Case Study 4 - Global Fishing

Loading Libraries & Data

```
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.1 --

## v ggplot2 3.3.5     v purrr   0.3.4
## v tibble  3.1.3     v dplyr   1.0.7
## v tidyr   1.1.3     v stringr 1.4.0
## v readr   2.0.1     v forcats 0.5.1

## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
library(readr)
library(skimr)
library(lubridate)
```

```
##
## Attaching package: 'lubridate'

## The following objects are masked from 'package:base':
##
##     date, intersect, setdiff, union
```

```
library(SimDesign)
library(janitor)
```

```
##
## Attaching package: 'janitor'

## The following objects are masked from 'package:stats':
##
##     chisq.test, fisher.test
```

```
library(RSQLite)
library(knitr)
library(scales)
```

```
##
## Attaching package: 'scales'
```

```
## The following object is masked from 'package:purrr':
##
##     discard
```

```
## The following object is masked from 'package:readr':
##
##     col_factor
```

```
library(corrplot)
```

```
## corrplot 0.90 loaded
```

```
library(RColorBrewer)
library(treemap)
library(readxl)
library(gridExtra)
```

```
##
## Attaching package: 'gridExtra'
```

```
## The following object is masked from 'package:dplyr':
##
##     combine
```

```
farmed <- readr::read_csv('https://raw.githubusercontent.com/rfordatascience/tidytuesday/master/data/20
```

```
## Rows: 11657 Columns: 4
```

```
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr (2): Entity, Code
## dbl (2): Year, Aquaculture production (metric tons)
```

```
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
captured_vs_farmed <- readr::read_csv('https://raw.githubusercontent.com/rfordatascience/tidytuesday/ma
```

```
## Rows: 14674 Columns: 5
```

```
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr (2): Entity, Code
## dbl (3): Year, Aquaculture production (metric tons), Capture fisheries produ...
```

```
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```r
captured <- readr::read_csv('https://raw.githubusercontent.com/rfordatascience/tidytuesday/master/data/2
```

```
## Rows: 14516 Columns: 4

## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr (2): Entity, Code
## dbl (2): Year, Capture fisheries production (metric tons)

##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```r
consumption <- readr::read_csv('https://raw.githubusercontent.com/rfordatascience/tidytuesday/master/dat
```

```
## Rows: 11028 Columns: 4

## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr (2): Entity, Code
## dbl (2): Year, Fish, Seafood- Food supply quantity (kg/capita/yr) (FAO, 2020)

##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```r
stock <- readr::read_csv('https://raw.githubusercontent.com/rfordatascience/tidytuesday/master/data/202
```

```
## Rows: 51 Columns: 5

## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr (2): Entity, Code
## dbl (3): Year, Share of fish stocks within biologically sustainable levels (...

##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```r
fishery <- readr::read_csv('https://raw.githubusercontent.com/rfordatascience/tidytuesday/master/data/20
```

```
## Rows: 61 Columns: 8

## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr (2): Entity, Code
## dbl (6): Year, Artisanal (small-scale commercial), Discards, Industrial (lar...

##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```r
production <- readr::read_csv('https://raw.githubusercontent.com/rfordatascience/tidytuesday/master/data
```

```
## Rows: 10326 Columns: 10

## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr (2): Entity, Code
## dbl (8): Year, Commodity Balances - Livestock and Fish Primary Equivalent - ...

##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

Cross checking the "captured" and the "farmed" tables with the "captured__vs__farmed" table

```r
#Checking if all "captured" data is found in the captured_vs_farmed table
captured_vs_farmed_filtered <- captured_vs_farmed%>%
  filter(`Capture fisheries production (metric tons)` != "NA")

sum(captured$`Capture fisheries production (metric tons)`)
```

```
## [1] 41264851330
```

```r
sum(captured_vs_farmed_filtered$`Capture fisheries production (metric tons)`)
```

```
## [1] 41264851330
```

```r
#Checking if all "farmed" data is found in the captured_vs_farmed table
captured_vs_farmed_filtered2 <- captured_vs_farmed%>%
  filter(`Aquaculture production (metric tons)` != "NA")

sum(farmed$`Aquaculture production (metric tons)`)
```

```
## [1] 19842737675
```

```r
sum(captured_vs_farmed_filtered2$`Aquaculture production (metric tons)`)
```

```
## [1] 19842737675
```

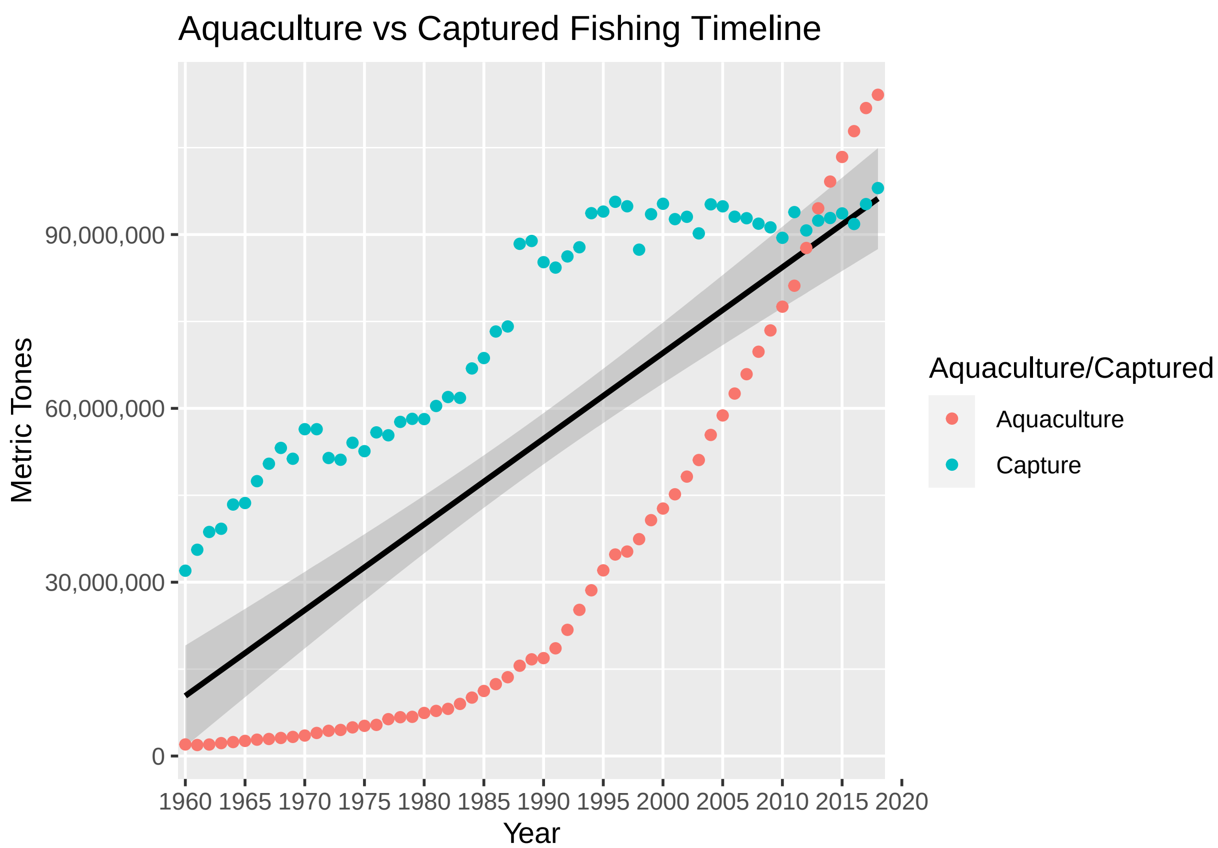
Removing the regions that are groups from the captured__vs__farmed and from consumption

