.3327135
## 9      0.3327135
##
## Group:ReleaseAgeYoung
##      1      2      3      4      5      6      7      8      9
## 1 0.1639623 0.2371382 0.1577488 0.5139398 0.1500249 0.1421848 0.1861622 0.2043670 0.3327135
## 2      0.2988087 0.1577488 0.5139398 0.1500249 0.1421848 0.1861622 0.2043670 0.3327135
## 3      0.1621799 0.5139398 0.1500249 0.1421848 0.1861622 0.2043670 0.3327135
## 4      0.3141595 0.1500249 0.1421848 0.1861622 0.2043670 0.3327135
## 5      0.1748910 0.1421848 0.1861622 0.2043670 0.3327135
## 6      0.2836192 0.1861622 0.2043670 0.3327135
## 7      0.2056785 0.2043670 0.3327135
## 8      0.1777123 0.3327135
## 9      0.1166580

```

```
# konkret die Schätzwerte aufrufen
mod.seber <- mod$results$real
```

Die Überlebensraten der adulten beringten Vögel ist höher als der jung beringten Vögel.

## Brownie Modell

Das Modell wird indiziert mit `model = "Brownie"` und geht auf Brownie et al. (1985) zurück. Details finden sich in Kapitel 11.11 des Buches.

```
br=process.data(brownie,model="Brownie",groups="ReleaseAge",
               age.var=1,initial.ages=c(1,0))
br.ddl=make.design.data(br,
                       parameters=list(S=list(age.bins=c(0,1,10)),

f=list(age.bins=c(0,1,10))),right=FALSE)
mod=mark(br,br.ddl,
        model.parameters=list(S=list(formula=~-1+age:time,link="sin"),

f=list(formula=~-1+age:time,link="sin")),delete=TRUE)
```

```
##
## Output summary for Brownie model
## Name : S(~-1 + age:time)f(~-1 + age:time)
##
## Npar : 34
## -2lnL: 20650.4
## AICc : 20718.55
##
## Beta
##
```

	estimate	se	lcl	ucl
S:age[0,1]:time1	3.1940363	0.1197356	2.9593545	3.4287182
S:age[1,10]:time1	0.1587910	0.2310322	-0.2940321	0.6116142
S:age[0,1]:time2	0.0179447	0.1404889	-0.2574136	0.2933030
S:age[1,10]:time2	0.2819131	0.1581180	-0.0279981	0.5918243
S:age[0,1]:time3	0.1068982	0.1348936	-0.1574933	0.3712897
S:age[1,10]:time3	0.2547035	0.1520827	-0.0433786	0.5527856
S:age[0,1]:time4	2.9514640	0.1467209	2.6638910	3.2390370
S:age[1,10]:time4	0.8299043	0.3112129	0.2199271	1.4398816
S:age[0,1]:time5	-0.0396190	0.1226788	-0.2800693	0.2008314
S:age[1,10]:time5	0.3112360	0.1528193	0.0117102	0.6107618
S:age[0,1]:time6	0.3152913	0.1527865	0.0158299	0.6147528
S:age[1,10]:time6	3.0313520	0.1174257	2.8011977	3.2615064
S:age[0,1]:time7	-0.0661529	0.1368476	-0.3343742	0.2020683
S:age[1,10]:time7	2.9887505	0.1352259	2.7237078	3.2537932
S:age[0,1]:time8	3.3226494	0.2405932	2.8510868	3.7942120
S:age[1,10]:time8	0.1312944	0.2709518	-0.3997710	0.6623599
f:age[0,1]:time1	-0.9745385	0.0322413	-1.0377315	-0.9113456
f:age[1,10]:time1	-1.1516087	0.0657952	-1.2805672	-1.0226502
f:age[0,1]:time2	-0.7846149	0.0377426	-0.8585903	-0.7106395
f:age[1,10]:time2	-0.9770169	0.0328456	-1.0413943	-0.9126396
f:age[0,1]:time3	-1.0257894	0.0297219	-1.0840443	-0.9675344
f:age[1,10]:time3	-1.0800838	0.0259161	-1.1308793	-1.0292883
f:age[0,1]:time4	-0.8408532	0.0288555	-0.8974100	-0.7842964

