

FinalProject_c234

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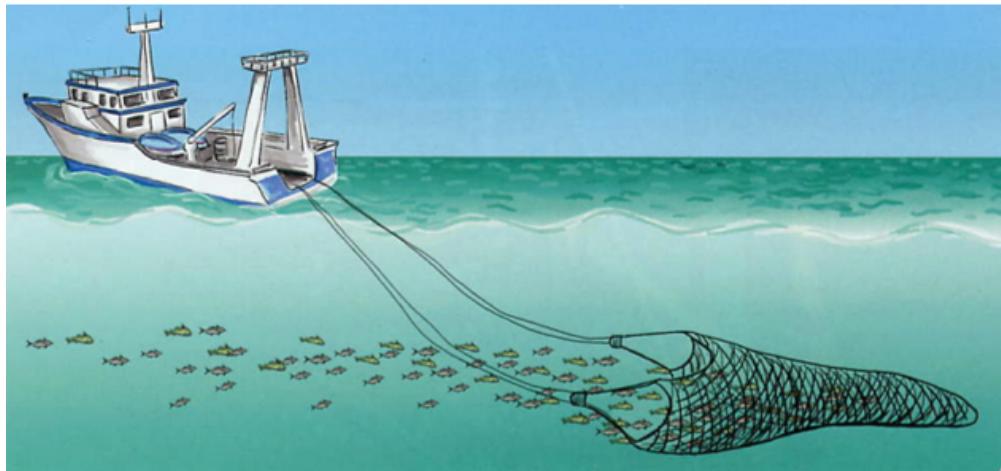
March 19, 2015

Final Project

What is a skate?

A skate is a dorsally compressed cartilaginous fish found on the Eastern Pacific. Their range is from Alaska to the Gulf of California. Skates are related to sharks and rays. Luckily, unlike rays, it doesn't have a barb, so it can't sting you.

Why skates?



Skates live deep in the ocean, roughly 100meters deep. They are long lived species that are especially vulnerable to overfishing. Like the finning of sharks their wings are cut off and the carcasses are thrown back into the deep. Since they live so deep they are extremely hard to find and it's important to understand where they are and where they will go for conservation management purposes.

The Goal

The goal of this research is to understand where they are now, what climate factors are they more susceptible to and where they will be in the future

Download occurrence data and save in a directory on your computer

```
##Getting GBIF data from the web
##Manipulating of a significant data set

setwd("~/Documents/UCLA/FirstYEAR/Winter_2015/C234/SpatialDataProject/BigSkate_GBIF_2.19.15")

bs_occurrence<- read.table("occurrence.txt", header= TRUE,
sep= "\t", na.strings= "NA", quote= "", fill= TRUE) #This is where I read the table into R
#fill and header true shows that they have unequal length and blank fills are implicitly added, na.strings is character vector
#of strings are considered missing values, quote is only to disable quoting altogether

bigskate_new_occurrence <- bs_occurrence[,c("gbifID",
"decimalLatitude", "decimalLongitude", "year", "species")]

bigskate_lat_lon <- bigskate_new_occurrence[,2:3] #This puts the lat lon data into columns, specifically takes the columns 2 and 3 from the bigskate_new_occurrence and reassigns them into a new object

bigskate_lat_lon1 <- bigskate_lat_lon[1:561,] #removes the last column, cause it had weird occurrence points
```

The second way of downloading GBIF data through R

```
library(dismo) #download this package first
install.packages("devtools") #this is to install rgbif from git_hub, instead of downloading from gbif.org we can directly download the species we want in R
devtools::install_github("ropensci/rgbif") #goes to the ropensci website and the rgbif directory
library("rgbif") #this is the package that allows R to go through GBIF

Rbi <- occ_search(scientificName= "Raja binoculata", limit = 50) #use the function occ_search to look for the name and you give a limit of how many occurrence points you want
write.table(Rbi, "Rbi.txt") #write the table to into a new txt file
```

Plotting GBIF Data points

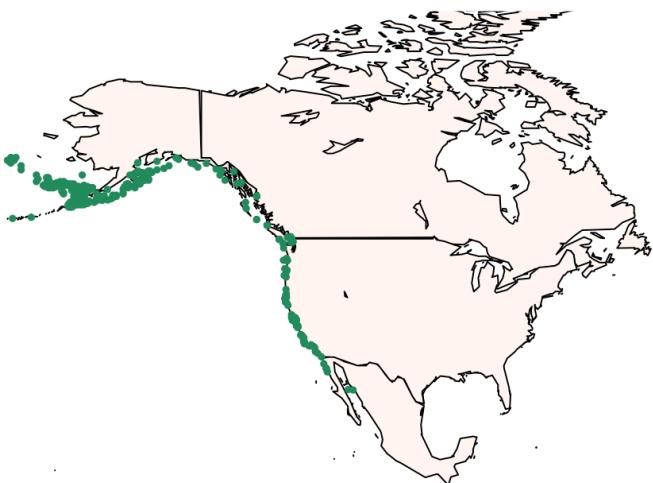
Plot the GBIF Data points. I ended up downloading the entire data from the GBIF website inputing it into R and then using that data to make a map.

```
library(maps) #all the libraries for maps
library(mapdata)
library(rworldmap) #this one is especially important

## Loading required package: sp
## ### Welcome to rworldmap ###
## For a short introduction type : vignette('rworldmap')

map1 <- map("worldHires",c("usa", "Canada", "Mexico"),xlim=c(-180,0), ylim=c(10,80), col="seashell1", fill=TRUE) #map of the west coast, using the function map and "world hires" allows you to get a 2 dimensional map of whatever countries you want. I use the cbind function to only map USA, Canada and Mexico
title("Big Skate occurrence from 1889- 2013") #title of the figure
points(x=bigskeate_lat_lon1$decimalLongitude, y=bigskeate_lat_lon1$decimalLatitude,col='seagreen',cex=0.75, pch= 20) # plot the data points on map1 with big skate data longitude at the x and latitude is the y axis and the color is seagreen and cex is the relavent scale of the points, pch is the shape of your points
```