```r
#Gather and exclude all the entities that are regions and not countries
ToExclude <- c("Americas", "Africa Eastern and Southern", "Africa Western and Central", "Arab World", "

captured_vs_farmed <- captured_vs_farmed%>%
  filter(!Entity %in% ToExclude)

consumption <- consumption%>%
  filter(!Entity %in% ToExclude)
```

Visualizing the Timeline graph of the captured_vs_farmed

```
cap_vs_farm_time <- select(captured_vs_farmed, c("Year", "Aquaculture production (metric tons)","Captur
cap_vs_farm_time[is.na(cap_vs_farm_time)] <- 0
cap_vs_farm_time <- cap_vs_farm_time %>%
  pivot_longer(!Year, names_to = "Aquaculture/Captured", values_to = "Metric Tones")
cap_vs_farm_time$`Aquaculture/Captured`[cap_vs_farm_time$`Aquaculture/Captured` == "Aquaculture producti
cap_vs_farm_time$`Aquaculture/Captured`[cap_vs_farm_time$`Aquaculture/Captured` == "Capture fisheries pr

cap_vs_farm_time %>%
  group_by(Year, `Aquaculture/Captured`)%>%
  summarize(Metric_Sum = sum(`Metric Tones`))%>%
  ggplot(aes(x = Year, y = Metric_Sum, colour = `Aquaculture/Captured`)) +
  geom_smooth(method= lm, color = "black") +
  geom_point() +
  scale_x_discrete(limits = c(1960, 1965, 1970,1975,1980,1985,1990,1995,2000,2005,2010,2015,2020)) +
  scale_y_continuous(labels = scales::comma) +
  labs(title = "Aquaculture vs Captured Fishing Timeline") +
  ylab("Metric Tones")
```

```
## `summarise()` has grouped output by 'Year'. You can override using the `.groups` argument.

## Warning: Continuous limits supplied to discrete scale.
## Did you mean `limits = factor(...)` or `scale_*_continuous()`?

## `geom_smooth()` using formula 'y ~ x'
```

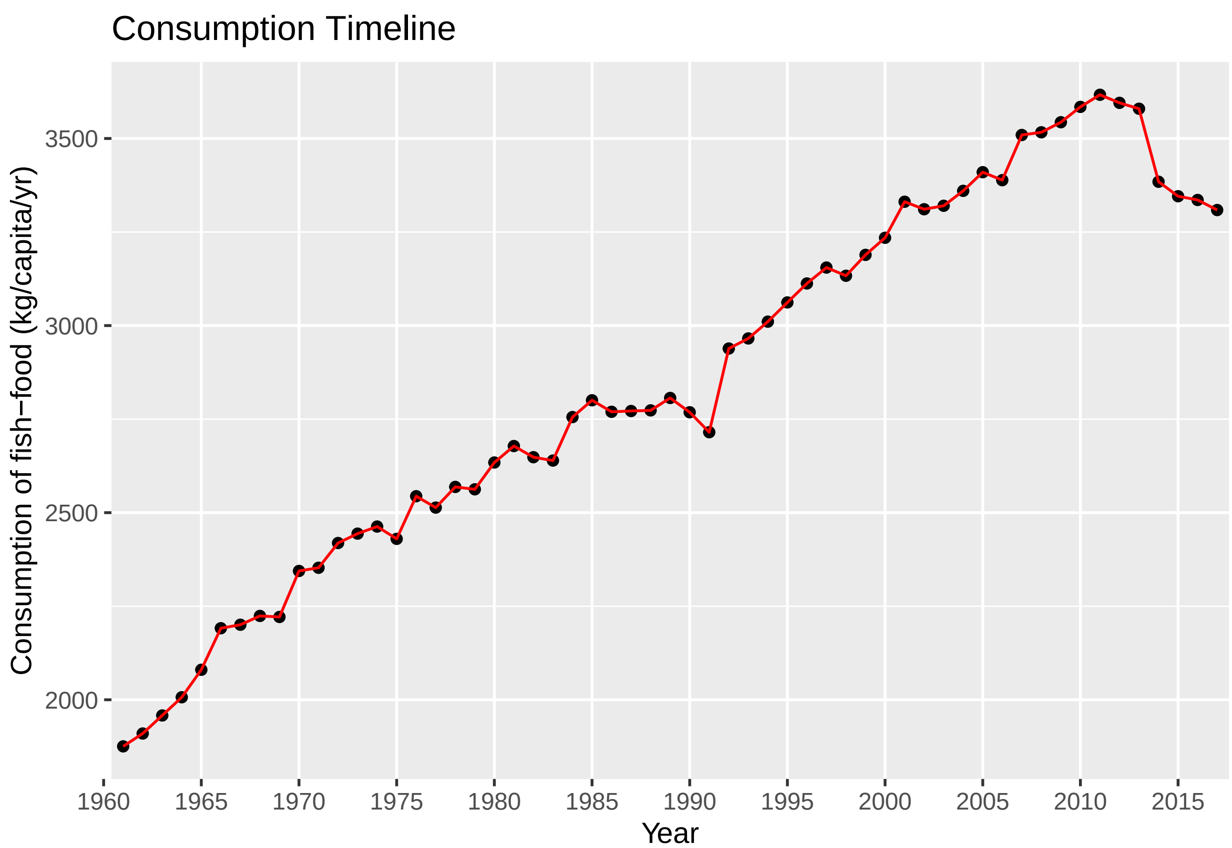


As we see here Aquaculture has evolved throughout the years. It's starting to incline more steeply arour

Consumption of seafood related data

