Case Scenario:

It's springtime in the Hudson's Bay Lowlands of Ontario as all of winter's snow has melted. In the last month, there has been a **catastrophic loss of over 50%** of the nearby fish populations along the shore. You have been asked to analyze one water sample from four different sites to identify the potential source of the fish loss.

Site #1:

This sample comes from a site that is fed by **irrigation water runoff** from commercial farming fields, averaging 728 acres in size, growing corn and various vegetables. Ten new farms opened last year.

Sample Taken from May 15, 2017

Sample Taken from May 27, 2018

Key

= Mosquito Larva: sensitive to insecticides, low dissolved oxygen, heavy metals, and high acidity/basicity

= Midge Larva: sensitive to heavy metals and high acidity/basicity

= Mayfly Nymph: sensitive to insecticides and high acidity/basicity

= Water Boatman: sensitive to insecticides, low dissolved oxygen, heavy metals, and high acidity/basicity

= Flatworm: sensitive to insecticides and heavy metals

Dissolved oxygen: contains 0.0007 g of oxygen per 200 g of water.

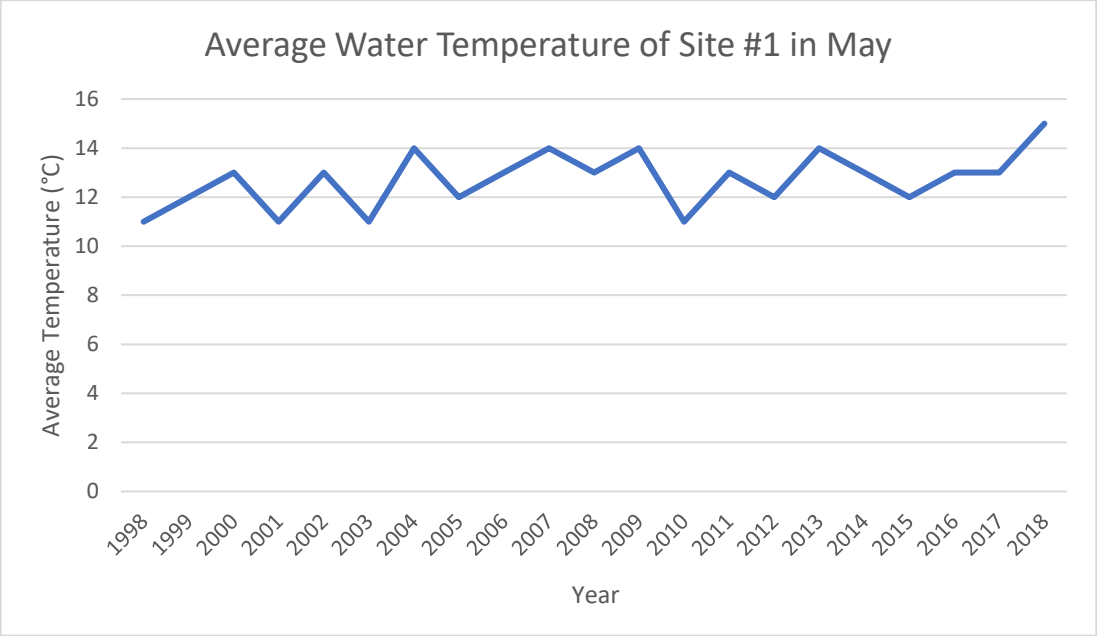
Acidity: measure the water sample using liquid indicator.

Heavy Metal Concentration: contains 0.0036 g of lead per 200 g of water.

Phosphorus Concentration: contains 0.00003 g of phosphorous per 200 g of water.

Pesticide Concentration: contains 0.00038 g of Fenthion per 200 g of water.

