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MTH 231-01

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Final Report

Introduction

During the second half of the semester, I successfully was able to complete the project as I had initially intended, with much of my time being spend working on attempting to access the datasets that I had obtained, reviewing the provided attributes to develop some questions of interest, performing a rough analysis of the data as needed, and then extrapolating the results of that analysis to attempt to answer the questions that I had formulated. Each of these four main steps will be described in this report, as will some screenshots and information on the code that I used for the analysis, and the results I yielded.

As described in my mid-semester report paper, the topic of the datasets I chose was fisheries surveys from New England water, specifically on the various species of prey and predators collected from several different surveys. I obtained the database from the National Marine Fisheries Service using their publicly-available InPort database management website; the specific database I selected came from the Food Web Dynamics Program at the Northeast Fisheries Science Center in Falmouth, MA. The database, entitled the Food Habits Database (FHDBS), contained four individual datasets; "FHSPECIES" documented the name and taxonomy of all species described; "FHPD" described a variety of habitat, physiology, and other data on predator species; "FHPY" documented a variety of habitat, physiology, and other data on prey species, and "FHPYL" described the length and sex of prey species, in a more compact file.

In addition to providing download links and metadata for the files, the InPort page for the FHDBS also contained a list of each of the attributes described in the four datasets, as well as an explanation for what they represented (for example, the attribute "BOTTEMP" was used in the "FHPY" and "FHPD" datasets, and the InPort page explained that "BOTTEMP" represented the temperature of the seabed where a given trawl survey was conducted). For my own convenience, I created a Google Sheets file containing the list of attributes and their respective definitions for all four datasets, which benefited me during my analysis.

Pre-Analysis

Shortly after I obtained the four dataset files (which I downloaded in CSV format), I ran into a problem. While I was able to download and view each of the files in a text editor without much issue, the "FHPD" and "FHPY" datasets were both much larger than I expected; so large that they were not able to be opened in either of the main spreadsheet softwares that I utilized (Google Sheets and Microsoft Excel, specifically). At this point, I had two paths forward: the first option was to attempt to open the two files in

some other software program, such as RStudio, JupyterNotebook, or Tableau, while the second option was to simply perform an analysis using the FHPYL and FHSPECIES datasets in Microsoft Excel or Google Sheets. After spending a decent amount of time comparing the two options, I decided to pursue the first one; while I am not nearly as experienced with RStudio, JupyterNotebook, or Tableau as I am with Sheets and Excel, I really wanted to utilize either the FHPD and/or FHPY datasets, so I decided to attempt to access them utilizing JupyterNotebook (which utilizes the programming language Python). I was able to accomplish this without much difficulty; in my DSC-201 course that I took this same semester, we were actually learning about how to open and read CSV files in JupyterNotebook at the exact same time that I was working on this project, so I was able to apply the information I learned from that course to access all four FHDBS files in JupyterNotebook. See Image 1 for the code involved in reading the data files in JupyterNotebook.

Once I was able to access all four datasets in JupyterNotebook, the next step was to formulate a question to investigate. I cross-referenced the available data with the information from the Attributes sheet that I made, to determine what each column was conveying for data and what I might be interested in investigating. After some superficial reviewing of each of the files, I decided that I wanted to investigate the predator data from the FHPD file; specifically, I wanted to look at the diversity and abundance of predator species in different habitats, specifically at different depths and different temperatures. The FHPD dataset provided information on the species ID, depth, and temperature of each sample (among many other pieces of data), while the FHSPECIES dataset provided a list of each species ID along with its common and scientific name; therefore, to begin my analysis, I utilized the Pandas package in JupyterNotebook to open the FHPD file and create a DataFrame entitled "PredatorData", containing four columns: the cruise ID, species ID, the "BOTTEMP" data (temperature of the water), and the "SETDEPTH" data (depth at which the trawl survey was conducted). I did not end up actually utilizing the cruise ID data, but the other three columns were all incorporated into my analysis. See Image 2 to see the code used in creating this DataFrame.

Once I created the DataFrame, I needed to filter out some data that was obviously inaccurate; for example, some columns listed the depth or temperature as being "999" or "-999", which are obviously not accurate and likely a result of missing data being automatically filled. I simply filtered out any value for temperature that was less than 0 or greater than 900, and then filtered out any value for depth that was less than 0 or greater than 900, in order to get the values most reflective of reality. See Image 3 for the code involved in removing the outlying data. Once this was complete, the next step was to add a column to the dataframe containing the name of the actual species, since at this point, the only identifying information was a three-digit "species ID". In order to do this, I first added a new blank column to the "PredatorData" dataframe, entitled "commonname". I then used Pandas to read the FHSPECIES file and create a

DataFrame entitled "IDtable", containing three columns: the species ID (which I set to function as the index of the dataframe), the species' common name, and the species' scientific name. At first, I attempted to set up a for-loop that would read the ID for each row in the "PredatorData" file, find that same ID in the FHSPECIES file, identify the corresponding species' common name, and then add that to the respective row's "commonname" in PredatorData. However, since the PredatorData dataframe was approximately 422,000 rows in size, this process was very time-consuming to the point of being infeasible; attempting to perform it produced an estimated wait-time of over an hour. Instead, I decided to leave the "commonname" column empty for now, and perform the analysis on "PredatorData" as it currently was, and then add the common names for each species once the analysis was complete. See Image 4 to see the code involved in creating the "IDtable" dataframe and the empty "commonname" column.