```
#Timeline viz of the total consumption over the years
consumption%>%
  group_by(Year)%>%
  summarize(Cons_sum = sum(`Fish, Seafood- Food supply quantity (kg/capita/yr) (FAO, 2020)`))%>%
  ggplot(aes(x = Year, y = Cons_sum)) + geom_point() + geom_line(linetype = 1, color = "red") +
  scale_x_discrete(limits = c(1960, 1965, 1970,1975,1980,1985,1990,1995,2000,2005,2010,2015,2020)) +
  labs(title = "Consumption Timeline") +
  ylab("Consumption of fish-food (kg/capita/yr)")
```

```
## Warning: Continuous limits supplied to discrete scale.
## Did you mean `limits = factor(...)` or `scale_*_continuous()`?
```



The consumption of seafood is increasing over time and of course this relates to the worldwide populati

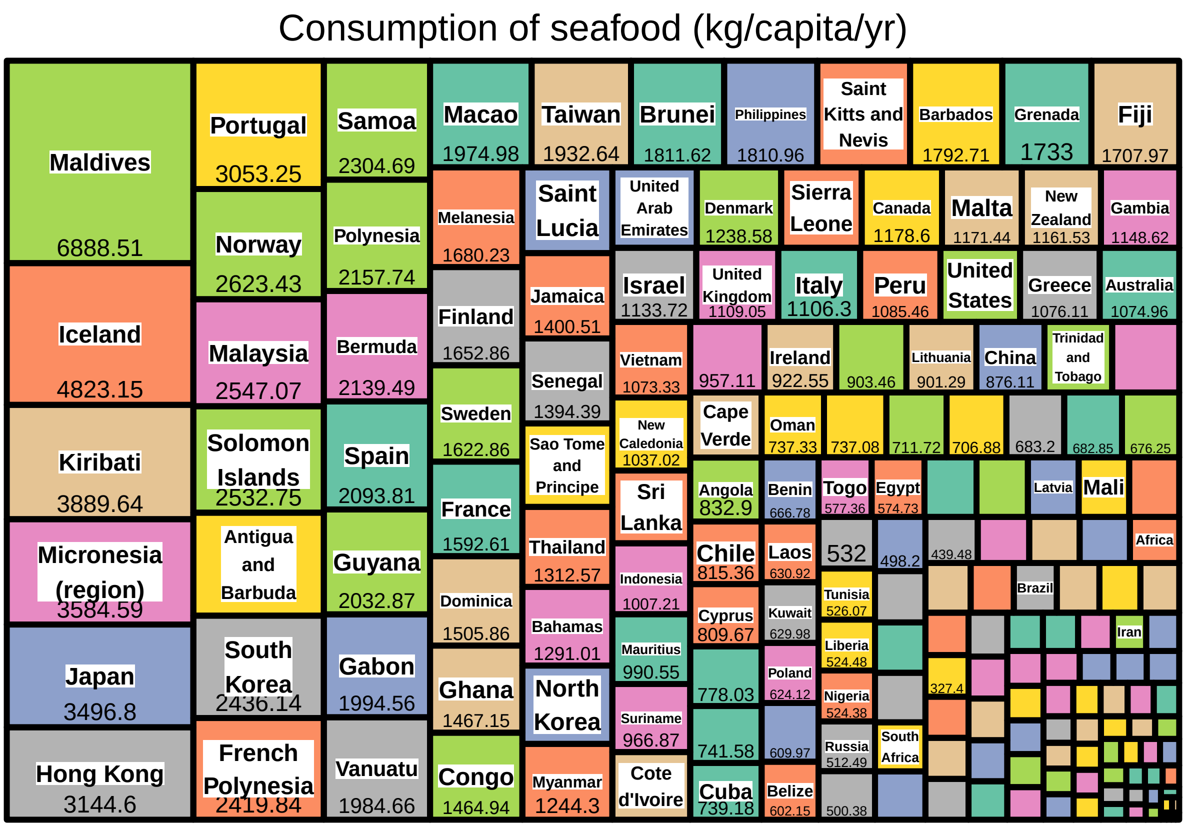
In 2014 though we can see a very sharp decrease in the consumption from 4000-4100 to 3300-3400 kg/capit

Consumption of seafood related data (Full TreeMap)

```
consumption_per_country_all <- consumption%>%
  group_by(Entity)%>%
  summarize(Cons_sum = sum(`Fish, Seafood- Food supply quantity (kg/capita/yr) (FAO, 2020)`))%>%
  treemap(index=c("Entity", "Cons_sum"),
          vSize="Cons_sum",
          type="index",
          palette = "Set2",
          bg.labels=c("white"),
          fontsize.labels = c(9,9),
          title = "Consumption of seafood (kg/capita/yr)",
          align.labels=list(
            c("center", "center"),
            c("center", "bottom")
          ),
        )
```

```
## Warning in if (class(try(col2rgb(bg.labels), silent = TRUE)) == "try-error")
```

```
## stop("Invalid bg.labels"): the condition has length > 1 and only the first
## element will be used
```

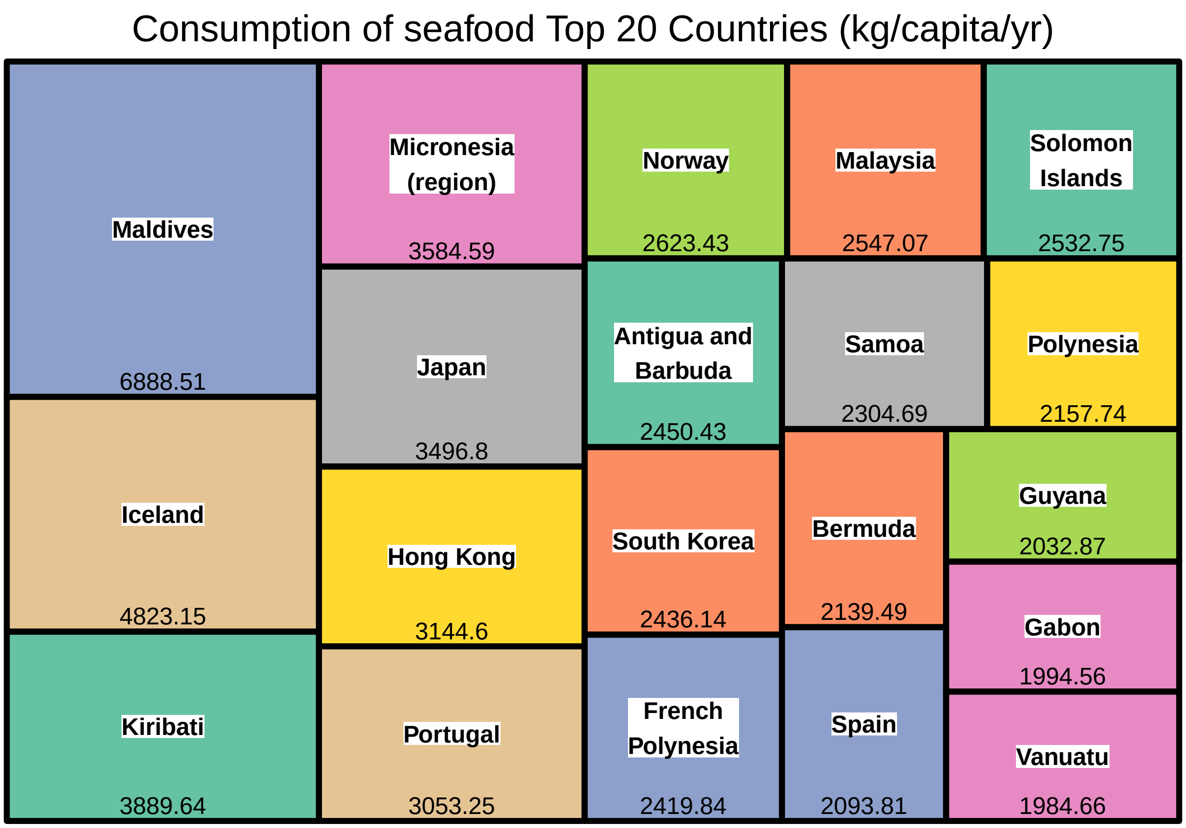


The Maldives hold the most consumpton of seafood by 6,888.51 kg/capita/yr followed by Iceland and Kriba

Consumption of seafood related data (Top 20 Countries TreeMap)

