Midterm 2 W24

Your Name Here

2024-02-27

Instructions

Answer the following questions and complete the exercises in RMarkdown. Please embed all of your code and push your final work to your repository. Your code must be organized, clean, and run free from errors. Remember, you must remove the `#` for any included code chunks to run. Be sure to add your name to the author header above.

Your code must knit in order to be considered. If you are stuck and cannot answer a question, then comment out your code and knit the document. You may use your notes, labs, and homework to help you complete this exam. Do not use any other resources- including AI assistance.

Don't forget to answer any questions that are asked in the prompt. Some questions will require a plot, but others do not- make sure to read each question carefully.

For the questions that require a plot, make sure to have clearly labeled axes and a title. Keep your plots clean and professional-looking, but you are free to add color and other aesthetics.

Be sure to follow the directions and upload your exam on Gradescope.

Background

In the `data` folder, you will find data about shark incidents in California between 1950-2022. The data (https://catalog.data.gov/dataset/shark-incident-database-california-56167) are from: State of California- Shark Incident Database.

Load the libraries

```
library("tidyverse")
library("janitor")
library("naniar")
```

Load the data

Run the following code chunk to import the data.

```
sharks <- read_csv("data/SharkIncidents_1950_2022_220302.csv") %>% clean_names()
```

Questions

1. (1 point) Start by doing some data exploration using your preferred function(s). What is the structure of the data? Where are the missing values and how are they represented?

```
glimpse(sharks)
```

```
## Rows: 211
## Columns: 16
## $ incident_num     <chr> "1", "2", "3", "4", "5", "6", "7", "8", "9", "10", "1…
## $ month            <dbl> 10, 5, 12, 2, 8, 4, 10, 5, 6, 7, 10, 11, 4, 5, 5, 8, …
## $ day              <dbl> 8, 27, 7, 6, 14, 28, 12, 7, 14, 28, 4, 10, 24, 19, 21…
## $ year             <dbl> 1950, 1952, 1952, 1955, 1956, 1957, 1958, 1959, 1959,…
## $ time             <chr> "12:00", "14:00", "14:00", "12:00", "16:30", "13:30",…
## $ county           <chr> "San Diego", "San Diego", "Monterey", "Monterey", "Sa…
## $ location         <chr> "Imperial Beach", "Imperial Beach", "Lovers Point", "…
## $ mode             <chr> "Swimming", "Swimming", "Swimming", "Freediving", "Sw…
## $ injury           <chr> "major", "minor", "fatal", "minor", "major", "fatal",…
## $ depth            <chr> "surface", "surface", "surface", "surface", "surface"…
## $ species          <chr> "White", "White", "White", "White", "White", "White",…
## $ comment          <chr> "Body Surfing, bit multiple times on leg, thigh and b…
## $ longitude        <chr> "-117.1466667", "-117.2466667", "-122.05", "-122.15",…
## $ latitude         <dbl> 32.58833, 32.58833, 36.62667, 36.62667, 35.13833, 35.…
## $ confirmed_source <chr> "Miller/Collier, Coronado Paper, Oceanside Paper", "G…
## $ wfl_case_number  <chr> NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, N…
```

```
miss_var_summary(sharks)
```

```
## # A tibble: 16 × 3
##    variable         n_miss pct_miss
##    <chr>             <int>    <dbl>
##  1 wfl_case_number     202   95.7
##  2 time                  7    3.32
##  3 latitude              6    2.84
##  4 longitude             5    2.37
##  5 confirmed_source      1    0.474
##  6 incident_num          0    0
##  7 month                 0    0
##  8 day                   0    0
##  9 year                  0    0
## 10 county                0    0
## 11 location              0    0
## 12 mode                  0    0
## 13 injury                0    0
## 14 depth                 0    0
## 15 species               0    0
## 16 comment               0    0
```

In Incident_number - There are observations that are NOT COUNTED, In addition there used NA in wfl_case_number, time, latitude, and longitude. Lastly they used unknown for unknown times in the time variable.

```
names(sharks)
```

```
##  [1] "incident_num"     "month"           "day"              "year"
##  [5] "time"             "county"          "location"         "mode"
##  [9] "injury"           "depth"           "species"          "comment"
## [13] "longitude"        "latitude"        "confirmed_source" "wfl_case_number"
```

2. (1 point) Notice that there are some incidents identified as “NOT COUNTED”. These should be removed from the data because they were either not sharks, unverified, or were provoked. It’s OK to replace the `sharks` object.