Big Skate occurrence from 1889- 2013



##Converting Lat and Lon from GBIF to

Spatial Points Data Frame

Now that I have a GBIF points on a map, I know want to rasterize the spatial points. What this means is that I want to convert the spatial points to a raster file so that it matches up with my climate points, which come as raster files.

```

library(sp) #a library that constructs spatialDataFrame from geometry and attributes

bs_space <- SpatialPointsDataFrame(bigskate_lat_lon1[ c("decimalLongitude", "decimalLatitude")], data= data.frame(bigskate_lat_lon1),proj4string= CRS("+proj=longlat +datum=WGS84")) #here we are using the spatial points data frame function to change the lat and lon to the same geometric frame as our climate data and the proj4string allows us to specify that it is a map and this does a point in polygon query

raster:::raster(bs_space) #from the raster package :: use raster function for bs_space

```

```

## class      : RasterLayer
## dimensions : 10, 10, 100  (nrow, ncol, ncell)
## resolution : 6.777694, 3.239061  (x, y)
## extent     : -178.83, -111.0531, 27.93939, 60.33  (xmin, xmax, ymin, ymax)
## coord. ref. : +proj=longlat +datum=WGS84

```

```
plot(bs_space) #now plot it
```



```
class(bs_space) #make sure the class description is the same
```

```

## [1] "SpatialPointsDataFrame"
## attr(,"package")
## [1] "sp"

```

Download Climate data from MARine SPatial ECology

Now we want to rasterize the climate data

-Go to www.marspec.org

-MARSPEC 5m.7z:

- ocean climate layers at low resolution
- recommended for global studies
- ESRI raster grids (shape GIS file)
- approx 10km grid cell sizes at the equator

Plotting Climate Data with Rasterized climate data

```
library(rgdal) #this contains functions that rasterize dataset
```

```
## rgdal: version: 0.9-1, (SVN revision 518)
## Geospatial Data Abstraction Library extensions to R successfully loaded
## Loaded GDAL runtime: GDAL 1.11.1, released 2014/09/24
## Path to GDAL shared files: /Library/Frameworks/GDAL.framework/Versions/1.11/Resources/gdal
## Loaded PROJ.4 runtime: Rel. 4.8.0, 6 March 2012, [PJ_VERSION: 480]
## Path to PROJ.4 shared files: (autodetected)
```

```
library(raster) #a library that contains functions that divide regions into pixels or cells
```

```
setwd("~/Documents/UCLA/FirstYEAR/Winter_2015/C234/SpatialDataProject/ClimateDATA/reformatted3") #sets the directory to reformatted 3, here is where I took the kml files and converted them to .tif files in a program called ARCGis so that I could map the material.
```

```
marspec.dir1 = ("~/Documents/UCLA/FirstYEAR/Winter_2015/C234/SpatialDataProject/ClimateDATA/reformatted3") #this reformatted files were converted from a kmz to kml to .bil extension files
```

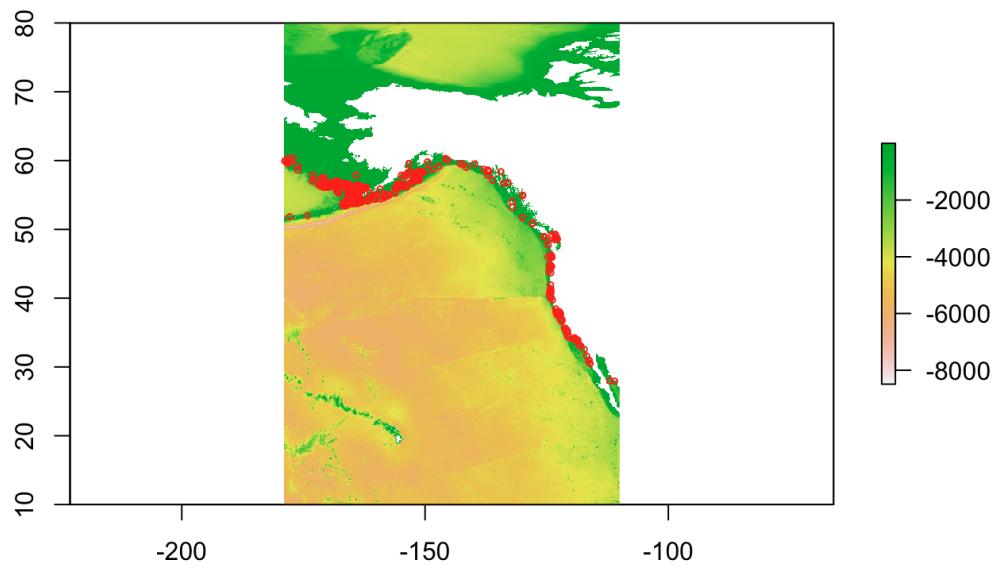
```
files= list.files(marspec.dir1, pattern= "tif$") #compiles the files together into a object that could be used to rasterize
```

```
marspec.rasters = stack(files[1:18])#changes the climate data to a raster file using the stack function
```

