

# A Comparison of the water quality of the Hudson River to DEC standards

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## **Abstract**

The Hudson River estuary has gallons and gallons of wastewater and toxins dumped into it every year. This causes possible issues for communities that use the Hudson as a water supply. Regardless of whether the water is obtained through aquifers, reservoirs, or straight from the river, the water may still contain chemicals. As a result, we participated in a special event held every year in which groups of students gather along the riverside to take water tests in order to see the water quality. This event is called Snapshot Day. Fortunately, the test results showed that the river was not at all caustic, let alone cancerous, but only slightly dirty. Surprisingly, the river was fairly healthy, 8 out of 10, or 80% of the parameters were within the DEC standards.

## **Background**

On October 7, 2008 our class participated in snapshot day. Snapshot day is where students from across the Hudson valley go to run tests on the Hudson River to check for water quality. We went and ran tests for salinity, pH, water temperature, air temperature, dissolved oxygen, percent saturation oxygen, stream flow, turbidity, electrical conductivity, total dissolved solids, nitrate, phosphate, Coliform, and alkalinity. We run these tests because over the past hundred years industries have dumped waste into the water. Municipalities have dumped wastewater and development has made nonpoint source of greater concern. So now there is cleaning being done to save the river and tests regularly to monitor progress. We ran our tests at the boat launch in Rensselaer NY. There was a gravel shore, many trees, and a few buildings near this site.

## **Results**

For data collection, there were ten groups that each tested for all of the parameters. The class collected an average temperature of 14°C, and most groups got that, or 15°C for a measurement. 12.73°C is the average for air temperature; most groups measured the temperature to be 12°C. On average, the groups collected data that showed 7.7mg/L for dissolved oxygen which is not far off of what most groups got which is 9mg/L. For the percent sat. Oxygen, the class average was 43.4%. That is high because most groups measured it to be 24%. The average pH was 6.73, and most groups got a neutral pH of 7. The stream flow average was 11.68m/s; most groups got 10m/s, or 14m/s. The average of the small turbidity test was 24.33 JTU, most groups got a result of 10 JTU. We also did a turbidity test with a large tube, the class average for that was one 109.7cm. 198ms was the average conductivity, most groups got results that showed the conductivity was 128ms. There was 164.3ppm of dissolved solids, most groups tested it to be either 125ppm or 128ppm. 2.61 was the average salinity in milliliters; most groups came up with 1mL. Nitrate was tested in parts per million, the class average was 4.28ppm; most groups collected data that showed 1ppm. There were 43mg/L of phosphate; most groups got a result of .1mg/L or 1mg/L of phosphate. The class measured coliform by incubating one milliliter of water on a bacteria plate. The average was 14.9 colonies, whereas most groups counted 14 colonies. The last parameter was alkalinity, the average was 73ppm; most groups found 80ppm.

## **Discussion**

The results shown above are most likely caused by a number of things. Most of the water quality parameters were, by the DEC standards, at the correct measurement. There were still a few that didn't get good results. There is a chart in the appendix labeled Comparisons to DEC standards that show our schools averages compared to the DEC standards. These parameters

included Nitrogen and both turbidity tests. The turbidity is fairly easy to decide why the results turned out like that. There is a lot of pollution in the Hudson River, and there are natural variables affecting turbidity such as erosion in the watershed. When there is runoff, it goes into bodies of water, also there is feces in the water from animals, but not very much because if there was a lot, the coliform would be much higher. Some of the causes of Nitrate is fertilizer runoff from lawns and farms. The problems with Nitrogen is that if there is a buildup of it, something called eutrophication will occur. Eutrophication is when there is a lot of nutrients causing the growth of algae which will decay and cause the amount of oxygen in the water to go down. For the most part, the Hudson is fairly healthy as far as DEC standards go.

## **Conclusion**

As it has been discussed in the paragraph above, there are some parameters that the Hudson River does not meet the DEC standards for. There are some things we can do to further test those areas. One of them was turbidity, there are some environmental factors that will affect the turbidity. One of these is runoff, if tests are before, and after it rains, there will be a better understanding as to how much of the turbidity that nature causes, and how much is caused by pollutants. We cannot be sure that these measurements are exact because many times there are experimental errors, or equipment errors. A few mistakes that could have been made are that we didn't have an exact measurement of water because there were really no level surfaces to use to see if the measurements were correct. Also, after the project, our teacher found out that there could have been an error with the nitrogen test, causing our nitrogen measurements to be so far off.

## **Bibliography**

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## Appendix

There was a special way to collect data for each of these parameters, the methods are fairly simple. While we were at the Rensselaer Boat Launch for Snapshot Day, we performed many tests. These tests were the water temperature, air temperature, dissolved oxygen, percent saturated oxygen, pH, stream flow, turbidity with both a small test and a large tube, conductivity, dissolved solids, salinity, nitrate, phosphate, coliform, and alkalinity. For both water, and air temperature, we simply used a thermometer. Dissolved oxygen was measured using the

CHEMets test kit which requires taking a water sample, filling the ampule that already has chemicals in it and waiting to record a color change representing the amount of dissolved oxygen. The percent saturated oxygen was measured with the Perce test kit. The pH, electrical conductivity and dissolved solids were all done with the PH/EC/TDS test which is just a meter that is placed in the water, and a number that represents one of those three is revealed. Nitrate and phosphate were measured with the LaMotte test kit that they correspond with. Bacteria was measured by using a bacteria plate, we put one millimeter of water in it, and put the plates in an incubator, the next day we could count the number of colonies.

#### Comparisons to DEC standards

Parameter-(DEC Standard)	Class Average	Does it Meet?
Dissolved Oxygen-( $\geq 7$ )	7.7	Yes
pH-(6.5-8.5)	7	Yes
Nitrogen-( $\leq .38$ )	4	No
Phosphorus-( $\leq 10$ )	0.4	Yes
Temperature-(about 17)	14	Yes
Turbidity-( $\leq 5$ )	24	No
Dissolved Solids-( $\leq 500$ )	160	Yes
Conductivity-( $\leq 767.9$ )	198	Yes
Coliform-( $\leq 25$ )	14	Yes

