Outline Data Collection

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Loading Packages and Scripts

```
library(geomorph)
library(Momocs)
```

```
source('./utility_functions/MorphometricExtraction_Functions.r')
source('./utility_functions/MorphoFiles_Function.r')
```

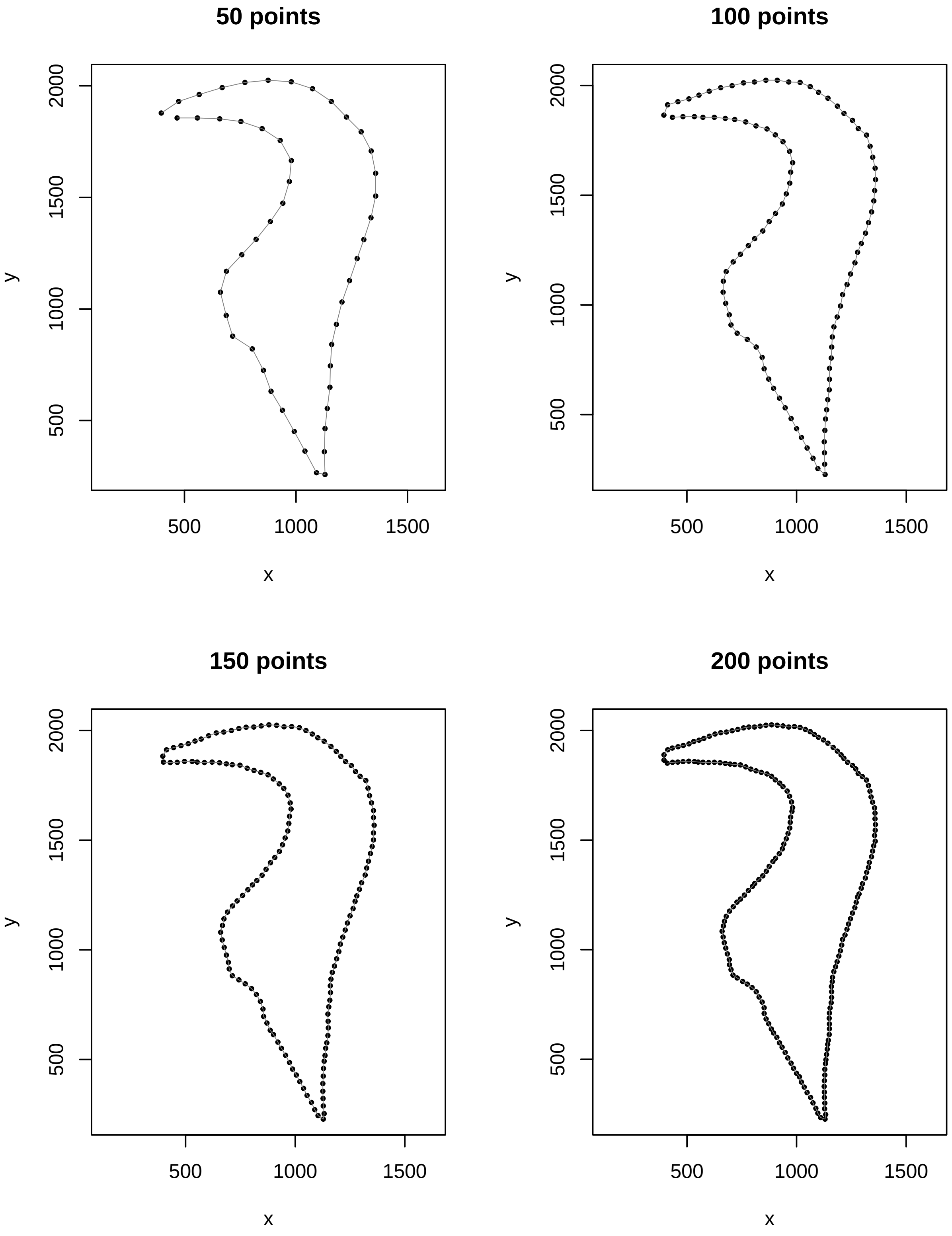
Locate Data

```
#Find all .tif files in the BelemniteHooks subfolder.
Image.files<-list.files(path = "./BelemniteHooks", pattern=".tif")
#87 images is too many to work on in this exercise.
#We can randomly choose a subset of the image list.
#You can change the number in set.seed() to choose a different subset.
#Change the 'size'-parameter in sample() to pick a different number of images
set.seed(12345)
Image.work<-sample(Image.files, size=10)
Image.work
```

```
[1] "021.tif" "055.tif" "081.tif" "030.tif" "061.tif" "077.tif" "010.tif"
[8] "083.tif" "043.tif" "018.tif"
```