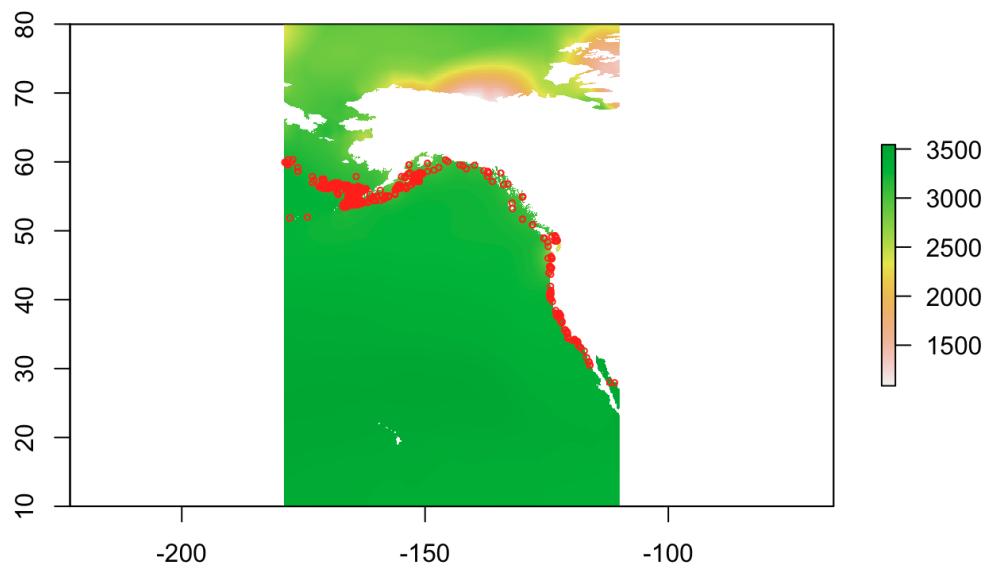
```
#writeRaster(marspec.rasters, filename= "marspec.rasters1.grd")
bs_brick <- brick("marspec.rasters1.grd") #this works
```

```
for (ii in 1:18){
plot(marspec.rasters, ii)
points(bs_space, col= 'red', cex= 0.5)
} #writing a for loop that plots all of the climate layers
```