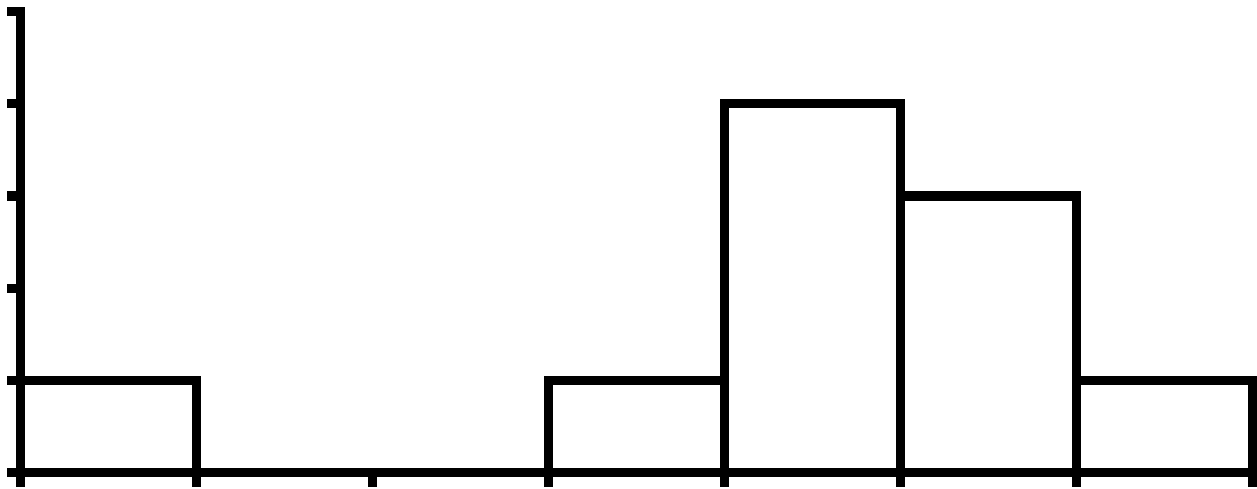
Parameter/ groups	1	2	3	4	5	6	7	8	9	10	Mean	Median	Mode
Water Temp ( C )	15	14	16	15	14	15	10	14.6	13	14	14.06	14.3	{14, 15}
Air Temp ( C )	12	12	11	13.4	12		15	13.4		13	12.73	13	{12}
Dissolved Ox. ( mg/L )	9	9	6	6	9	9	5	6	10	8	7.7	8.5	{9}
% Sat. Ox ( % )			24	24			49	24	96		43.4	24	{24}
pH	7.01	7.89	7	8	6.65	5	5	7		7	6.73	7	{7}
Stream Flow ( m/s )		10		14	10		22	14		0.05	11.68	12	{10, 14}
Turbidity (small) ( JTU )		10		66	10		15	20	25		24.33	17.5	{10}
Turbidity (large tube) ( cm )	120	41	120	248	90	127	117	54		64.6	109.07	117	no mode
Conductivity ( ms )		248		128	268	118	128	246		250	198	246	{128}
Dissolved Solids ( ppm )		128		124	128	235	258	125		125	160.43	128	{125, 128}
Salinity ( mL )	2	1	3	3.75	1	5	3.75	3		1	2.61	3	{1}
Nitrate ( ppm )	1	4.4	4.4	1	4.4	1	1	8.8	8.8	8	4.28	4.4	{1}
Phosphate ( mg/L )	1	0.1	1	0.1	0.1	1	0			0.15	0.43	0.58	{0.1, 1}
Coliform ( colonies )	11	13	14	13	18	15	20	14	17	14	14.9	14	{14}
Alkalinity ( ppm )	70	1	40	80	80	100	140				73	80	{80}

#### The Class data with Central Tendencies

Water Temperature ( c ) (box and whisker/ histogram/ stem and leaf)



Minimum: 10; First Quartile: 14; Median: 14.3; Third Quartile: 15; Maximum: 16

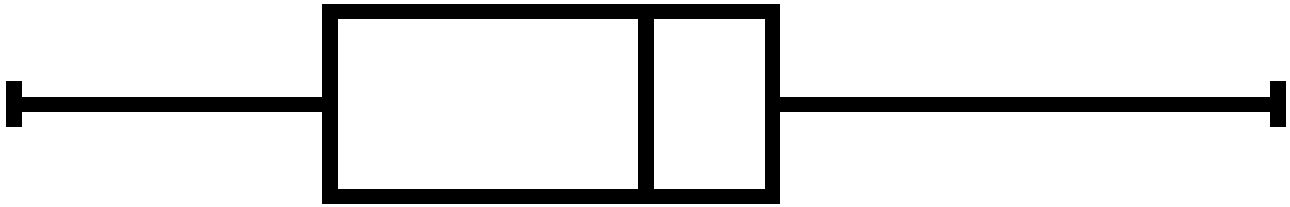


Less than 11: 1; 11-11.9: 0; 12-12.9: 0; 13-13.9: 1; 14-14.9: 4; 15-15.9: 3; 16-16.9: 1

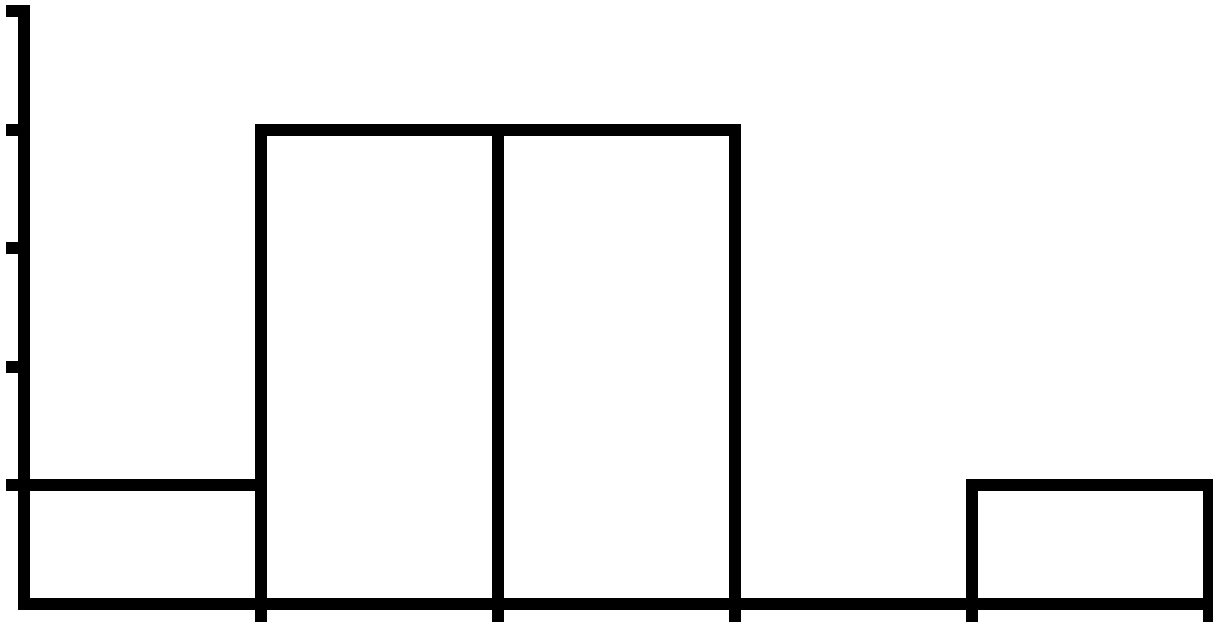
Stem	Leaf
10	0
11	
12	
13	0
14	0, 0, 0, 6
15	0, 0, 0
16	0