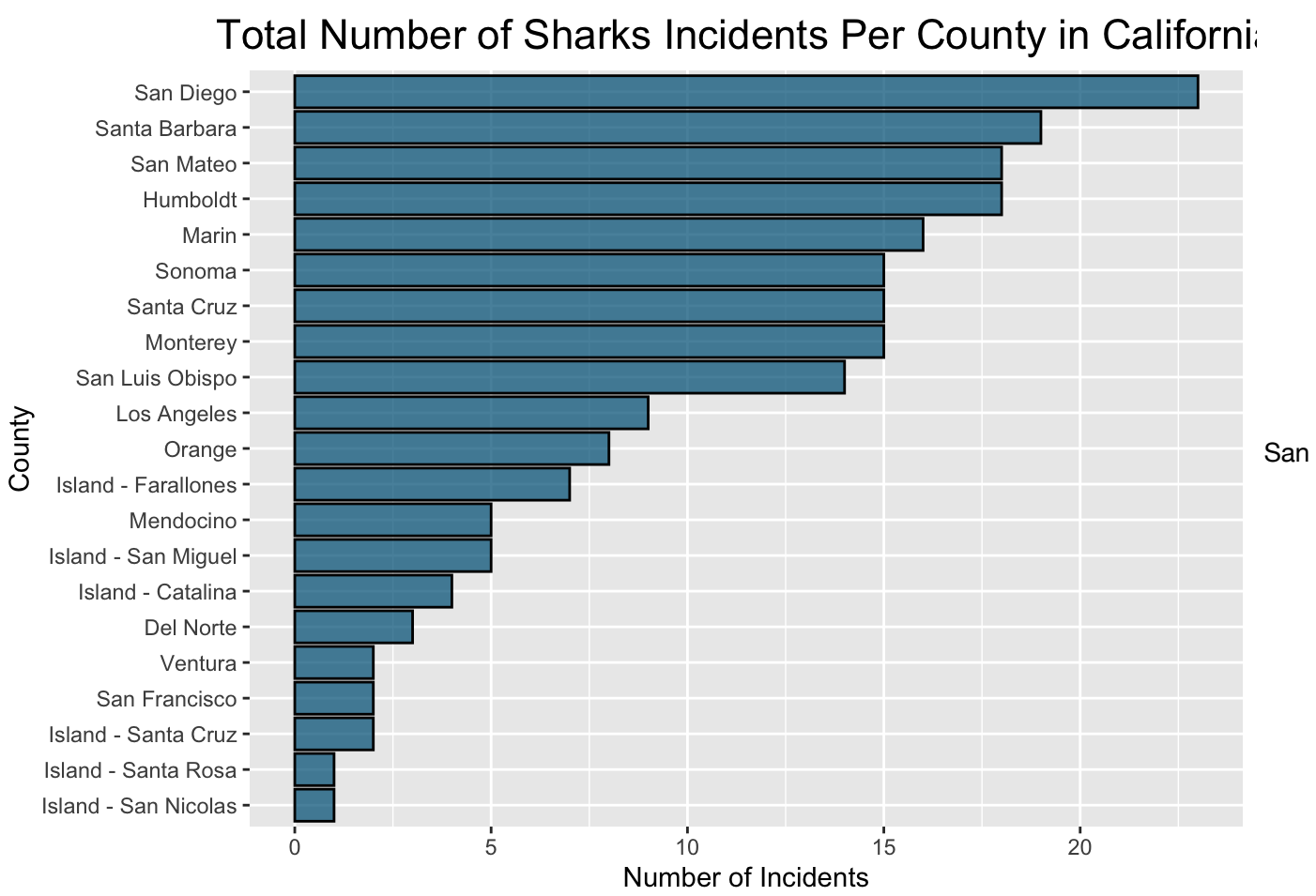
```
sharks <- sharks %>%
  filter(incident_num!="NOT COUNTED")
```

