International Nalaysis

```
##      dplyr      tidyr    ggplot2     plotly      knitr data.table
##       TRUE       TRUE       TRUE       TRUE       TRUE       TRUE
```

Landings data

- Estimate landings and revenue for each country form the Sea Around Us (http://www.seaaroundus.org/) database.

Notes

- Using reconstructed catch
- Filter out external countries (China, South Korea and "unknown")
- Removed Chile's reported landings in Peruvean waters

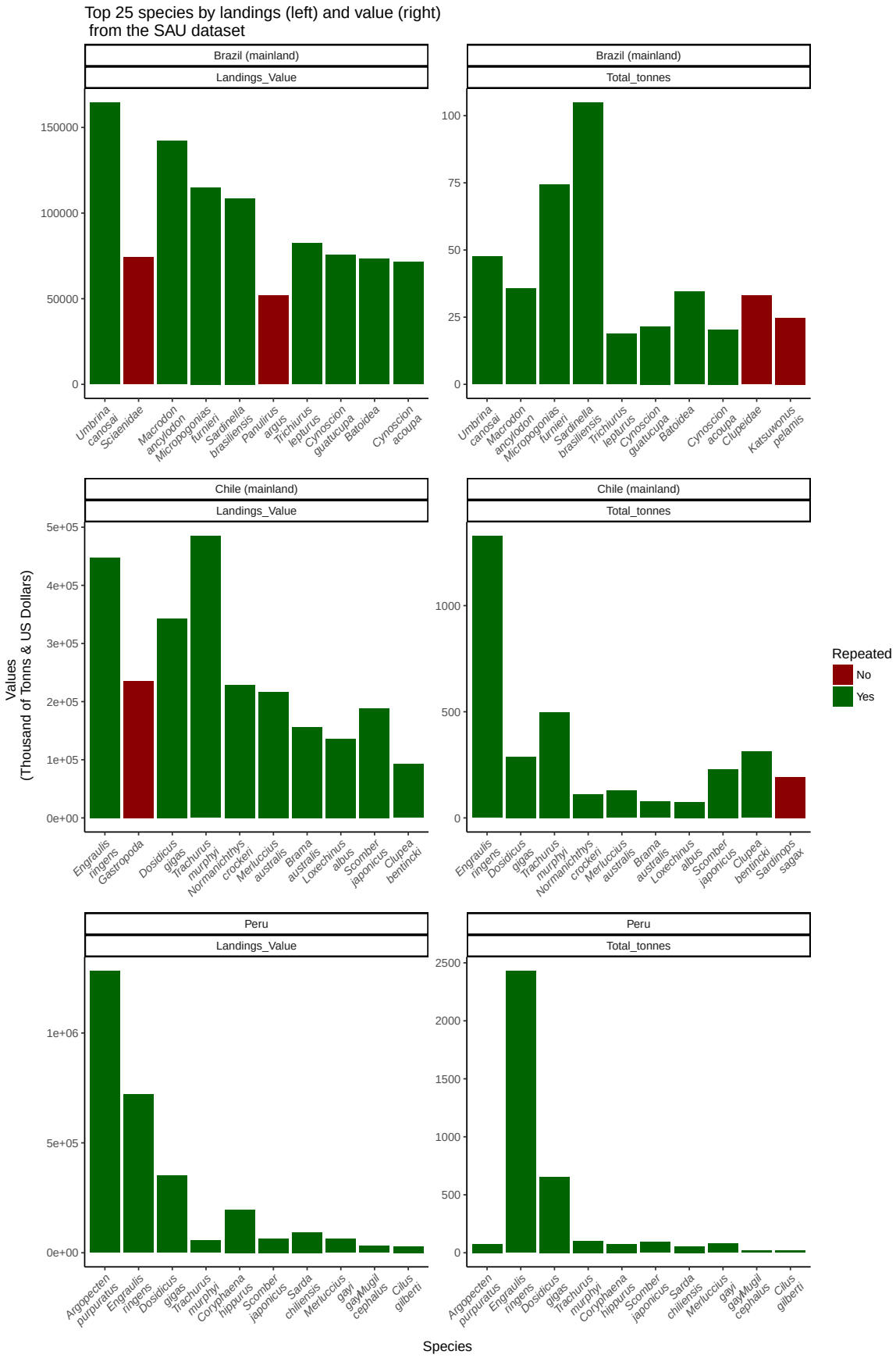
Questions to discuss with the team:

- Should we remove Recreational landings?
- Removed Chile's reported landings in Peruvean waters?

```
#Data Path
Data_Path <- "./information/raw_databases/"
# File name
SAU_F_Name <- "SAU EEZ 604,152,76 v47-0.csv"
#read dataset
SAU <- fread(paste(Data_Path,SAU_F_Name,
                   sep = ""))
# Data exploration
# names(SAU)
# head(SAU)
# unique(SAU$fishing_sector) # "Industrial"   "Subsistence"  "Artisanal"    "Recreational"

# Countries excluded from the analysis
unique(SAU$fishing_entity) # There are 29 countries fishing in these waters, fill filter them
```

```
##  [1] "Brazil"                  "Chile"
##  [3] "Peru"                    "Venezuela"
##  [5] "Sint Maarten"            "Cuba"
##  [7] "Unknown Fishing Country" "Malta"
##  [9] "Bahamas"                 "USA"
## [11] "Japan"                   "Argentina"
## [13] "Curacao"                 "Russian Federation"
## [15] "Lithuania"               "South Africa"
## [17] "Taiwan"                  "Estonia"
## [19] "Latvia"                  "Ukraine"
## [21] "Korea (South)"           "Georgia"
## [23] "Uruguay"                 "Spain"
## [25] "Mexico"                  "Ecuador"
## [27] "Barbados"                "Panama"
## [29] "China"
```

```r
#Main fisheries

SAU$scientific_name <- gsub(" ", "\n",SAU$scientific_name)

# Plot <-
SAU %>%
  filter(scientific_name != "Marine\nfishes\nnot\nidentified") %>%  #Removed but top in B and P
  group_by(area_name,
           year,
           scientific_name, # Trade data is too generic for species details
           fishing_entity#,
           # fishing_sector # #Trade data is too generic for sector details
  ) %>%
  summarise(
    Total_tonnes = sum(tonnes),
    Landings_Value = sum(landed_value)
  ) %>%
  filter(fishing_entity %in% Countries, # Remove China, Korea and unknown fishing country
         year == Year_an) %>%  # Choose year to be analyzed
  rename(Reporter = fishing_entity) %>%  # Change name of variable to match UN trade dataset
  filter(area_name != "Peru" | Reporter != "Chile") %>%
  tidyr::gather("Variable","Value",5:6)  %>%
  group_by(area_name,Variable) %>%
  top_n(n = 10, wt = Value) %>%  # Top 10, change if interactive plot
  # Determine what species are in both "Top" categories
  group_by(area_name,scientific_name) %>%
  mutate(Repeated = n()) %>%
  mutate(Repeated = ifelse(Repeated == 1, "No", "Yes")) %>%
  # Plot
  ggplot(.,
         aes(
           x= reorder(scientific_name,-Value),
           y = Value/1000, #thousands
           fill = Repeated
         )
  ) +
  geom_bar(stat = "identity") +
  theme_classic() +
  theme(axis.text.x = element_text(angle = 45,
                                   hjust = 1,
                                   face = "italic")
  ) +
  scale_fill_manual(values =c("darkred",
                              "darkgreen"),
                    name ="Repeated") +
  facet_wrap(~area_name + Variable,
             scales = "free",
             ncol = 2) +
  labs(title="Top 25 species by landings (left) and value (right)\n from the SAU dataset",
       x ="Species",
       y = "Values \n (Thousand of Tonns & US Dollars)"
  )
```


Top 25 species by landings (left) and value (right)
from the SAU dataset
Brazil (mainland)
Landings_Value
Total_tonnes
Chile (mainland)
Peru
Values
(Thousand of Tonns & US Dollars)
Species
Repeated
No
Yes

```r
# For interactive plot
# Name the plot and then call it
# ggplotly(g_plot)


## Totals per Country

SAU_Clean <- SAU %>%
  group_by(area_name,
           year,
           # scientific_name, # Trade data is too generic for species details
           fishing_entity#,
           # fishing_sector # #Trade data is too generic for sector details
           ) %>%
  summarise(
    Total_tonnes = sum(tonnes),
    Landings_Value = sum(landed_value)
  ) %>%
  filter(fishing_entity %in% Countries, # Remove China, Korea and unknown fishing country
         year == Year_an) %>%  # Choose year to be analyzed
  rename(Reporter = fishing_entity) %>%  # Change name of variable to match UN trade dataset
  filter(area_name != "Peru" | Reporter != "Chile") # Remove Chile report in Peruvean waters*

  head(SAU_Clean)
```

```
## # A tibble: 3 x 5
## # Groups:   area_name, year [3]
##           area_name  year Reporter Total_tonnes Landings_Value
##               <chr> <int>    <chr>        <dbl>          <dbl>
## 1 Brazil (mainland)  2014   Brazil     879461.9     2298751150
## 2  Chile (mainland)  2014    Chile    3494985.2     2954129645
## 3              Peru  2014     Peru    3923988.5     3262441002
```

```r
# names(SAU_Clean)
# head(SAU_Clean)
# unique(SAU_Clean$fishing_entity)

# Clenaed!

#Write csv
# write.csv(SAU_Clean,
#           "sau_clean_dataset.csv")
```