```

## f:age[1,10]:time4 -1.0457101 0.0287228 -1.1020068 -0.9894134
## f:age[0,1):time5 -0.9582416 0.0288795 -1.0148455 -0.9016377
## f:age[1,10]:time5 -2.0310996 0.0226914 -2.0755747 -1.9866245
## f:age[0,1):time6 -0.9345453 0.0294245 -0.9922173 -0.8768733
## f:age[1,10]:time6 -2.0793329 0.0225826 -2.1235948 -2.0350710
## f:age[0,1):time7 -0.8958253 0.0297351 -0.9541060 -0.8375446
## f:age[1,10]:time7 -2.1402778 0.0224472 -2.1842743 -2.0962812
## f:age[0,1):time8 -0.9112772 0.0332228 -0.9763938 -0.8461605
## f:age[1,10]:time8 -2.1759968 0.0282601 -2.2313867 -2.1206070
## f:age[0,1):time9 -0.9022161 0.0532246 -1.0065364 -0.7978959
## f:age[1,10]:time9 -1.0459175 0.0566137 -1.1568804 -0.9349547
##
##
## Real Parameter S
## Group:ReleaseAgeAdult
##      1      2      3      4      5      6      7      8
## 1 0.5790623 0.6390969 0.6259792 0.8689334 0.6531177 0.5550087 0.5761239 0.5654588
## 2      0.6390969 0.6259792 0.8689334 0.6531177 0.5550087 0.5761239 0.5654588
## 3      0.6259792 0.8689334 0.6531177 0.5550087 0.5761239 0.5654588
## 4      0.8689334 0.6531177 0.5550087 0.5761239 0.5654588
## 5      0.6531177 0.5550087 0.5761239 0.5654588
## 6      0.5550087 0.5761239 0.5654588
## 7      0.5761239 0.5654588
## 8      0.5654588
##
## Group:ReleaseAgeYoung
##      1      2      3      4      5      6      7      8
## 1 0.4737902 0.6390969 0.6259792 0.8689334 0.6531177 0.5550087 0.5761239 0.5654588
## 2      0.5089719 0.6259792 0.8689334 0.6531177 0.5550087 0.5761239 0.5654588
## 3      0.5533474 0.8689334 0.6531177 0.5550087 0.5761239 0.5654588
## 4      0.5944926 0.6531177 0.5550087 0.5761239 0.5654588
## 5      0.4801957 0.5550087 0.5761239 0.5654588
## 6      0.6550467 0.5761239 0.5654588
## 7      0.4669477 0.5654588
## 8      0.4099654
##
##
## Real Parameter f
## Group:ReleaseAgeAdult
##      1      2      3      4      5      6      7      8      9
## 1 0.0432901 0.085584 0.0590014 0.0673596 0.0520411 0.063271 0.0789097 0.088806 0.0673077
## 2      0.085584 0.0590014 0.0673596 0.0520411 0.063271 0.0789097 0.088806 0.0673077
## 3      0.0590014 0.0673596 0.0520411 0.063271 0.0789097 0.088806 0.0673077
## 4      0.0673596 0.0520411 0.063271 0.0789097 0.088806 0.0673077
## 5      0.0520411 0.063271 0.0789097 0.088806 0.0673077
## 6      0.063271 0.0789097 0.088806 0.0673077
## 7      0.0789097 0.088806 0.0673077
## 8      0.088806 0.0673077
## 9      0.0673077
##
## Group:ReleaseAgeYoung
##      1      2      3      4      5      6      7      8      9
## 1 0.0862786 0.0855840 0.0590014 0.0673596 0.0520411 0.0632710 0.0789097 0.0888060 0.0673077
## 2      0.1467236 0.0590014 0.0673596 0.0520411 0.0632710 0.0789097 0.0888060 0.0673077

```