3. (3 points) Are there any “hotspots” for shark incidents in California? Make a plot that shows the total number of incidents per county. Which county has the highest number of incidents?

```
sharks %>%
  count(county) %>%
  arrange(-n)
```

```
## # A tibble: 21 × 2
##    county              n
##    <chr>           <int>
##  1 San Diego          23
##  2 Santa Barbara      19
##  3 Humboldt           18
##  4 San Mateo          18
##  5 Marin              16
##  6 Monterey           15
##  7 Santa Cruz         15
##  8 Sonoma             15
##  9 San Luis Obispo    14
## 10 Los Angeles         9
## # ℹ 11 more rows
```

```
sharks %>%
  count(county) %>%
  ggplot(aes(x=reorder(county, n), y=n))+
  geom_col(fill="deepskyblue4", alpha  =0.75, color = "black")+
  coord_flip()+
  labs(title = "Total Number of Sharks Incidents Per County in California",
       x="County",
       y="Number of Incidents")+
  theme(plot.title = element_text(size=rel(1.5),hjust = 0.5))
```



Diego seems to be a hot spot as it is the county with the highest number of incidents.

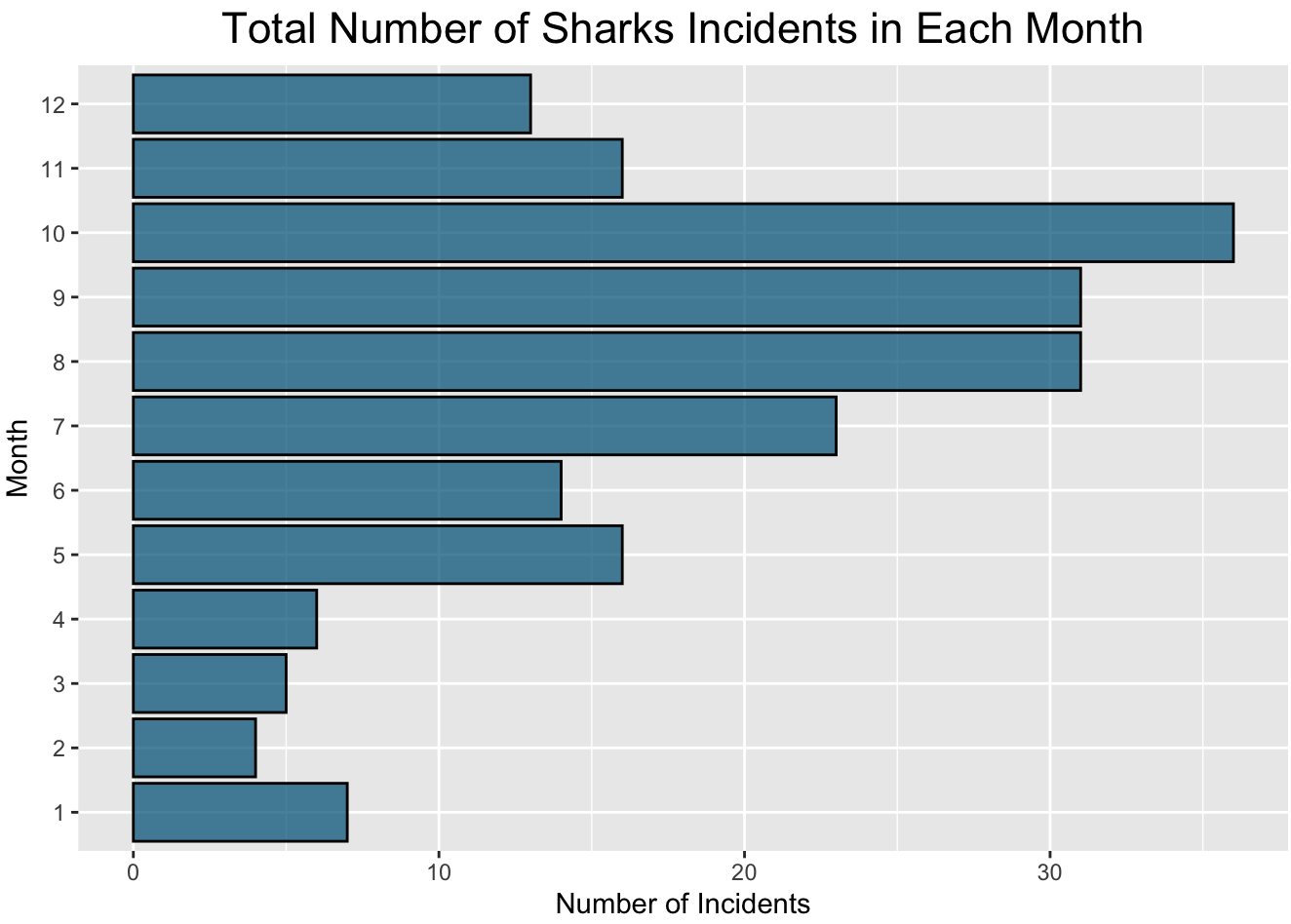
4. (3 points) Are there months of the year when incidents are more likely to occur? Make a plot that shows the total number of incidents by month. Which month has the highest number of incidents?

```
sharks %>%
  count(month) %>%
  arrange(-n)
```

```
## # A tibble: 12 × 2
##    month     n
##    <dbl> <int>
##  1    10    36
##  2     8    31
##  3     9    31
##  4     7    23
##  5     5    16
##  6    11    16
##  7     6    14
##  8    12    13
##  9     1     7
## 10     4     6
## 11     3     5
## 12     2     4
```

