Biomagnification Through A Food Chain

Introduction:
Biomagnification and bioaccumulation are often confused. Some toxins remain in the body, while others are excreted. The toxins that remain in an organisms body can be eaten by consumers and are therefore, especially vulnerable to the effects of biomagnification.

In this investigation, you will use M&Ms to model the bioaccumulation and biomagnification of the pesticide DDT through a food chain.

Pre-Lab Questions:
1. Define bioaccumulation and biomagnification (1 mark).

2. Draw a food chain involving phytoplankton, zooplankton, minnow, eel and osprey. (2 marks)

Materials
- 100 M&Ms
- 20 small cups, “zooplankton”
- 5 medium cups, “minnow”
- 2 large cups, “eel #1” and “eel #2”
- 1 bowl, “osprey”
- paper towel

Usually you are not permitted to eat in a lab. However, using clean hands and a paper towel, you will be allowed to eat the M&Ms at the END of this activity.
Procedure
1. The M&Ms represents the phytoplankton population in a lake. The printed “M” on the candy represents the amount of DDT the algae ingested from pesticide runoff from a nearby agricultural area. Each circle represents one phytoplankton. Dump your M&Ms on a paper towel. For every M that is showing, fill in the circles below with an M. These M&Ms represent phytoplankton contaminated with DDT. The rest of the circles represent phytoplankton that are not contaminated with DDT.

2. Zooplankton in the lake each eat 5 algae. Move 5 M&Ms into each zooplankton cup. Record the amount of DDT (Ms) that each zooplankton ingests in the illustrations below.

3. Minnow in the lake each eat 4 zooplankton, ingesting energy and the toxin that is stored in the zooplankton. Move the M&Ms from 4 zooplanktons into each minnow cup. Record the amount of DDT ingested by each minnow in the illustrations below.
4. Two eels compete for food. One eel eats 2 minnows, and the other eel eats 3 minnows. Move the M&Ms from the minnow cups into each eel cup. Record the amount of DDT ingested by each eel in the illustrations below.

5. Finally, an osprey flies by and eats both eels. Move the correct number of M&Ms from the eel cups into the osprey bowl. Record the amount of DDT ingested by the osprey in the illustrations below.

6. After you are finished, clean up, put the cups away and eat your M&Ms! (share with your partners!)

**Data** (7 marks)

1. Using the number you have written on the images above, calculate the average amount of DDT ingested at each tropic level.  

**Table 1: Bioaccumulation and Biomagnification of DDT**

<table>
<thead>
<tr>
<th>Trophic level</th>
<th>Average DDT ingested</th>
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<tbody>
<tr>
<td></td>
<td>Calculations</td>
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<td>Phytoplankton</td>
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<td>Zooplankton</td>
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<td>Minnow</td>
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<td>Eel #1</td>
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<td>Eel #2</td>
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<td>Osprey</td>
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Analysis and Conclusion
1. Compare the amount of DDT found in the osprey with the amount of toxin found in one phytoplankton using data from your lab. (1 mark) Which species is more susceptible to toxicity? Why? (2 marks)

2. Draw an energy pyramid showing the amount of energy acquired at each trophic level (1 mark) and label. Each phytoplankton has 200 kcal (kilocalories) of energy stored in its tissues. Only 10% of the energy at each trophic level moves to the next level. Calculate the energy acquired by each individual at each trophic level. (5 marks)