

# Range of Tolerance Graphing Activity

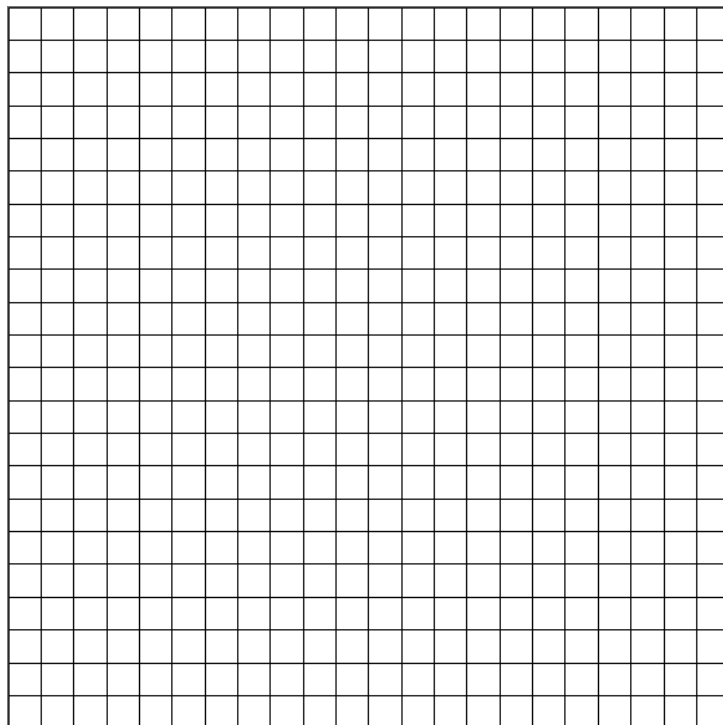
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Steelhead trout, otherwise known as rainbow trout, have seen a population decline in the Western United States over the last decades. There are a wide variety of conditions that are threatening the population, including pollution, climate change, and invasive species. This activity will look at the effects of varying two specific abiotic factors on a controlled population of trout.

Graph the range of tolerance data below for steelhead trout. Water temperature is the independent variable for graph 1 and dissolved oxygen is the independent variable for graph 2, these should be graphed on the x-axis. The number of fish, the dependent variable, should be graphed on the y-axis.

Water Temp (°C)	Number of Fish
0	0
1	1
2	2
3	5
4	7
5	10
6	15
7	21
8	24
9	20
10	17
11	14
12	12
13	10
14	8
15	5
16	3
17	2
18	1
19	1
20	0

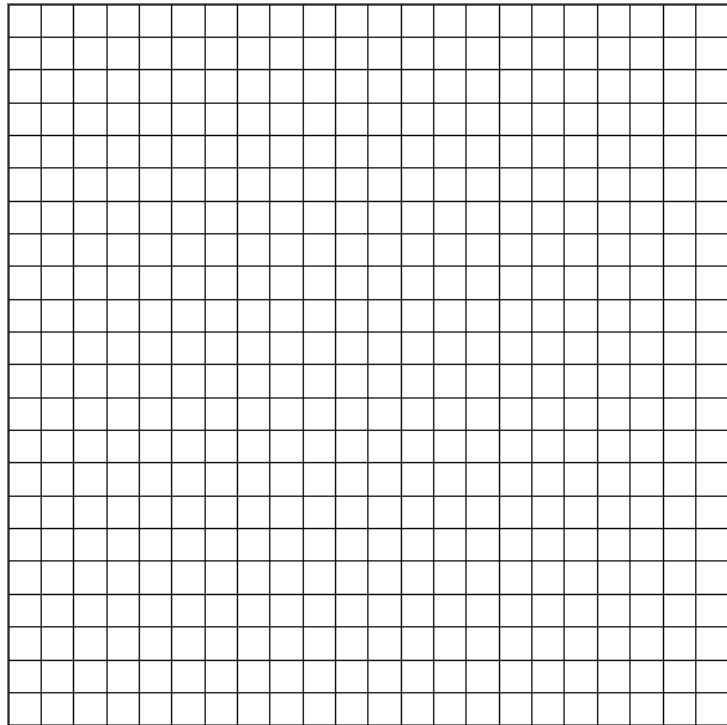
**Graph 1**



1. Label the **optimal range** on the graph. This is the amount of an abiotic factor that produces the highest possible population. For water temperature, this would be about 6-10°C.
2. Label the **zone of physiological stress** on the graph. This occurs when an abiotic factor exists at levels that are too high or low to support normal biotic potential. This would be 3-5°C and 11-16°C.
3. Label the **zone of intolerance** on the graph. This occurs when a population is absent (or in this case, nearly absent). This occurs at either extreme of our water temperature graph, below 3°C and above 16°C.

Dissolved Oxygen (mg/L)	Number of Fish
0	0
1	0
2	2
3	3
4	3
5	5
6	8
7	11
8	15
9	18
10	22
11	24
12	23
13	20
14	18
15	15
16	12
17	10
18	6
19	3
20	1
21	0

**Graph 2**



1. Label the optimal range, zone of physiological stress, and zone of intolerance on graph 2.
2. Biological indicator species are those whose overall health and population numbers can offer a signal of the overall health of an ecosystem. Explain why fish, especially steelhead trout, would be an effective indicator species.