The tenth month (October) has the highest number of incidents with 36.

```
sharks %>%
  mutate(month=as.factor(month)) %>%
  count(month) %>%
  ggplot(aes(x=month, y=n))+
  geom_col(fill="deepskyblue4", alpha  =0.75, color = "black")+
  coord_flip()+
  labs(title = "Total Number of Sharks Incidents in Each Month",
       x="Month",
       y="Number of Incidents")+
  theme(plot.title = element_text(size=rel(1.5),hjust = 0.5))
```



5. (3 points) How do the number and types of injuries compare by county? Make a table (not a plot) that shows the number of injury types by county. Which county has the highest number of fatalities?

```
sharks %>%
  count(county, injury) %>%
  pivot_wider(names_from = injury,
              values_from = n) %>%
  arrange(-fatal)
```

```
## # A tibble: 21 × 5
##    county              minor  none major fatal
##    <chr>               <int> <int> <int> <int>
##  1 San Luis Obispo         1     7     3     3
##  2 Monterey                2     3     8     2
##  3 San Diego               8     9     4     2
##  4 Santa Barbara           6     9     2     2
##  5 Island - San Miguel     2    NA     2     1
##  6 Los Angeles             6     2    NA     1
##  7 Mendocino               1    NA     3     1
##  8 San Francisco          NA     1    NA     1
##  9 San Mateo               4    12     1     1
## 10 Santa Cruz              3     8     3     1
## # ℹ 11 more rows
```

San Luis Obispo has the largest number of fatal injuries, with 3.

6. (2 points) In the data, `mode` refers to a type of activity. Which activity is associated with the highest number of incidents?

```
sharks %>%
  count(mode) %>%
  arrange(-n)
```

```
## # A tibble: 7 × 2
##   mode                    n
##   <chr>               <int>
## 1 Surfing / Boarding     80
## 2 Freediving             35
## 3 Kayaking / Canoeing    29
## 4 Swimming               22
## 5 Scuba Diving           19
## 6 Hookah Diving          10
## 7 Paddleboarding          7
```

Surfing/ Boarding is associated with the highest number of incidents

7. (4 points) Use faceting to make a plot that compares the number and types of injuries by activity. (hint: the x axes should be the type of injury)

```
sharks %>%
  count(injury, mode) %>%
  ggplot(aes(x=injury, y=n))+
  geom_col(fill="deepskyblue4", alpha  =0.75, color = "black")+
  facet_wrap(.~mode)+
  labs(title = "Different Types of Injuries by Activity",
       x="Type of Injury",
       y="Number of Incidents")+
    theme(plot.title = element_text(size=rel(1.5),hjust = 0.5))
```

8. (1 point) Which shark species is involved in the highest number of incidents?

