Slide 1

Good morning committee members!

Thank you very much for being here and taking part in my thesis project work and another step for graduation.

My name is Volodymyr Kozyr but you can call me Vova.

My topic if called “A study on data visualization for fishery management”

Slide 2

I would like to begin this presentation with the agenda.

First, I will go through introduction and goals of the project, Its objective and the targeted audience

After that I will explain the tasks for the project.

Then we will quickly overview architecture of the implemented system.

And finally, more particular examples of use cases implementation and conclusions.

Slide 3

To make data analysis faster and more productive for various users.

Fishery data, like data from other domains, deals with observations across time, and across space. Depending on decisions made after analysis it can lead to different economic and environmental consequences. Also, there are many data sources available for fisheries, which I will touch briefly further in my presentation.

This work will help people who are domain experts but are not very familiar with data analysis tools. The tool can help fishery management regulate fishery catching in certain Canadian provinces and help decide which policies or fishing quotas for specific fish types should be applied.

Slide 4

There are different groups of users in the fishery domain like fishery management companies, environmental policy issuers and simple fishermen etc. All of them need to get different data and analyze it in some way. For example, marine environmentalists analyze data about the quantity of fish in a particular region, they issue quotas for fishery companies. After that companies analyze the fish stock market, plan, and distribute information to their employees.

Slide 5

FishCAM2000 is a computer-based integrated information system for fisheries management and marine environmental monitoring. It incorporates visualization of the fishery activity over the same spatial area of interest for a particular type of fish. It has a user-friendly and straightforward interface implemented in Windows Forms.

It presents complex geodata, which includes the amount of fish caught in the geographical zone.

Slide 6

Scottish Sea Fisheries Statistics

The total amount of fish caught is shown in blue, and the value of all landings by Scottish vessels is shown in red. By comparing the blue and red lines, the user can easily and quickly determine the connection between the catch's value and the amount of fish caught. For instance, the user can see that despite the tonnage falling since 2017, the value of landings remains constant.

Slide 7

We can see that the marine industry requires to see overall reports on such parameters as “tonnage” and “value”. From the pie charts, users can determine which type of fish gives which revenue according to tonnage.

Slide 8

Based on literature review for the project we can stress some fishery domain problems

* Determining the optimal amount of catch for each type of fish to reduce environmental damage in a specific region
* Predicting which species may also be subject to negative or positive effects (trends)
* Establishing quotas (the proper amount of unloading of fish) which will minimize the negative impact on the environment
* Analyzing the safety of methods for catching a particular type of fish in each region
* And other…

Slide 9

Analysis of the data presented in a table or text format may take significant amount of time. For example, it is hard to see trends, how values change through the years, as well as comparing data for different provinces and fish type.

FishPlots is developed for people who may not be data scientists. The main goal is to make it usable for people with average knowledge about computers. It also will not require any installation steps, because it is a web application that can be accessed just by typing a URL in any modern browsers. Another feature of FishPlots is that it will allow the user to select range, provinces, and any fish type from dropdowns, zoom into details, etc.

Slide 10

* **Requirement 1. Interactivity**

The main difference between existing static reports and FishPlots is that we allow users to interact with data before producing a visualization. These interactions involve operations like filtering, zooming, and so on.

* **Requirement 2. Data Scaling for Further Analysis**

FishPlots should allow users to discover patterns, trends, and anomalies

* **Requirement 3. Summary and Overall Statistics**

Showing global summarized data.

Slide 11 - 12

The data layer for FishPlots uses public data provided by DFO Canada. Data is converted from Excel to JSON format, which is suitable for use inside a web browser environment.

Logic part of FishPlots is doing data-transformation from JSON files to a format which is suitable for the library to render and display visuals. It also reacts on user actions and emits events to charts to refresh data if needed and handles switching between charts.

As a framework engine, FishPlots uses TypeScript framework Angular.

For presenting data there is an amCharts4 library included in the project, which allows generation of complex interactive  data visualizations inside a web browser.

UI overview

* + The date range slider (from 1990 to 2018).
  + There are two multiple selection pickers for provinces and fish types which are also filtering data.
  + Based on the user input, there may be 4 different visualizations generated.

Slide 13 - 14

This visualization will help users to determine relationships between fish quantities and prices . time on the horizontal and price and quantity on the vertical axis. For each province there is color-coding and legends defined.

* Features:
  + multiple values on same axises (quantity axis on the left and values on the right)
  + Easy to follow and use for further deep data investigation. (Zooming feature)
  + Ability to explore a yearly trend.

Slide 15 - 16

The second chart is a scatter plot on which the x-axis is price and the y-axis shows quantities of. particular fish types and provinces. Bullet points and labels represent years. This visualization helps users to clearly see the correlation between price and quantities throughout the selected years.

* Features:
  + Presents the ability to analyze and compare data efficiently by visualizing multiple values simultaneously.
  + The chart allows us to quickly understand the trend over the years and build analysis on the selected fishery market.
  + The chart could be expanded to show more than one type of fish.

Slide 17

To sum it up, the charts help the user to explore relations between fish values and amounts.

The implemented improvements can be listed like this: the ability to select/deselect fish types/provinces, zoom feature which allows users to see data for smaller date range without a need to re-render visualization. Scatter plot, which combines 3 dimensions: value, amount, year.

And, of course, there is an ability to see trends of the value/amount ratio for different fish types.

Slide 18

After implementing the visualizations for this project, there are still some improvements that could be applied to the FishPlots that can make it more reliable for the user.

Firstly, bringing more data sources.

Secondly, saving visualization state (serialization. For example, saving the state of particular visualization in JSON file on the user's machine.

And finally, users will most likely want to have synchronization of new data from sources. This improvement requires communication with data providers, implementing external APIs from their side.

Slide 19 - 20

The summary charts allow identifying the top fish species by catch amount or value (price) per the selected year. This type of visualization enables a quick and clear understanding of the top fish species in the selected category. The summary information helps compare the data for different years.

There is also a grouping for fish types that have a small percentage of catch or value comparing to the others which is an improvement (for more than 20 legends, pie charts usually look overcrowded and not readable).

To make the chart user-friendly and structured, the number of legends is adapted depending on the top values per the selected year. FishPlots would sort and group the value ($) or catch quantities (tons) of fish types and assign the applicable percentage per type. The top fish types are separated into their own sections, and the rest is grouped into the category “other”. This solves a well-known problem of having too many unnecessary labels (legends). The chart also allows to expand the “Other” category and drill down to see more details for the fish types which are the “outliers” in the dataset.

Slide 21 - 22

The main goal of the following visualization is to provide the ability to compare and analyze the data between the selected years quickly and easily. The Chart below is an improvement of the standard bar chart called a categorized bar chart. This kind of data presentation is particularly useful for determining trends for the current and previous year. For fishery management it is important to know if, for example, new policies and laws or fishing quotas are working into the intended direction. Years 1990 and 2018 were chosen to better emphasize how the charts’ setup assists in quickly identifying trends.

As mentioned before, the proposed chart is created to compare the data between the two years easy to analyze and review. The space on the x-axis is used to include both of the values that are important for the industry: quantity and price. The y-axis represents the type of fish that was added to the chart for the review. The chart itself serves as a great visual and data centre that could allow the industry professionals to improve the decision-making processes or assist in the further planning of the fishery industry per type. In the provided example, we notice the drastic change in the Cod quantity and price. Both levels have dropped significantly through the decade, highlighting that Cod is no longer a highly available or valuable fish type at the market.