Using Plotly to Make Figures and Charts

Why Use Plotly?

Plotly is a good choice for several reasons:

- It allows for easy interactive plotting
- Interactive plots can be embedded in notebooks
- Can be run on a server
- Plotly has developed a dashboard API to complement their plotting library (similar to Shiny for R)
- It also has a shorthand library `plotly_express` for rapid exploration

Getting Started

```
import plotly.express as px
```

First, we want to import `plotly.express`, which will serve as the engine for creating our figures in `plotly`.

Using Existing Data

Let's import a `pandas` Data Frame to play with some 🐟 data:

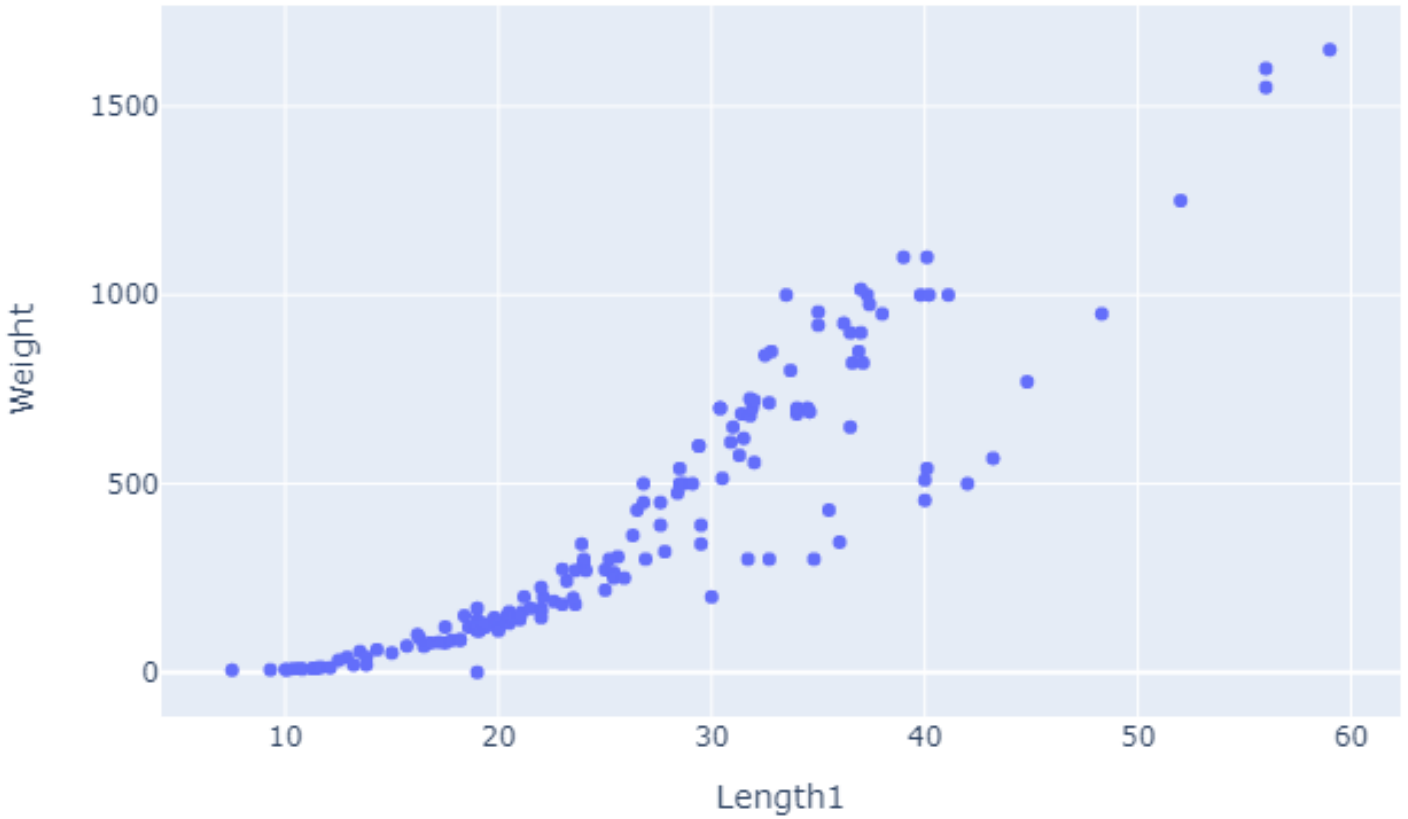
```
import pandas as pd

data = pd.read_csv( # put link back on one line!
    "https://github.com/dustywhite7/pythonMikkeli/
    raw/master/exampleData/fishWeight.csv")
```