Temperature:



Normal Levels of Environmental Chemical Indicators

Chemical Indicator	**Healthy Limit**
Dissolved Oxygen	≥5 ppm
Acidity	5.5 ≤ pH ≤ 8.5
Phosphorous	≤0.08 ppm
Lead	≤70 ppm
Fenthion (Insecticide)	≤1.1 ppm

Red Cabbage Indicator Colour Chart

pH	pH less than 7 = Acid			pH more than 7 = Base		
	2	4	6	8	10	12
Colour	Red	Purple	Violet	Blue	Blu-Grn	Grn-Yel

Remember:

$$\text{ppm} = \frac{\text{amount of solute}}{\text{total amount of solution}} \text{ x } 1{,}000{,}000$$

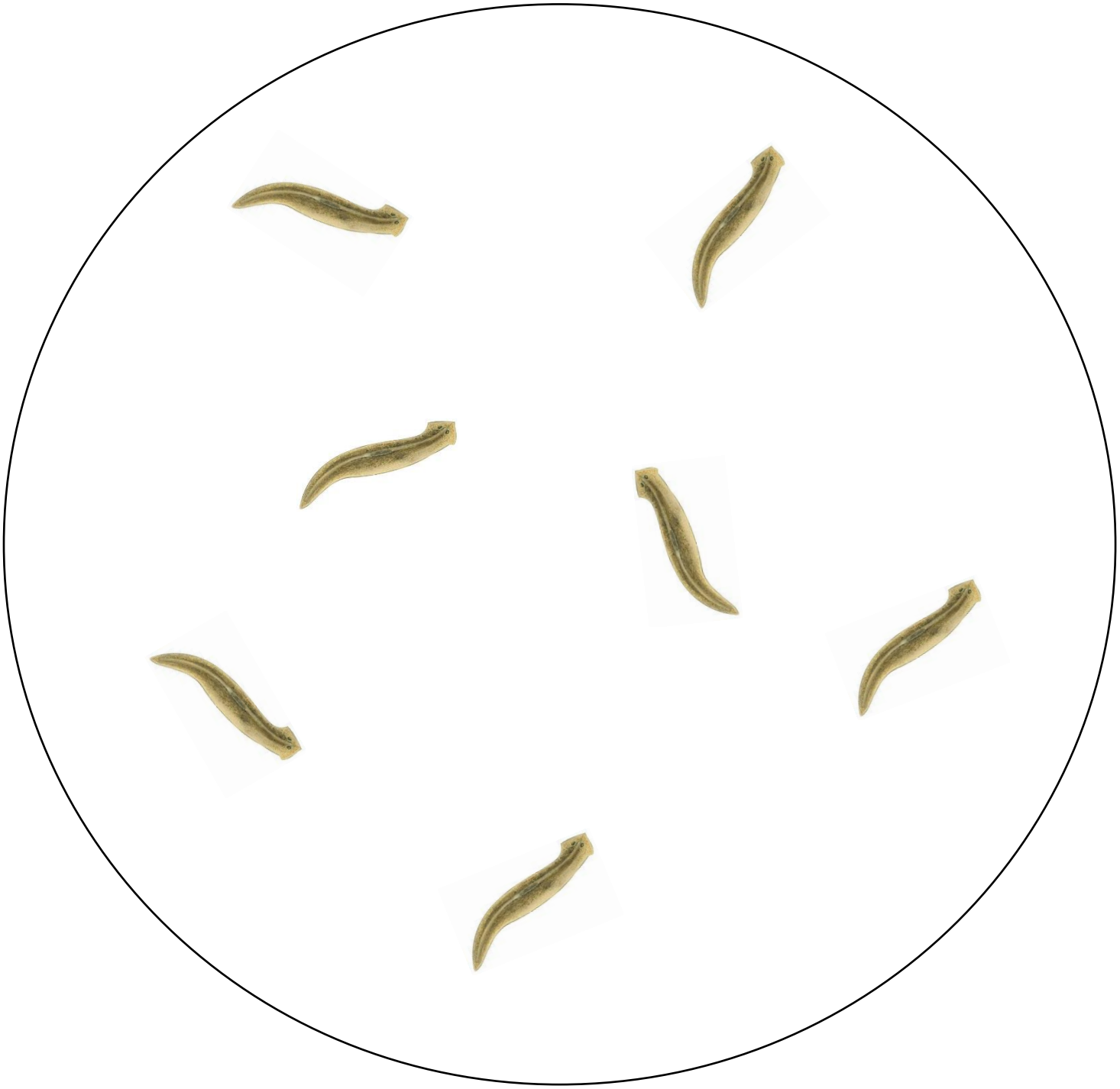
Case Scenario:

It's springtime in the Hudson's Bay Lowlands of Ontario as all of winter's snow has melted. In the last month, there has been a **catastrophic loss** of over 50% of the nearby fish populations along the shore. You have been asked to analyze one water sample from four different sites to identify the potential source of the fish loss.