Analysis

At this point, I began the actual analysis. My goal was to create a dataframe that contained a list of species observed by depth, at 25-meter intervals. While I initially attempted to do this manually, it soon became apparent that it was to time-consuming; the total range for the depth data was from 0 to about 675 meters, so it would've been too much manually typing and too time-consuming. Instead, I decided to use a For-loop. I created an empty dataframe entitled "maxbydepth", and set up a for-loop to read through the PredatorData dataframe and create two "Series": one called "currmeterrange", with contained all data from meter-X to meter-X+25, and one called "currfreqcount", which contained the count of each species ID in "currmeterrange". Because "currfreqcount" was made using the "value_counts" function in Pandas, it contained two columns: one being the original data (the list of species ID from "currmeterrange"), and one listing the count of that respective ID; in other words, it listed every species observed in the given 25-meter range, and then listed the frequency of that species. For every 25-meter interval in "PredatorData", the "currfreqcount" and "currmeterrange" Series were added to the "maxbydepth" dataframe; once the for-loop was complete, there was a "species ID" and "species frequency" row for every 25-meter interval from 0 to 625 meters.

The next step was to add the name of each species to the "maxbydepth" dataframe; to do this, I first had to change the datraframe from being an integer-dataframe to a string-dataframe, since I wanted to replace each three-digit ID with the corresponding species name (which, in Jupyter, meant I needed to change the species ID from being an integer to a string). I then set up another for-loop that would go through every column in "maxbydepth". For each column, the loop would read every other row (i.e. the species ID data) as a 'float', and then search in the "TableID" dataframe for the index corresponding to that 'float' (recall that the index of the TableID is the list of species ID's, so it was essentially looking for that particular index in the dataframe). The loop would then find the corresponding "common name", and

then replace the species ID in "maxbydepth" with that common name. If a given species ID was not found in the "TableID" dataframe for any reason, the value in the "maxbydepth" dataframe was simply changed to say "NOT AVAIL". It would do this for every other row in a column, and then move on to the next column. The end result was that "maxbydepth" no longer contained the species ID, but instead contained the actual species common name, meaning it was easier to understand visually. See Image 5 for all the code involved in creating the "maxbydepth" table, and see Image 6 for an overview of the first 9 rows in the table.

The next step was to essentially do the exact same thing, but for temperature, since I wanted to examine the populations of predator species with respect to water temperature as well. I created a new empty dataframe, "maxbytemp", and then I essentially repeated this same process as above, except instead of 25-meter intervals from 0 to 675 meters, I used 5 degree intervals from 0 to 100 degrees. I performed roughly the same procedure so that "maxbytemp" contained the species ID and species frequency from each 5-degree interval, and then used the "IDtable" dataframe to replace the species ID in "maxbytemp" with the species' common name. See Image 7 for all of the code involved in creating the "maxbytemp" table, and see Image 8 for an overview of the first 9 rows in the table.

One thing I noted in the "maxbytemp" table that struck me as odd was a massive gap in the predator populations. There was a high count of predators for each 5-degree interval from 0 degrees to 30 degrees, but there were none from 30 degrees to 95 degrees, and then a very high count in the interval from 95 degrees to 100 degrees. I soon realized that I made an oversight within the data; I had assumed the temperature data was based on Fahrenheit, which is why I chose a range from 0 to 100, but it was more likely Celsius. The actual metadata on the InPort file did not specify the unit of temperature, but since Celsius is standard in the sciences, I assumed that was likely the case; I also assumed that the row of data in the 95-100 degree column was likely a result of an oversight from whoever managed the raw data at the NMFS, and decided I should simply disregard that row and assume it was not accurate. The unusual results are visible in Image 8, which shows the first 9 rows of the "maxbytemp" data.

Results: Temperature

Now that both of the dataframes were complete, I debated on how I wanted to actually examine them. Looking over them roughly, I noticed that the most common species listed in both tables tended to be different species of flounder, hake, skate, and shark, so I therefore decided that I would analyze the abundance of these species at each depth and temperature interval, and extrapolate whether I thought the species were specialized to certain environments, or more generalistic. Note that, since I only looked at the top 9 species in each table, the species and families I examined were far from being comprehensive; there were certainly more species of hake, skate, flounder, and shark in the table, but if they weren't in the top 9 rows then they were not included in my examination.

First up, I analyzed the abundance of these four groups of species with respect to water temperature, beginning with the hake. A total of four species of hake were observed in the "maxbytemp" table, all of which shared relatively similar abundance patterns. Silver hake was incredibly common in cool waters, often being the most abundant predator present, with several thousand being observed at every interval from 0 degrees to 15 degrees (over 21,000 observations were made in the 5-10deg interval alone). Also very common were red hake, which had over 3000 observations at the 0-5deg, 5-10deg, and 10-15deg intervals; white hake, which had over 3000 observations at the 10-15deg interval, and spotted hake, which has almost 4000 observations at the 10-15deg interval and almost 400 observations at the 20-25deg interval. Overall, all four species experienced similar patterns, being very abundant in cool waters and gradually becoming less frequent in warmer environments, which lead me to assume that they were all relatively specialized for cooler waters and preferred to avoid warm temperatures.

The next group I examined with respect to temperature were the skates. Two species of skate were present, the little skate and the winter skate, both of which had very high observation counts in the 0-5deg range (>6000 little skates and almost 4000 winter skates) and the 15-20deg range (almost 800 little skates and >800 winter skates). The little skate was also incredibly common at the 5-10deg range (with over 10,000 observations) and the 10-15deg range (>2000 observations). Both species were significantly less common at temperatures above 20 degrees, which lead me to assume that, much like the hakes, both skate species were well-adapted to cooler temperatures and preferred to avoid warmer waters.