```
consumption_per_country_top20Tree <- consumption%>%
  group_by(Entity)%>%
  summarize(Cons_sum = sum(`Fish, Seafood- Food supply quantity (kg/capita/yr) (FAO, 2020)`))%>%
  top_n(20)%>%
  treemap(index=c("Entity", "Cons_sum"),
            vSize="Cons_sum",
            type="index",
            palette = "Set2",
            bg.labels=c("white"),
            fontsize.labels = c(9,9),
            title = "Consumption of seafood Top 20 Countries (kg/capita/yr)",
            align.labels=list(
              c("center", "center"),
              c("center", "bottom")
            ),
          )
```

```
## Selecting by Cons_sum

## Warning in if (class(try(col2rgb(bg.labels), silent = TRUE)) == "try-error")
## stop("Invalid bg.labels"): the condition has length > 1 and only the first
## element will be used
```

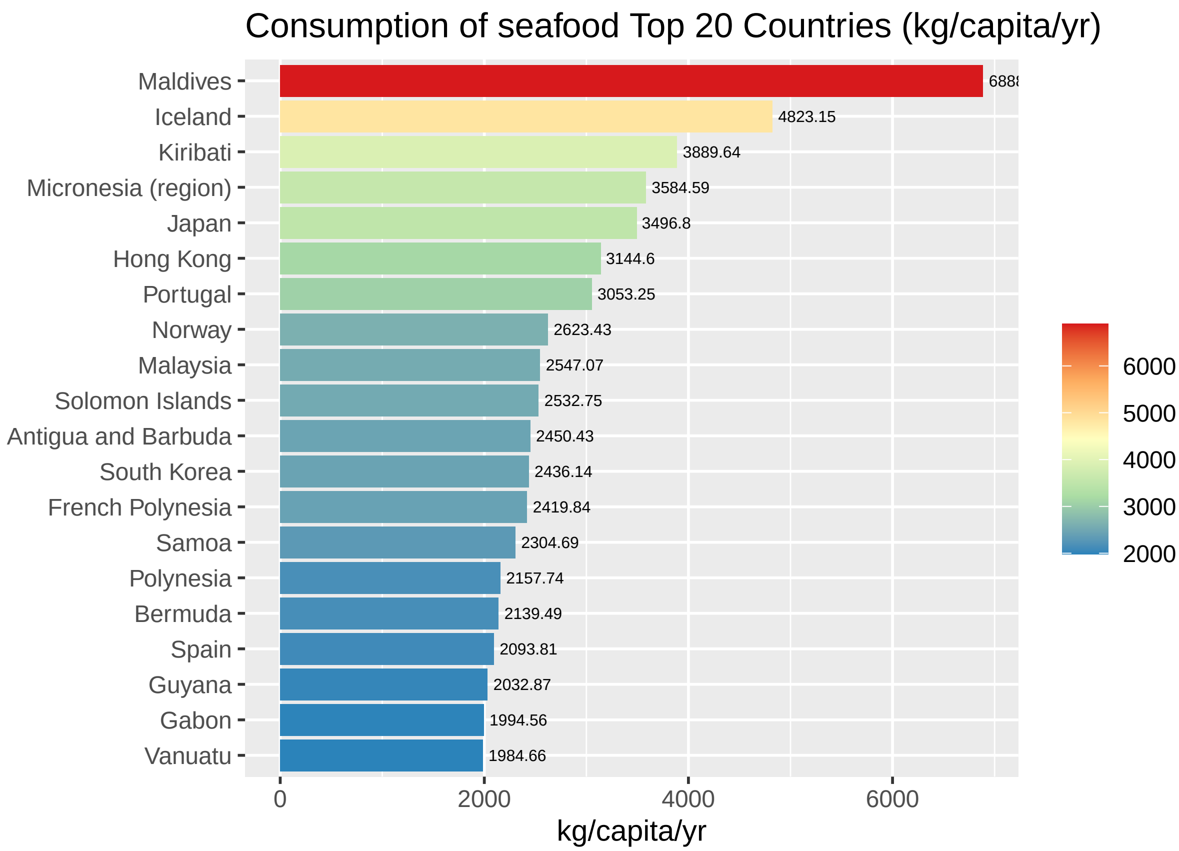


Consumption of seafood related data (BarChart)

```
consumption_per_country_top20Bar <- consumption%>%
  group_by(Entity)%>%
  summarise(Conss_Sum = sum(`Fish, Seafood- Food supply quantity (kg/capita/yr) (FAO, 2020)`))%>%
  top_n(20)%>%
  ggplot(aes(x = Conss_Sum,y = reorder(factor(Entity),Conss_Sum), fill = Conss_Sum)) +
  geom_bar(stat = "identity") +
  scale_fill_gradientn(name = '',colours = rev(brewer.pal(5,'Spectral'))) +
  geom_text(aes(label = Conss_Sum), hjust = -0.1, size = 2) +
  labs(title = "Consumption of seafood Top 20 Countries (kg/capita/yr)") +
  xlab("kg/capita/yr") +
  ylab("")
```

```
## Selecting by Conss_Sum
```

```
consumption_per_country_top20Bar
```



Checking the Percentage of the top 20 countries over the total number of consumption

