



# How long can zebra mussels survive out of water? A math model!

Name \_\_\_\_\_ Date \_\_\_\_\_

## EXPLORE THE MODEL: AN ONLINE QUARANTINE ESTIMATOR

In this exercise you will use an online quarantine estimator to determine how long zebra mussels can survive out of water. This quarantine estimator is based on a scientific model that predicts how long a boat would need to be out of the water to ensure zebra and quagga mussels are not spread to new bodies of water. By varying the settings, such as location (click on the desired area to move the flag) and month of the year, you can observe how the time needed to dry a boat is related to the time of year and the local weather (humidity and temperature).

Fill out the table below, and then chart your results by creating a line graph showing temperature and humidity by location for each of the three months.

Answer the questions below as you explore the model.



The model is available at the 100th Meridian website: <http://100thmeridian.org/emersion.asp>

## RECORD YOUR RESULTS

Location	Month	Temperature	Humidity	Days of Quarantine
Seattle	May			
Seattle	August			
Seattle	December			
San Diego	May			
San Diego	August			
San Diego	December			
Maine	May			
Maine	August			
Maine	December			
Florida	May			
Florida	August			
Florida	December			

## CHART YOUR RESULTS

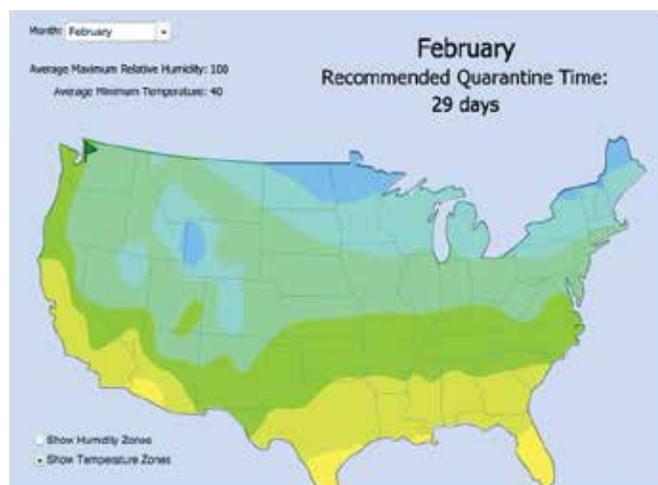
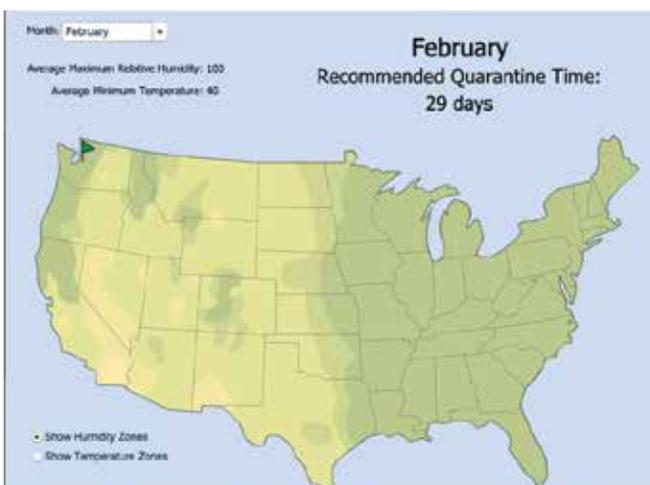
Use graph paper to create a line graph showing temperature and humidity by location for each of the three months.

# Zebra and Quagga Mussels

---

## ONLINE ESTIMATOR QUESTIONS

- 1 How would you describe the variation in results from the model for northern and southern locations such as Seattle and San Diego? How about Maine and Florida?
- 2 Why does it take longer for the mussels to die in Maine than in southern California?
- 3 Is it likely you will actually have to quarantine your boat for 181 days in Maine in the winter? Why or why not?
- 4 What is the best time of year for zebra mussels to survive out of water? Why?
- 5 Is it likely people will be using their boats in the winter?



Screenshots from the 100th Meridian website (<http://100thmeridian.org/emersion.asp>), showing recommended drying time in the Seattle area for zebra/quagga mussel-contaminated boats. Note that both humidity and temperature are taken into account when making these estimates. To change location, click on desired area to move flag.

- 6 Do zebra mussels survive better out of water in low or high relative humidity? Why?
  
- 7 Do zebra mussels survive better out of water in cold or warm temperatures?
  
- 8 Compare the quarantine time in January to the quarantine time in August for western Oregon. Is this difference primarily due to a change in temperature or a change in relative humidity?
  
- 9 Compare the quarantine time in northern Nevada, near the Oregon border, to the quarantine time in Pennsylvania during the month of July. Is this primarily due to a change in temperature or a change in relative humidity?
  
- 10 Would you say zebra mussel survival time is more affected by temperature or humidity?
  
- 11 Pretend that you and your family live in San Francisco, California, and every July the whole family piles into the truck and hauls the boat to Lake Mead near Las Vegas, Nevada, for a one-week bass-fishing trip. At the boat dock, a ranger warns you that you will need to thoroughly wash your boat before driving home to San Francisco. Friends told you that any mussels attached to your boat will die before you get home. Use the quarantine calculator and a travel website to determine which recommendation is correct.
  
- 12 Repeat the exercise, traveling from Lake Mead to Seattle, Washington. Is the driving time from Las Vegas to Seattle sufficient for the mussels to die in the month of July, or will additional time be needed?