Next, I examined the species of flounders. Three species of flounder were present; the winter flounder, the summer flounder, and the fourspot flounder. Unlike hakes and skates, however, the flounder species seemed to be more specialized based on species. Fourspot flounder were most common in cool waters, being extremely common at the 5-10deg and 10-15deg intervals and relatively uncommon elsewhere. Summer flounder were much more common in slightly warmer waters, being near-dominant predators at the 15-20deg and 20-25deg intervals, where they were the first and second most abundant predators, respectively. Winter flounder seemed less specialized, being very common at the 0-5deg range and the 15-20 deg range, but also being present (albeit less common) in the 20-25 deg range. I found it very interesting that the species seemed to be relatively divided by temperatures, with fourspot flounder being most common in cool water, summer flounder dominating in warm water, and winter flounder living in more intermediate waters; I assume that, since they are all flounder, they likely all fill similar ecological niches in their respective environments.

Finally, with respect to temperature, I examined the sharks. Three species of sharks were observed: smooth dogfish, spiny dogfish, and Atlantic sharpnose shark. Spiny dogfish was extraordinarily common, being the dominant predator in the 0-5, 5-10, and 10-15deg ranges, with >9000 observations, >27,000 observations, and >10,000 observations in each respective interval. From the 15-20deg range and

beyond, they became much less common until they became virtually nonexistent. The smooth dogfish seemed to take over their role, being the second-dominant predator in the 15-20deg range and the fourth-dominant in the 20-25deg range, with over 1000 observations in each range, before gradually becoming less common until virtually disappearing. The Atlantic sharpnose shark was much less common, being observed only in the 25-30 deg range, where it was observed 66 times. I find it fascinating how the shark species seem so distinct, far more so than even the flounders. All three of these species are very similar in size, and the very clear distinctions in temperature-preferences leads me to assume that they all perform very similar niches in their habitats, with spiny dogfish and smooth dogfish in particular being near-apex predators in their respective environments. I'm not sure if the differences are a result of the sharks inhabiting different geographic regions, or perhaps being dominant at different times of year, but in either case, the differences are very prominent.

Results: Depth

At this point, I had completed my analysis based on temperature, and moved on to perform an analysis based on depth inhabited. I stuck with the same four "families" as before (hake, skates, flounder, and sharks), since they seemed to dominate the different depth ranges as well. I began by examining the abundance of hake. Six total species were observed: silver hake, red hake, white hake, spotted hake, longfin hake, and offshore hake. Interestingly, species seemed to be quite distinct in terms of depth. Red hake was common primarily in intermediate shallow water, with several thousand observations at every 25-meter interval from 50m to 200m, while spotted hake were also common in an even more narrow range of intermediate shallow waters, with over a thousand observations at the 100-125m interval and over 800 at the 125-150m interval. Offshore hake, on the other hand, seemed to be only found in much deeper waters, with several hundred observations at the 250-275m, 275-300m, and 325-350m and a few dozen observations at the 300-325, 350-375, and 375-400m intervals, as well as one singular observation at the 575-600m interval. Longfin hake were the least common and also one of the deepest-inhabiting hake, with only three observations at the 400-425m range and one observation at the 575-600m range. The silver hake and white hake were much more generalistic (and much more common overall); the silver hake had thousands of observations at every interval from 25m to 250m, and several dozen to hundred observations from every interval from 250m down to 375m, and white hake has several thousand of observations in each interval from 100m to 225m, and a few dozen to a few hundred in each interval down to 325m, as well as a single observation at the 575-600m interval. The diversity of depths inhabited is clearly distinct between species, with red hake and spotted hake being more common in intermediate waters, offshore hake inhabiting exclusively deep water, and silver hake and white hake being very more generalistic. Silver hake in particularly was incredibly abundant, often being in the top three predators at most intervals it inhabited, and was likely in the top three predators total in terms of abundance.

Next, I examined the skates, of which two species were present: the little skate and the winter skate. The two of them were both very common in shallow waters, with each of them having thousands of observations in each interval from 0m to 100m. The little skate in particular was incredibly abundant, being the dominant predator in the 0-25m range and the second-dominant in the 25-50m range. Both species were almost completely absent in waters deeper than 100m, likely indicating that they are specialized for shallow waters closer to the surface; the fact that they seem to coexist very frequently leads me to speculate that they may perform slightly different niches in their ecosystem to avoid competition, or possibly inhabit different depths at different times of year (though this seems unlikely, since they both inhabited very similar temperature ranges in my analysis of abundance by temperature), or simply coexist and compete with each other in the same niche. I'm not quite sure which of these explanations is reflective of reality, and it's something I may pursue more information on via Google on my own time out of curiosity.

Next up, I examined the flounders. Five species were present: the winter flounder, the summer flounder, the yellowtail flounders, the fourspot flounder, and the witch flounder, and they seemed very from each other by depth. The winter flounder and summer flounder were very common in shallow waters, with thousands of observations for each in the 0-25m interval, as well as several thousand summer flounder in each interval from 25m to 125m. The yellowtail flounder inhabited a more restrictive range, typically intermediate shallow waters from 50m to 100m, with a few thousand observations in each interval. Similarly, the fourspot flounder seemed to inhabit more intermediate deeper waters, where it proved to be very common, having several thousand observations in each interval from 75m to 150m. The witch flounder, on the other hand, was an exclusively deep-water species, with a few hundred species being observed in every interval from 200 to 325m, and it was also the deepest species found in the entire dataset, with 4 observations being found in the 625-650 meter range, making it the only species found below 600 meters. The clear distinction in flounder habitat is interesting due to the fact that flounders also observed clear distinctions in temperature preference, and the population patterns even align quite well: fourspot flounder were more common in deep waters, which tend to be cooler, while summer and winter flounder were more common in intermediate and shallow waters, which tend to be warmer. Of note is that the yellowtail flounder and witch flounder were not present in the examine portion (first 9 columns) of the temperature data, presumably because they simply aren't very common overall.