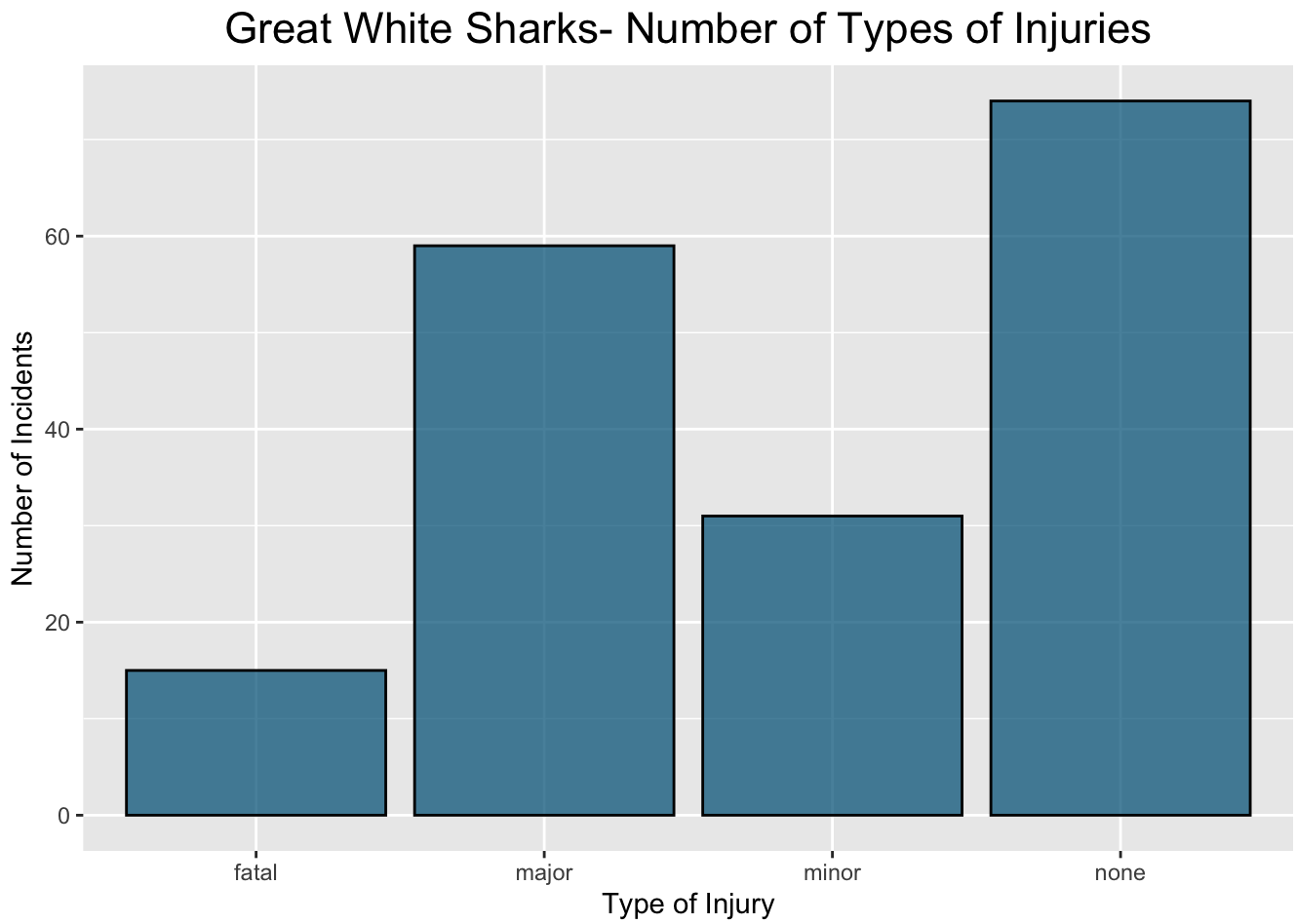
```
sharks %>%
  count(species) %>%
  arrange(-n)
```

```
## # A tibble: 8 × 2
##   species        n
##   <chr>      <int>
## 1 White        179
## 2 Unknown       13
## 3 Hammerhead     3
## 4 Blue           2
## 5 Leopard        2
## 6 Salmon         1
## 7 Sevengill      1
## 8 Thresher       1
```