```
## 3          0.0724382 0.0673596 0.0520411 0.0632710 0.0789097 0.0888060 0.0673077
## 4          0.1273938 0.0520411 0.0632710 0.0789097 0.0888060 0.0673077
## 5          0.0909091 0.0632710 0.0789097 0.0888060 0.0673077
## 6          0.0978355 0.0789097 0.0888060 0.0673077
## 7          0.1096375 0.0888060 0.0673077
## 8          0.1048565 0.0673077
## 9          0.1076487
```

```
#mod=mark(br,br.ddl,model.parameters=list(S=list(formula=~-1+age,link="sin"),
#
#f=list(formula=~-1+age,link="sin")),delete=TRUE)
summary(mod)
```

```
## Output summary for Brownie model
```

```
## Name : S(~-1 + age:time)f(~-1 + age:time)
```

```
##
```

```
## Npar : 34
```

```
## -2lnL: 20650.4
```

```
## AICc : 20718.55
```

```
##
```

```
## Beta
```

	estimate	se	lcl	ucl
## S:age[0,1]:time1	3.1940363	0.1197356	2.9593545	3.4287182
## S:age[1,10]:time1	0.1587910	0.2310322	-0.2940321	0.6116142
## S:age[0,1]:time2	0.0179447	0.1404889	-0.2574136	0.2933030
## S:age[1,10]:time2	0.2819131	0.1581180	-0.0279981	0.5918243
## S:age[0,1]:time3	0.1068982	0.1348936	-0.1574933	0.3712897
## S:age[1,10]:time3	0.2547035	0.1520827	-0.0433786	0.5527856
## S:age[0,1]:time4	2.9514640	0.1467209	2.6638910	3.2390370
## S:age[1,10]:time4	0.8299043	0.3112129	0.2199271	1.4398816
## S:age[0,1]:time5	-0.0396190	0.1226788	-0.2800693	0.2008314
## S:age[1,10]:time5	0.3112360	0.1528193	0.0117102	0.6107618
## S:age[0,1]:time6	0.3152913	0.1527865	0.0158299	0.6147528
## S:age[1,10]:time6	3.0313520	0.1174257	2.8011977	3.2615064
## S:age[0,1]:time7	-0.0661529	0.1368476	-0.3343742	0.2020683
## S:age[1,10]:time7	2.9887505	0.1352259	2.7237078	3.2537932
## S:age[0,1]:time8	3.3226494	0.2405932	2.8510868	3.7942120
## S:age[1,10]:time8	0.1312944	0.2709518	-0.3997710	0.6623599
## f:age[0,1]:time1	-0.9745385	0.0322413	-1.0377315	-0.9113456
## f:age[1,10]:time1	-1.1516087	0.0657952	-1.2805672	-1.0226502
## f:age[0,1]:time2	-0.7846149	0.0377426	-0.8585903	-0.7106395
## f:age[1,10]:time2	-0.9770169	0.0328456	-1.0413943	-0.9126396
## f:age[0,1]:time3	-1.0257894	0.0297219	-1.0840443	-0.9675344
## f:age[1,10]:time3	-1.0800838	0.0259161	-1.1308793	-1.0292883
## f:age[0,1]:time4	-0.8408532	0.0288555	-0.8974100	-0.7842964
## f:age[1,10]:time4	-1.0457101	0.0287228	-1.1020068	-0.9894134
## f:age[0,1]:time5	-0.9582416	0.0288795	-1.0148455	-0.9016377
## f:age[1,10]:time5	-2.0310996	0.0226914	-2.0755747	-1.9866245
## f:age[0,1]:time6	-0.9345453	0.0294245	-0.9922173	-0.8768733
## f:age[1,10]:time6	-2.0793329	0.0225826	-2.1235948	-2.0350710
## f:age[0,1]:time7	-0.8958253	0.0297351	-0.9541060	-0.8375446
## f:age[1,10]:time7	-2.1402778	0.0224472	-2.1842743	-2.0962812
## f:age[0,1]:time8	-0.9112772	0.0332228	-0.9763938	-0.8461605
## f:age[1,10]:time8	-2.1759968	0.0282601	-2.2313867	-2.1206070
## f:age[0,1]:time9	-0.9022161	0.0532246	-1.0065364	-0.7978959