Creating Plot Objects

```
px.scatter(data, x='Length1', y='Weight')
```

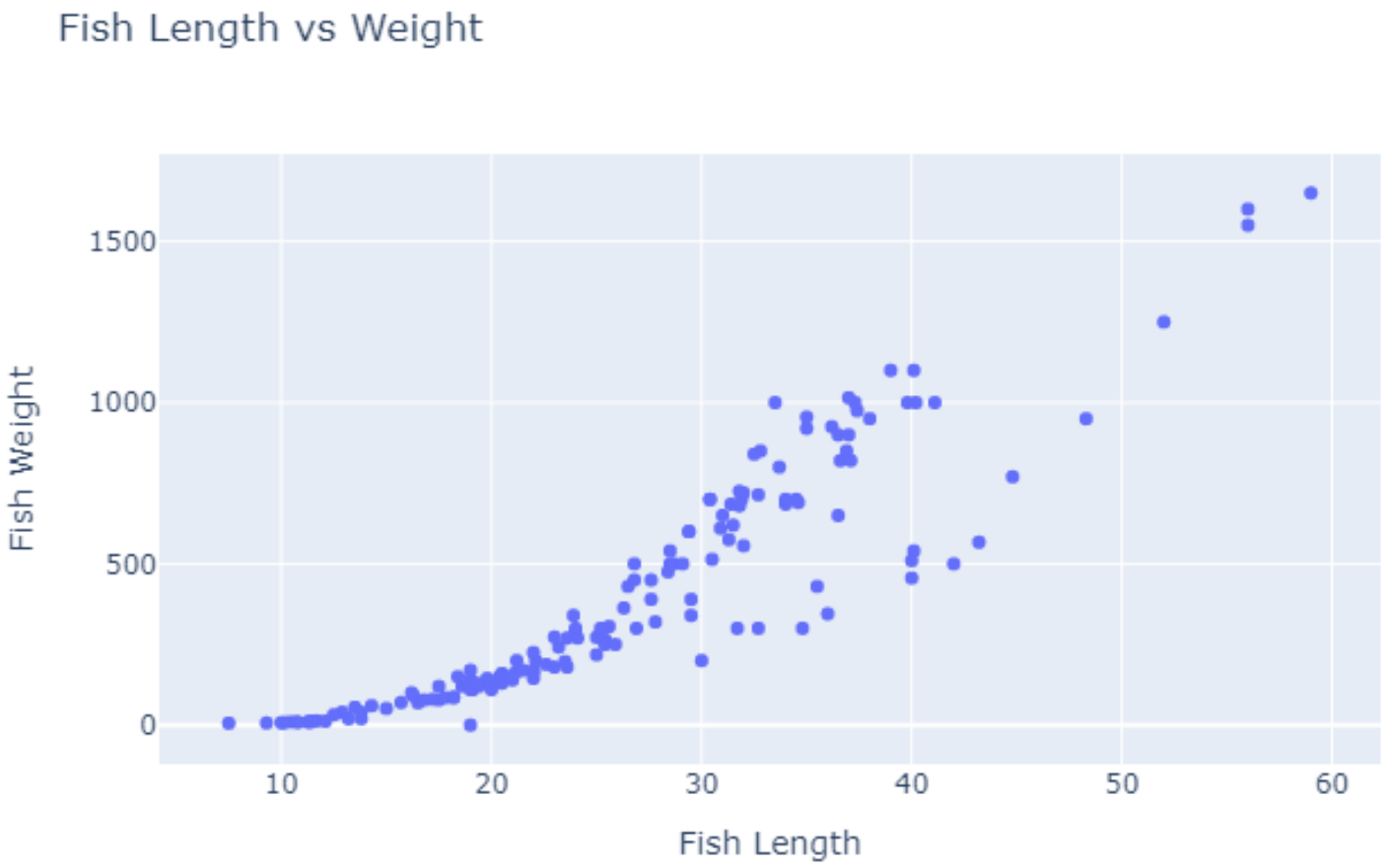
In this (very) simple example, we plot some data about length and weight. Our figure is rendered in the notebook.


Weight
1500
1000
500
0
10
20
30
40
50
60
Length1

Formatting

Let's add some formatting. First, we can change the axis labels and title to match :

```
px.scatter(data, x='Length1', y='Weight',
    title = "Fish Length vs Weight", # update the title of the figure
    labels = { # dictionary for axis labels
        'Length1' : 'Fish Length', # key should match original label
        'Weight' : "Fish Weight" # value should be new label value
    })
```

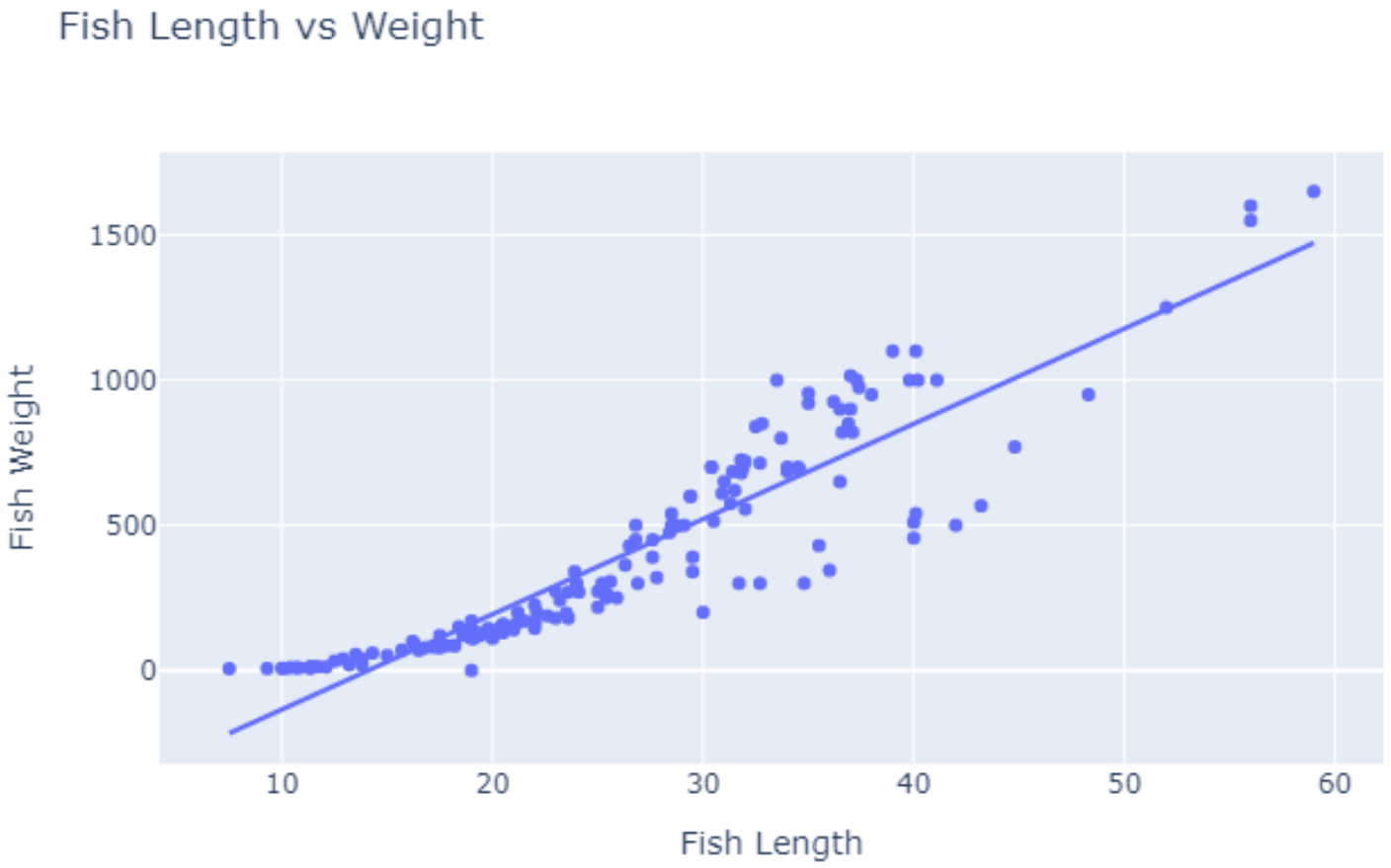

Fish Length vs Weight
Fish Weight
1500
1000
500
0
10
20
30
40
50
60
Fish Length

Trendlines

Next, we can add a regression trendline:

```
px.scatter(data, x='Length1', y='Weight',
    title = "Fish Length vs Weight", # update the title of the figure
    labels = { # dictionary for axis labels
        'Length1' : 'Fish Length', # key should match original label
        'Weight' : "Fish Weight" # value should be new label value
    },
    trendline = 'ols' # add a linear trendline
)
```