Site #2:

This sample comes from a site that has **water runoff** from a factory. The factory has added a new division for **paper and pulp production** in the last year.

Sample Taken from May 15, 2017



Sample Taken from May 27, 2018

Key

= Mosquito Larva: sensitive to insecticides, low dissolved oxygen, heavy metals, and high acidity/basicity

= Midge Larva: sensitive to heavy metals and high acidity/basicity

= Mayfly Nymph: sensitive to insecticides and high acidity/basicity

= Water Boatman: sensitive to insecticides, low dissolved oxygen, heavy metals, and high acidity/basicity

= Flatworm: sensitive to insecticides and heavy metals

Dissolved oxygen: contains 0.0015 g of oxygen per 350 g of water.

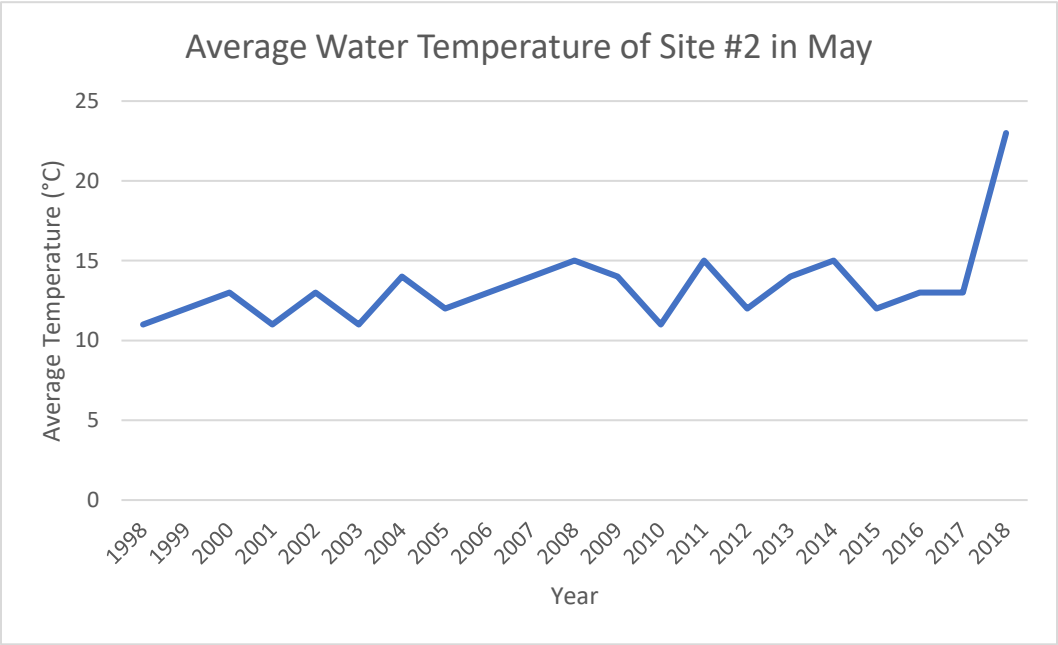
Acidity: measure the water sample using the litmus paper.

Heavy Metal Concentration: contains 0.0018 g of lead per 350 g of water.

Phosphorus Concentration: contains 0.00002275 g of phosphorous per 350 g of water.

Pesticide Concentration: contains 0.00011 g of Fenthion per 350 g of water.