```
Total_consumption <- sum(consumption$`Fish, Seafood- Food supply quantity (kg/capita/yr) (FAO, 2020)`)

consumption_per_country_top20 <- consumption%>%
  group_by(Entity)%>%
  summarise(Conss_Sum = sum(`Fish, Seafood- Food supply quantity (kg/capita/yr) (FAO, 2020)`))%>%
  top_n(20)
```

```
## Selecting by Conss_Sum
```

```
Total_top20_consumption <- sum(consumption_per_country_top20$Conss_Sum)

Percentage_Total <- Total_top20_consumption/Total_consumption*100
Percentage_Total
```

```
## [1] 36.10231
```

```
#The top 20 countries have %36 of the consumption comparing to the total consumption in the world
```

Tracking the difference of the total production and total consumption

```
#Removing the NA values and Adding a total production column
captured_vs_farmed$`Aquaculture production (metric tons)`[is.na(captured_vs_farmed$`Aquaculture producti
captured_vs_farmed$`Capture fisheries production (metric tons)`[is.na(captured_vs_farmed$`Capture fishe
captured_vs_farmed$Total_Production <- captured_vs_farmed$`Aquaculture production (metric tons)`+captur


#Grouping the captured/farmed table by entity
captured_vs_farmed_group <- captured_vs_farmed%>%
  group_by(Entity)%>%
  summarise(Total_Production = sum(Total_Production))

#Grouping the consumption table by entity
consumption_group <- consumption%>%
  group_by(Entity)%>%
  summarise(Total_Consumption = sum(`Fish, Seafood- Food supply quantity (kg/capita/yr) (FAO, 2020)`))

##Converting the Kg to Metric Tonnes
consumption_group$Total_Consumption <- consumption_group$Total_Consumption/1000

##In order to be able to get and analyze the difference between the production and the consumption we n

#Importing the Population data
population_data <- read_excel("~/Desktop/Data Analysis Case Studies/Case Study 4/API_SP.POP.TOTL_DS2_en
```

TOTALS WITH NO TIMLINE

```
## New names:
## * `` -> ...3
## * `` -> ...4
## * `` -> ...5
## * `` -> ...6
## * `` -> ...7
## * ...
```

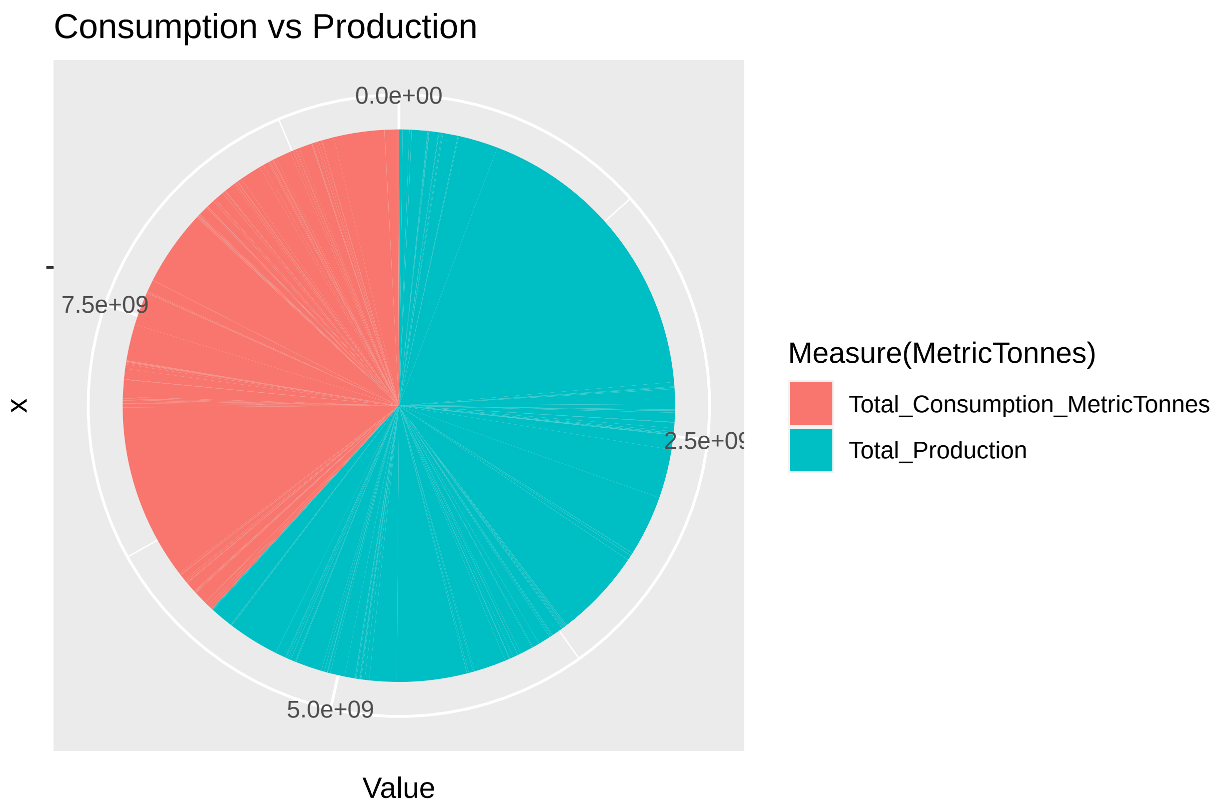
```
#Manipulation of the population data
population_data <- population_data[-c(1,2),]
names(population_data) <- population_data[1,]
```

```
## Warning: The `value` argument of `names<-` must be a character vector as of
## tibble 3.0.0.
```

```
population_data <- population_data[-c(1),]
population_data <- population_data[-c(3,4)]
population_data <- population_data%>%
  pivot_longer(!`Country Name` & !`Country Code`,names_to = "Year", values_to = "Population_count")
```

```r
population_data$Population_count <- as.numeric(population_data$Population_count)

#Group the population table by Country Name
population_data <- population_data %>%
  rename(Entity = `Country Name`)

population_data_Group <- population_data%>%
  group_by(Entity)%>%
  summarise(Average_Population = mean(Population_count))

#Merging the Population_data with the Consumption_group
Consumption_population_data <- merge(x = population_data_Group, y = consumption_group, by = "Entity" )
Consumption_population_data$Total_Consumption_MetricTonnes <- Consumption_population_data$Total_Consump
Consumption_population_data <-Consumption_population_data[-c(2,3)]

#Merging the Consumption data with the captured/Farmed data ("Production" data)
Cons_Prod_Diff <- merge(x = Consumption_population_data, y = captured_vs_farmed_group, by = "Entity")
Cons_Prod_Diff$Total_Production <- round(Cons_Prod_Diff$Total_Production, digits = 0)

#Creating a difference column which measures the difference between the production and the consumption f
Cons_Prod_Diff$Difference <- Cons_Prod_Diff$Total_Production-Cons_Prod_Diff$Total_Consumption_MetricTonn