Trade data

- Estimate imports and exports of fish for each country form the UN come-trade database

Methods Notes:

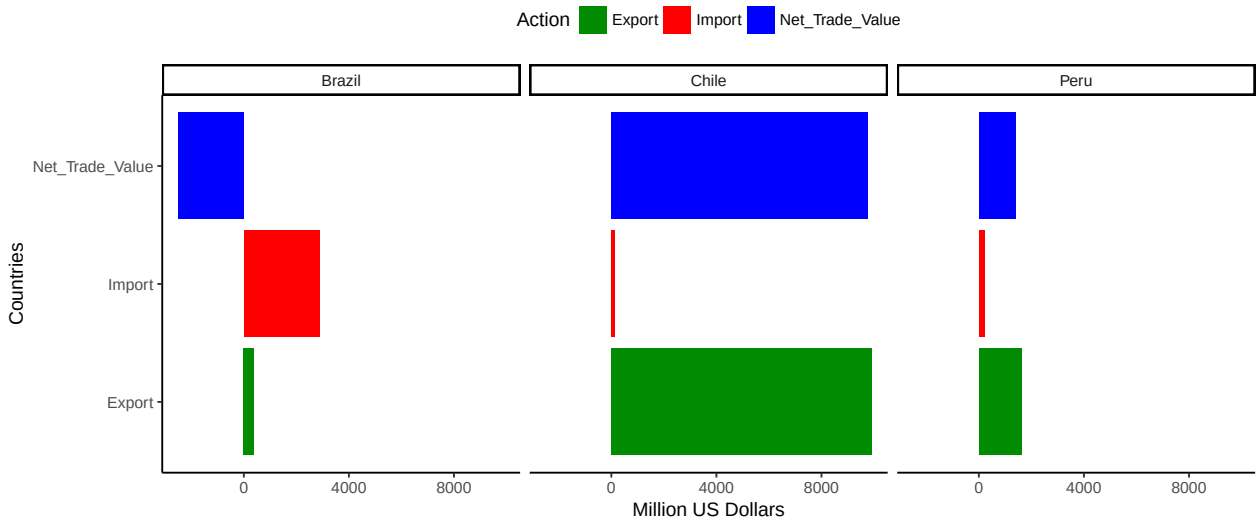
- Data set does not contain weight information, just US dollars
- "Fish and crustaceans, molluscs and other aquatic invertebrates" is the only clasification for all three countries
- Exports - Imports - Re-Imports

Questions to discuss with the team:

- What are "re-import"? Do we consider them? I'm assuming that they cost money to the country re-importing

