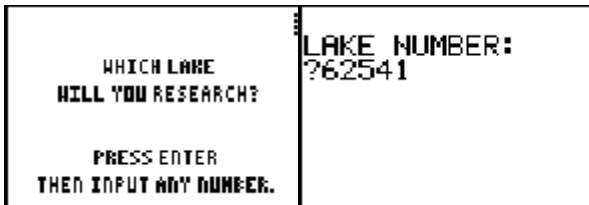


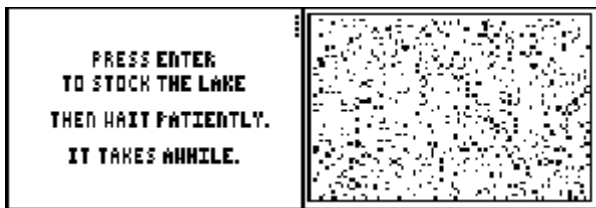
FISHY WATERS for the TI-73/83/84

The objective of FISHY WATERS is to determine the population of fish in a lake. This is done by examining buckets of random water samples to count the fish in each sample. The problem is how to use this information to estimate the number of fish. How many samples will you need to give an accurate estimate? How close is “good enough”?

The “lake” is the interior of a framed section of the window screen. Each darkened pixel in the interior represents 1 fish. A smaller square frame represents the bucket. To help make an estimate you need to know a bit more information. The size of the interior of the bucket is 5 x 5 pixels. The size of the lake is 93 x 61 pixels. **The student needs to be given this information before beginning the problem.**



The program begins by asking you to input the lake you want to examine. This really is just a ploy to seed the random number generator. If you want everyone to examine the same lake with the same number of fish located in the same positions, then everyone should input the same number.



The program will then stock the lake with fish. Each pixel represents one fish. This may take awhile depending on how many fish there are – which the calculator selected randomly (and secretly!).



Next, the program needs a starting point from which to begin. This once again is a random number seed in disguise. If you want everyone to have the exact same samples, have everyone input the same number. However you may want students to gather different random samples so that you would get more data more quickly. In this case, have everyone choose their own starting point.

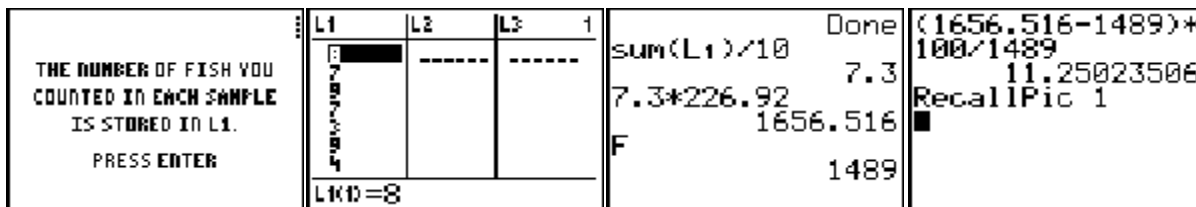


The program allows the student to choose how many samples will be examined.

The set of screen shots below illustrates what the screens for a single sample look like. Sometimes it's like the book "Where's Waldo?" to locate the 5x5 square that represents the bucket! The student needs to observe carefully when counting the pixels inside the bucket. Can you count 8 fish in the sample below? Sometimes it is easier to count which pixels are missing in each row of the bucket. After counting the student must press **ENTER** to access the input screen, input the fish count in the bucket, and press **ENTER** again.



Once all the samples have been counted, the data can be examined by opening the List Editor¹. Engage the students in a discussion about how this information can be used to estimate the number of fish in the lake. The sum of $L1^2$ divided by the number of samples will give the average fish per sample (i.e.; average fish per bucket). The students need to determine how many "buckets" it takes to cover the lake. Recall that the size of a bucket is 5x5 pixels and the size of the lake is 93x61 pixels. Though the program could easily have calculated the estimated number of fish in the lake, it leaves it to the student to understand the mathematics needed and to perform the calculations. This can be compared with the value of F, the program variable that stored the exact count of the number of fish in the lake. If one wants to look at the stocked lake again, use the RecallPic³ command.



Note 1: the number of buckets needed to cover the lake is $(93 \times 61) / (5 \times 5)$ or 226.92 buckets.

Note 2: a final step would be to calculate the percent error; more samples drawn usually results in a smaller percent error.

$$\% \text{ error} = (\text{estimated count} - \text{actual count}) \times 100 / (\text{actual count})$$

Note 3: help your students understand that this is just a two-dimensional model of a three-dimensional situation; encourage a discussion about what would be similar and what would be different in the real situation.

¹To access the List Editor on the TI-73 press **LIST**; on the TI-83/84 press **STAT** 1:Edit.

²To access the sum command on the TI-73 select **2nd****LIST** **▶** **MATH** 7:sum(; on the TI-83/84 select **2nd****STAT** **▶** **▶** **MATH** 5:sum(.

³To access the RecallPic command on the TI-73 select **DRAW** **▶** **▶** **STO** 2:RecallPic; on the TI-83/84 select **2nd****DRAW** **▶** **▶** **STO** 2:RecallPic.