8.4 Selection Ratios

Manual of Applied Spatial Ecology

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We are going to focus the remainder of this chapter on Selection Ratios and Resource Selection Functions (RSFs) because Selection Ratios identify a general use of habitat given what is available that can be further explored and studied through use of RSFs. Resource Selection Functions are spatially-explicit models that predict the (relative) probability of use by an animal at a given area/location during a given time, based on the environmental conditions that influence or account for selection. There are numerous types of RSFs that can be performed based on the availability of data collected during the study and there are volumes of literature devoted to the topic of resource selection and sampling designs for radiotelemetry studies (Manly et al. 2002, Cooper and Millspaugh 2001, Erickson et al. 2001, Leban et al. 2001).

Selection Ratio basic functions

widesI may be used to explore resource selection by animals when designs I occur (i.e., habitat use and availability are measured at the population level because individual animals are not identified). The Manly selectivity measure (selection ratio = used/available) is computed and preference/avoidance is tested for each habitat, and the differences between selection ratios are computed and tested (Manly et al. 2002).

widesII computes the selection ratios with design II data (i.e., the same availability for all animals, but use is measured for each one). An example would be to place a minimum convex polygon around all animal locations throughout a study site and define this as "available" to all animals.

widesIII computes the selection ratios for design III data (i.e., use and the availability are measured for each animal with use and availability unique to each individuals movements and habitat use).

Note that all these methods rely on the following hypotheses: (i) independence between animals, and (ii) all animals are selecting habitat in the same way (in addition to "traditional" hypotheses in these kinds of studies: no territoriality, all animals having equal access to all available resource units, etc. (Manly et al. 2002).

1. Exercise 8.3 - Download and extract zip folder into your preferred location

2. Set working directory to the extracted folder in R under Session - Set Working Directory…

3. Now open the script MuleDeerSR.Rmd" and run code directly from the script

4. First we need to load the packages needed for the exercise

```
library(adehabitatHS)
```

5. Load the mule deer dataset we used in the previous exercise with 5 habitat categories: 1 = Sunflower,summer crops, random crops, grassland 2 = Winter crops 3 = Alfalfa 4 = Forest 5 = Shrubland

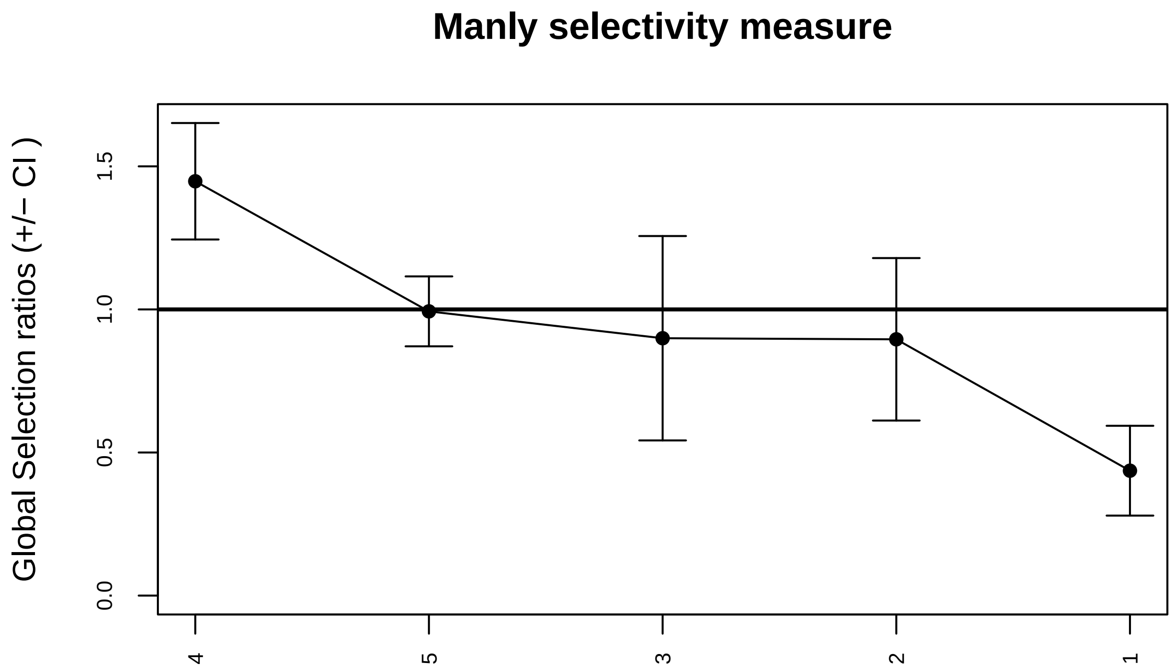
```
MDsr <- read.csv("MD_winter12.csv",header=T)
#Remove deer that cause errors in plot function later
MDsr <- subset(MDsr,MDsr$animal_id !="647579A")
MDsr$animal_id <- factor(MDsr$animal_id)
used <- subset(MDsr, MDsr$use == 1)
used <- used[c(-1,-3:-6,-8:-15)]
used <- xtabs(~used$animal_id + used$crop, used)
```

```r
used <- as.data.frame.matrix(used[1:13, 1:5])

rand <- subset(MDsr, MDsr$use == 0)
rand <- rand[c(-1,-3:-6,-8:-16)]
rand <- xtabs(~rand$animal_id + rand$crop, rand)
rand <- as.data.frame.matrix(rand[1:13, 1:5])

# PVT Code for VegRSF #
pvt.W <- widesIII(used,rand,avknown = FALSE, alpha = 0.1)
pvt.W
```