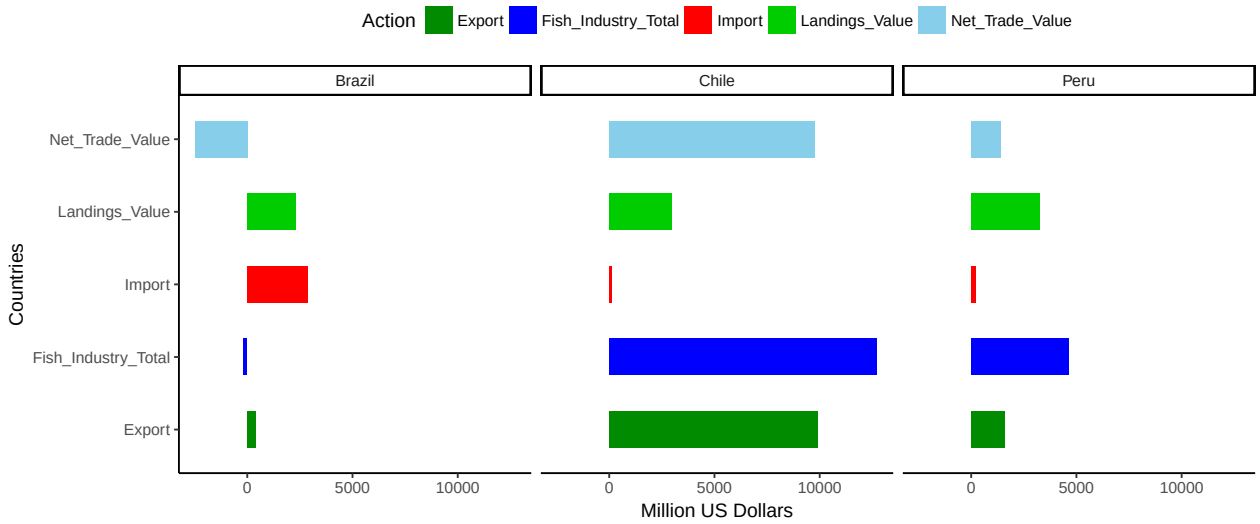
```
#File name
UN_F_Name <- "UN_Comtrade_Statistics.csv"


UN <- fread(paste(Data_Path,UN_F_Name,
                  sep = ""))

# Data exploration

# head(UN)
# names(UN)
# unique(UN$Commodity) # [1] "Fish and crustaceans, molluscs and other aquatic invertebrates
# unique(UN$Reporter) # [1] "Brazil" "Chile"  "Peru"
# min(UN$Year) # 2013
# max(UN$Year) #2017

# max(UN$Gross_weight_kg)


#### Trade Graph ####

# UN_Clean <-
UN %>%
  filter(Year == Year_an) %>%
  group_by(Reporter,
           Trade_Flow
  ) %>%
  summarise(
    Trade_Value = sum(Trade_Value_US, na.rm =T)
  ) %>%
  spread(Trade_Flow,Trade_Value) %>%
  mutate(
    Net_Trade_Value = (Export-Import),
    Net_Re_Import_value = ifelse(!is.na(`Re-Import`),(Net_Trade_Value -`Re-Import`),Net_Trade_Value)
  ) %>%
  tidyr::gather("Action","Value",2:6) %>%
  filter(!Action %in% c("Re-Import","Net_Export_Value","Net_Re_Import_value")) %>%
  ggplot(.,
         aes(
           x = Action,
           y = Value/1000000,
           # colour = Action
           fill = Action
         )
  ) +
  # geom_point()
  geom_bar(stat = "identity") +
  facet_wrap(~Reporter) +
  scale_fill_manual(values =c("green4", # Export
                              "red", # Import
```

```
                                "blue" # Totals
  )
  ) +
  theme_classic() +
  theme(legend.position = "top") +
  coord_flip() +
  labs(title="",
       x ="Countries",
       y = "Million US Dollars"
  )
```




```
  #### Trade Graph With Landings ####


# UN_Clean <-
  UN %>%
  filter(Year == Year_an) %>%
  group_by(Reporter,
           Trade_Flow
  ) %>%
  summarise(
    Trade_Value = sum(Trade_Value_US, na.rm =T)
  ) %>%
  spread(Trade_Flow,Trade_Value) %>%
  mutate(
    Net_Trade_Value = (Export-Import),
    Net_Re_Import_value = ifelse(!is.na(`Re-Import`),(Net_Trade_Value -`Re-Import`),Net_Trade_Value)
  ) %>%
  left_join(SAU_Clean,
            by = "Reporter") %>%
  mutate(Fish_Industry_Total = Net_Trade_Value + Landings_Value) %>%
  select(1:3,5,10:11) %>%
  tidyr::gather("Action","Value",2:6) %>%
  ggplot(.,
         aes(
           x = Action,
           y = Value/1000000,
```

```
          # colour = Action
          fill = Action
        )
) +
# geom_point()
geom_bar(stat = "identity",
         width = 0.5 #Bar size
) +
facet_wrap(~Reporter) +
scale_fill_manual(values =c("green4",
                            "blue",
                            "red",
                            "green3",
                            "skyblue"
)
) +
theme_classic() +
theme(legend.position = "top") +
coord_flip() +
labs(title="",
     x ="Countries",
     y = "Million US Dollars"
)
```



Analysis

- Merge datasets and estimate total tons of fish and revenue from fishing activity

Methods Notes

- Total fishing value + Net exportation gain

Questions to discuss with the team

```r
# Merge Datasets ####

SAU_Clean %>%
  left_join(UN_Clean,
            by = "Reporter") %>%
  mutate(
    Total_Fishing_Value = Total_value + Net_Re_Import_value
  ) %>%
  ggplot(.,
           aes(
             x = Reporter,
             y = Total_Fishing_Value,
             fill = Reporter
           )) +
  geom_bar(stat = "identity") +
  theme_classic()
```