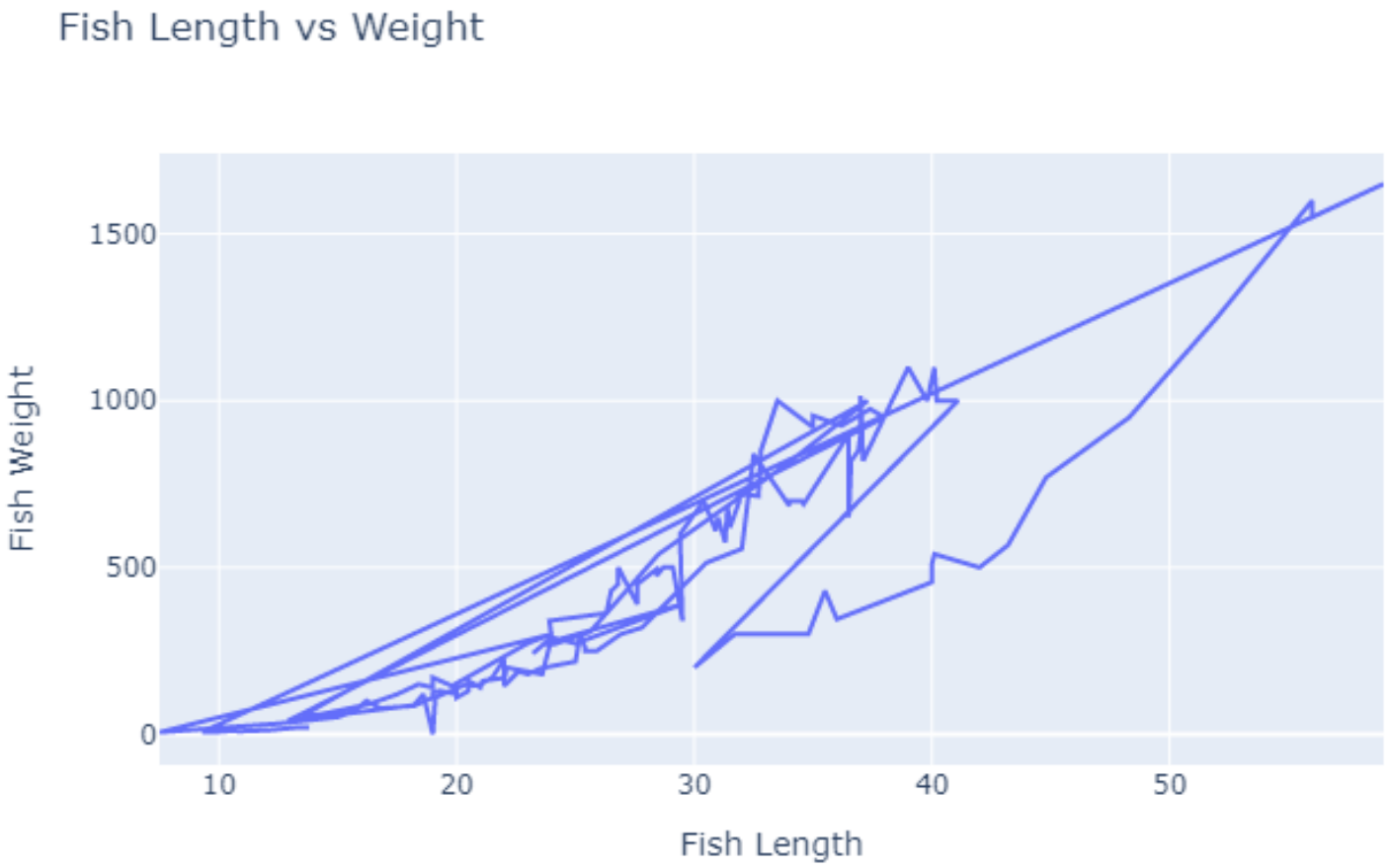
We can also use `lowess` trendlines!


Fish Length vs Weight
Fish Weight
1500
1000
500
0
10
20
30
40
50
60
Fish Length

Line Charts

We could instead use line charts

```
px.line(data, x='Length1', y='Weight',
    title = "Fish Length vs Weight", # update the title of the figure
    labels = { # dictionary for axis labels
        'Length1' : 'Fish Length', # key should match original label
        'Weight' : "Fish Weight" # value should be new label value
    })
```