Great White Sharks are involved in the highest number of incidents

9. (3 points) Are all incidents involving Great White's fatal? Make a plot that shows the number and types of injuries for Great White's only.

```
sharks %>%
  filter(species=="White") %>%
  count(injury) %>%
  ggplot(aes(x=injury,y=n))+
  geom_col(fill="deepskyblue4", alpha  =0.75, color = "black")+
  labs(title = "Great White Sharks- Number of Types of Injuries",
       x="Type of Injury",
       y= "Number of Incidents")+
  theme(plot.title = element_text(size=rel(1.5),hjust = 0.5))
```



Background

Let's learn a little bit more about Great White sharks by looking at a small dataset that tracked 20 Great White's in the Fallaron Islands. The data (https://link.springer.com/article/10.1007/s00227-007-0739-4) are from: Weng et al. (2007) Migration and habitat of white sharks (*Carcharodon carcharias*) in the eastern Pacific Ocean.

Load the data

```
white_sharks <- read_csv("data/White sharks tracked from Southeast Farallon Island, CA, USA, 1999 2004.csv", na = c("?", "n/a")) %>% clean_names()
```

10. (1 point) Start by doing some data exploration using your preferred function(s). What is the structure of the data? Where are the missing values and how are they represented?

```
glimpse(white_sharks)
```

```
## Rows: 20
## Columns: 10
## $ shark           <chr> "1-M", "2-M", "3-M", "4-M", "5-F", "6-M", "7-F", "8-M"…
## $ tagging_date    <chr> "19-Oct-99", "30-Oct-99", "16-Oct-00", "5-Nov-01", "5-…
## $ total_length_cm <dbl> 402, 366, 457, 457, 488, 427, 442, 380, 450, 530, 427,…
## $ sex             <chr> "M", "M", "M", "M", "F", "M", "F", "M", "M", "F", NA, …
## $ maturity        <chr> "Mature", "Adolescent", "Mature", "Mature", "Mature", …
## $ pop_up_date     <chr> "2-Nov-99", "25-Nov-99", "16-Apr-01", "6-May-02", "19-…
## $ track_days      <dbl> 14, 26, 182, 182, 256, 275, 35, 60, 209, 91, 182, 240,…
## $ longitude       <dbl> -124.49, -125.97, -156.80, -141.47, -133.25, -138.83, …
## $ latitude        <dbl> 38.95, 38.69, 20.67, 26.39, 21.13, 26.50, 37.07, 34.93…
## $ comment         <chr> "Nearshore", "Nearshore", "To Hawaii", "To Hawaii", "O…
```

```
miss_var_summary(white_sharks)
```

```
## # A tibble: 10 × 3
##    variable        n_miss pct_miss
##    <chr>            <int>    <dbl>
##  1 sex                  3       15
##  2 maturity             1        5
##  3 longitude            1        5
##  4 latitude             1        5
##  5 shark                0        0
##  6 tagging_date         0        0
##  7 total_length_cm      0        0
##  8 pop_up_date          0        0
##  9 track_days           0        0
## 10 comment              0        0
```

11. (3 points) How do male and female sharks compare in terms of total length? Are males or females larger on average? Do a quick search online to verify your findings. (hint: this is a table, not a plot).