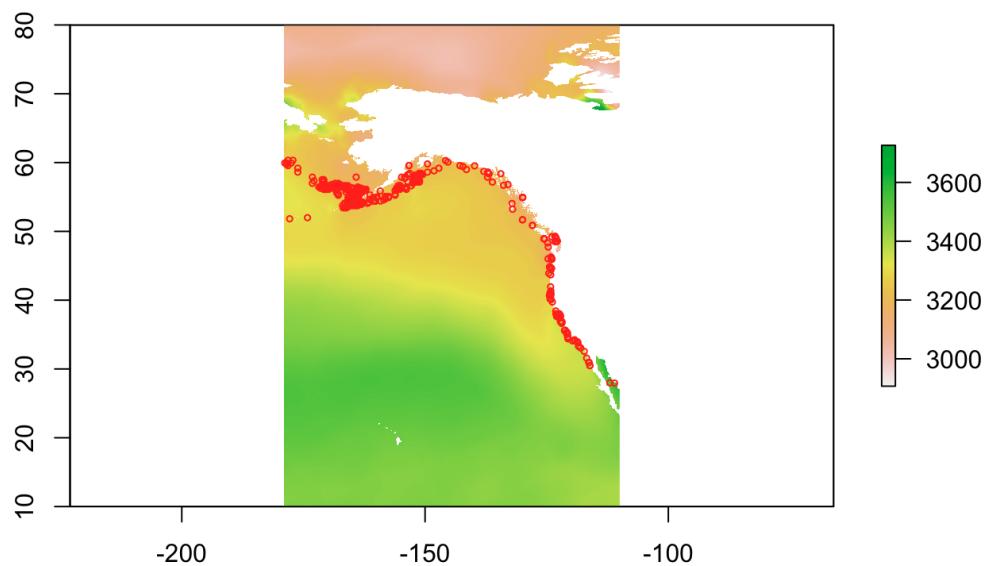
biogeo1



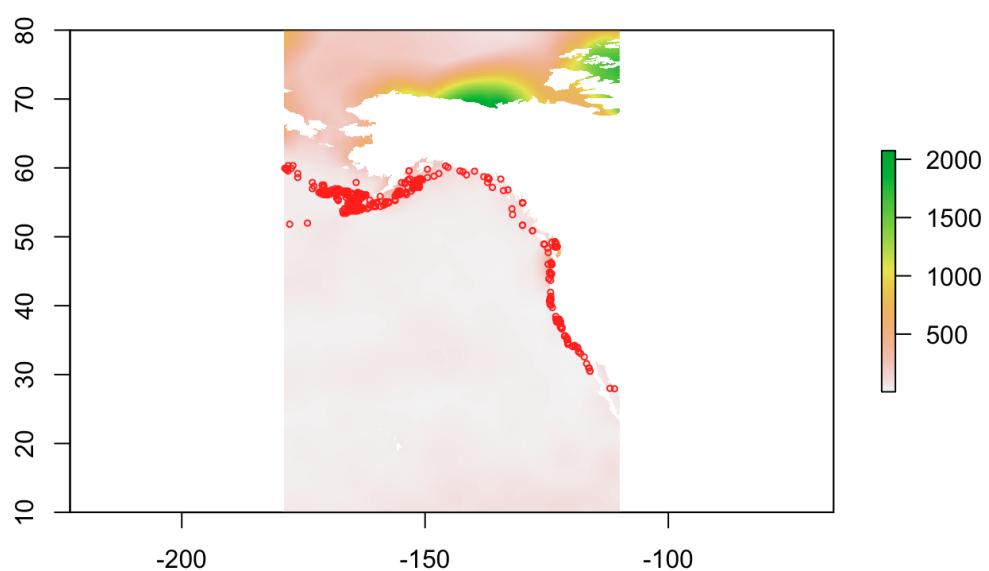
biogeo10



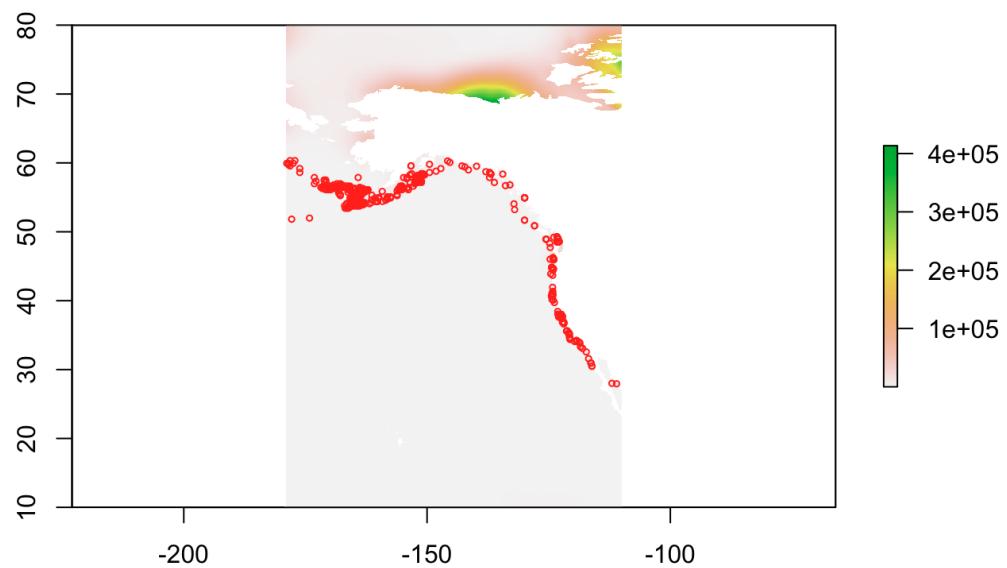
biogeo11



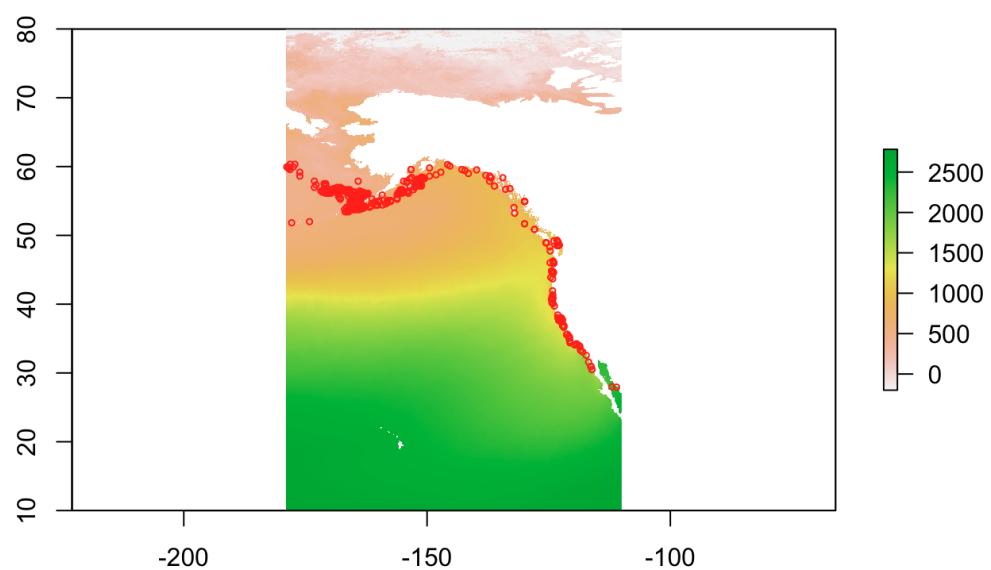
biogeo12



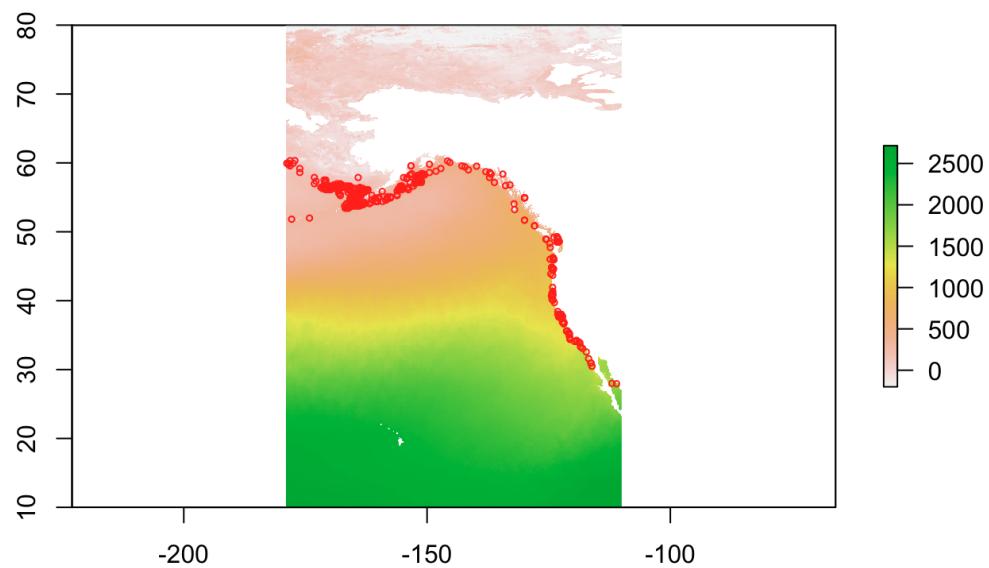
biogeo13



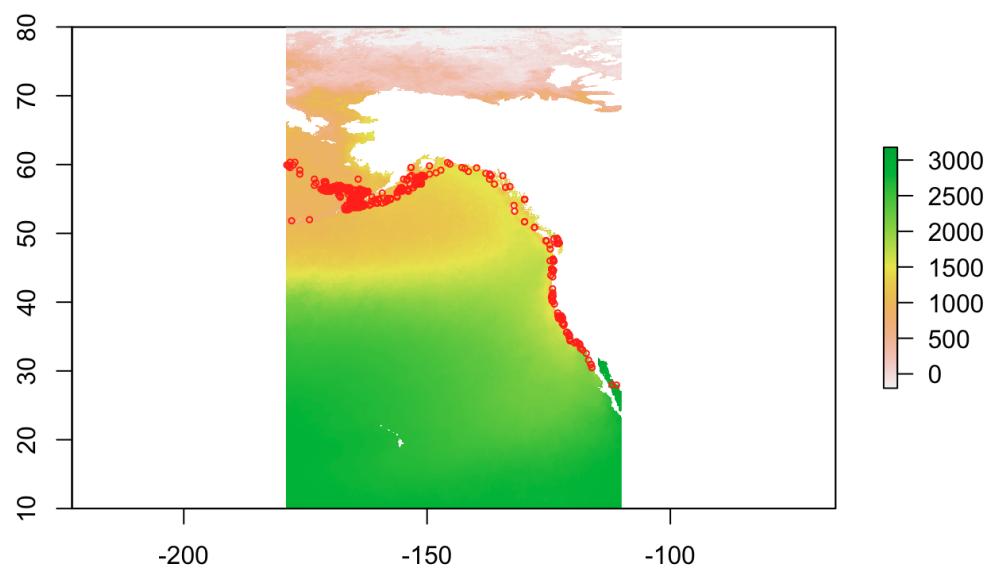
biogeo14



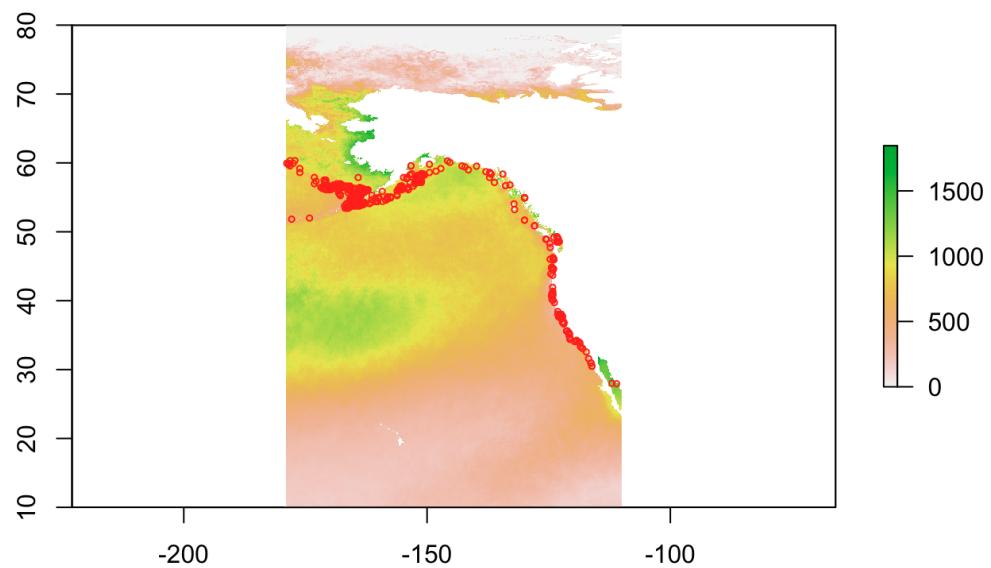
biogeo15



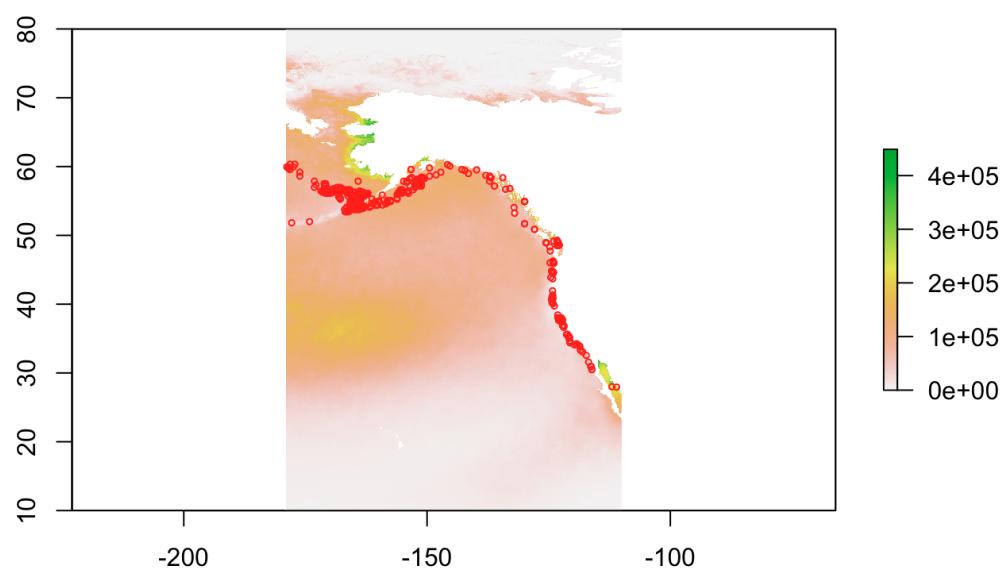
biogeo16



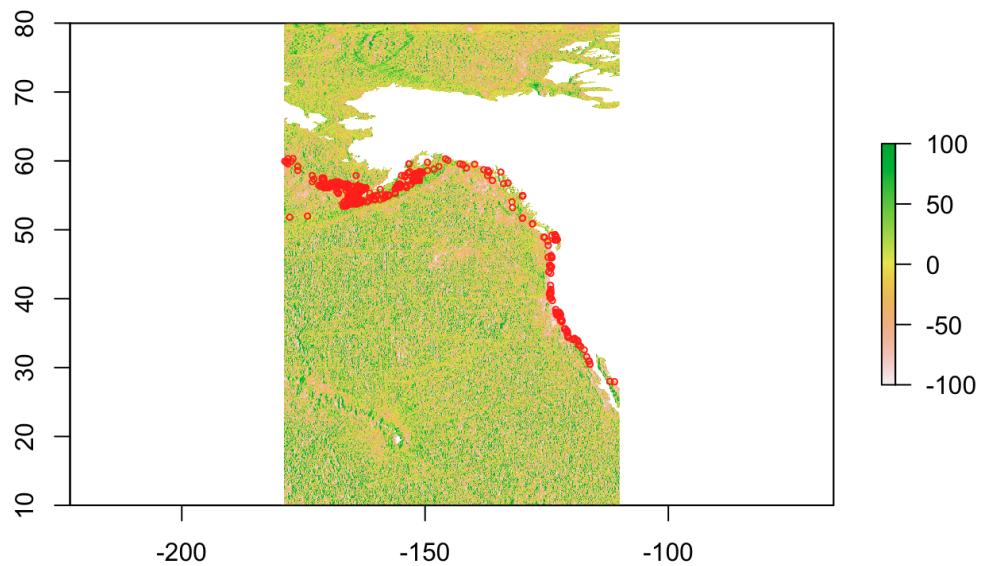
biogeo17



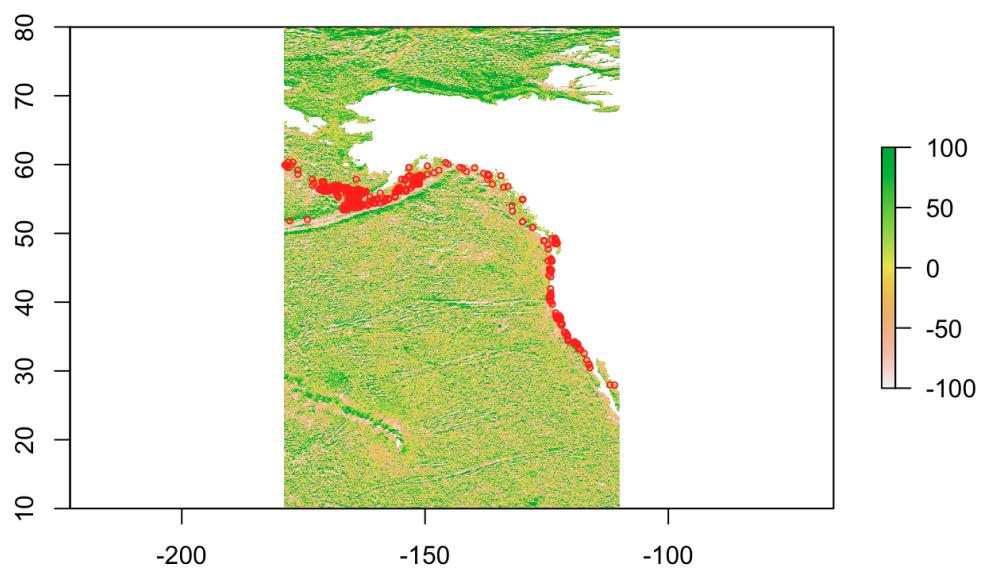
biogeo18



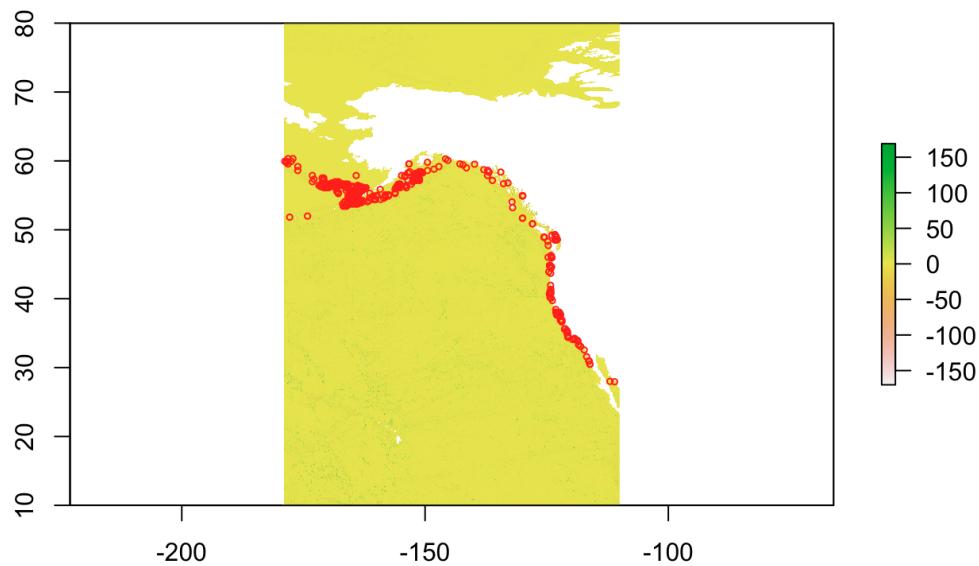
biogeo2



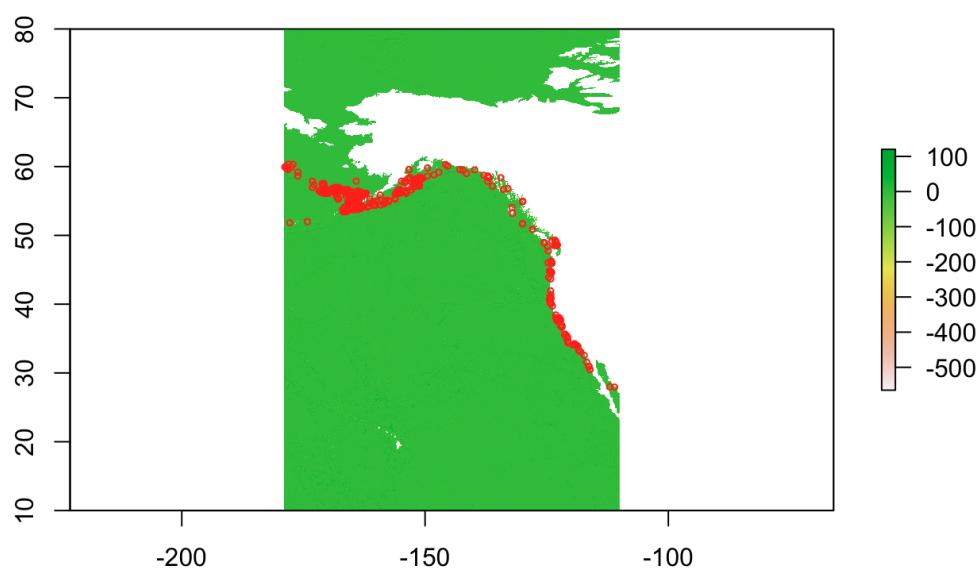
biogeo3



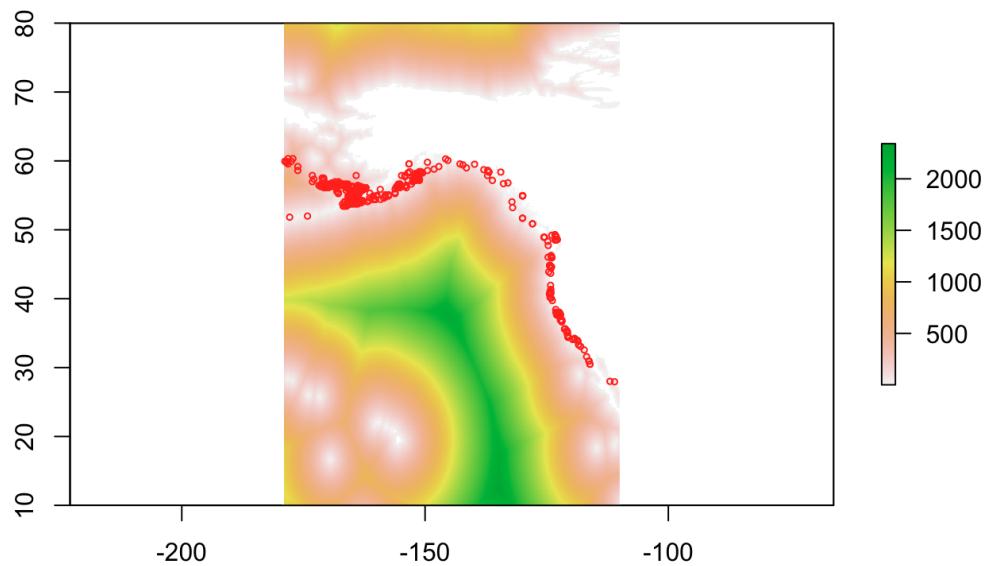
biogeo4



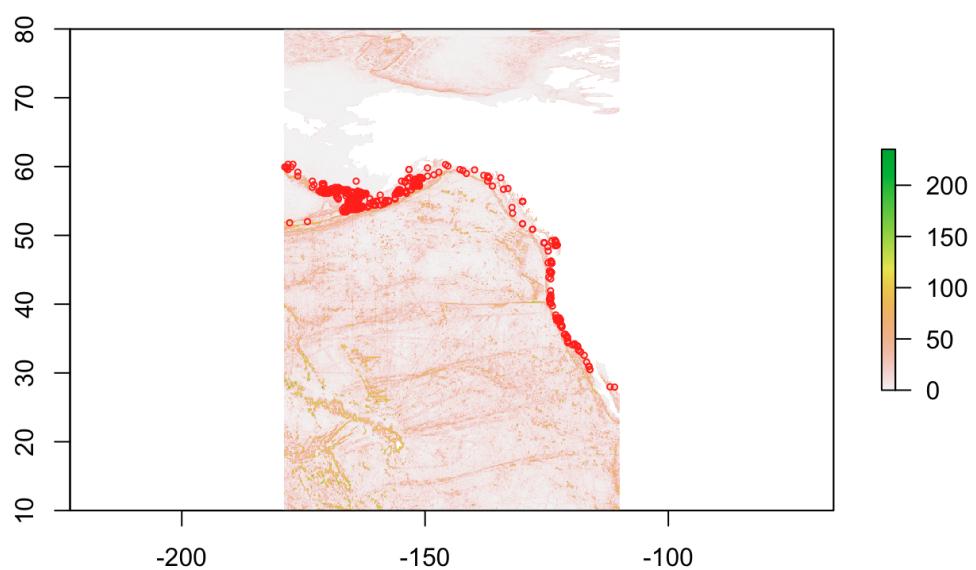
biogeo5



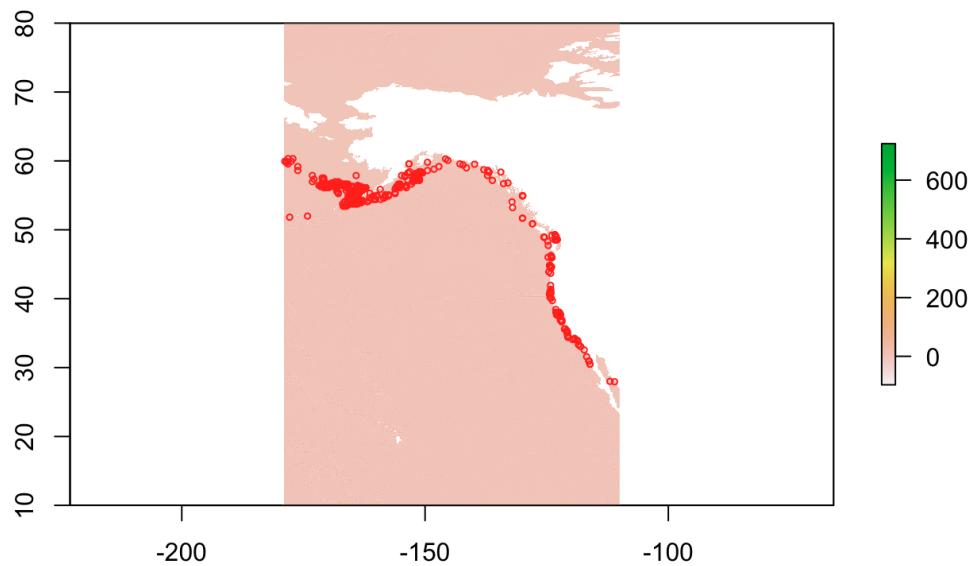
biogeo6



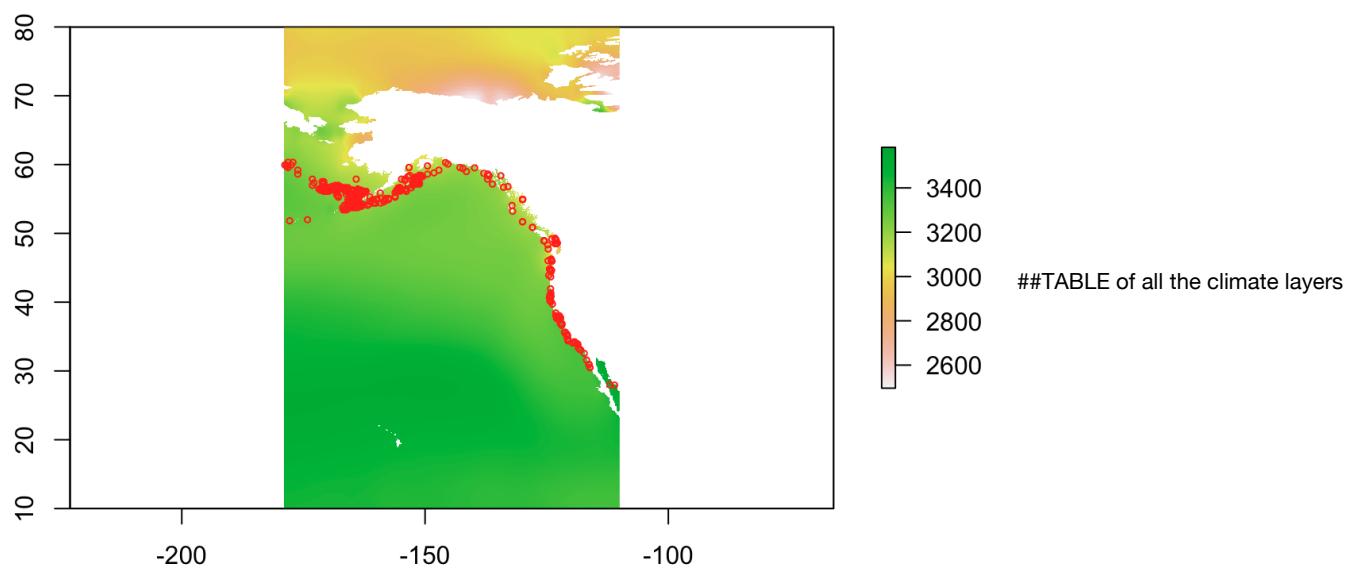
biogeo7



biogeo8



biogeo9



```