Key: 10/0 is the same as 10.0

Air Temperature ( c ) (box and whisker/ histogram/ stem and leaf)



Minimum: 11; First Quartile: 12; Median: 13; Third Quartile: 13.4; Maximum: 15



Less than 12: 1; 12-12.9: 4; 13-13.9: 4; 14-14.9: 0; 15-15.9: 1

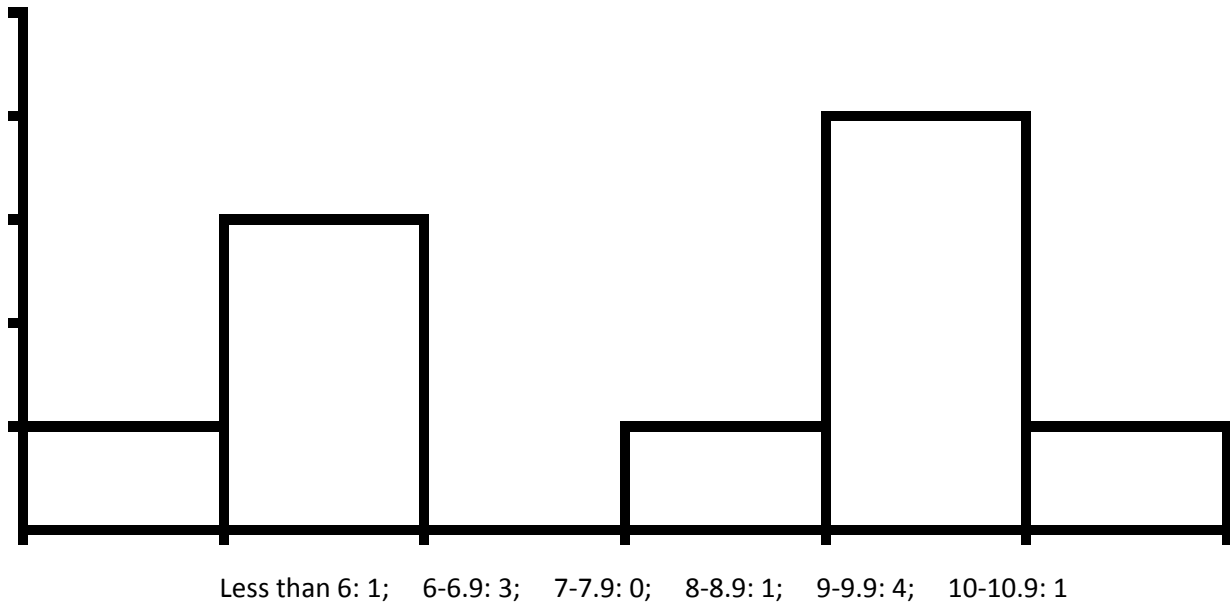
Stem	Leaf
11	0
12	0, 0, 0
13	0, 4, 4
14	
15	0

Key: 11/0 is the same as 11.0

Dissolved Oxygen ( mg/L ) (box and whisker/ histogram/ stem and leaf)



Minimum: 5; First Quartile: 6; Median: 8.5; Third Quartile: 9; Maximum: 10



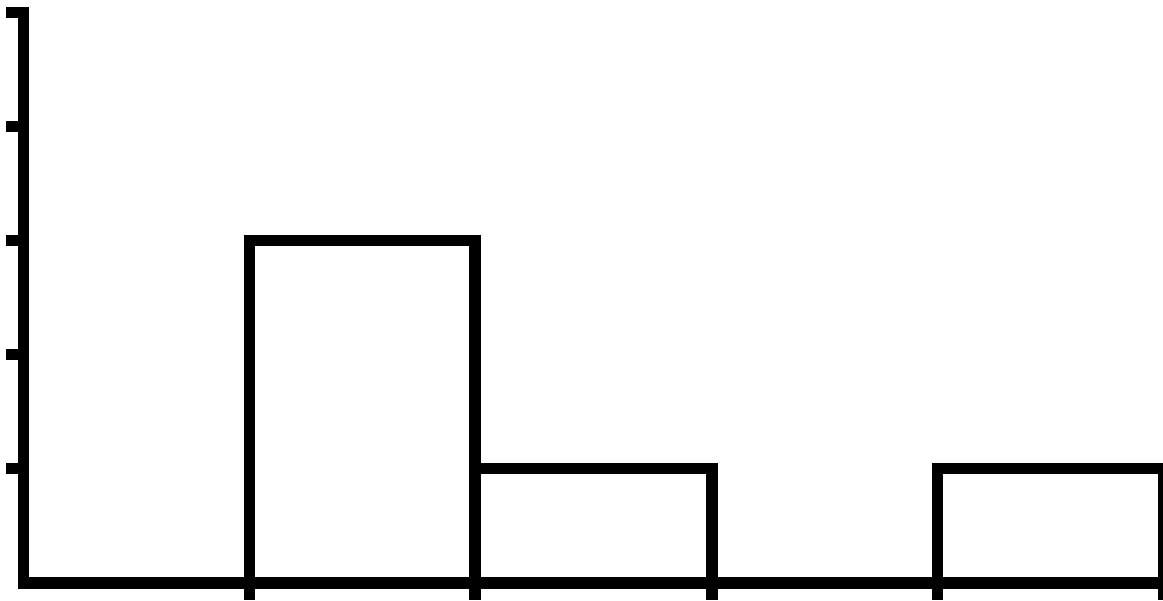
Stem	Leaf
5	0
6	0, 0, 0
7	
8	0
9	0, 0, 0, 0
10	0

Key: 5/0 is the same as 5.0

Percent Saturated Oxygen ( %) (box and whisker/ histogram/ stem and leaf)