#Visualizing and Analyzing the Difference to see if there is a surplus or a deficit in the seafood prod
Cons_Prod_Diff <- Cons_Prod_Diff%>%
  pivot_longer(!Entity, names_to = "Measure(MetricTonnes)", values_to = "Value")
Cons_Prod_Diff %>%
  filter(Cons_Prod_Diff$`Measure(MetricTonnes)` != "Difference")%>%
  ggplot(aes(x = "", y = Value, fill = `Measure(MetricTonnes)`, fill = `Measure(MetricTonnes)`)) +
  geom_bar(stat = "identity", width = 6) +
  coord_polar("y", start = 0) +
  labs(title = "Consumption vs Production")
```

```
## Warning: Duplicated aesthetics after name standardisation: fill

## Warning: Removed 1 rows containing missing values (position_stack).
```



This shows clearly that there is a good amount of surpluss between what is produced vs what is consumed

```
#Grouping the captured/farmed table by entity and year
captured_vs_farmed_TimeGroup <- captured_vs_farmed%>%
  group_by(Entity,Year)%>%
  summarise(Total_Production = sum(Total_Production))
```

TIMELINE DIFFERENCE OVER THE YEARS

```
## `summarise()` has grouped output by 'Entity'. You can override using the `.groups` argument.
```

```
#Grouping the consumption table by entity and year
consumption_TimeGroup <- consumption%>%
  group_by(Entity,Year)%>%
  summarise(Total_Consumption = sum(`Fish, Seafood- Food supply quantity (kg/capita/yr) (FAO, 2020)`))
```

```
## `summarise()` has grouped output by 'Entity'. You can override using the `.groups` argument.
```

```
consumption_TimeGroup$Total_Consumption <- consumption_TimeGroup$Total_Consumption/1000

#Group the population table by Country Name
```

```r
population_data_TimeGroup <- population_data[-c(2)]

#Merging the Population_data with the Consumption_group
Consumption_population_TimeData <- merge(x = population_data_TimeGroup, y = consumption_TimeGroup, by =
Consumption_population_TimeData <- Consumption_population_TimeData%>%
  filter(Total_Consumption != 0)
Consumption_population_TimeData$Total_Consumption_MetricTonnes <- Consumption_population_TimeData$Total_
Consumption_population_TimeData <- Consumption_population_TimeData[-c(4)]

#Merging the Consumption data with the captured/Farmed data ("Production" data)
Cons_Prod_TimeDiff <- merge(x = Consumption_population_TimeData, y = captured_vs_farmed_TimeGroup, by =
Cons_Prod_TimeDiff$Total_Production <- round(Cons_Prod_TimeDiff$Total_Production, digits = 0)
Cons_Prod_TimeDiff$Total_Consumption_MetricTonnes <- round(Cons_Prod_TimeDiff$Total_Consumption_MetricT

#Creating a difference column which measures the difference between the production and the consumption
Cons_Prod_TimeDiff$Difference <- Cons_Prod_TimeDiff$Total_Production-Cons_Prod_TimeDiff$Total_Consumpti

#Converting the table into a long structure
Cons_Prod_TimeDiff <- Cons_Prod_TimeDiff%>%
  pivot_longer(!Entity & !Year, names_to = "Description", values_to = "Value")

#Visualizing and Analyzing the Difference to see if there is a surplus or a deficit in the seafood prod
Cons_Prod_TimeDiff$Description[Cons_Prod_TimeDiff$Description == "Total_Consumption_MetricTonnes"] <- "


Cons_Prod_TimeDiff$Year <- as.character(Cons_Prod_TimeDiff$Year)
p1 <- Cons_Prod_TimeDiff %>%
  filter(Description != "Population_count")%>%
  group_by(Year, Description)%>%
  summarise(Metric_Tonnes = sum(Value))%>%
  ggplot(aes(x =Year, y = Metric_Tonnes, color = Description, group = Description)) +
  geom_line() +
  geom_point() +
  scale_y_discrete(limits =  c(25000000, 50000000, 75000000, 100000000,125000000,150000000, 175000000))
  scale_x_discrete(limits = c("1961", "1965", "1970", "1975", "1980", "1985", "1990", "1995", "2000", "
  scale_y_discrete(limits =  c(25000000, 50000000, 75000000, 100000000,125000000,150000000, 175000000),
  labs(title = "Difference Between Consumption & Production") +
  ylab("Metric Tones")
```

```
## `summarise()` has grouped output by 'Year'. You can override using the `.groups` argument.

## Warning: Continuous limits supplied to discrete scale.
## Did you mean `limits = factor(...)` or `scale_*_continuous()`?

## Warning: Continuous limits supplied to discrete scale.
## Did you mean `limits = factor(...)` or `scale_*_continuous()`?

## Scale for 'y' is already present. Adding another scale for 'y', which will
## replace the existing scale.
```

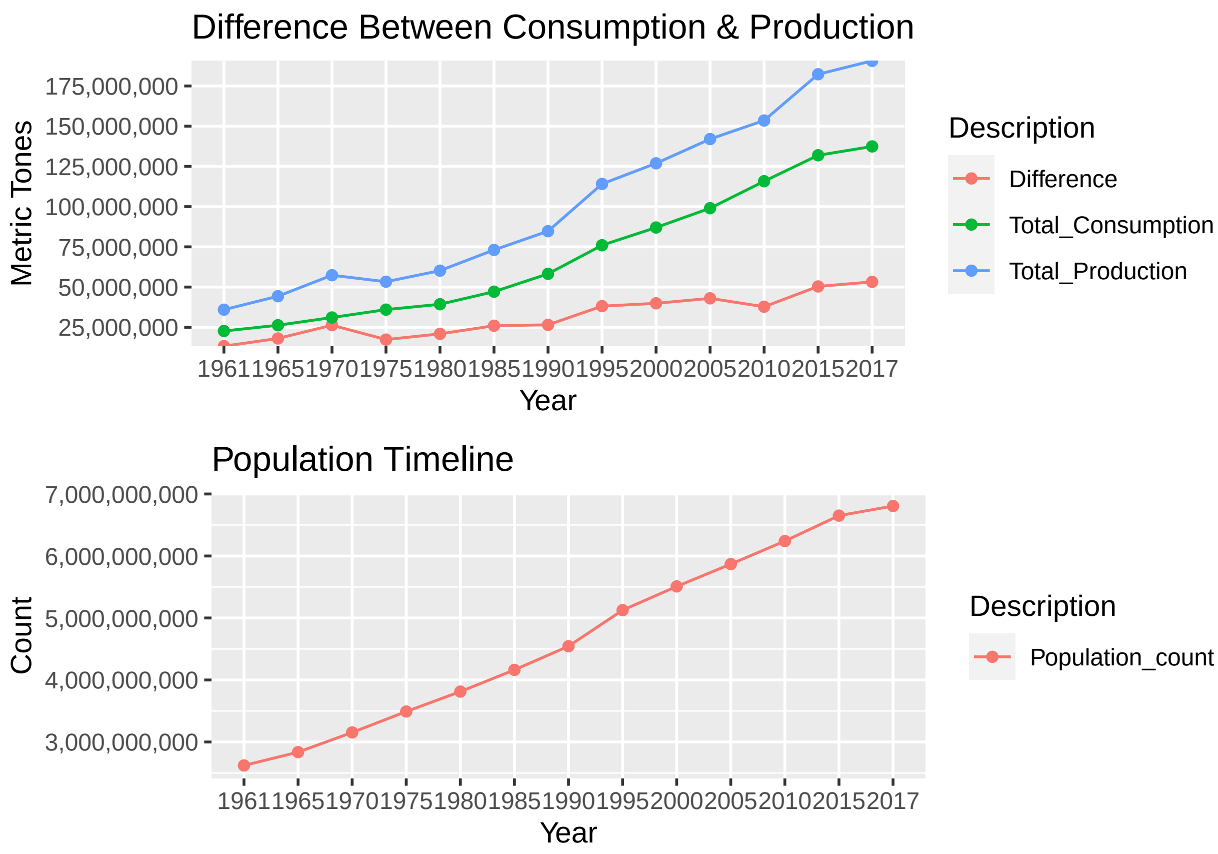
```r
p2 <- Cons_Prod_TimeDiff %>%
  filter(Description == "Population_count")%>%
```