Collect data

```
Outline.50  <- readland.nts("./BelemniteHooks/PointNumberTest_50_Raw.nts")
Outline.100 <- readland.nts("./BelemniteHooks/PointNumberTest_100_Raw.nts")
Outline.150 <- readland.nts("./BelemniteHooks/PointNumberTest_150_Raw.nts")
Outline.200 <- readland.nts("./BelemniteHooks/PointNumberTest_200_Raw.nts")
layout(matrix(1:4, 2, 2, byrow=TRUE))
plot(Outline.50[,1,1], Outline.50[,2,1], type="p", xlab="x", ylab="y", asp=1,
     pch=16, cex=0.6, main="50 points")
lines(Outline.50[,1,1], Outline.50[,2,1], lwd=0.5, col="grey50")
plot(Outline.100[,1,1], Outline.100[,2,1], type="p", xlab="x", ylab="y", asp=1,
     pch=16, cex=0.6, main="100 points")
lines(Outline.100[,1,1], Outline.100[,2,1], lwd=0.5, col="grey50")
plot(Outline.150[,1,1], Outline.150[,2,1], type="p", xlab="x", ylab="y", asp=1,
     pch=16, cex=0.6, main="150 points")
lines(Outline.150[,1,1], Outline.150[,2,1], lwd=0.5, col="grey50")
plot(Outline.200[,1,1], Outline.200[,2,1], type="p", xlab="x", ylab="y", asp=1,
     pch=16, cex=0.6, main="200 points")
lines(Outline.200[,1,1], Outline.200[,2,1], lwd=0.5, col="grey50")
```