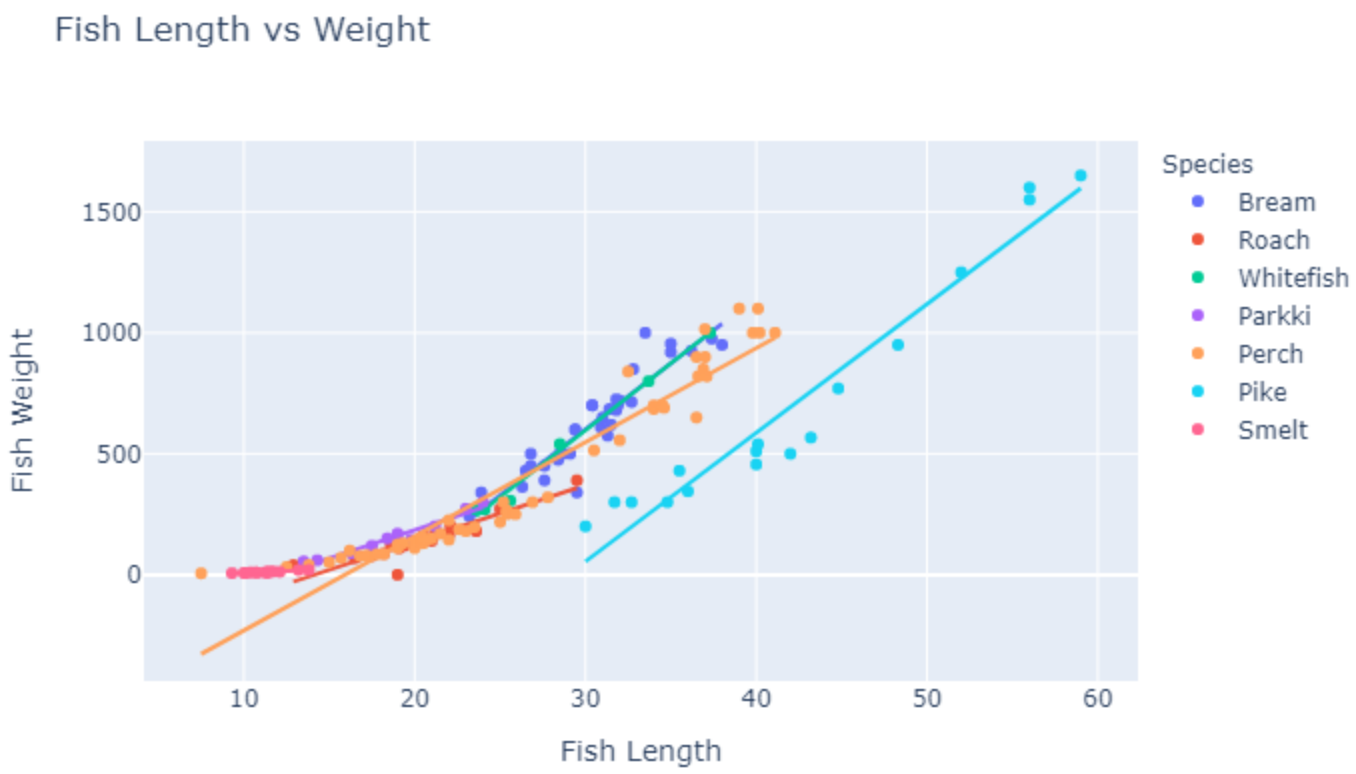
Clearly, not helpful here... (our data is not ordinal)

Creating Plot Objects

Let's show multiple series by separating our observations according to species:

```
px.scatter(data, x='Length1', y='Weight',
    title = "Fish Length vs Weight", # update the title of the figure
    labels = { # dictionary for axis labels
        'Length1' : 'Fish Length', # key should match original label
        'Weight' : "Fish Weight" # value should be new label value
    },
    trendline = 'ols', # add a linear trendline,
    color = 'Species'
)
```

Creating Plot Objects



Note that we even get a separate trend line for each color group! 😃

Other Plot Types

We can do a LOT more than scatter plots!

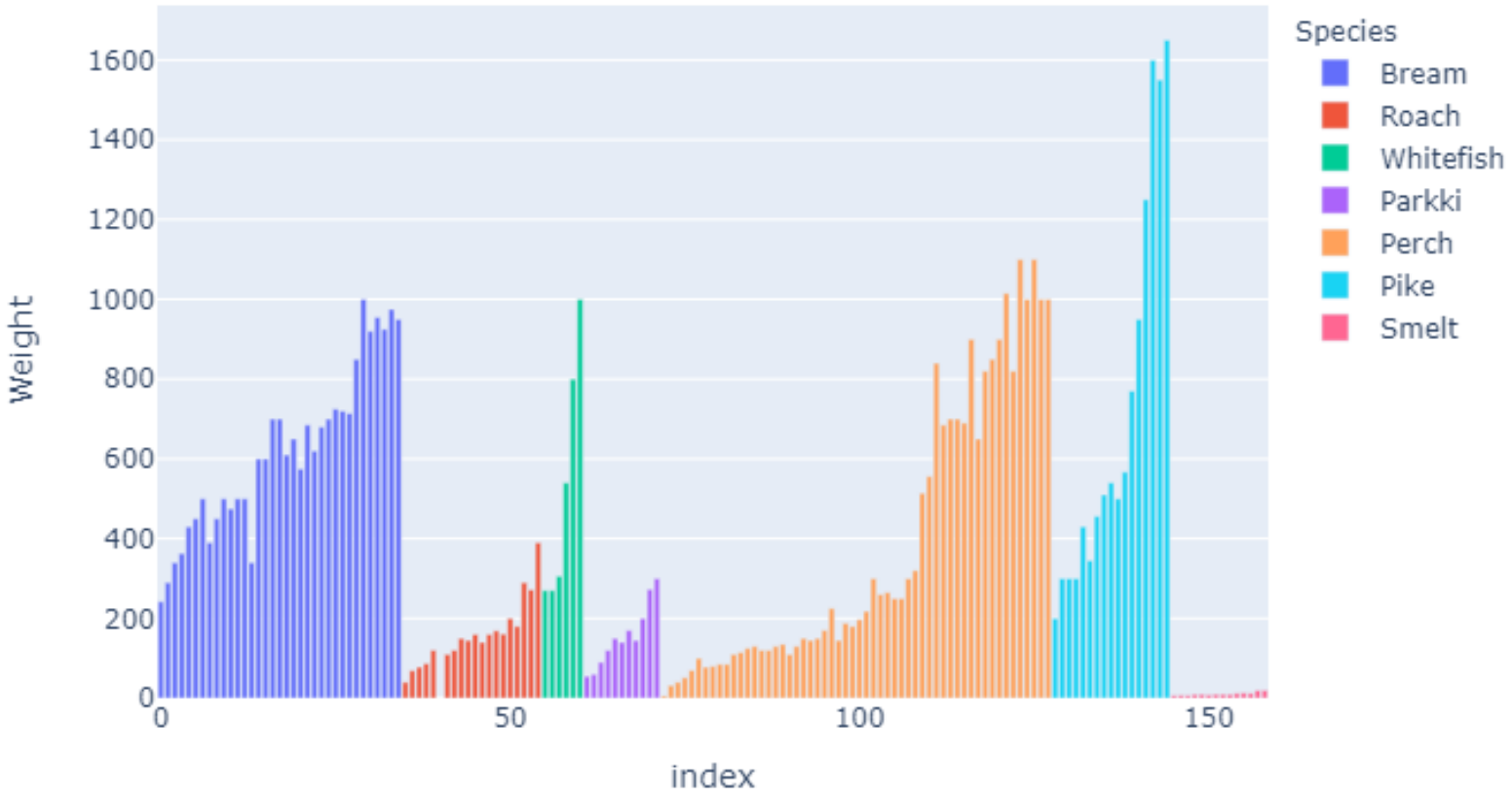
- Bar Charts
- Box Plots
- Histograms, with distribution stats, too!
- Heatmaps
- Choropleth, Line, and Bubble Maps

among many others.