Temperature:



Normal Levels of Environmental Chemical Indicators

Chemical Indicator	**Healthy Limit**
Dissolved Oxygen	≥5 ppm
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Phosphorous	≤0.08 ppm
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Red Cabbage Indicator Colour Chart

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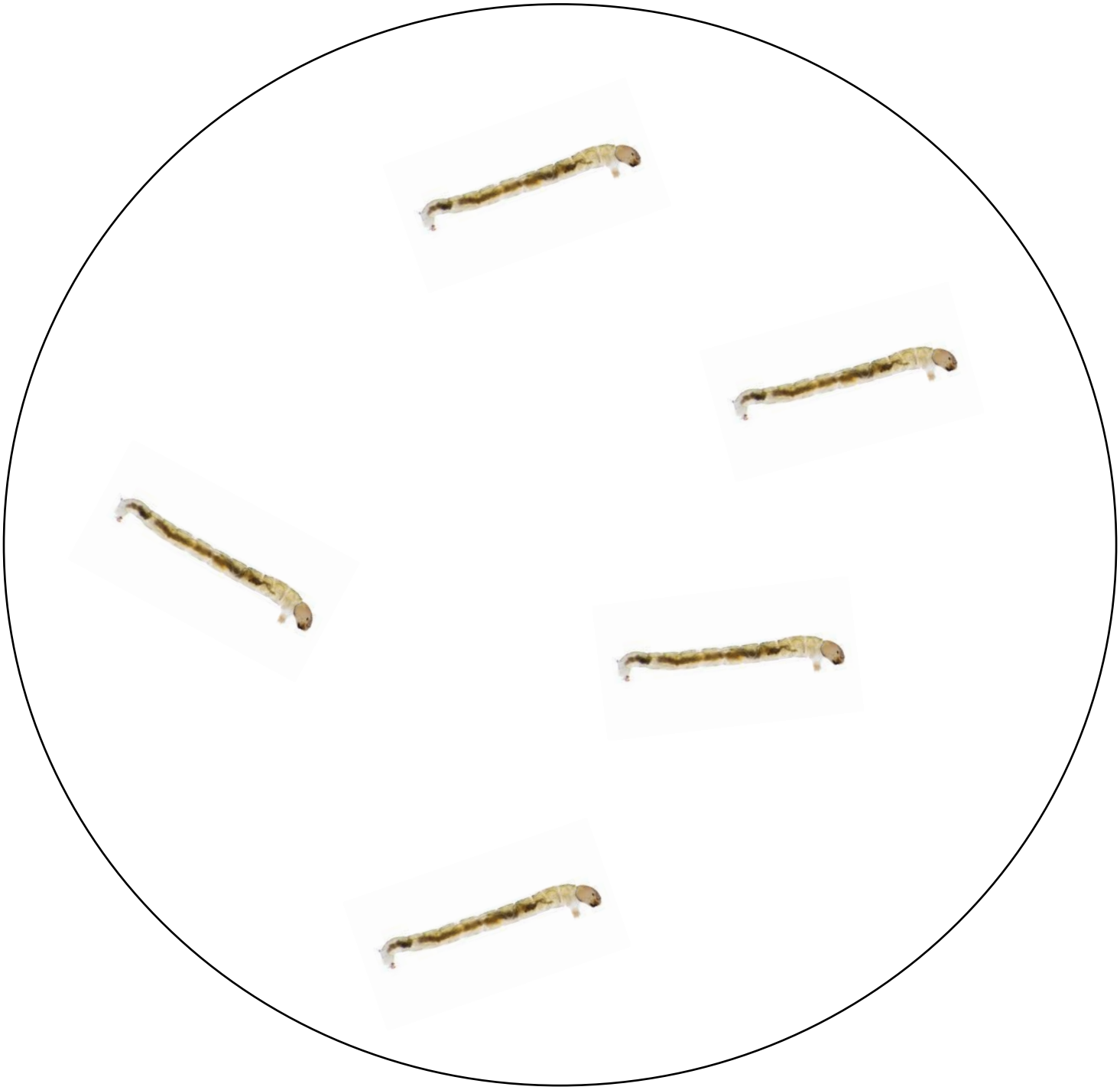
Case Scenario:

It's springtime in the Hudson's Bay Lowlands of Ontario as all of winter's snow has melted. In the last month, there has been a **catastrophic loss of over 50%** of the nearby fish populations along the shore. You have been asked to analyze one water sample from four different sites to identify the potential source of the fish loss.