Minimum: 24; First Quartile: 24; Median: 24; Third Quartile: 72.5; Maximum: 96



Less than 21: 0; 21-40: 3; 41-60: 1; 61-80: 0; 81-100: 1

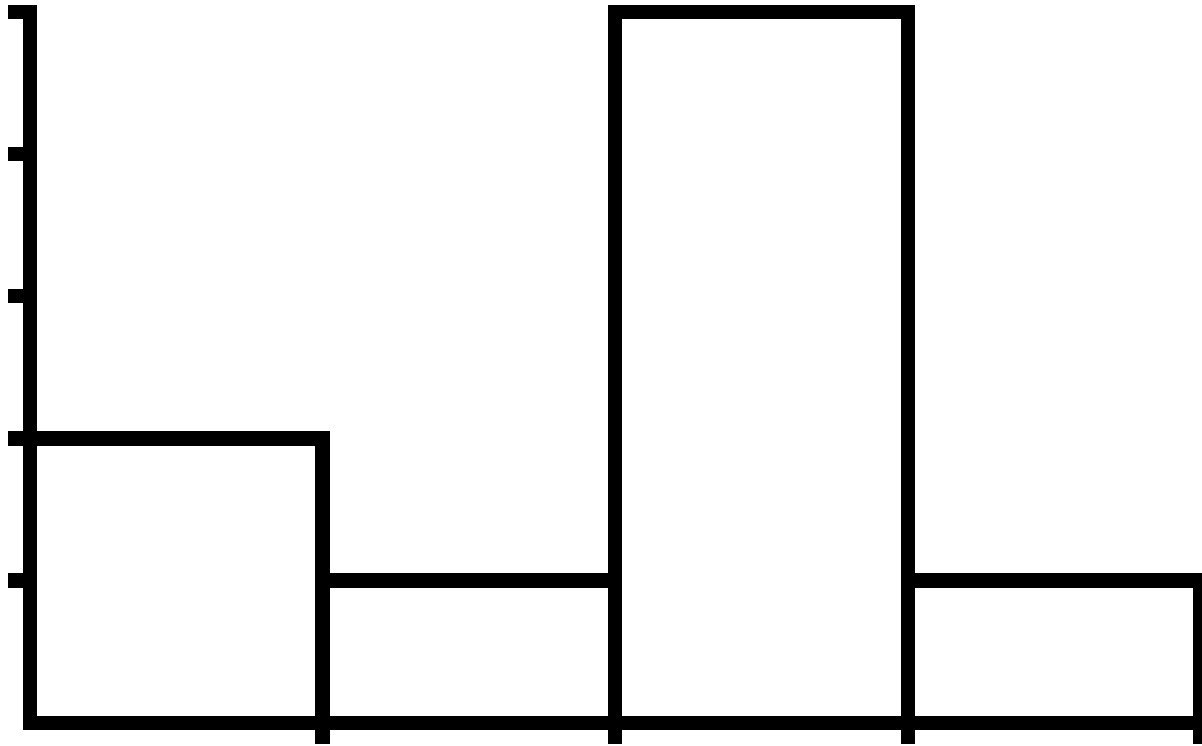
Stem	Leaf
2	4, 4, 4
3	
4	9
5	
6	
7	
8	
9	6

Key: 2/4 is the same as 24



pH (box and whisker/ histogram/ stem and leaf)

Minimum: 5; First Quartile: 5.825; Median: 7; Third Quartile: 7.45; Maximum: 8

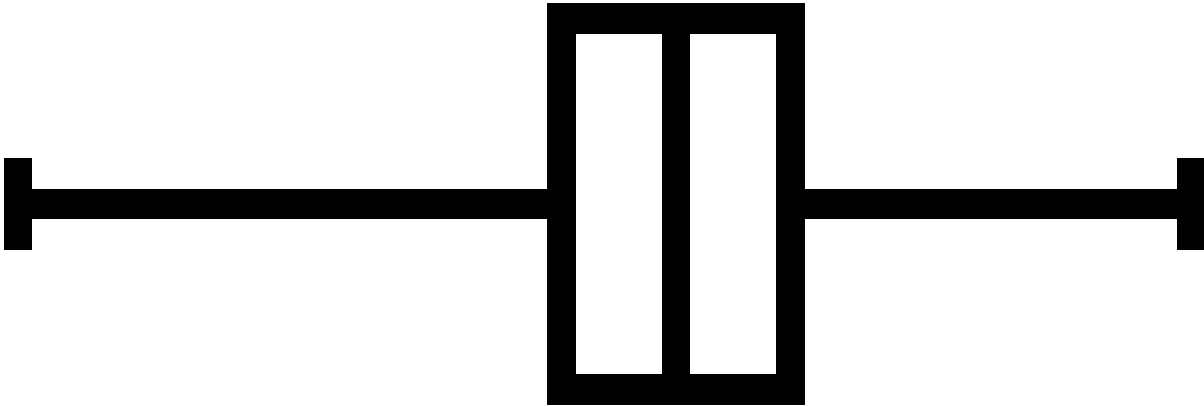


Less than 6: 2; 6-6.9: 1; 7-7.9: 5; 8-8.9: 1

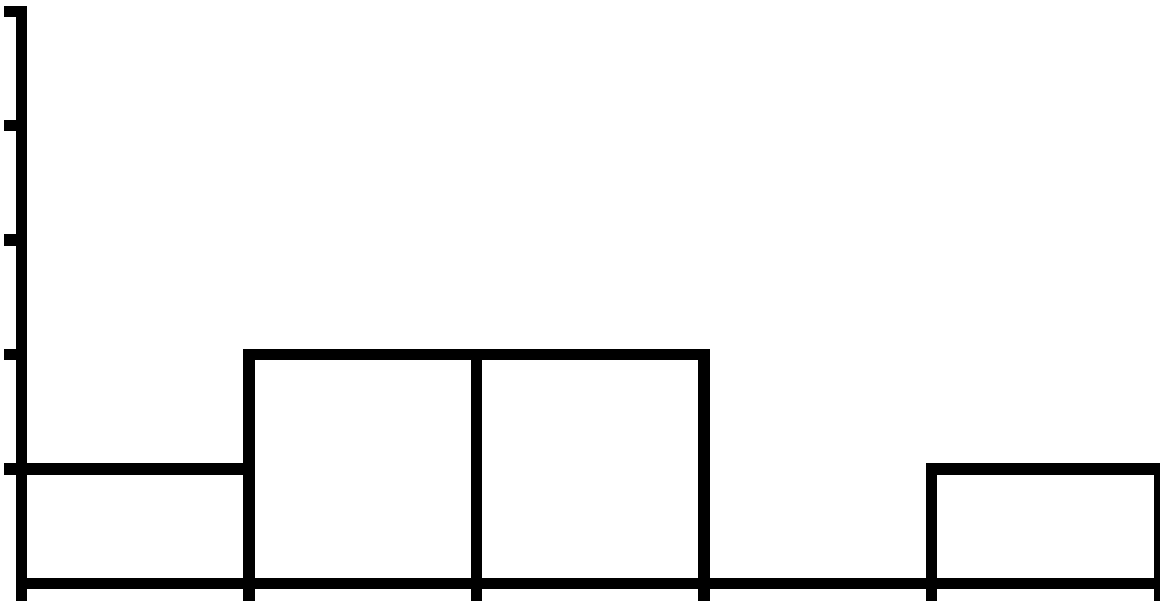
Stem	Leaf
5	0, 0
6	65
7	0, 0, 0, 01, 89
8	0

Key: 7/01 is the same as 7.01

Stream Flow ( m/s ) (box and whisker/ histogram/ stem and leaf)