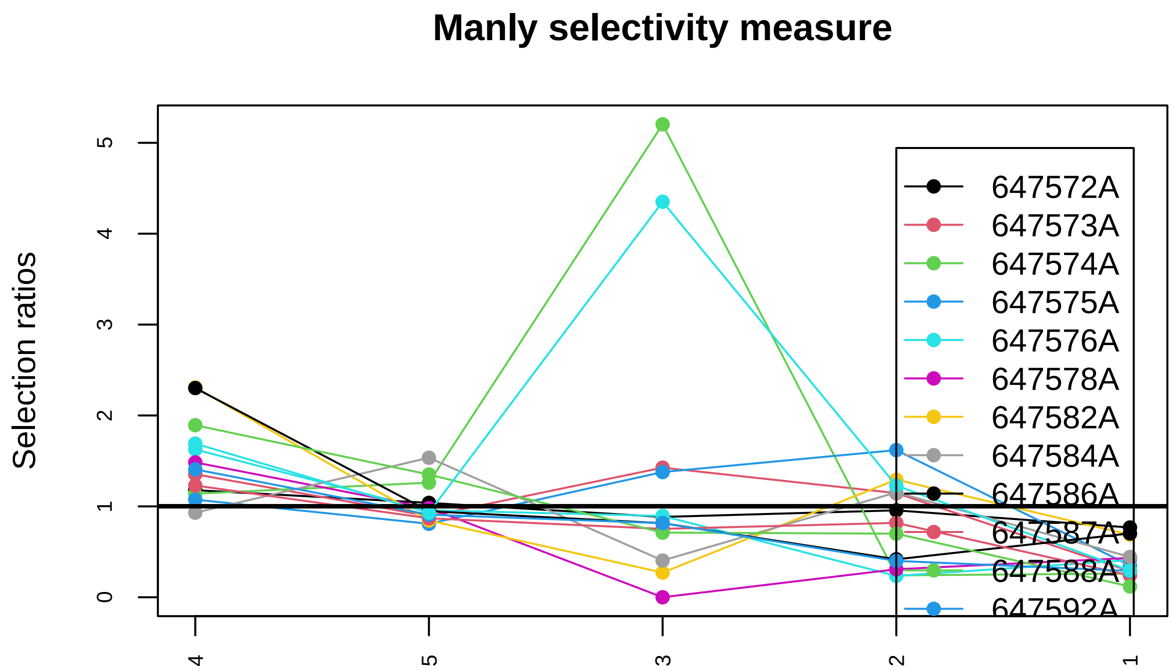
```
##
##
## ************** Manly's Selection ratios for design III ********
##
## 1. Test of habitat selection for each animal:
##
##             Khi2Lj df       pvalue
## 647572A  12.91033  4 1.172236e-02
## 647573A 152.03711  4 0.000000e+00
## 647574A 294.32661  4 0.000000e+00
## 647575A 121.30788  4 0.000000e+00
## 647576A 159.37964  4 0.000000e+00
## 647578A  30.86599  3 9.071081e-07
## 647582A 165.65100  4 0.000000e+00
## 647584A 201.84871  4 0.000000e+00
## 647586A 186.57206  4 0.000000e+00
## 647587A  32.81041  4 1.306135e-06
## 647588A 400.29363  4 0.000000e+00
## 647592A 119.00251  4 0.000000e+00
## 647593A 391.90801  4 0.000000e+00
##
##
## 2. Test of overall habitat selection:
##    Khi2L       df   pvalue
## 2268.914   51.000    0.000
##
##
## Table of selection ratios:
##          Wi          SE ICLower ICupper
## 1 0.4364081 0.07639517  0.2587  0.6141
## 2 0.8955675 0.13824727  0.5740  1.2172
## 3 0.8993044 0.17389108  0.4948  1.3038
## 4 1.4478687 0.09908524  1.2174  1.6784
## 5 0.9932287 0.05949948  0.8548  1.1316
##
##
## Bonferroni classement
## Based on 90 % confidence intervals on the differences of Wi :
##
## habitat  4  5  3  2  1
## 4       ---
## 5          ---------
## 3          ---------
```

```
## 2          ---------
## 1                    ---
```

```
plot(pvt.W)
```