Site #3:

This sample comes from a site that is fed by storm drains from a local **municipality**. The **municipality** features over 40,000 residents with many residents having acreages, vehicles, and washing machines. A new golf course just opened in the last year.

Sample Taken from May 15, 2017



Sample Taken from May 27, 2018

Key

= Mosquito Larva: sensitive to insecticides, low dissolved oxygen, heavy metals, and high acidity/basicity

= Midge Larva: sensitive to heavy metals and high acidity/basicity

= Mayfly Nymph: sensitive to insecticides and high acidity/basicity

= Water Boatman: sensitive to insecticides, low dissolved oxygen, heavy metals, and high acidity/basicity

= Flatworm: sensitive to insecticides and heavy metals.

Dissolved oxygen: contains 0.00105 g of oxygen per 300 g of water.

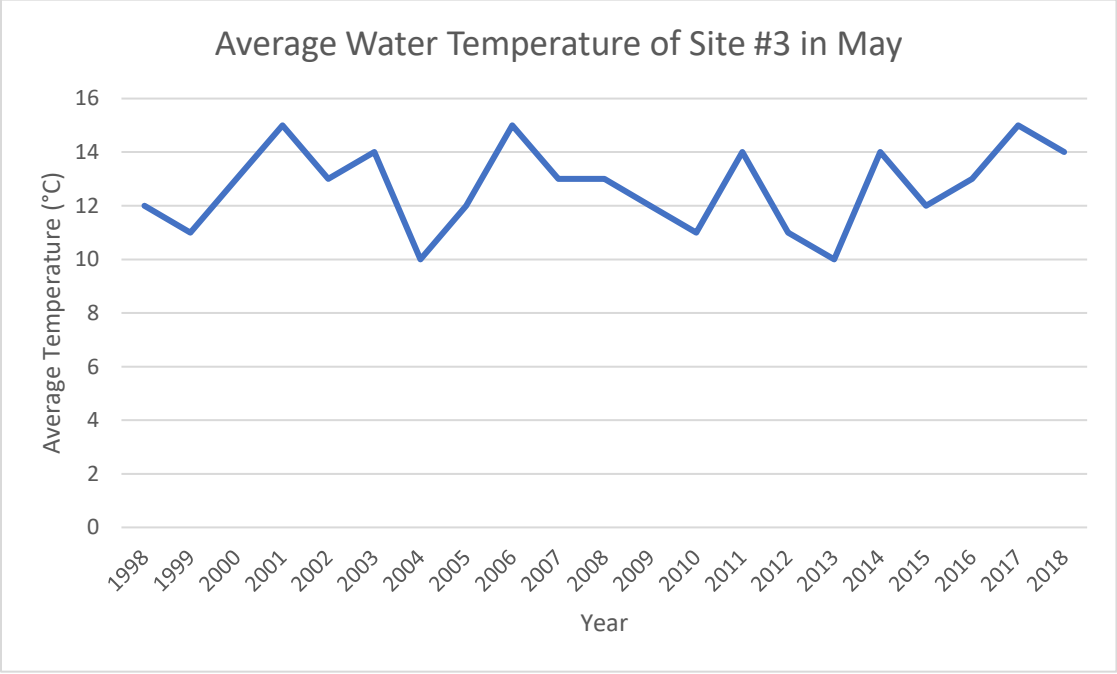
Acidity: measure the water sample using the litmus paper.

Heavy Metal Concentration: contains 0.0043 g of lead per 300 g of water.

Phosphorus Concentration: contains 0.000105 g of phosphorous per 300 g of water.

Pesticide Concentration: contains 0.000603 g of Fenthion per 300 g of water.