Minimum: 0.5; First Quartile: 10; Median: 12; Third Quartile: 14; Maximum: 22



Less than 6: 1; 6-10: 2; 11-15: 2; 16-20: 0; 21-25: 1

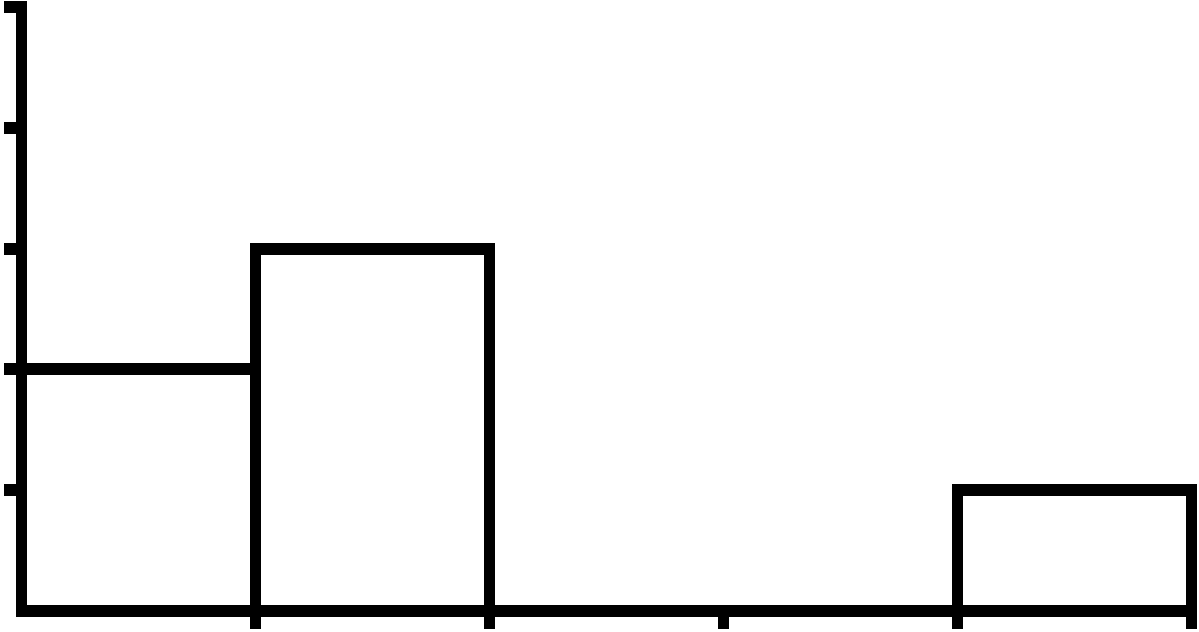
Stem	Leaf
0	0.05
1	0, 0, 4, 4
2	2

Key: 0/0.05 is the same as 00.05

Turbidity (small) (JTU) (box and whisker/ histogram/ stem and leaf)



Minimum: 10; First Quartile: 10; Median: 17.5; Third Quartile: 25; Maximum: 66



Less than 15: 2; 15-28: 3; 29-42: 0; 43-56: 0; 56-70: 1

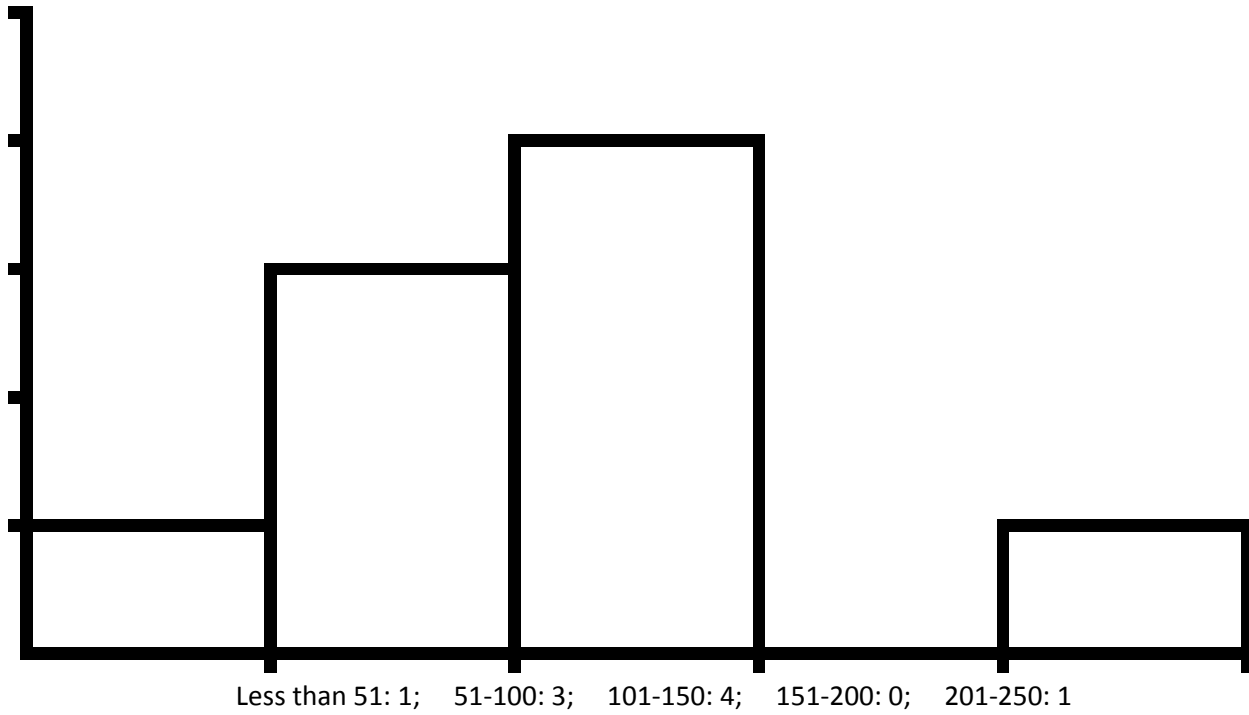
Stem	Leaf
1	0, 0, 5
2	0, 5
3	
4	
5	
6	6

Key: 1/0 is the same as 10

Turbidity (large) ( cm ) (box and whisker/ histogram/ stem and leaf)



Minimum: 41; First Quartile: 59.3; Median: 117; Third Quartile: 123.5; Maximum: 248