Manly selectivity measure
Global Selection ratios (+/− CI)
0.0
0.5
1.0
1.5
4
5
3
2
1

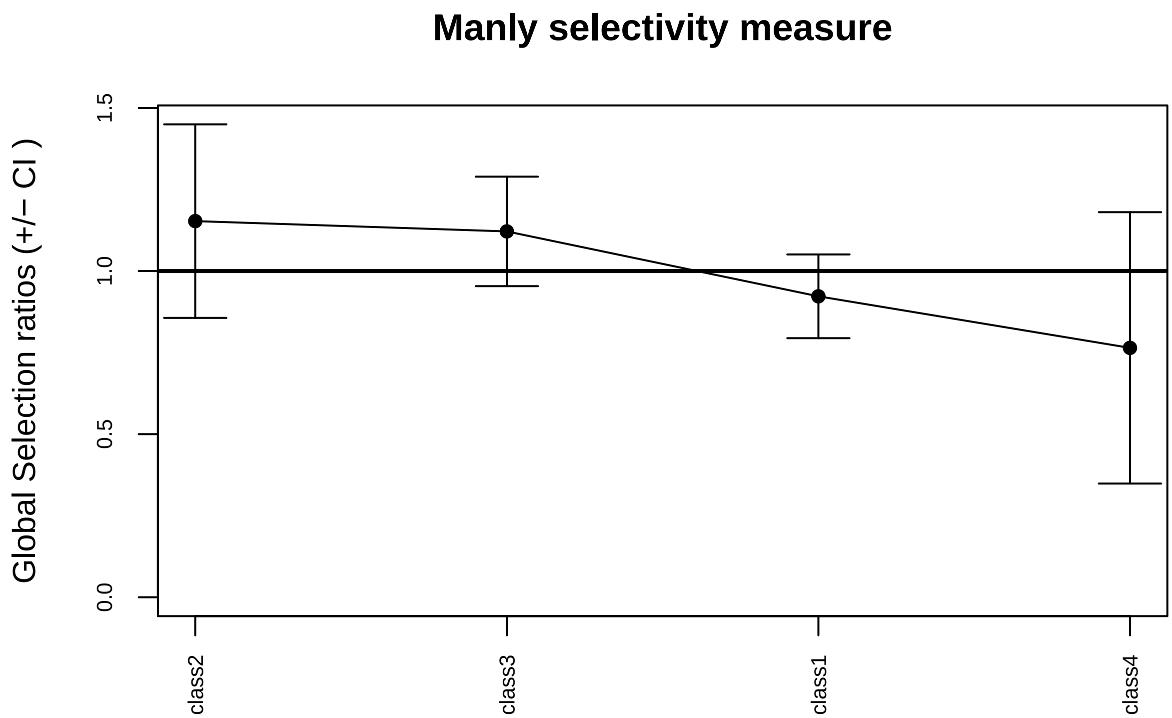


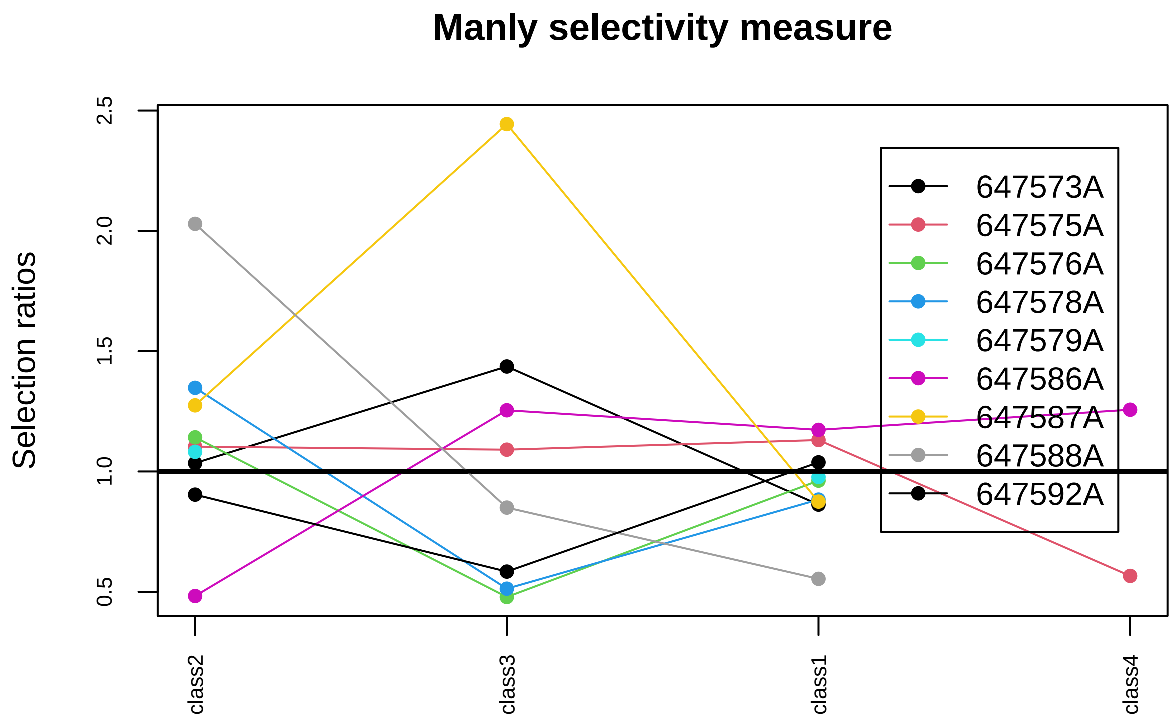
Next we will run on distance to road binned into 10 categories

```
#Now run on distance to roads binned into 10 categories
MDsr_road <- read.csv("MD_winter12.csv",header=T)
#Delete deer that have limited data and will result in errors in code below
MDsr_road <- subset(MDsr_road,MDsr_road$animal_id !="647582A" & MDsr_road$animal_id
!="647584A" & MDsr_road$animal_id !="647572A" & MDsr_road$animal_id !="647574A" &
MDsr_road$animal_id !="647593A" )
MDsr_road$animal_id <- factor(MDsr_road$animal_id)

#Bin roads into 4 categories instead of 10
MDsr_road$NewRoad <- as.factor(MDsr_road$BinRoad)
levels(MDsr_road$NewRoad)<-list(class1=c("0-200","200-400"), class2=c("400-600","600-800"),
class3=c("800-1000","1000-12000","1200-1400"),class4=c("1400-1600","1600-1800","1800-2000"))

used_road <- subset(MDsr_road, MDsr_road$use == 1)
used_road <- used_road[c(-1:-6,-8:-15)]
used_road <- xtabs(~used_road$animal_id + used_road$NewRoad, used_road)
used_road <- as.data.frame.matrix(used_road[1:9, 1:4])

rand_road <- subset(MDsr_road, MDsr_road$use == 0)
rand_road <- rand_road[c(-1:-6,-8:-15)]
rand_road <- xtabs(~rand_road$animal_id + rand_road$NewRoad, rand_road)
rand_road <- as.data.frame.matrix(rand_road[1:9, 1:4])

pvt.road <- widesIII(used_road,rand_road,avknown = FALSE, alpha = 0.1)
pvt.road
```