Temperature:



Normal Levels of Environmental Chemical Indicators

Chemical Indicator	**Healthy Limit**
Dissolved Oxygen	≥5 ppm
Acidity	5.5 ≤ pH ≤ 8.5
Phosphorous	≤0.08 ppm
Lead	≤70 ppm
Fenthion (Insecticide)	≤1.1 ppm

Red Cabbage Indicator Colour Chart

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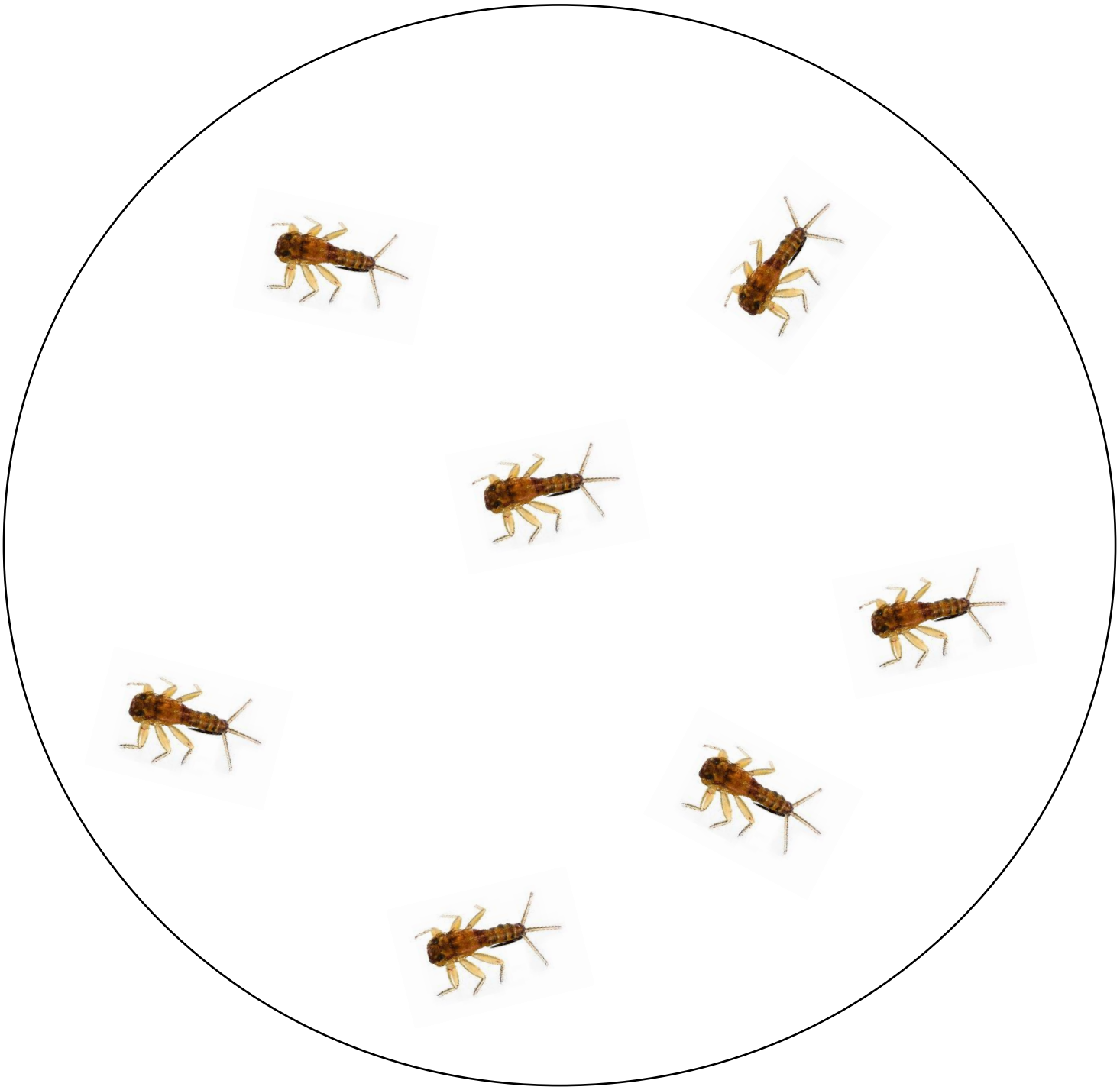
Case Scenario:

It's springtime in the Hudson's Bay Lowlands of Ontario as all of winter's snow has melted. In the last month, there has been a **catastrophic loss of over 50%** of the nearby fish populations along the shore. You have been asked to analyze one water sample from four different sites to identify the potential source of the fish loss.