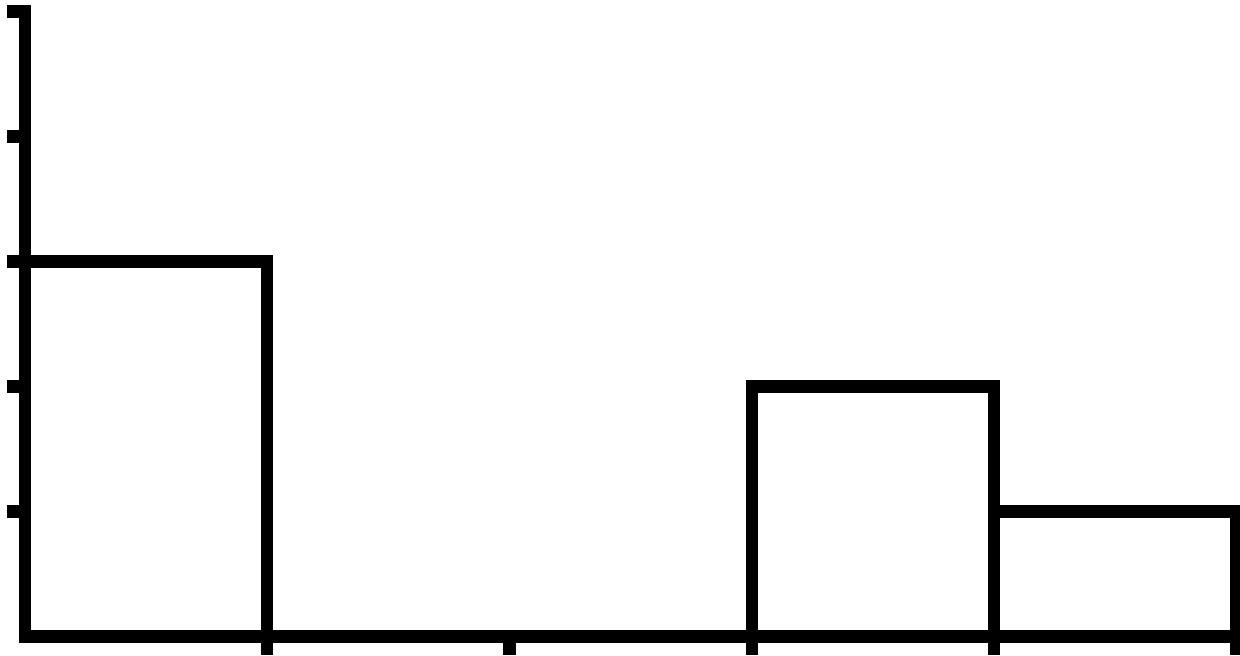
Stem	Leaf
0	41, 54, 64.6
1	17, 20, 20, 27
2	48

Key: 1/17 is the same as 117

Conductivity ( ms ) (box and whisker/ histogram/ stem and leaf)



Minimum:118; First Quartile: 128; Median: 146; Third Quartile: 140; Maximum: 268



Less than 141: 3; 141-180: 0; 181-220: 0; 221-240: 0; 241-260: 2; 261-300: 1

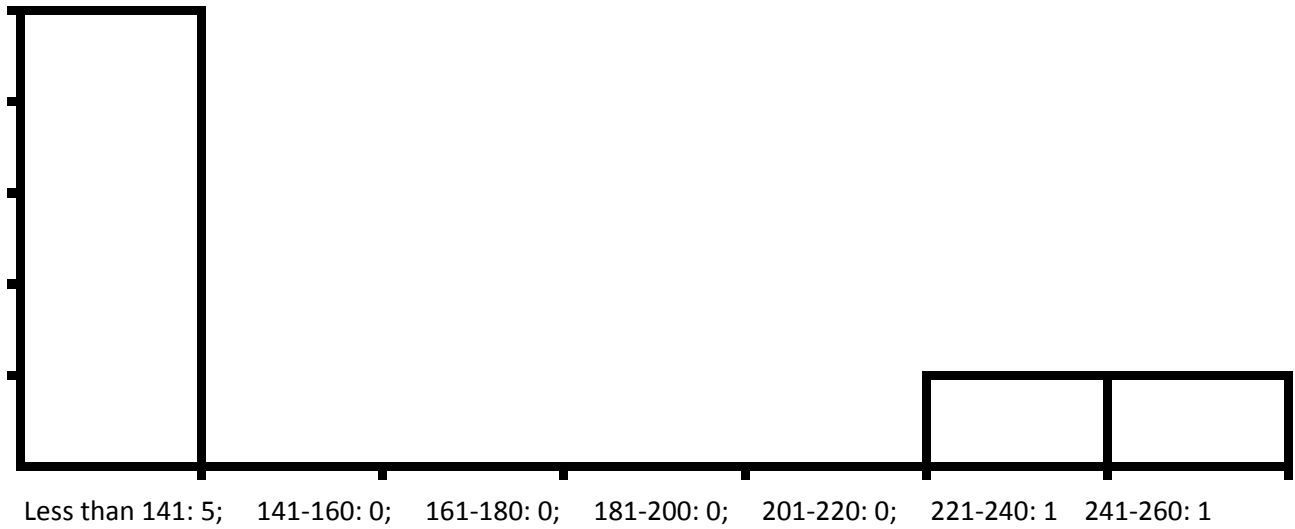
Stem	Leaf
1	18, 28, 28
2	46, 48, 50, 68

Key: 1/18 is the same as 118

Dissolved Solids ( ppm ) (box and whisker/ histogram/ stem and leaf)

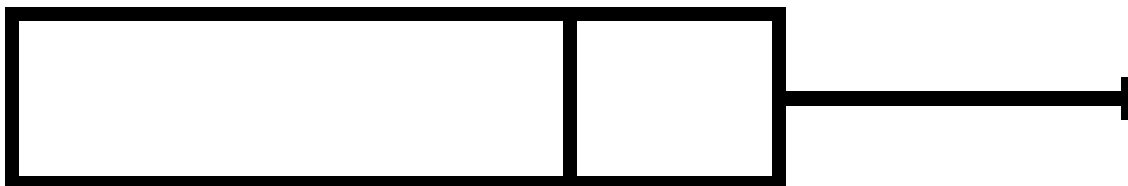


Minimum:124; First Quartile: 125; Median: 128; Third Quartile: 253; Maximum: 258



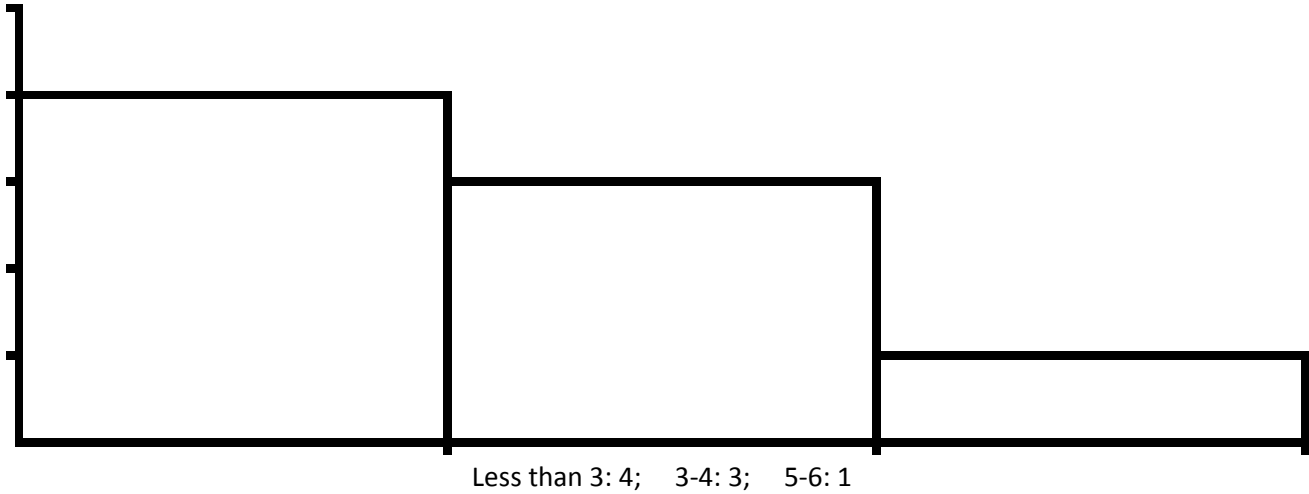
Stem	Leaf
1	24, 25, 25, 28
2	35, 58

Key: 1/24 is the same as 124



Salinity ( mL ) (box and whisker/ histogram/ stem and leaf)