```
##
##
## ************** Manly's Selection ratios for design III ********
##
## 1. Test of habitat selection for each animal:
##
##             Khi2Lj df       pvalue
## 647573A  23.156014  2 9.369910e-06
## 647575A  43.618294  3 1.818935e-09
## 647576A  19.130089  2 7.013808e-05
## 647578A  14.413804  2 7.414506e-04
## 647579A   1.697957  1 1.925553e-01
## 647586A  99.947539  3 0.000000e+00
## 647587A  31.950959  2 1.153287e-07
## 647588A 361.725781  2 0.000000e+00
## 647592A   7.312625  2 2.582758e-02
##
##
## 2. Test of overall habitat selection:
##    Khi2L       df   pvalue
## 602.9531  19.0000   0.0000
##
##
## Table of selection ratios:
##               Wi         SE IClower ICupper
## class1 0.9225643 0.06548381  0.7758  1.0693
## class2 1.1531010 0.15136762  0.8138  1.4924
## class3 1.1215628 0.08562584  0.9296  1.3135
## class4 0.7645326 0.21223118  0.2888  1.2402
##
##
## Bonferroni classement
## Based on 90 % confidence intervals on the differences of Wi :
##
## habitat  class2  class3  class1  class4
## class2  ----------------
## class3  ----------------
## class1                  ----------------
## class4                  ----------------
```

```
plot(pvt.road)
```


Manly selectivity measure
Global Selection ratios (+/− CI)
0.0
0.5
1.0
1.5
class2
class3
class1
class4


Manly selectivity measure
Selection ratios
2.5
2.0
1.5
1.0
0.5
class2
class3
class1
class4
647573A
647575A
647576A
647578A
647579A
647586A
647587A
647588A
647592A