Using Bar Charts

First, we can make a bar chart:

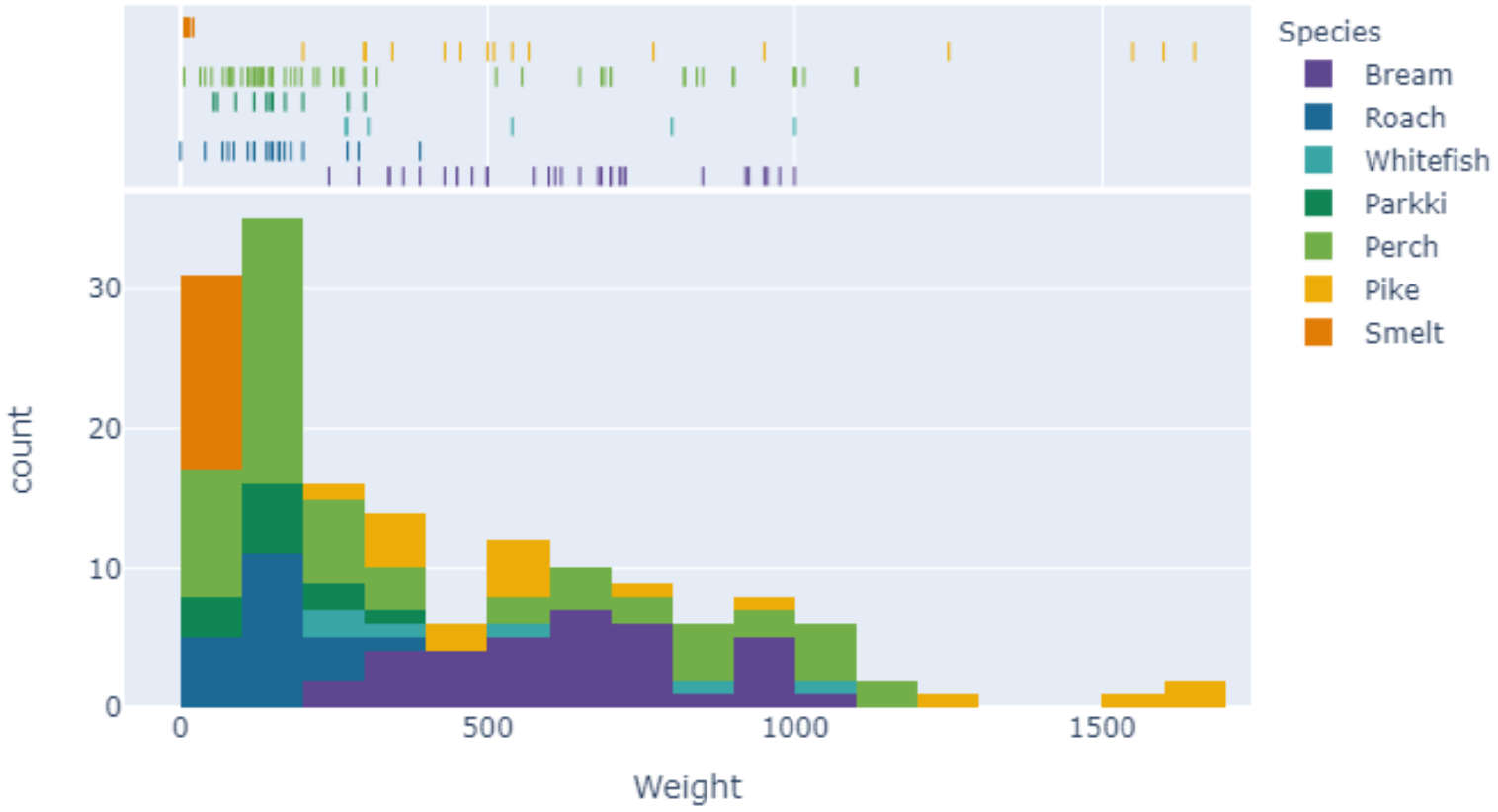
```
px.bar(data, y="Weight", color="Species")
```


Species
Bream
Roach
Whitefish
Parkki
Perch
Pike
Smelt
Weight
index
0
200
400
600
800
1000
1200
1400
1600
0
50
100
150