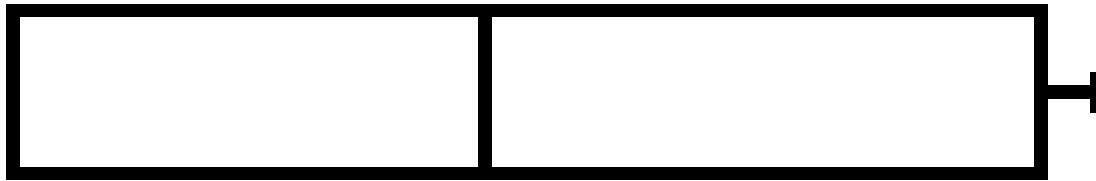
Minimum:1; First Quartile: 1; Median: 3; Third Quartile: 3.75; Maximum: 5



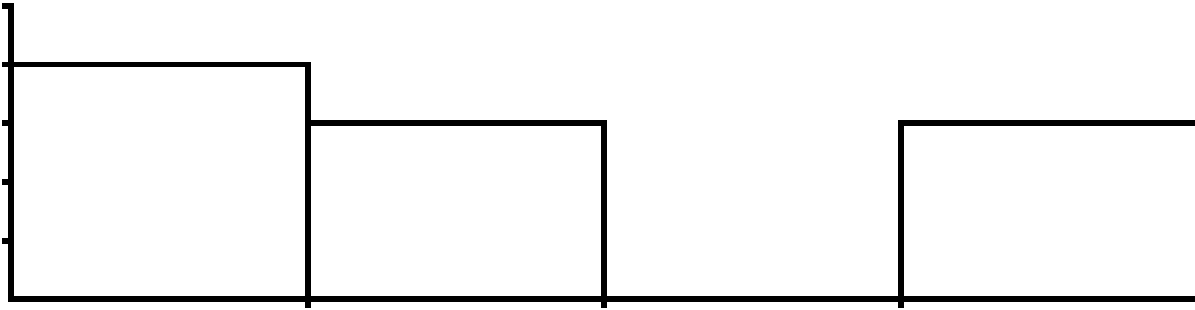
Stem	Leaf
1	0, 0, 0
2	0
3	0, 0, 75, 75
4	
5	0

Key: 1/0 is the same as 1.0

Nitrate ( ppm ) (box and whisker/ histogram/ stem and leaf)



Minimum:1; First Quartile: 1; Median: 4.4; Third Quartile: 8.4; Maximum: 8.8



Less than 3: 4; 3-4: 3; 5-6: 0; 7-8: 3

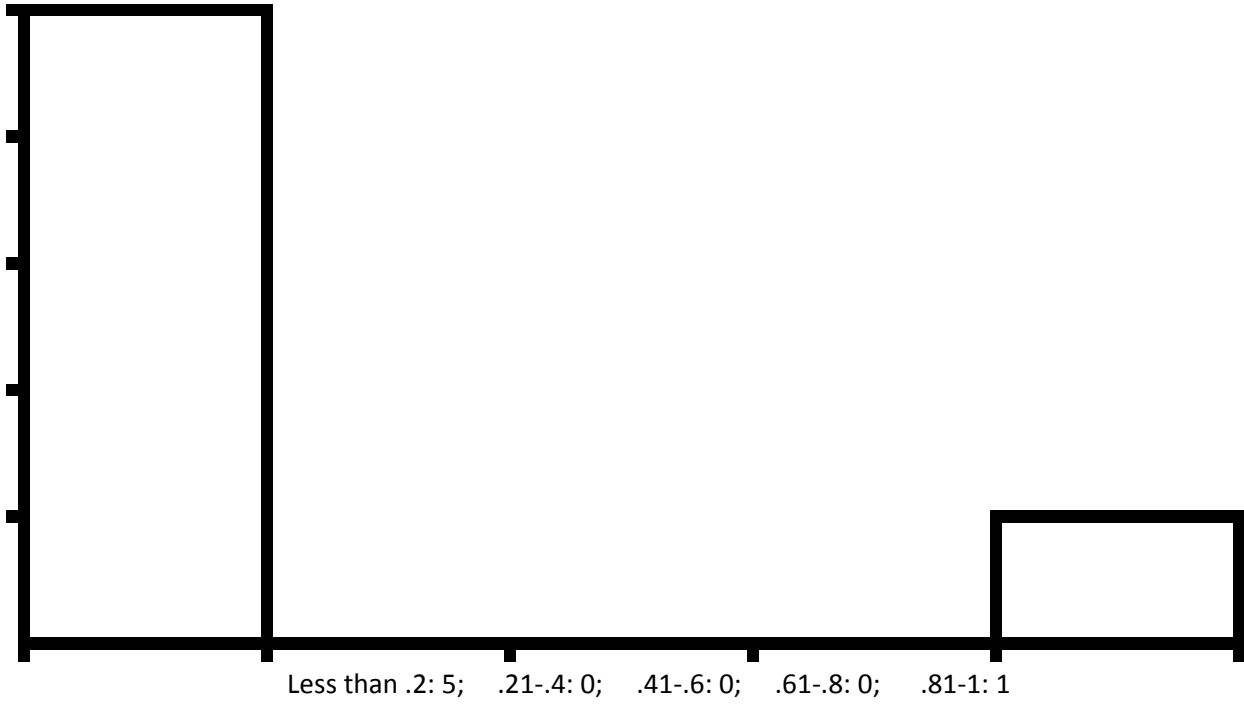
Stem	Leaf
1	0, 0, 0, 0
4	4, 4, 4
8	0, 8, 8

Key: 1/0 is the same as 1.0

Phosphate ( mg/L ) (box and whisker/ histogram/ stem and leaf)