Finally, I examined the sharks, of which only two species were present in the examined portion of the depth graph. The smooth dogfish was quite common in shallow waters, with over 3500 observations in the 0-25m range, though it was seemingly absent from any other examined depth ranges. The spiny dogfish, however, was arguably the single most common species in the entire dataset. The spiny dogfish was the dominant predator in every interval from 25m to 125m, as well as in the 250-275m, 275-300m,

375-400, and 425-450m intervals, and it was the second most abundant each interval from 150m-250m, as well as in the 300-235m and 425-450m intervals. There were continuously hundreds or thousands of observations at almost every depth, indicating that the spiny dogfish is both extraordinarily common and highly generalistic, able to survive and thrive at almost any depth except for the most extreme waters. This matches up with how extremely common spiny dogfish where in the temperature dataframe, though it's quite interesting that the two dataframes seem to contradict each other: the fact that spiny dogfish were so common at almost every depth seems to contradict the fact that they were relatively rare in warmer waters, since their abundance in shallow depths would presumably mean they'd be more common in warmer temperatures. I can't be sure of the precise reason for this apparent contradiction, and it's something I am interested in doing more research on via Google.

Conclusion

Overall, this project has given me a great deal of insight in both skills of data analysis, as well as information related to fisheries science and population biology, both of which are fields that I have great interest in. There were several things that I would do differently if I did this project again, with the two major changes being to improve my time management (since I, admittedly, procrastinated on some parts of the project more than I should have) and more planning on the analysis phase, since I went in a bit blind and didn't have a concrete plan at first, which meant I wasted a lot of time writing code that I didn't need and using inefficient methods that could have been replaced with something else. In general, though, I enjoyed the knowledge I gained from this project in both analytics and fisheries science, and I'm glad I was able to work on a topic that I find so fascinating and enjoyable to learn about.

Images:

Image 1:

Import Pandas and Read Files

```
In [1]: import pandas as pd
        import numpy as np
        from IPython.display import clear_output

In [2]: PredatorData = pd.read_csv('FHPD.csv')
        #PredatorData

In [3]: #PreyData = pd.read_csv('FHPY.csv')
        #PreyData

In [4]: SpeciesData = pd.read_csv('FHSPECIES.csv')
        #SpeciesData

In [5]: #PreyLengthData = pd.read_csv('FHPYL.csv')
        #PreyLengthData
```

Image 2:

Create Dataframe Containing Desired Predator Data

```
In [6]: PredatorData2 = pd.DataFrame({"species":PredatorData["SVSPP"], "depth":PredatorData["SETDEPTH"],
                                      "temp":PredatorData["BOTTEMP"], "cruise ID":PredatorData["CRUISE6"]})
        PredatorData2
```

Out[6]:

	species	depth	temp	cruise ID
0	9	32.0	16.9	198102
1	9	121.0	16.4	198102
2	16	121.0	16.4	198102
3	18	43.0	17.7	198102
4	375	43.0	17.7	198102
...	...	...	...	...
630910	26	47.0	NaN	201302
630911	72	47.0	NaN	201302
630912	15	47.0	NaN	201302
630913	103	47.0	NaN	201302
630914	15	47.0	NaN	201302

630915 rows × 4 columns

Image 3:

Remove Outliers for Depth and Temp

```
In [7]: PredatorData2["depth"].describe()
```

```
Out[7]: count    570713.000000
        mean         97.417847
        std          80.010737
        min           0.000000
        25%          44.000000
        50%          76.000000
        75%         137.000000
        max        9999.000000
        Name: depth, dtype: float64
```

```
In [8]: PredatorData3 = PredatorData2[PredatorData2["depth"]<900]
        PredatorData4 = PredatorData3[PredatorData3["depth"]>0]
        PredatorData4["depth"].describe()
```

```
Out[8]: count    570704.00000
        mean         97.27922
        std          70.90458
        min           5.00000
        25%          44.00000
        50%          76.00000
        75%         137.00000
        max         650.00000
        Name: depth, dtype: float64
```

```
In [9]: PredatorData4["temp"].describe()
```

```
Out[9]: count    435321.000000
        mean         16.478941
        std          29.464533
        min           0.000000
        25%           5.100000
        50%           7.600000
        75%          11.500000
        max         999.000000
        Name: temp, dtype: float64
```

```
In [10]: PredatorData5 = PredatorData4[PredatorData4["temp"]<900]
         PredatorData6 = PredatorData5[PredatorData5["temp"]>0]
         PredatorData6["temp"].describe()
```

```
Out[10]: count    422615.000000
         mean         16.827824
         std          27.283540
         min           1.000000
         25%           5.400000
         50%           7.800000
         75%          11.700000
         max          99.900000
         Name: temp, dtype: float64
```

Image 4:

Add species names

```
In [11]: PredatorData6["commonname"] = ""
         PredatorData6 = PredatorData6.reset_index()
```

. . .

```
In [12]: IDtable = pd.DataFrame({"species ID":SpeciesData["SVSPP"], "common name":SpeciesData["COMNAME"],
                                 "scientific name":SpeciesData["SCINAME"]})
         IDtable = IDtable.set_index("species ID")
         IDtable
```