Histogram

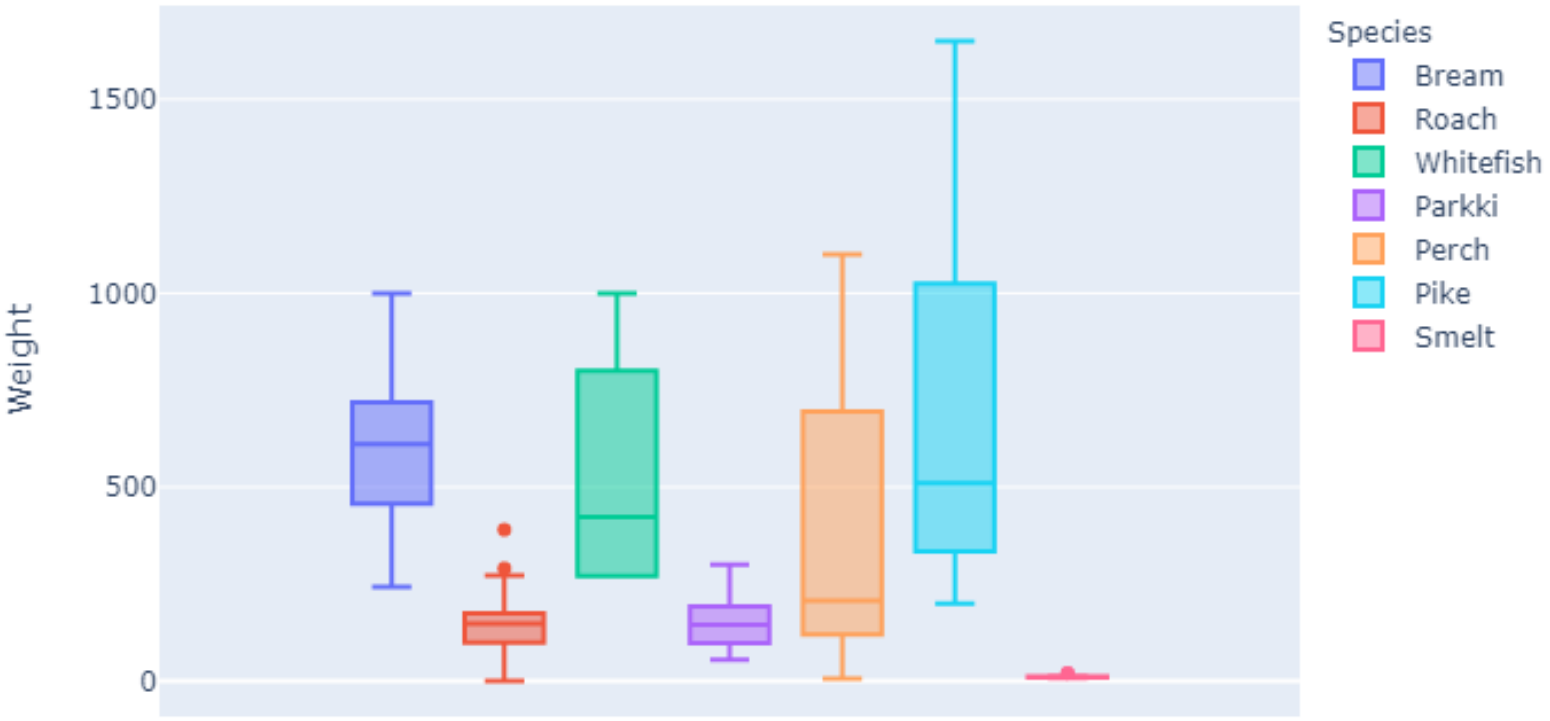
Maybe that data would do better if we could aggregate it in bins to better understand how many fish were observed in each weight bin:

```
px.histogram(data,
        x="Weight",
        marginal="rug",
        color="Species",
        color_discrete_sequence=px.colors.qualitative.Prism)
```


Species
Bream
Roach
Whitefish
Parkki
Perch
Pike
Smelt
count
0
10
20
30
0
500
1000
1500
Weight

Box Plots

```
px.box(data, y="Weight", color="Species")
```

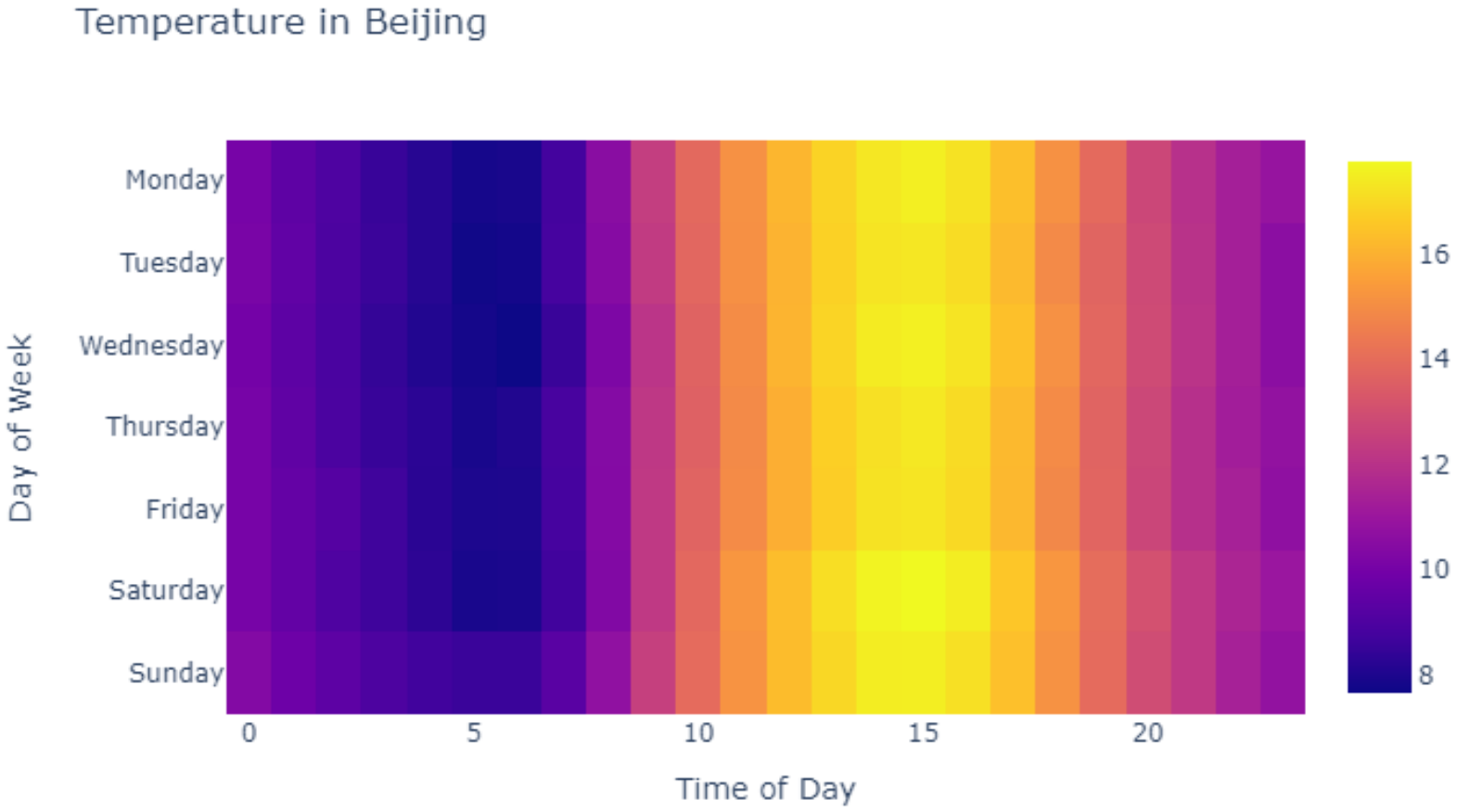

Weight
1500
1000
500
0
Species
Bream
Roach
Whitefish
Parkki
Perch
Pike
Smelt

Heatmaps

```
data = pd.read_csv(
    "https://raw.githubusercontent.com/dustywhite7/pythonMikkeli/master/exampleData/pollutionBeijing.csv")

data['datetime'] = pd.to_datetime(data['datetime'])
data['weekday'] = data['datetime'].dt.dayofweek
data['hour'] = data['datetime'].dt.hour
data = data.groupby(['weekday', 'hour'])['TEMP'].mean()
data = data.values.reshape((7,24))

px.imshow(data, title="Temperature in Beijing" ,
          labels=dict(y="Day of Week", x="Time of Day"),
          y=['Monday', 'Tuesday', 'Wednesday', 'Thursday', 'Friday', 'Saturday', 'Sunday'])
```

