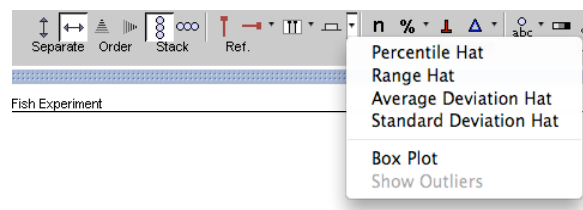


## Fish-Length Distributions

Name(s): \_\_\_\_\_

A fish farmer stocked a pond with a new type of genetically engineered fish. The company that supplied the new type claims that these fish will grow to be longer than normal fish. The farmer decided to test this claim by stocking the pond with 625 fish, some normal and some genetically engineered. When the fish were fully grown, the farmer caught some of the fish and measured them.

1. Open the TinkerPlots document **Fish.tp**. These are the 130 fish the farmer caught and measured.
2. Use the plot to make a graph of the data that allows you to compare the lengths of the two groups of fish.
3. Sketch the graph you made.
4. Do the genetically engineered fish tend to grow longer than the normal fish? Support your conclusion by referring to your graph.
5. If you concluded that the genetically engineered fish do tend to grow longer, about how much longer than the normal fish do they tend to be? Support your conclusion by referring to your graph. (You may want to use the **Ruler** tool to help you answer this question.)
6. From the sample, does it appear that the genetically engineered fish are any more or less variable in length than the normal fish? Support your conclusion with data. (Hat plots may help in comparing variability. You can select different types of hat plots from the **Hat Options** menu.)



**Looking at the Population**



The sample of 130 fish was picked from a population of 625 fish. Based on that sample, you were asked to draw a conclusion about *all* the fish, not just the sample of 130. A question you might be thinking when you make such an **inference** is, “What would I have concluded if a different random sample of 130 fish were picked? Is 130 fish a big enough sample to make a conclusion about all the fish?”

To explore that question, you will take more samples from the whole population of 625 fish and see how similar or different the samples are.

7. Open the TinkerPlots document **Fish Population.tp**.

The 625 fish are in a mixer. The mixer is set to draw a sample of 200 fish. It is also set to sample without replacement – meaning that when a fish is selected, it is not put back into the mixer (pond) before the selection of another fish.

8. Change the sampler to select 130 fish. To do this, click the number beneath Repeat in the sampler and change it to 130. Click the **RUN** button to run the sampler.

9. Make a plot showing the lengths of the two types of fish. Then compare the averages for the two types of fish. (Select the plot and then click the **Mean** or **Median** button. When you hover over  or  (representing the mean or median), its exact value is shown in the lower left corner of the TinkerPlots window.) Would you have reached the same conclusion about the data from this sample of 130 fish as you did for the data from your last sample of 130 fish? Explain.

10. Draw several more random samples of 130 fish by clicking the **RUN** button on the sampler again. (You may want to speed up the sampler if you haven't already.) Record similarities and differences you observe.

11. Suppose the farmer were to catch only 15 fish. Set Repeat to 15. Now run several random samples and record what you observe.
  
  
  
  
  
  
  
  
  
  
12. Is 15 fish a big enough sample to decide whether the genetic fish are longer than normal fish and how much longer they tend to be?
  
  
  
  
  
  
  
  
  
  
13. Usually, you cannot see the entire population from which a sample is drawn, but in this example you can. Set Repeat to 625 to “catch” all the fish. Sample them to see what the plot of all the fish looks like.
  
  
  
  
  
  
  
  
  
  
14. What is the average length for each group of fish? What is the difference between the averages of the two groups? How do the estimates you got from the various samples you took during this activity compare with the measures from the entire population?