Out[12]:

species ID	common name	scientific name
1	ATLANTIC HAGFISH	MYXINE GLUTINOSA
3	DUSKY SHARK	CARCHARHINUS OBSCURUS
4	ROUGHTAIL STINGRAY	DASYATIS CENTROURA
9	SANDBAR SHARK	CARCHARHINUS PLUMBEUS
12	SAND TIGER	CARCHARIAS TAURUS
...	...	...
925	THRESHER SHARK	ALOPIAS VULPINUS
934	NIGHT SHARK	CARCHARHINUS SIGNATUS
938	STRIPED BONITO	SARDA ORIENTALIS
950	LOGGERHEAD SEATURTLE	CARETTA CARETTA
978	UNKNOWN 01	UNKNOWN 01

197 rows × 2 columns

```
In [13]: PredatorData6
```

Out[13]:

	index	species	depth	temp	cruise ID	commonname
0	0	9	32.0	16.9	198102	
1	1	9	121.0	16.4	198102	
2	2	16	121.0	16.4	198102	
3	3	18	43.0	17.7	198102	
4	4	375	43.0	17.7	198102	
...	...	...	...	...	...	...
422610	585139	77	275.0	7.9	200709	
422611	585140	107	275.0	7.9	200709	
422612	585581	156	275.0	7.9	200709	
422613	585582	156	275.0	7.9	200709	
422614	585583	156	275.0	7.9	200709	

422615 rows × 6 columns

Image 5:

Analyzing Species by Depth

```
In [14]: maxbydepth = pd.DataFrame({})
         maxbydepth
```

```
Out[14]: ___
```

```
In [15]: for x in range(0, 675, 25):
             currmeterrange = PredatorData6[PredatorData6["depth"]<x+25]
             currmeterrange = currmeterrange[currmeterrange["depth"]>x]

             currfreqcount = pd.value_counts(currmeterrange["species"]).to_frame().reset_index()
             currfreqcount.columns = ["species ID: "+str(x)+"m to "+str(x+25)+"m", "frequency: "+str(x)+"m to "+str(x+25)+"m"]

             maxbydepth = maxbydepth.append(currfreqcount["species ID: "+str(x)+"m to "+str(x+25)+"m"])
             maxbydepth = maxbydepth.append(currfreqcount["frequency: "+str(x)+"m to "+str(x+25)+"m"])

         maxbydepth
```

Out[15]:

	0	1	2	3	4	5	6	7	8	9	...	104	105	106	107	108	109	110	111	112
species ID: 0m to 25m	26.0	108.0	15.0	103.0	145.0	13.0	135.0	106.0	23.0	32.0	...	629.0	373.0	21.0	357.0	645.0	490.0	198.0	925.0	573.0
frequency: 0m to 25m	4572.0	4055.0	4010.0	3958.0	3622.0	3534.0	3258.0	2380.0	2305.0	2106.0	...	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
species ID: 25m to 50m	15.0	26.0	23.0	106.0	108.0	103.0	73.0	72.0	32.0	163.0	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
frequency: 25m to 50m	12096.0	7591.0	5286.0	4692.0	4596.0	3606.0	3540.0	3536.0	2993.0	2209.0	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
species ID: 50m to 75m	15.0	72.0	26.0	23.0	105.0	73.0	104.0	77.0	163.0	103.0	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
frequency: 50m to 75m	12676.0	7825.0	6736.0	4411.0	4409.0	4294.0	4092.0	4027.0	3387.0	2956.0		NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN

```
In [16]: maxbydepth = maxbydepth.astype(str)
```

```
In [17]: for i in range(0,114,1):
             for x in range (0,54,2):
                 q = float(maxbydepth.iat[x, i])
                 try:
                     m = IDtable.loc[q]["common name"]
                     maxbydepth.iloc[x, i]= m
                 except:
                     maxbydepth.iat[x, i] = "NOT AVAIL"
```

```
In [18]: maxbydepth
```

Out[18]:

	0	1	2	3	4	5	6	7	8	9
species ID: 0m to 25m	LITTLE SKATE	WINDOWPANE	SPINY DOGFISH	SUMMER FLOUNDER	WEAKFISH	SMOOTH DOGFISH	BLUEFISH	WINTER FLOUNDER	WINTER SKATE	ATLANTIC HERRING
frequency: 0m to 25m	4572.0	4055.0	4010.0	3958.0	3622.0	3534.0	3258.0	2380.0	2305.0	2106.0
species ID: 25m to 50m	SPINY DOGFISH	LITTLE SKATE	WINTER SKATE	WINTER FLOUNDER	WINDOWPANE	SUMMER FLOUNDER	ATLANTIC COD	SILVER HAKE	ATLANTIC HERRING	LONGHORN SCULPIN
frequency: 25m to 50m	12096.0	7591.0	5286.0	4692.0	4596.0	3606.0	3540.0	3536.0	2993.0	2209.0
species ID: 50m to 75m	SPINY DOGFISH	SILVER HAKE	LITTLE SKATE	WINTER SKATE	YELLOWTAIL FLOUNDER	ATLANTIC COD	FOURSPOT FLOUNDER	RED HAKE	LONGHORN SCULPIN	SUMMER FLOUNDER
frequency: 50m to	12676.0	7825.0	6736.0	4411.0	4409.0	4294.0	4092.0	4027.0	3387.0	2956.0

Image 6a:

	0	1	2	3	4	5	6	7	8	9	...
species ID: 0m to 25m	LITTLE SKATE	WINDOWPANE	SPINY DOGFISH	SUMMER FLOUNDER	WEAKFISH	SMOOTH DOGFISH	BLUEFISH	WINTER FLOUNDER	WINTER SKATE	ATLANTIC HERRING	...
frequency: 0m to 25m	4572	4055	4010	3958	3622	3534	3258	2380	2305	2106	...
species ID: 25m to 50m	SPINY DOGFISH	LITTLE SKATE	WINTER SKATE	WINTER FLOUNDER	WINDOWPANE	SUMMER FLOUNDER	ATLANTIC COD	SILVER HAKE	ATLANTIC HERRING	LONGHORN SCULPIN	...
frequency: 25m to 50m	12096	7591	5286	4692	4596	3606	3540	3536	2993	2209	...
species ID: 50m to 75m	SPINY DOGFISH	SILVER HAKE	LITTLE SKATE	WINTER SKATE	YELLOWTAIL FLOUNDER	ATLANTIC COD	FOURSPOT FLOUNDER	RED HAKE	LONGHORN SCULPIN	SUMMER FLOUNDER	...
frequency: 50m to 75m	12676	7825	6736	4411	4409	4294	4092	4027	3387	2956	...
species ID: 75m to 100m	SPINY DOGFISH	SILVER HAKE	RED HAKE	ATLANTIC COD	FOURSPOT FLOUNDER	HADDOCK	LITTLE SKATE	LONGHORN SCULPIN	SUMMER FLOUNDER	YELLOWTAIL FLOUNDER	...
frequency: 75m to 100m	8691	7093	4063	3829	3318	3090	2775	2633	2273	2213	...
species ID: 100m to 125m	SPINY DOGFISH	SILVER HAKE	FOURSPOT FLOUNDER	RED HAKE	ATLANTIC COD	SPOTTED HAKE	SUMMER FLOUNDER	HADDOCK	AMERICAN PLAICE	WHITE HAKE	...
frequency: 100m to 125m	3987	3890	2025	1882	1723	1522	1509	1424	1194	1139	...
species ID: 125m to 150m	SILVER HAKE	SPINY DOGFISH	RED HAKE	FOURSPOT FLOUNDER	AMERICAN PLAICE	ATLANTIC COD	WHITE HAKE	HADDOCK	SPOTTED HAKE	GOOSEFISH	...
frequency: 125m to 150m	3396	3243	1735	1343	1172	1144	1121	993	844	812	...
species ID: 150m to 175m	SILVER HAKE	SPINY DOGFISH	RED HAKE	WHITE HAKE	AMERICAN PLAICE	ACADIAN REDFISH	WITCH FLOUNDER	ATLANTIC COD	ATLANTIC HERRING	POLLOCK	...
frequency: 150m to 175m	3895	2243	2004	1933	1329	1160	1079	853	775	710	...
species ID: 175m to 200m	SILVER HAKE	SPINY DOGFISH	WHITE HAKE	RED HAKE	ACADIAN REDFISH	AMERICAN PLAICE	WITCH FLOUNDER	ATLANTIC HERRING	ATLANTIC COD	HADDOCK	...
frequency: 175m to 200m	4434	2818	2335	2124	1368	1078	896	792	725	649	...
species ID: 200m to 225m	SILVER HAKE	SPINY DOGFISH	WHITE HAKE	RED HAKE	ACADIAN REDFISH	AMERICAN PLAICE	ATLANTIC HERRING	GOOSEFISH	WITCH FLOUNDER	POLLOCK	...
frequency: 200m to 225m	3286	2543	1775	1480	903	710	590	485	474	409	...
species ID: 225m to 250m	SILVER HAKE	SPINY DOGFISH	WHITE HAKE	RED HAKE	GOOSEFISH	AMERICAN PLAICE	ACADIAN REDFISH	FOURSPOT FLOUNDER	WITCH FLOUNDER	ATLANTIC HERRING	...
frequency: 225m to 250m	1680	1553	1044	618	368	314	274	231	215	213	...
species ID: 250m to 275m	SPINY DOGFISH	SILVER HAKE	WHITE HAKE	RED HAKE	GOOSEFISH	FOURSPOT FLOUNDER	HADDOCK	AMERICAN PLAICE	OFFSHORE HAKE	WITCH FLOUNDER	...
frequency: 250m to 275m	912	777	390	240	171	121	119	119	119	94	...
species ID: 275m to 300m	SPINY DOGFISH	SILVER HAKE	WHITE HAKE	GOOSEFISH	RED HAKE	WITCH FLOUNDER	BLACKBELLY ROSEFISH	OFFSHORE HAKE	ACADIAN REDFISH	HADDOCK	...
frequency: 275m to 300m	617	602	360	186	182	147	135	131	110	102	...
species ID: 300m to 325m	SILVER HAKE	SPINY DOGFISH	WHITE HAKE	WITCH FLOUNDER	GOOSEFISH	OFFSHORE HAKE	BLACKBELLY ROSEFISH	RED HAKE	ACADIAN REDFISH	FOURSPOT FLOUNDER	...
frequency: 300m to 325m	317	264	147	132	105	83	76	71	65	56	...
species ID: 325m to 350m	SPINY DOGFISH	SILVER HAKE	WHITE HAKE	GOOSEFISH	OFFSHORE HAKE	WITCH FLOUNDER	ACADIAN REDFISH	RED HAKE	BLACKBELLY ROSEFISH	NORTHERN SHORTFIN SQUID	...
frequency: 325m to 350m	365	330	238	134	108	106	77	72	65	55	...