setwd("~/Documents/UCLA/FirstYEAR/Winter_2015/C234/SpatialDataProject/ClimateDATA/MARSPEC_5m")
climate_table <- read.csv(file="table1_climate.csv", head= TRUE, sep=",") #reads in csv table of all the climate variables

climate_table
```

```

##   Layer.Name           Layer.Definition      Units
## 1 bathymetry          depth of the seafloor    meters
## 2 biogeo01             East/West Aspect
## 3 biogeo02             North/South Aspect
## 4 biogeo03             Plan Curvature
## 5 biogeo04             Profile Curvature
## 6 biogeo05             Distance to Shore  kilometers
## 7 biogeo06             Bathymetric Slope   degrees
## 8 biogeo07             Concavity        degrees
## 9 biogeo08  Mean Annual Sea Surface Salinity (SSS)      psu
## 10 biogeo09            Minimum Monthly SSS       psu
## 11 biogeo10            Maximum Monthly SSS       psu
## 12 biogeo11            Annual Range in SSS       psu
## 13 biogeo12            Annual Variance in SSS     psu
## 14 biogeo13            Mean Annual SST        degrees
## 15 biogeo14            SST of the coldest ice-free month degrees
## 16 biogeo15            SST of the warmest ice-free month degrees
## 17 biogeo16            Annual Range in SST        degrees
## 18 biogeo17            Annual Variance in SST     degrees

```

Maxent Function

This maxent function allows us to compare which climate variable is most associated with our occurrence data.

```

#maxent_bs <- maxent(bs_brick, p =bs_space , na.rm= TRUE)
#the command above is commented out because it does not knit, but at the bottom of the page there is a link that will take you
to the maxent results.
#maxent_bs

```

Conclusions

To run the analysis I had to use the maxent function on maxent.jar on the GUI interface and in R, I found that biogeo1 which is actually bathymetry is most