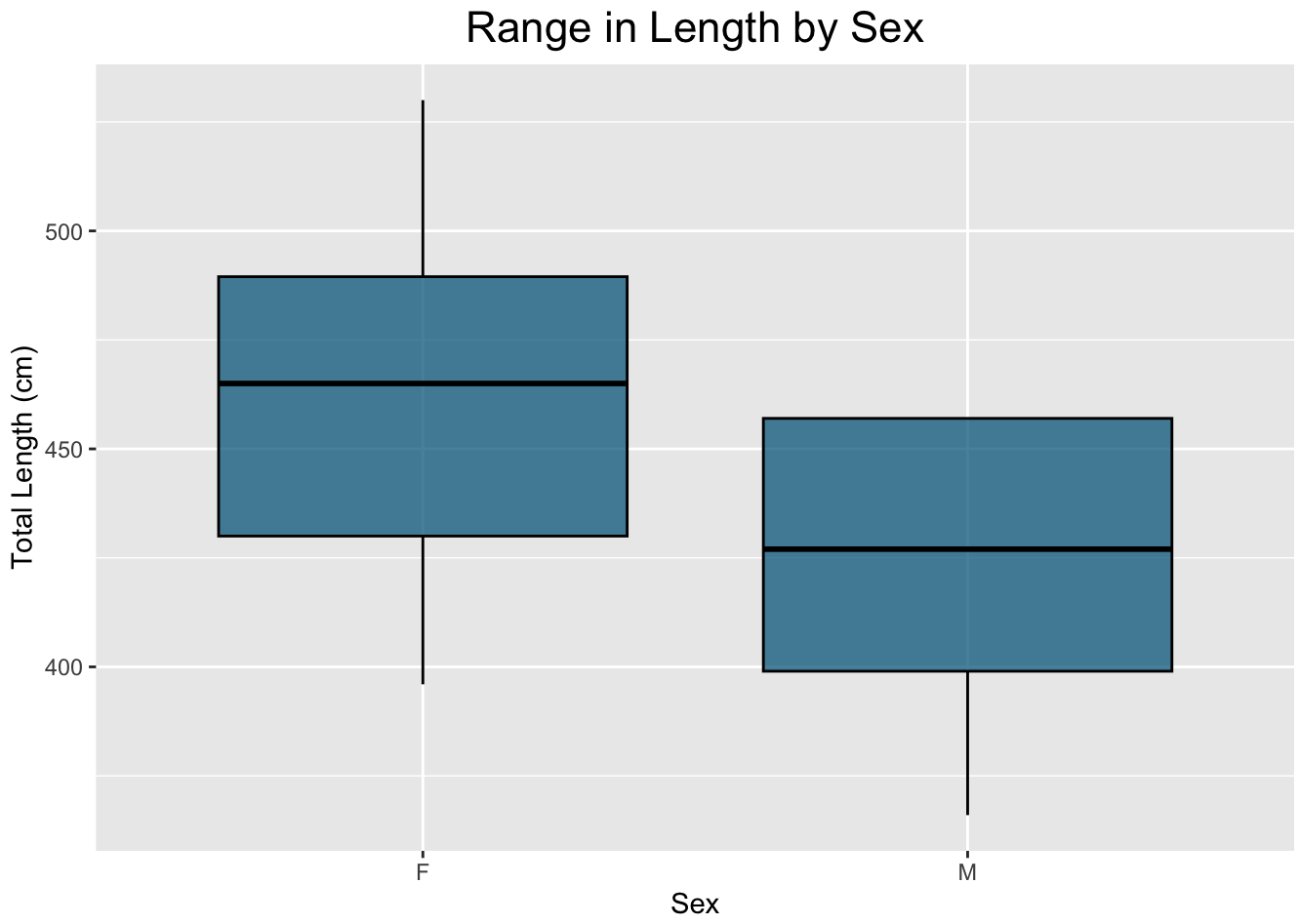
```
white_sharks %>%
  pivot_wider(names_from = sex,
              values_from = total_length_cm) %>%
  summarise(mean_M=mean(M, na.rm = T),
            mean_F=mean(F,na.rm = T))
```

```
## # A tibble: 1 × 2
##   mean_M mean_F
##    <dbl>  <dbl>
## 1   425.    462
```

The average length for females is longther than males. Which I verifies with a google search! “Male great whites on average measure 3.4 to 4.0 m (11 to 13 ft) in length, while females measure 4.6 to 4.9 m (15 to 16 ft)” From wikipedia.

12. (3 points) Make a plot that compares the range of total length by sex.