Image 6b:

species ID: 350m to 375m	SILVER HAKE	WHITE HAKE	GOOSEFISH	SPINY DOGFISH	WITCH FLOUNDER	OFFSHORE HAKE	BLACKBELLY ROSEFISH	ACADIAN REDFISH	THORNY SKATE	RED HAKE	...
frequency: 350m to 375m	135	98	76	66	52	49	42	39	19	17	...
species ID: 375m to 400m	SPINY DOGFISH	GOOSEFISH	OFFSHORE HAKE	SILVER HAKE	RED HAKE	BLACKBELLY ROSEFISH	FOURSPOT FLOUNDER	WITCH FLOUNDER	BUTTERFISH	WHITE HAKE	...
frequency: 375m to 400m	47	34	29	29	23	17	15	12	10	8	...
species ID: 400m to 425m	GOOSEFISH	SILVER HAKE	LONGFIN SQUID	FOURSPOT FLOUNDER	SPOTTED HAKE	RED HAKE	WITCH FLOUNDER	OFFSHORE HAKE	LONGFIN HAKE	WHITE HAKE	...
frequency: 400m to 425m	35	27	10	10	9	7	5	5	3	2	...
species ID: 425m to 450m	SPINY DOGFISH	SILVER HAKE	GOOSEFISH	OFFSHORE HAKE	WITCH FLOUNDER	BLACKBELLY ROSEFISH	FOURSPOT FLOUNDER	LITTLE SKATE	WHITE HAKE	RED HAKE	...
frequency: 425m to 450m	11	10	10	7	4	4	3	3	3	2	...
species ID: 450m to 475m	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	...
frequency: 450m to 475m	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...
species ID: 475m to 500m	GOOSEFISH	SPINY DOGFISH	WITCH FLOUNDER	BLACKBELLY ROSEFISH	OFFSHORE HAKE	FOURSPOT FLOUNDER	ROSETTE SKATE	SPOTTED HAKE	ATLANTIC MACKEREL	WHITE HAKE	...
frequency: 475m to 500m	10	9	7	7	7	4	4	3	1	1	...
species ID: 500m to 525m	GOOSEFISH	ATLANTIC HALIBUT	THORNY SKATE	WINTER FLOUNDER	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	...
frequency: 500m to 525m	1	1	1	1	NaN	NaN	NaN	NaN	NaN	NaN	...
species ID: 525m to 550m	SILVER HAKE	GOOSEFISH	WHITE HAKE	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	...
frequency: 525m to 550m	14	2	1	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...
species ID: 550m to 575m	OFFSHORE HAKE	BLACKBELLY ROSEFISH	THORNY SKATE	WHITE HAKE	GOOSEFISH	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	...
frequency: 550m to 575m	3	2	2	1	1	NaN	NaN	NaN	NaN	NaN	...
species ID: 575m to 600m	LONGFIN HAKE	OFFSHORE HAKE	WHITE HAKE	FOURSPOT FLOUNDER	ATLANTIC HERRING	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	...
frequency: 575m to 600m	1	1	1	1	1	NaN	NaN	NaN	NaN	NaN	...
species ID: 600m to 625m	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	...
frequency: 600m to 625m	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...
species ID: 625m to 650m	WITCH FLOUNDER	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	...
frequency: 625m to 650m	4	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...
species ID: 650m to 675m	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	...
frequency: 650m to 675m	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...

54 rows × 114 columns

Image 7:

Analyzing Species by Temp

```
In [19]: maxbytemp = pd.DataFrame({})
         maxbytemp
```

Out[19]:

```
In [20]: for x in range(0, 100, 5):
             currtemprange = PredatorData6[PredatorData6["temp"]<x+5]
             currtemprange = currtemprange[currtemprange["temp"]>x]

             tmpfreqcount = pd.value_counts(currtemprange["species"]).to_frame().reset_index()
             tmpfreqcount.columns = ["species ID: "+str(x)+"° to "+str(x+5)+" °", "frequency: "+str(x)+"° to "+str(x+5)+" °"]

             maxbytemp = maxbytemp.append(tmpfreqcount["species ID: "+str(x)+"° to "+str(x+5)+" °"])
             maxbytemp = maxbytemp.append(tmpfreqcount["frequency: "+str(x)+"° to "+str(x+5)+" °"])

         maxbytemp
```

Out[20]:

	0	1	2	3	4	5	6	7	8	9	...	97	98	99	100	101	102	103	104	1
species ID: 0° to 5 °	15.0	72.0	26.0	73.0	32.0	23.0	106.0	163.0	77.0	108.0	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	N
frequency: 0° to 5 °	9222.0	7739.0	6232.0	4518.0	4407.0	3992.0	3823.0	3585.0	3380.0	3376.0	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	N
species ID: 5° to 10 °	15.0	72.0	77.0	26.0	76.0	32.0	73.0	74.0	104.0	102.0	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	N
frequency: 5° to 10 °	27941.0	21771.0	12022.0	10604.0	8384.0	8344.0	7839.0	6184.0	6099.0	5888.0	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	N
species ID: 10° to 15 °	15.0	72.0	104.0	78.0	77.0	103.0	131.0	26.0	197.0	106.0	...	360.0	541.0	856.0	205.0	12.0	203.0	188.0	764.0	14
frequency: 10° to 15 °	10642.0	6594.0	4367.0	3882.0	3223.0	3186.0	2829.0	2660.0	2159.0	2052.0	...	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	

```
In [21]: maxbytemp = maxbytemp.astype(str)
```

```
In [22]: for i in range(0,107,1):
             for x in range (0,40,2):
                 q = float(maxbytemp.iat[x, i])
                 try:
                     m = IDtable.loc[q]["common name"]
                     maxbytemp.iloc[x, i]= m
                 except:
                     maxbytemp.iat[x, i] = "NOT AVAIL"
```

```
In [23]: maxbytemp
```

Out[23]:

	0	1	2	3	4	5	6	7	8	9	...
species ID: 0° to 5 °	SPINY DOGFISH	SILVER HAKE	LITTLE SKATE	ATLANTIC COD	ATLANTIC HERRING	WINTER SKATE	WINTER FLOUNDER	LONGHORN SCULPIN	RED HAKE	WINDOWPANE	...
frequency: 0° to 5 °	9222.0	7739.0	6232.0	4518.0	4407.0	3992.0	3823.0	3585.0	3380.0	3376.0	...
species ID: 5° to 10 °	SPINY DOGFISH	SILVER HAKE	RED HAKE	LITTLE SKATE	WHITE HAKE	ATLANTIC HERRING	ATLANTIC COD	HADDOCK	FOURSPOT FLOUNDER	AMERICAN PLAICE	...
frequency: 5° to 10 °	27941.0	21771.0	12022.0	10604.0	8384.0	8344.0	7839.0	6184.0	6099.0	5888.0	...
species ID: 10° to 15 °	SPINY DOGFISH	SILVER HAKE	FOURSPOT FLOUNDER	SPOTTED HAKE	RED HAKE	SUMMER FLOUNDER	BUTTERFISH	LITTLE SKATE	GOOSEFISH	WINTER FLOUNDER	...
frequency: 10° to 15 °	10642.0	6594.0	4367.0	3882.0	3223.0	3186.0	2829.0	2660.0	2159.0	2052.0	...

Image 8a:

Out[20]:

	0	1	2	3	4	5	6	7	8	9	...	
species ID: 0° to 5 °	SPINY DOGFISH	SILVER HAKE	LITTLE SKATE	ATLANTIC COD	ATLANTIC HERRING	WINTER SKATE	WINTER FLOUNDER	LONGHORN SCULPIN	RED HAKE	WINDOWPANE	...	Na
frequency: 0° to 5 °	9222	7739	6232	4518	4407	3992	3823	3585	3380	3376	...	Na
species ID: 5° to 10 °	SPINY DOGFISH	SILVER HAKE	RED HAKE	LITTLE SKATE	WHITE HAKE	ATLANTIC HERRING	ATLANTIC COD	HADDOCK	FOURSPOT FLOUNDER	AMERICAN PLAICE	...	Na
frequency: 5° to 10 °	27941	21771	12022	10604	8384	8344	7839	6184	6099	5888	...	Na
species ID: 10° to 15 °	SPINY DOGFISH	SILVER HAKE	FOURSPOT FLOUNDER	SPOTTED HAKE	RED HAKE	SUMMER FLOUNDER	BUTTERFISH	LITTLE SKATE	GOOSEFISH	WINTER FLOUNDER	...	360
frequency: 10° to 15 °	10642	6594	4367	3882	3223	3186	2829	2660	2159	2052	...	2
species ID: 15° to 20 °	SUMMER FLOUNDER	SMOOTH DOGFISH	WINDOWPANE	BLUEFISH	SCUP	SPINY DOGFISH	BUTTERFISH	LITTLE SKATE	WINTER SKATE	WINTER FLOUNDER	...	682
frequency: 15° to 20 °	1830	1811	1201	1019	948	915	914	879	839	617	...	1
species ID: 20° to 25 °	WEAKFISH	SUMMER FLOUNDER	BLUEFISH	SMOOTH DOGFISH	SCUP	BUTTERFISH	ATLANTIC CROAKER	SPOT	WINDOWPANE	SPOTTED HAKE	...	Na
frequency: 20° to 25 °	1732	1325	1231	1091	820	681	540	538	509	389	...	Na
species ID: 25° to 30 °	SPOT	BLUEFISH	ATLANTIC CROAKER	BLACK SEA BASS	WEAKFISH	SCUP	BUTTERFISH	SUMMER FLOUNDER	ATLANTIC SHARPNOSE SHARK	SCUP	...	Na
frequency: 25° to 30 °	195	137	134	129	125	84	74	68	66	43	...	Na
species ID: 30° to 35 °	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	...	Na
frequency: 30° to 35 °	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	Na
species ID: 35° to 40 °	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	...	Na
frequency: 35° to 40 °	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	Na
species ID: 40° to 45 °	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	...	Na
frequency: 40° to 45 °	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	Na
species ID: 45° to 50 °	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	...	Na
frequency: 45° to 50 °	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	Na

Image 8b:

species ID: 50° to 55 °	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	...	Na
frequency: 50° to 55 °	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	Na
species ID: 55° to 60 °	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	...	Na
frequency: 55° to 60 °	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	Na
species ID: 60° to 65 °	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	...	Na
frequency: 60° to 65 °	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	Na
species ID: 65° to 70 °	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	...	Na
frequency: 65° to 70 °	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	Na
species ID: 70° to 75 °	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	...	Na
frequency: 70° to 75 °	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	Na
species ID: 75° to 80 °	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	...	Na
frequency: 75° to 80 °	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	Na
species ID: 80° to 85 °	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	...	Na
frequency: 80° to 85 °	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	Na
species ID: 85° to 90 °	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	...	Na
frequency: 85° to 90 °	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	Na
species ID: 90° to 95 °	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	NOT AVAIL	...	Na
frequency: 90° to 95 °	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	Na
species ID: 95° to 100 °	SPINY DOGFISH	SILVER HAKE	ATLANTIC COD	WINTER SKATE	RED HAKE	LITTLE SKATE	WHITE HAKE	WINDOWPANE	FOURSPOT FLOUNDER	LONGHORN SCULPIN	...	Na
frequency: 95° to 100 °	8010	6977	3657	2230	2176	2119	2077	1115	1042	971	...	Na

40 rows × 107 columns