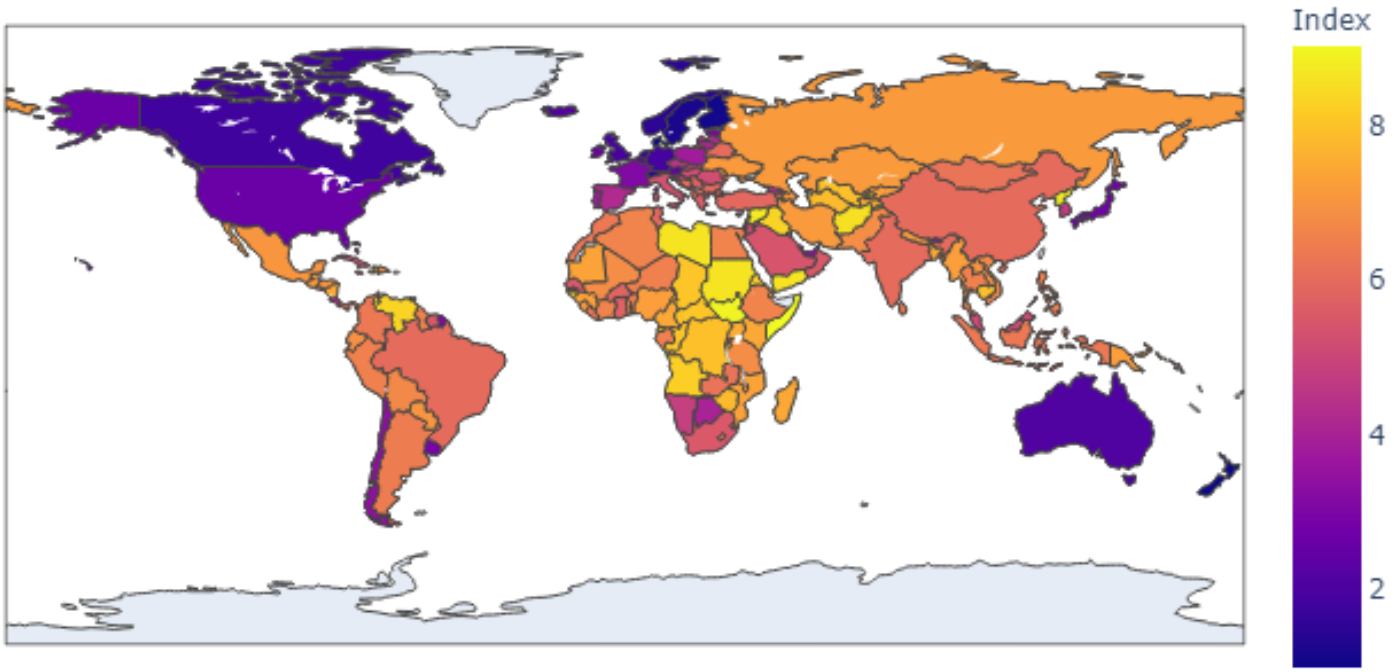

Temperature in Beijing
Day of Week
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
0
5
10
15
20
Time of Day
16
14
12
10
8

Choropleth Maps

```
data = pd.read_csv(
  "https://raw.githubusercontent.com/dustywhite7/Econ8320/master/LabCode/corruption2018.csv")

px.choropleth(data, locations = 'Abbr',
    color = 'Index',
    hover_name= "Name"
    )
```

Map data from the INFORM Index


Index
8
6
4
2

Mapping Options: Layout->Geo

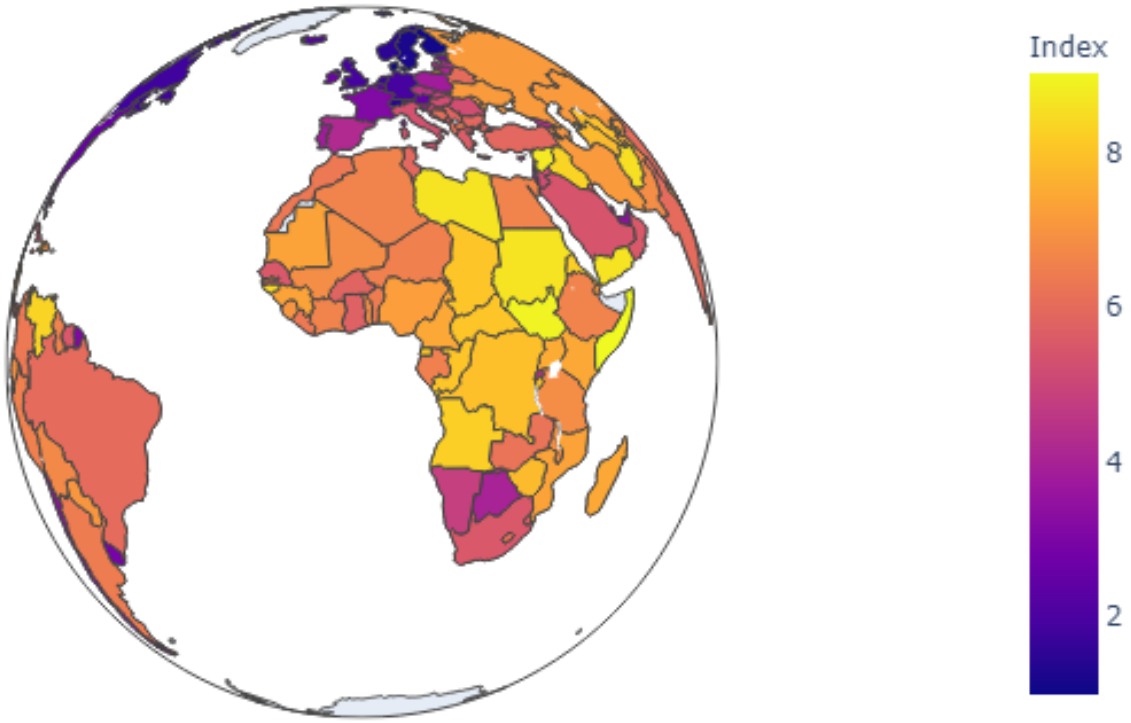
We have many additional options that we can pass to the layout of our plot when dealing with geographic data.