Minimum:0; First Quartile: .1; Median: .13; Third Quartile: 1; Maximum: 1



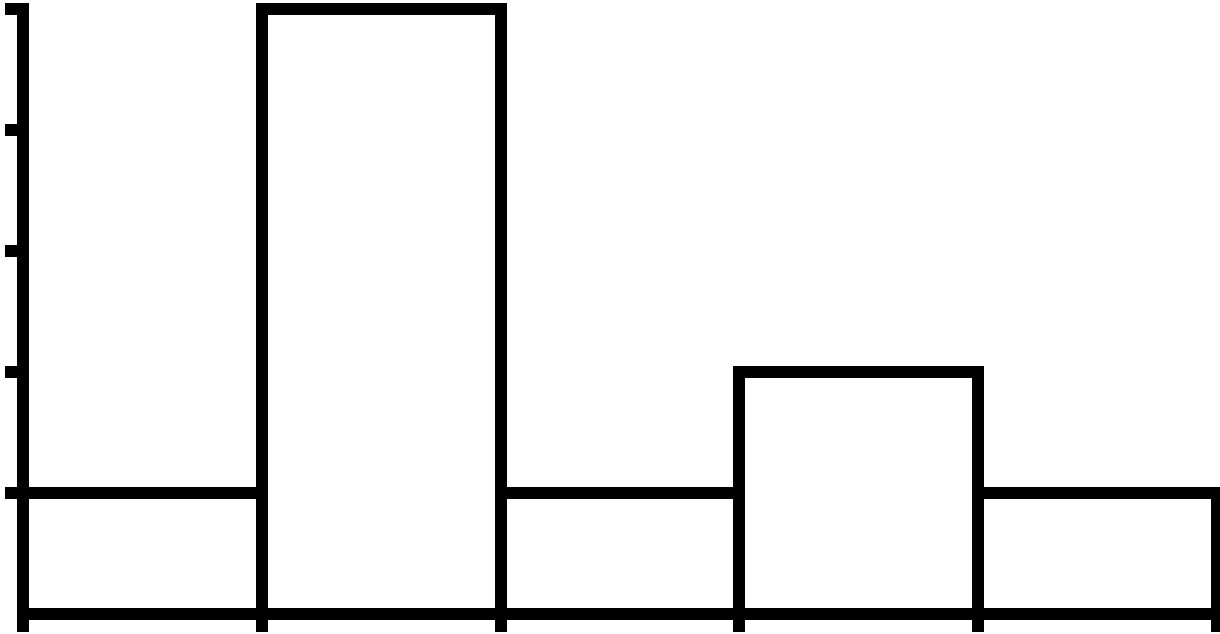
Stem	Leaf
0	0, 1, 1, 1, 15
1	0, 0, 0

Key: 0/0 is the same as 0.0

Coliform ( colonies ) (box and whisker/ histogram/ stem and leaf)



Minimum:11;    First Quartile: 13;    Median: 14;    Third Quartile: 17.5;    Maximum: 20



Less than 13: 1; 13-14: 5; 15-16: 1; 17-18: 2; 19-20: 1

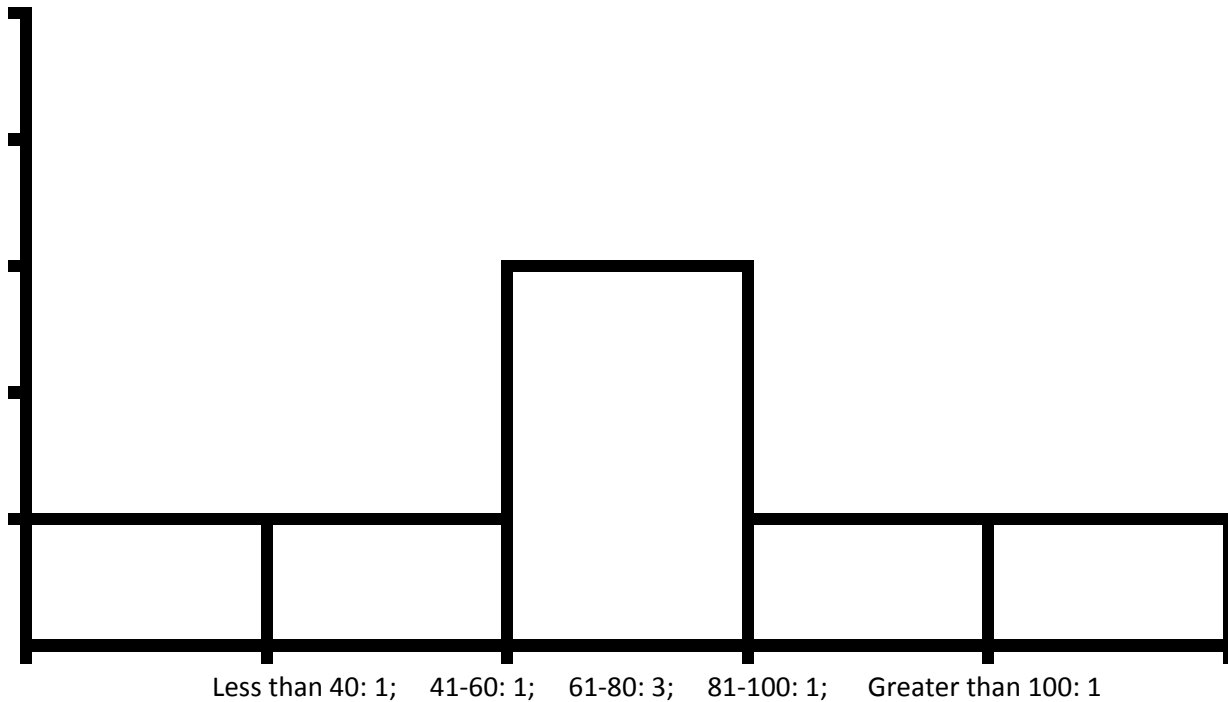
Stem	Leaf
1	1, 3, 3, 4, 4, 4, 5, 7, 8
2	0

Key: 1/1 is the same as 11

Alkalinity ( ppm ) ( box and whisker/ histogram/ stem and leaf)



Minimum:1; First Quartile: 40; Median: 80; Third Quartile: 100; Maximum: 140



Stem	Leaf
0	1
4	0
7	0
8	0, 0
10	0
14	0

Key: 0/1 is the same as 1

Features of the data that are brought forth from the analysis

The box and whisker plots show how the data is spread out. Sometimes you don't realize that there is not a very big selection of data because the range is so big. For example, the parameter called 'percentage of saturated oxygen' has a very wide range of data, from twenty-four percent to ninety-six percent. What we don't usually realize is that the mean is an inaccurate measurement for that particular parameter because most of the data is at the twenty-four point, but the mean is nearly forty-four percent. That can be misleading because most people would interpret that to mean that the data is around the forty-four percent mark with a few above and a few below, not that most of the percentages are twenty-four.

The histogram shows where most of the data is. The histogram shows where most of the data is. This is useful when someone needs to find where the largest amount of the data is. For parameters like

the percentage of saturated oxygen this would be a good way to display data because it shows that most of the data is at the twenty-four percent, but there are some higher percentages.