```
  group_by(Year, Description)%>%
  summarise(Count = sum(Value))%>%
  ggplot(aes(x =Year, y = Count, color = Description, group = Description)) +
  geom_line() +
  geom_point() +
  scale_x_discrete(limits = c("1961", "1965", "1970", "1975", "1980", "1985", "1990", "1995", "2000", "2
  labs(title = "Population Timeline") +
  scale_y_continuous(labels = scales::comma)
```

```
## `summarise()` has grouped output by 'Year'. You can override using the `.groups` argument.
```

```
grid.arrange(p1,p2, nrow = 2, ncol = 1)
```

```
## Warning: Removed 132 row(s) containing missing values (geom_path).

## Warning: Removed 132 rows containing missing values (geom_point).

## Warning: Removed 44 row(s) containing missing values (geom_path).

## Warning: Removed 44 rows containing missing values (geom_point).
```




```
All the numbers in the above graphs show a significant increase from the 1960s till 2017, by all we are
It seems that as the population increases along with the consumption, naturally, of seafood related pro
```

Visualizing the Sustainable vs Overexploited fish throughout the years

```
stock_Pivoted <- select(stock,c(!"Code"))
stock_Pivoted <- stock_Pivoted%>%
  rename(Sustainable = `Share of fish stocks within biologically sustainable levels (FAO, 2020)`) %>%
  rename(Overexploited = `Share of fish stocks that are overexploited`)

stock_Pivoted <- pivot_longer(stock_Pivoted, !`Year` & !`Entity`, names_to = 'Description', values_to =



p3 <- stock_Pivoted %>%
  filter(Entity == "World")%>%
  group_by(Year, Description)%>%
  summarize(`Value(%)` = sum(Value))%>%
  ggplot(aes(x = Year, y = `Value(%)`, color = Description)) +
  geom_line(linetype = 1) +
  #geom_smooth(method= lm, color = "black") +
  geom_point() +
  stat_summary(fun.y = sum, na.rm = TRUE, group = 3, color = 'green', geom ='line' ) +
  scale_x_discrete(limits = c(1975,1980,1985,1990,1995,2000,2005,2010,2015,2017)) +
  scale_y_discrete(limits = c(0,10,20,30,40,50,60,70,80,90,100)) +
  theme(legend.position = "right",legend.direction = "vertical") +
  labs(title = "Sustainable vs Overexploited fish")
```

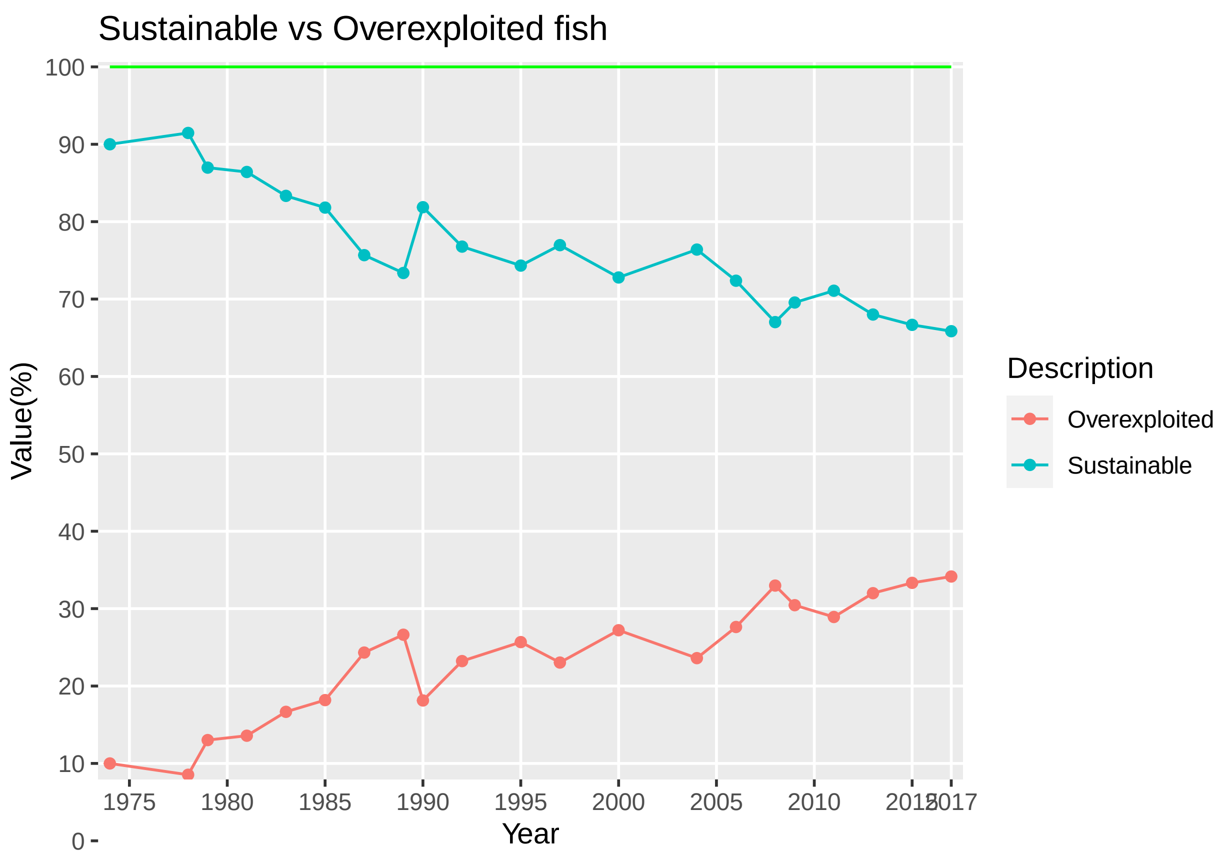
```
## `summarise()` has grouped output by 'Year'. You can override using the `.groups` argument.
```

