**Black Tide – Oil in the Water**

**Student's document**

**Introduction**: Since the mid-nineteenth century, when we learned to distil oil and separate it into various components such as gasoline, diesel, kerosene (fuel used in airplanes) and oil tar, demand for oil worldwide has been increasing. Since it is a natural resource that is not evenly distributed across the planet, it is necessary to transport it from the countries of production to where it is consumed. One of the main ways to transport oil is by sea. For this, large ships equipped with big reservoirs, known as tankers, are used, which can reach over 400 m in length with a capacity exceeding 500 000 tons of oil.

The oil is a viscous black liquid and when a tanker has an accident, the oil may be spilled at sea and its removal is very difficult. Recently, scientists have been working to find ways to remove spilled oil from water, but have not had much success. What happens to the oil spill in the ocean?

***How does oil behave when spilled into the ocean?*** To answer to this question, you have to plan and carry out experiment(s) to investigate the behaviour of oil when poured into a mass of water.

**1. Think**, with your colleagues, of possible answers to the previous question.

**2.** Now **plan**, **in groups**, **an experiment** that helps you to find an answer to the previous question. On the laboratory bench, you will find some materials and equipment, listed below, that can be used in your planning. You must take into account the different natural factors that interfere with the ocean’s activity – currents, waves, winds – and consider them in your planning.



**Materials:** *Glass or plastic bowls, spoon, water, oil (such as vegetable oil or “simulated oil,” prepared by mixing 12 tablespoons of vegetable oil and 8 tablespoons of cocoa powder).*

If you need other materials that are not in the list above, please request these from your teacher.

When planning the experiment don’t forget to identify the different variables:

* the independent variable (what you change during the investigation),
* the dependent variable (what you will measure or observe), and
* the controlled variables (what you are you going to keep constant).

**2.1. Discuss** your group’s experimental plan with the teacher, before you carry out the experiment.

**2.2. Write down what you predict will happen** as a result of the experiment that you have planned. **Present a justification** for this prediction.

**2.3.** In your group, **carry out the experiment**.

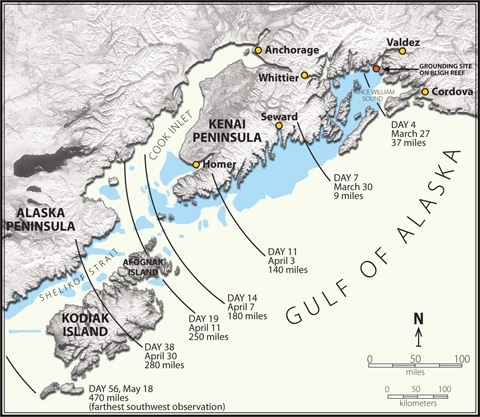
**2.4. Record** the results.

**2.5. Compare** the prediction presented in question 2.2 with the obtained results. Do you need to re-evaluate your initial prediction?

**2.6. Explain** the results registered in question 2.4. If needed, you may consult literature or websites that help you build an explanation.

**2.7.** **Answer** the initial question: ***How does oil behave when spilled into the ocean?***

**3.** In the following figure you can observe the area affected by the oil spill released from the *Exxon Valdez* tanker during an accident that occurred on March 24, 1989 near Valdez town, Alaska. The sea regions demarcated in blue (or light grey) denote the area affected over the 56 days following the accident.

*(Exxon Valdez Oil Spill Trustee Council - http://www.evostc.state.ak.us/)*

This map shows the distances in imperial units (miles). For a better understanding of the scale of this disaster it is useful to convert these values to kilometres, since you're more familiar with this length unit. Knowing that 1 mile = 1.61 km, convert and register the values in the map. Convert the value of the affected area indicated in the map legend to km2. Confirm the results with your teacher.

**3.1.** Based on the conclusions you made from your investigations, explain the expansion of the oil spill from the Exxon Valdez.

**3.2.** Find a justification for the statement from the text: “In recent years, scientists have been working to find ways to remove the spilled oil from the water, but have not had much success.”

**3.3** To get a better idea of the extent of the spill, use Google Maps to find the location of the spill and make an image similar to that shown in the figure.

**4.** As you can imagine, the *Exxon Valdez* oil spill had not only an environmental impact, but also economic and social effects. Search for information on the implications of this accident on marine life and human populations in the affected coastal areas. Write a story for a newspaper telling what happened, the adverse consequences of the accident and the effect it had on the establishment of new rules for the transport of oil at sea.

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*Image of the Exxon Valdez (Wikimedia Commons)*