Modeling Mold Population Growth

We have seen a number of examples of differential equations modeling population growth. Among them, the one based on the assumption that the population increases at a rate proportional to the population at time, t and the logistic model are the most common. In this project you will derive a model based on data you collect from a small biology experiment.

The Experiment
Place a piece of relatively fresh bread in a plastic bag with a small amount of water and leave the bag in a warm place. Each day, record the area of the bread that is covered with mold. (You will receive a piece of clear plastic with 1 cm^2 grid lines on it.)
You may want to try several samples of different bread types as some are more inclined to grow mold than others. You should take proper precautions to make sure your assignment isn't unintentionally discarded. Your report should discuss the following:

1. Model the growth of mold using an exponential growth model. How accurately does the model fit the data? Be sure to explain carefully how you obtained the value for the growth-rate parameter.

2. Model the growth of mold using a logistic growth model. How accurately does the model fit the data? Be sure to explain carefully how you obtained the value for the growth-rate parameter and the carrying capacity.

3. Model the growth of mold using a Taylor polynomial growth model of degree three. How accurately does the model fit the data? Be sure to explain carefully how you obtained the values for the coefficients.

4. Discuss the three models for the mold population. Were there any surprises? Does it matter that we are measuring area rather than volume or weight of the mold? To what extent do you think predictions made from these models are limited?

The Report
You should include in your report the details of the type of bread used, where it was kept, and how often the mold was measured. Your analysis should include qualitative, numerical, analytical, and graphical information. Photographs of the experiment are acceptable but please do not submit the bread itself.