closely associated with the big skate occurrence data. Which makes sense, because skates are deep dwelling species that live on the continental shelves. When I remove bathymetry and other variable that are associated with the deep from the analysis, the most correlated variables are the “maximum month salinity” and “sea surface temperature of the coldest ice free month”. Which is pretty interesting for two reasons: first, salinity is predicted to increase due to climate change and how that affects their distribution will be interesting. Second, climate change is predicted for the earth to get warmer causing ice to melt and less ice to form, when the coldest ice free month is weakly associated with the occurrence data points of skates, it may suggests that skates have a certain thermal tolerance and it would be interesting to see a range of temperatures they are most tolerant too.

Some caveats: is that most of these climate layers are sea surface temperatures and sea surface salinity. These are deep dwelling species and so the temperature that is at the surface is not the same as the temperature they are experiencing. I could take temperatures at each layer from the bottom of the ocean to the surface and use an analysis to see their thermal range. Alternatively, I could use landscape genetics to test for their thermal range and look at the how the genes are distributed across the eastern pacific.

It would be interesting to compare the predictive models of where they will be to occurrence data and genetic data to get a complete answer.

!maxent_analysis

(file:///Users/chiquillo2/Documents/UCLA/FirstYEAR/Winter_2015/C234/SpatialDataProject/ClimateDATA/MaxentResults/Maxent_Raja_binoculata_4.html)

Click on the link above and it will show you the maxent results.