```

## f:age[1,10]:time9 -1.0459175 0.0566137 -1.1568804 -0.9349547
##
##
## Real Parameter S
## Group:ReleaseAgeAdult
##      1      2      3      4      5      6      7      8
## 1 0.5790623 0.6390969 0.6259792 0.8689334 0.6531177 0.5550087 0.5761239 0.5654588
## 2      0.6390969 0.6259792 0.8689334 0.6531177 0.5550087 0.5761239 0.5654588
## 3      0.6259792 0.8689334 0.6531177 0.5550087 0.5761239 0.5654588
## 4      0.8689334 0.6531177 0.5550087 0.5761239 0.5654588
## 5      0.6531177 0.5550087 0.5761239 0.5654588
## 6      0.5550087 0.5761239 0.5654588
## 7      0.5761239 0.5654588
## 8      0.5654588
##
## Group:ReleaseAgeYoung
##      1      2      3      4      5      6      7      8
## 1 0.4737902 0.6390969 0.6259792 0.8689334 0.6531177 0.5550087 0.5761239 0.5654588
## 2      0.5089719 0.6259792 0.8689334 0.6531177 0.5550087 0.5761239 0.5654588
## 3      0.5533474 0.8689334 0.6531177 0.5550087 0.5761239 0.5654588
## 4      0.5944926 0.6531177 0.5550087 0.5761239 0.5654588
## 5      0.4801957 0.5550087 0.5761239 0.5654588
## 6      0.6550467 0.5761239 0.5654588
## 7      0.4669477 0.5654588
## 8      0.4099654
##
##
## Real Parameter f
## Group:ReleaseAgeAdult
##      1      2      3      4      5      6      7      8      9
## 1 0.0432901 0.085584 0.0590014 0.0673596 0.0520411 0.063271 0.0789097 0.088806 0.0673077
## 2      0.085584 0.0590014 0.0673596 0.0520411 0.063271 0.0789097 0.088806 0.0673077
## 3      0.0590014 0.0673596 0.0520411 0.063271 0.0789097 0.088806 0.0673077
## 4      0.0673596 0.0520411 0.063271 0.0789097 0.088806 0.0673077
## 5      0.0520411 0.063271 0.0789097 0.088806 0.0673077
## 6      0.063271 0.0789097 0.088806 0.0673077
## 7      0.0789097 0.088806 0.0673077
## 8      0.088806 0.0673077
## 9      0.0673077
##
## Group:ReleaseAgeYoung
##      1      2      3      4      5      6      7      8      9
## 1 0.0862786 0.0855840 0.0590014 0.0673596 0.0520411 0.0632710 0.0789097 0.0888060 0.0673077
## 2      0.1467236 0.0590014 0.0673596 0.0520411 0.0632710 0.0789097 0.0888060 0.0673077
## 3      0.0724382 0.0673596 0.0520411 0.0632710 0.0789097 0.0888060 0.0673077
## 4      0.1273938 0.0520411 0.0632710 0.0789097 0.0888060 0.0673077
## 5      0.0909091 0.0632710 0.0789097 0.0888060 0.0673077
## 6      0.0978355 0.0789097 0.0888060 0.0673077
## 7      0.1096375 0.0888060 0.0673077
## 8      0.1048565 0.0673077
## 9      0.1076487

```

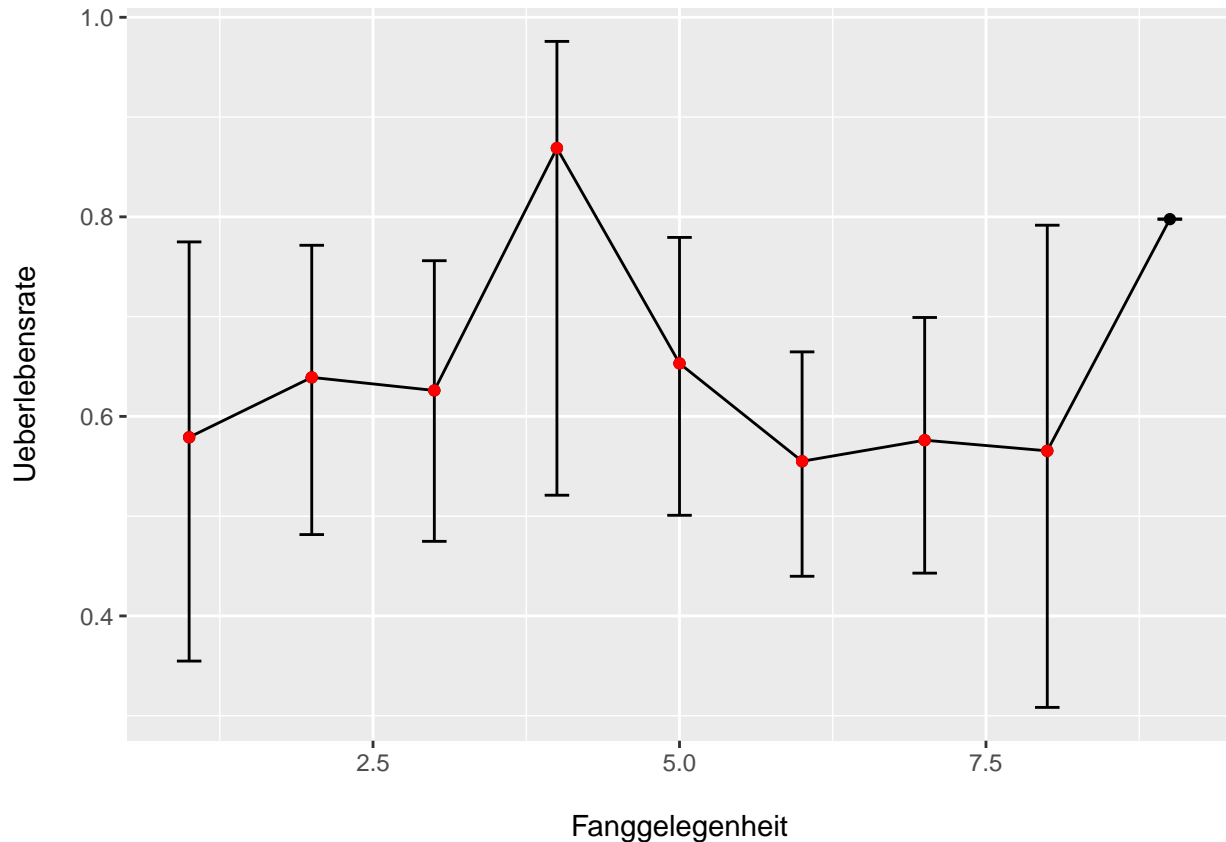
*# konkret die Schätzwerte aufrufen*

