

Group 2: Impact of Algal Blooms in Trøndelag, Norway

Stakeholders in Trøndelag are expressing concerns about the possibility of an algal bloom infestation, similar to the one recently observed in Ireland, occurring along the coast of Norway. Norway, as the world's largest exporter of salmon¹, annually producing 1.3 billion tons of this valuable fish, faces a critical situation if such an algal bloom were to develop. The consequences could be far-reaching, impacting various stakeholders.

Fishermen might face a loss of income, while fish processing companies and the fishing industry as a whole could potentially suffer significant job losses, thereby affecting the overall Norwegian economy. Furthermore, tourism plays a vital role in Norway's economy, and residents of Trondheim (largest city in Trøndelag) are particularly concerned about how a potential algal bloom could negatively impact the natural experience for tourists. It could also pose a threat to local seafood quality and the livelihoods of people in the region.



Figure S2.1. A map of Norway that highlights the location of Trøndelag.

The stakeholders of Trøndelag have asked for your expertise in analyzing previous year's data to determine whether or not there's a possibility of an algal bloom infestation this year. **Objective: Create at least one graph, run at least one statistical test, and reason through your results to prove or disprove the possibility of an algal bloom event.**

Access Previous Year's Data: [here](#) (note there are multiple tabs with data)

Definitions of Algal Bloom Toxins to Help Decipher the Above Data:

Saxitoxins: Saxitoxin is a potent neurotoxin (substance that is toxic to the nervous system). It is produced by certain species of marine and freshwater microorganisms such as harmful algal blooms. When humans consume something contaminated by saxitoxin, they can experience a range of symptoms, including numbness, tingling, muscle weakness, and, in severe cases, paralysis and death.

Okadaic Acid: Okadaic acid is a naturally occurring marine biotoxin present in harmful algal blooms. Even though it is not lethal when it comes to human consumption it is still hazardous for the human body. The effects are typically gastrointestinal distress, such as diarrhea, nausea, vomiting, and abdominal pain.

¹ Interested in learning more? Check out [this](#) article.

Instructions for Graphing:

To create a graph of algal bloom data, the first step should be to assess which data points go along the x versus the y-axis. All data provided contains some form of information relative to time like a date or a year. This information should be placed along the x-axis, with anything like biomass, mortality rate, average toxin amount, etc. on the y-axis. For example, if you wanted to see how the salmon population was affected in Trøndelag over time, you could graph the date on the x-axis with the number of salmon on the y-axis. In this case, the x variable explains the y variable.

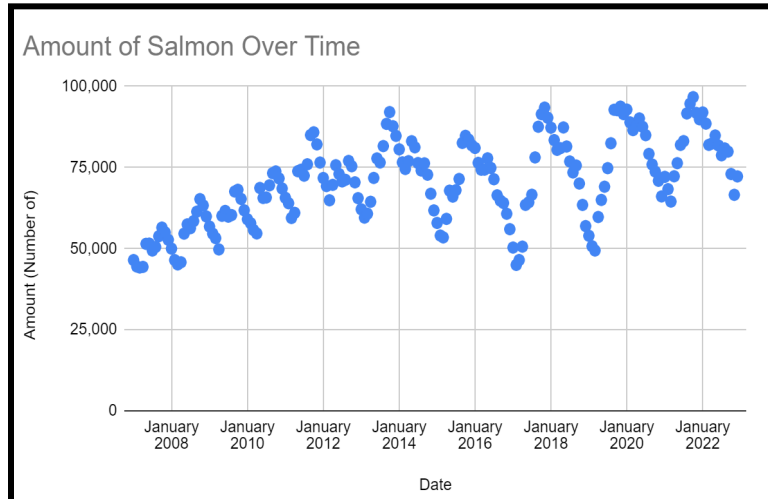


Figure S2.2. Example of a graph generated in Google Sheets.

Other information to keep in mind when graphing is including information like a title, legend if appropriate, axis title, as well as an appropriate trendline. Google Sheets will likely populate most of this information, but you should review the details before proceeding. For example, it will auto-populate as a line graph, but typically a scatter plot with a trendline is more appropriate for scientific data, especially if we want to derive an equation.

In Google Sheets, a graph can be created by selecting two columns of data, clicking insert, and then chart. From here, you can change the graph type to a scatter plot within 'Chart Editor'.

Running a Statistical Test:

A t-test is a statistical test that allows you to determine if the means of two sets of data are different. In a t-test, one output is a p-value, and this value will help determine if the means are statistically different.

When running a t-test, there are certain assumptions that need to be made about your data. One assumption is that your data is normally distributed. Normally distributed data is where your data occurs evenly around the mean, with data points near the mean occurring more frequently than data far from the mean. There are several tests you can run to determine if your data is normal, but **for this activity, we will assume our data is normally distributed and proceed with a t-test.**

To run a t-test in google sheets you will use the function T.TEST. To compare means you will need two lists of data. These are often columns in a dataset and can be selected by entering the range of cells. A range includes the following the first datapoint in the column, a colon, and the last datapoint in the column (ex. A1:A30).

To run a t-test, you will enter the following equation into an empty cell in your document:

=T.TEST(Range 1, Range 2, 2, 2)

The end of that equation has two “2’s” separated by a comma, shown in red. These tell Google Sheets what function to use, and you should just leave them alone. From your t-test you will get an output called a p-value. Based on the results of your t-test, you can make conclusions about your data. If $p < 0.05$, the means between groups are different. If $p > 0.05$, means between groups are the same.

References

International Trade Council. (2024, January 4). *Norwegian Seafood Exports Surge to New Heights, Fueled by Salmon Success* - International Trade Council.

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NordNordWest. (2019). *Location of county Trøndelag in Norway (2020)* [Online]. Wikipedia.

https://commons.wikimedia.org/wiki/File:Tr%C3%B8ndelag_in_Norway_2020.svg