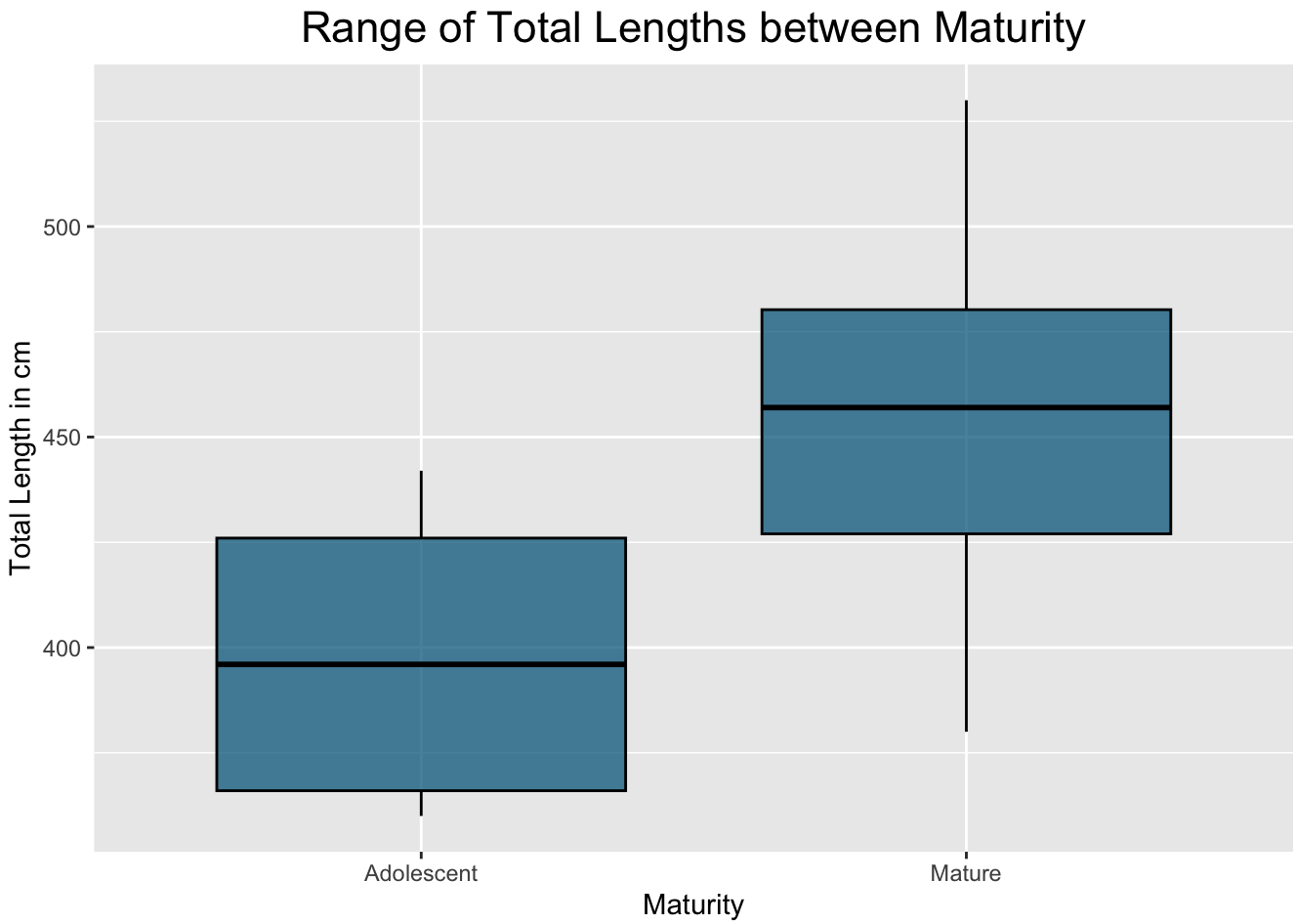
```
white_sharks %>%
  filter(sex!="NA") %>%
  ggplot(aes(x=sex, y=total_length_cm))+
  geom_boxplot(fill="deepskyblue4", alpha  =0.75, color = "black")+
  labs(title = "Range in Length by Sex",
       x= "Sex",
       y="Total Length (cm)")+
  theme(plot.title = element_text(size=rel(1.5),hjust = 0.5))
```



13. (2 points) Using the `sharks` or the `white_sharks` data, what is one question that you are interested in exploring? Write the question and answer it using a plot or table.

How does the range of lengths in Great White Sharks differ for different maturity levels?

```
white_sharks %>%
  filter(maturity!="NA") %>%
  ggplot(aes(x=maturity, y=total_length_cm))+
  geom_boxplot(fill="deepskyblue4", alpha  =0.75, color = "black")+
  labs(title = "Range of Total Lengths between Maturity",
       x="Maturity",
       y= "Total Length in cm")+
    theme(plot.title = element_text(size=rel(1.5),hjust = 0.5))
```


Range of Total Lengths between Maturity
Total Length in cm
500
450
400
Adolescent
Mature
Maturity