```
mod.brownie <- mod$results$real
```

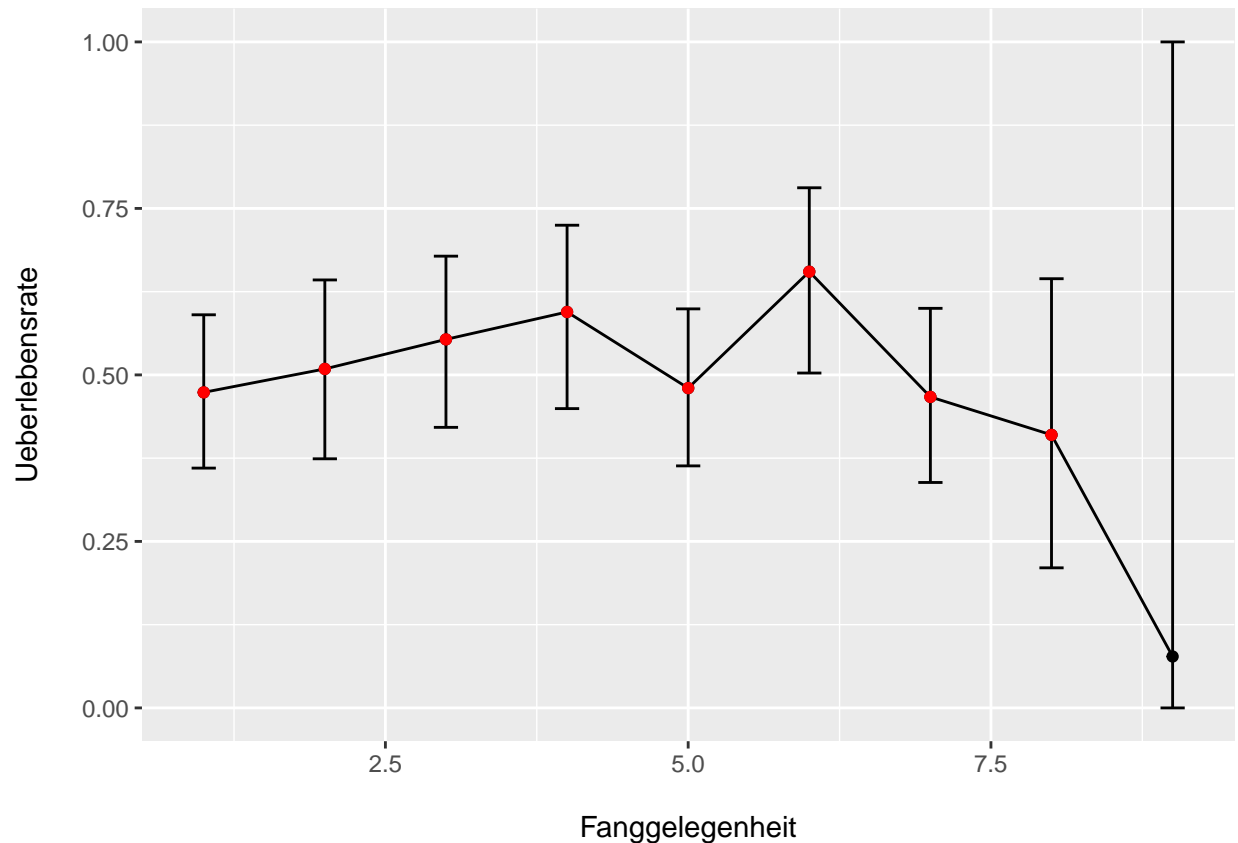
Vergleichen wir die Daten aus beiden Modellen miteinander. Dazu nutzen wir das Paket ggplot2 (Wickham 2016).