```
## Warning: `fun.y` is deprecated. Use `fun` instead.
```

```
## Warning: Continuous limits supplied to discrete scale.
## Did you mean `limits = factor(...)` or `scale_*_continuous()`?
```

```
## Warning: Continuous limits supplied to discrete scale.
## Did you mean `limits = factor(...)` or `scale_*_continuous()`?
```

```
p3
```




```
Starting from 1978 the sustainable Fish % is on almost a constant decrease starting from %91.46 till it
```

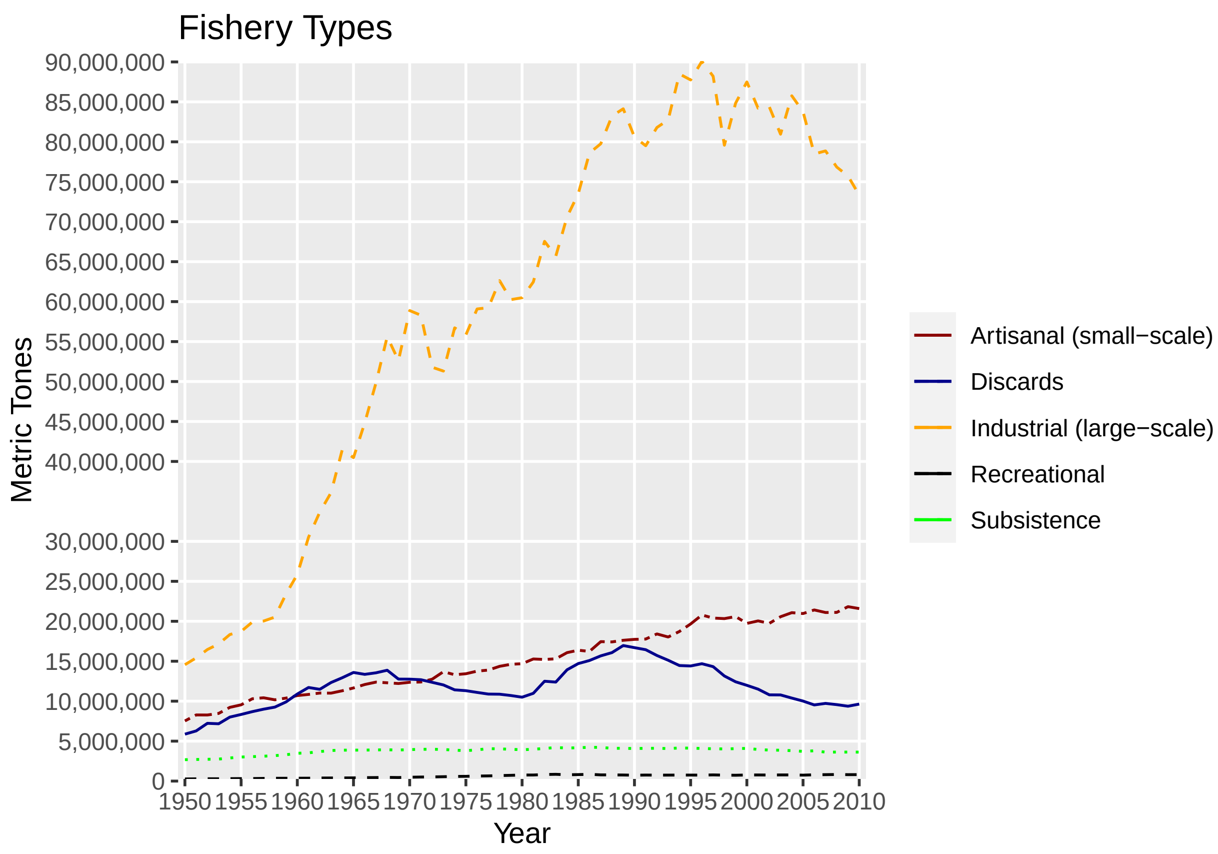
Visualizing the type of fisheries throughout the years

```
fishery <- fishery %>%
  rename(`Artisanal (small-scale)` = "Artisanal (small-scale commercial)") %>%
  rename(`Industrial (large-scale)` = "Industrial (large-scale commercial)")


p5 <- fishery%>%
  ggplot(aes(x = Year)) +
  geom_line(aes(y = fishery$`Artisanal (small-scale)`, color = "Artisanal (small-scale)"), linetype = "
  geom_line(aes(y = fishery$Discards, color = "Discards"), linetype = "solid") +
  geom_line(aes(y = fishery$`Industrial (large-scale)`, color = "Industrial (large-scale)"), linetype =
  geom_line(aes(y = fishery$Recreational, color = "Recreational"), linetype = "dashed") +
  geom_line(aes(y = fishery$Subsistence, color = "Subsistence"), linetype = "dotted") +
  scale_color_manual(values = c(
    "Artisanal (small-scale)" = 'darkred',
    "Discards" = "darkblue",
    "Industrial (large-scale)" = "orange",
    "Recreational" = "black",
    "Subsistence" = "green"
  )) +
  scale_x_discrete(limits = c(1950, 1955, 1960, 1965, 1970, 1975, 1980, 1985, 1990, 1995, 2000, 2005, 20
```

```r
  scale_y_discrete(limits = c(0, 5000000, 10000000,15000000,20000000,25000000,30000000,40000000,4500000
  #theme(legend.title = element_blank(),legend.position = "bottom",legend.direction = "horizontal") +
  theme(legend.title = element_blank(),legend.position = "right",legend.direction = "vertical") +
  labs(title = "Fishery Types",x = "Year", y = "Metric Tones")
```

```
## Warning: Continuous limits supplied to discrete scale.
## Did you mean `limits = factor(...)` or `scale_*_continuous()`?

## Warning: Continuous limits supplied to discrete scale.
## Did you mean `limits = factor(...)` or `scale_*_continuous()`?
```

```r
p5
```




```
The graph is showing us here that the industrial (large scale) fisheries, even though are the largest, 
```