50 points
100 points
150 points
200 points
y
x
500
1000
1500
2000

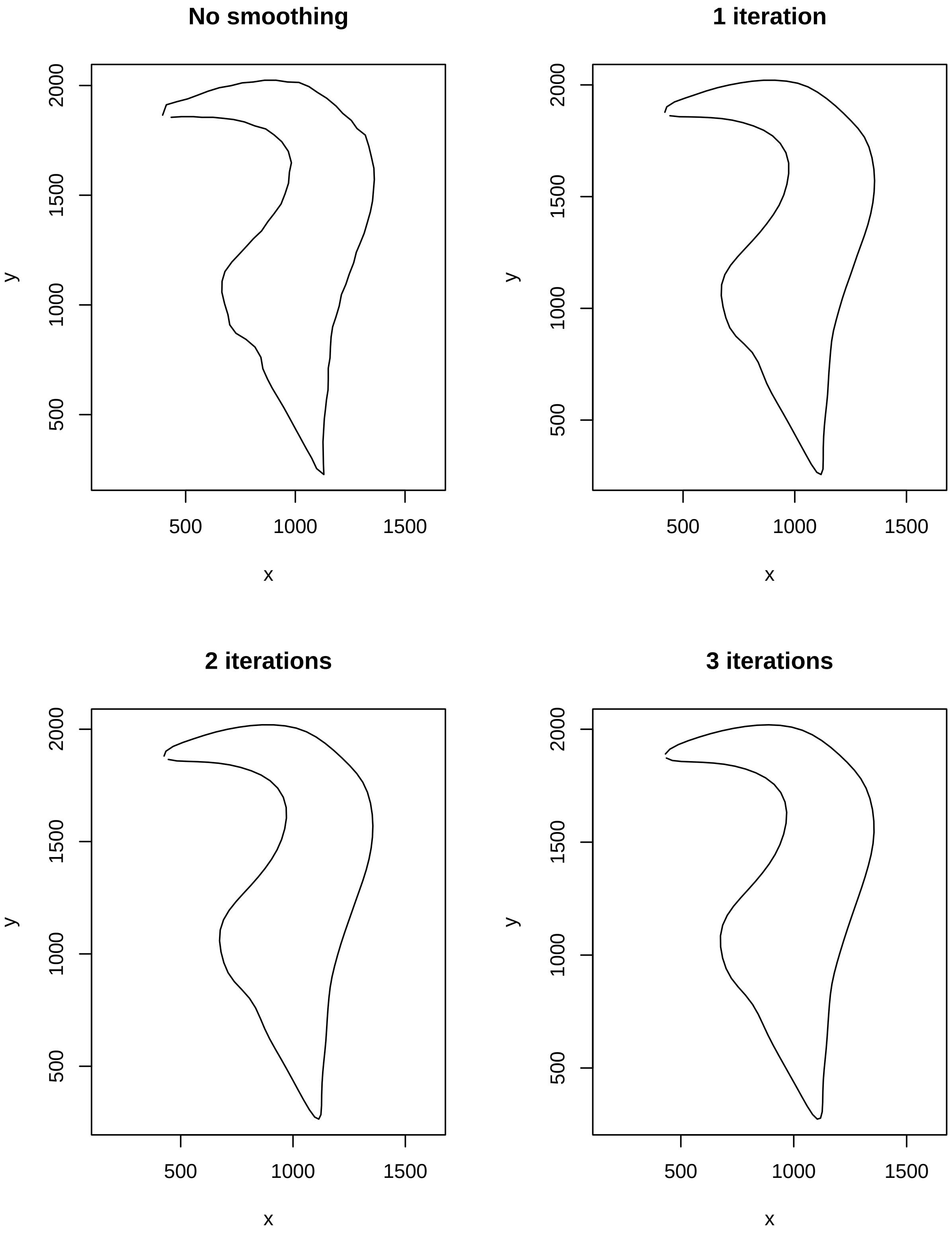
Smoothing

When we collected the outline data for this specimen moments ago, we chose the option “Smoothing = 1”. There can be some noise in the outline of your black/white thresholded image that represents non-biological variation that we arent really interested in. For this reason, outline morphometrics software like SHAPE and this OutlineExtraction function have options for smoothing. By default, OutlineExtraction saves the raw landmarks (Smoothing = 0) and the data smoothed to your specified level.

Let’s run the data collection again with Smoothing = 2 and Smoothing =3 and compare to 0 and 1:

And then compare visually

```
setwd('./BelemniteHooks')
Outline.Raw<-Read.NTS("PointNumberTest_100_Raw.nts")
Outline.1<-Read.NTS("PointNumberTest_100.nts")
Outline.2<-Read.NTS("SmoothTest_2.nts")
Outline.3<-Read.NTS("SmoothTest_3.nts")
layout(matrix(1:4, 2, 2, byrow=TRUE))
plot(Outline.Raw[,"x",1], Outline.Raw[,"y",1],
     type="l", xlab="x", ylab="y", asp=1,
     main="No smoothing")
plot(Outline.1[,"x",1], Outline.1[,"y",1],
     type="l", xlab="x", ylab="y", asp=1,
     main="1 iteration")
plot(Outline.2[,"x",1], Outline.2[,"y",1],
     type="l", xlab="x", ylab="y", asp=1,     main="2 iterations")
plot(Outline.3[,"x",1], Outline.3[,"y",1],
     type="l", xlab="x", ylab="y", asp=1,
     main="3 iterations")
```


No smoothing
1 iteration
2 iterations
3 iterations
y
x
500
1000
1500
2000