```
mod.seber.adult <- mod.seber[1:9,]
mod.seber.adult$Occasion <- 1:9
mod.seber.young <- mod.seber[10:18,]
mod.seber.young$Occasion <- 1:9
mod.brownie.adult <- mod.brownie[1:8,]
mod.brownie.adult$Occasion <- 1:8
mod.brownie.young <- mod.brownie[9:16,]
mod.brownie.young$Occasion <- 1:8

# Adult markierte Tiere
ggplot(mod.seber.adult, aes(Occasion, estimate,
                           ymin=lcl, ymax=ucl)) +
  geom_errorbar(width=0.2) + geom_point() + geom_line() +
  geom_point(data=mod.brownie.adult,
            aes(Occasion, estimate, ymin=lcl, ymax=ucl), color="red") +
  xlab("\nFanggelegenheit") + ylab("Ueberlebensrate\n")
```



```
# Juvenil markierte Tiere
ggplot(mod.seber.young, aes(Occasion, estimate,
                           ymin=lcl, ymax=ucl)) +
  geom_errorbar(width=0.2) + geom_point() + geom_line() +
  geom_point(data=mod.brownie.young,
            aes(Occasion, estimate, ymin=lcl, ymax=ucl), color="red") +
  xlab("\nFanggelegenheit") + ylab("Ueberlebensrate\n")
```



Die berechneten Überlebensraten sind nahezu identisch.

## Literaturverzeichnis

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Wickham, H. 2016. ggplot2: Elegant Graphics for Data Analysis. Springer-Verlag, New York.