- Map projection
- Map scope
- Country lines
- Lots more

Here is a link to the full documentation

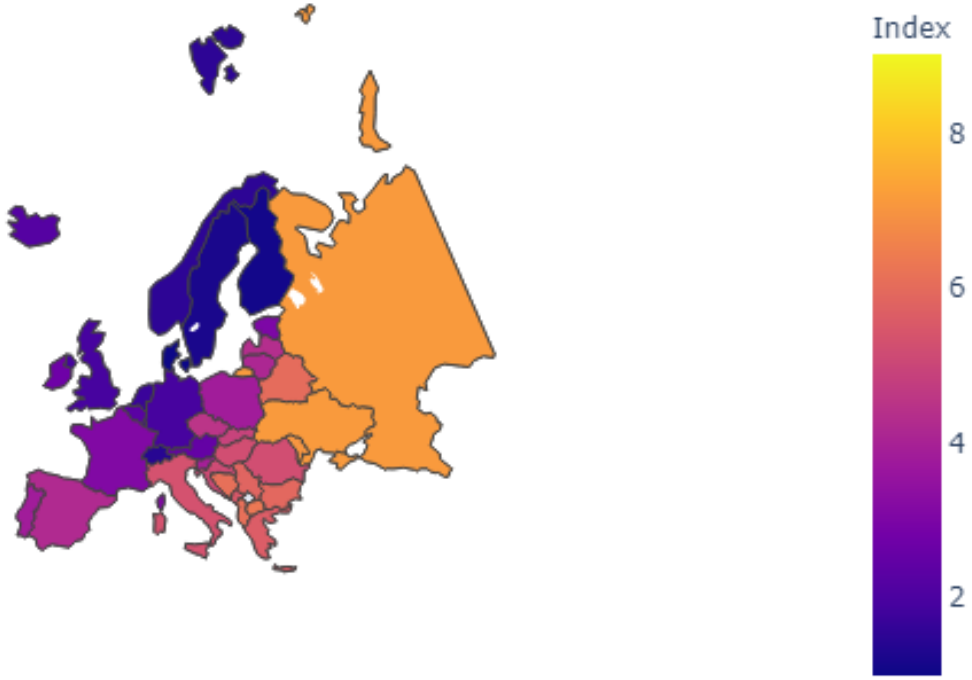
Choropleth Maps - Projection

```
px.choropleth(data, locations = 'Abbr',
    color = 'Index',
    hover_name= "Name",
    projection = "orthographic"
    )
```


Index
8
6
4
2

Choropleth Maps - Scope

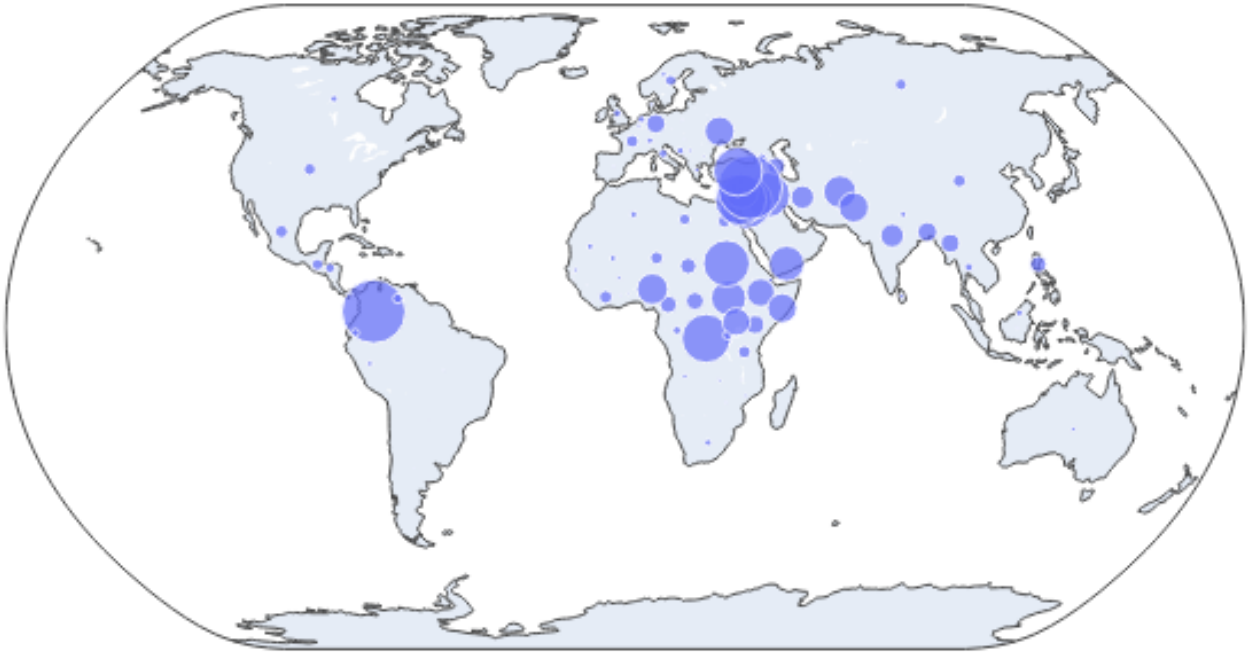
```
px.choropleth(data, locations = 'Abbr',
    color = 'Index',
    hover_name= "Name",
    scope = "europe"
    )
```


Index
8
6
4
2

Bubble Maps

```
data = pd.read_csv(
  "https://raw.githubusercontent.com/dustywhite7/Econ8320/
  master/LabCode/displaced2018.csv")

px.scatter_geo(data, locations="Abbr",
                     hover_name="Name", size="Displaced",
                     projection="natural earth")
```



Lab Time!