Site #4:

This water sample is from the **surface water runoff** from a nearby mine that collects various precious metals. The mining company has recently started using **hydraulic mining practices** to increase efficiency.

Sample Taken from May 15, 2017



Sample Taken from May 27, 2018

Key

= Mosquito Larva: sensitive to insecticides, low dissolved oxygen, heavy metals, and high acidity/basicity

= Midge Larva: sensitive to heavy metals and high acidity/basicity

= Mayfly Nymph: sensitive to insecticides and high acidity/basicity

= Water Boatman: sensitive to insecticides, low dissolved oxygen, heavy metals, and high acidity/basicity

= Flatworm: sensitive to insecticides and heavy metals

Dissolved oxygen: contains 0.000908 g of oxygen per 300 g of water.

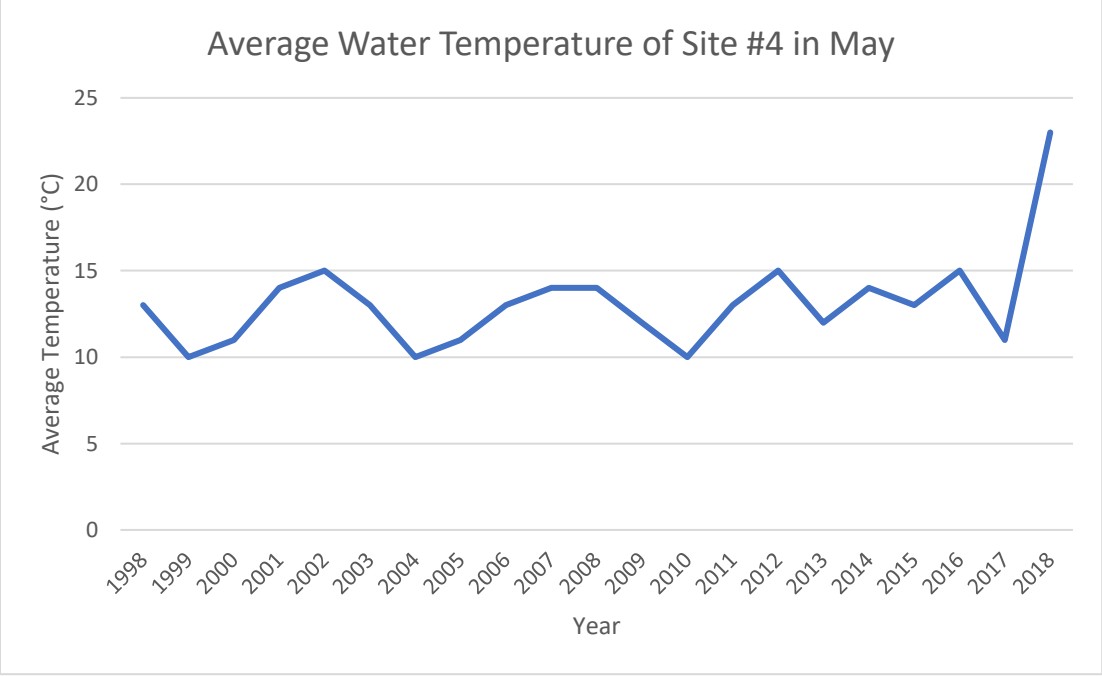
Acidity: measure the water sample using the litmus paper.

Heavy Metal Concentration: contains 0.025 g of lead per 300 g of water.

Phosphorus Concentration: contains 0.000004 g of phosphorus per 300 g of water.

Pesticide Concentration: contains 0.00021 g of Fenthion per 300 g of water.

Temperature:



Normal Levels of Environmental Chemical Indicators

Chemical Indicator	**Healthy Limit**
Dissolved Oxygen	≥5 ppm
Acidity	5.5 ≤ pH ≤ 8.5
Phosphorous	≤0.08 ppm
Lead	≤70 ppm
Fenthion (Insecticide)	≤1.1 ppm

Red Cabbage Indicator Colour Chart

pH	pH less than 7 = Acid			pH more than 7 = Base		
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Colour						
	Red	Purple	Violet	Blue	Blu-Grn	Grn-Yel

Remember:

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