

**HAB Handout**  
**Harmful Algal Blooms (HABs): Track them like a scientist**

Work in groups of 2 or 3 to complete the heat map you are assigned. The teacher will assign you each with one of the years in Table 1 below. Additional paper may be required to answer the questions.

1. Match the site letters below to the locations on the map (Figure A). Fill in the box for each site with the cyst abundance value for the year you were assigned.
  - Use colored pencils to fill in the scale bar below the map.
  - Locate all sites with 0-149 cysts/cm. Color the squares at these sites blue to match the scale bar.
  - Find all sites with 150-299 cysts/cm. Color the squares at these sites green to match the scale bar.
  - Repeat this process for yellow, orange and red.
  - Find the sites with the most cysts that you colored red. Draw a large red circle or oval that encompasses these sites and shade it in. Your teacher can show you an example if you need more help.
  - Draw an orange shape surrounding each of the sites within that concentration range. Fill this in.
  - Draw a yellow shape surrounding your other shapes, which also includes any yellow points nearby.
  - Repeat for green and blue.

Table 1. Cyst concentrations (per cubic centimeter) of dinoflagellate *Alexandrium catenella* in the sediment for three different years in the Gulf of Maine.

Site	2006	2009	2011
A	9	25	18
B	84	38	15
C	46	5203	546
D	140	755	557
E	119	183	106
F	590	4205	912
G	668	4080	2115
H	116	78	86
I	25	73	68
J	205	220	243
K	30	65	43
L	18	75	50
M	504	1280	1100
N	28	3315	145

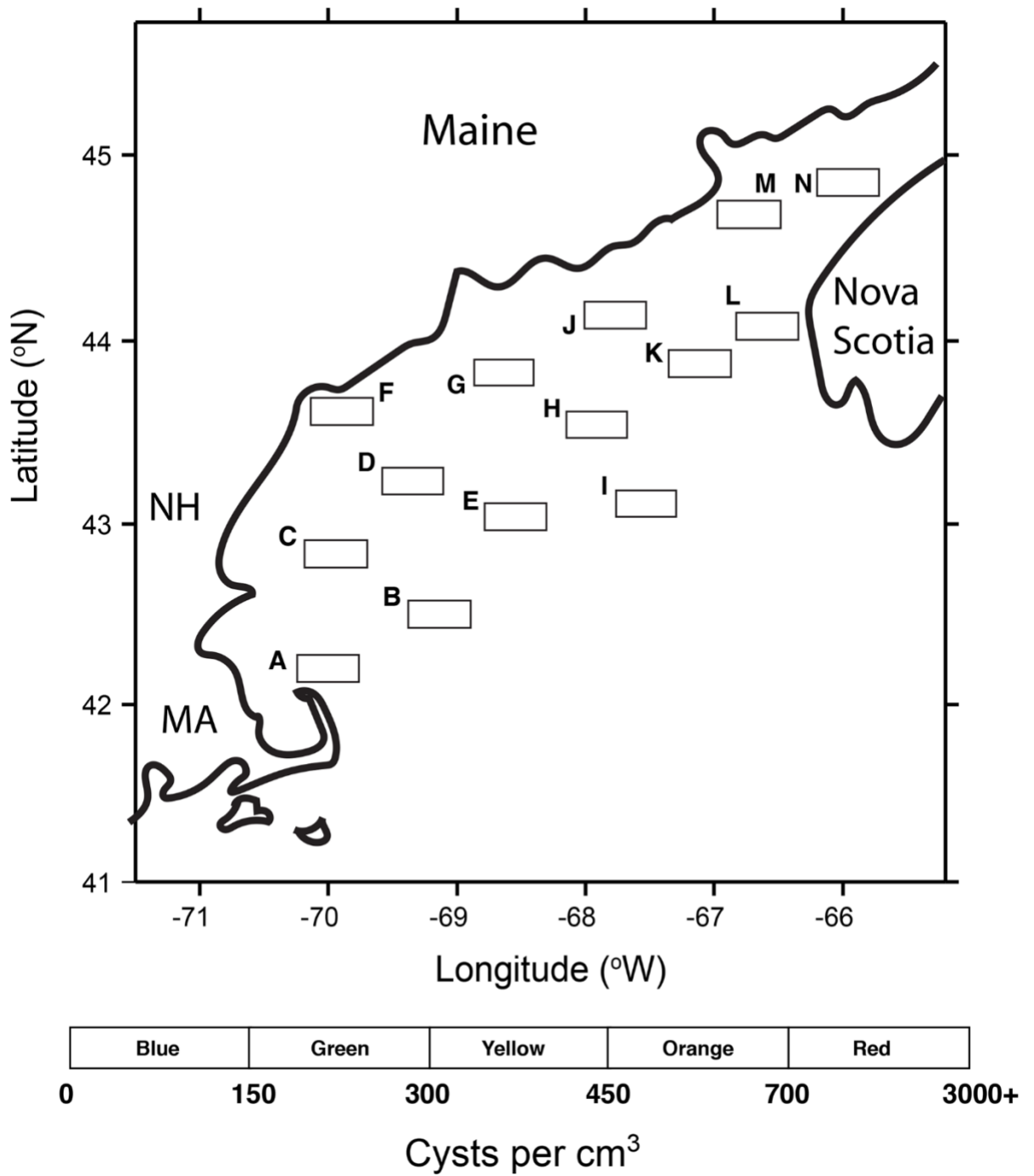


Figure A. Heat map of the cyst concentrations (per cubic centimeter) of the dinoflagellate *Alexandrium catenella* in the sediment in the Gulf of Maine. The term “heat map” is used to describe a scale of, in this case, concentrations from low values (cool colors like blue) to high values (hot colors like red).

2. Which sites have the most *Alexandrium catenella* cysts (red color)? \_\_\_\_\_  
Where are there the least (blue color)? \_\_\_\_\_
3. Now look at your partner's heat map. At what sites are there the most cysts? \_\_\_\_\_  
and where are there the least? \_\_\_\_\_  
What are some other similarities and differences?
4. Now compare your results with the actual heat map provided by your teacher. Note that your teacher's heat map included data from over 30 sites, while yours only had 14 sites. What details did your teacher's map show that yours did not have? In other words, how would having data from more locations change your map? Which of the heat maps that you created was most similar to the heat map constructed by the scientists?
5. Figure B below shows the concentration of cysts in the sediment samples collected from 2006-2011. Site B is already plotted for you. Plot the data for the three other sites provided in Table 2. Use a different symbol (and/or color) for each of these sites and then connect the points for each of the sites using a separate line for each. What differences do you see across years within a site? What differences do you see across the four sites? In other words, is there a benefit to monitoring more than one site or over multiple years? How does that help scientists understand what is happening?

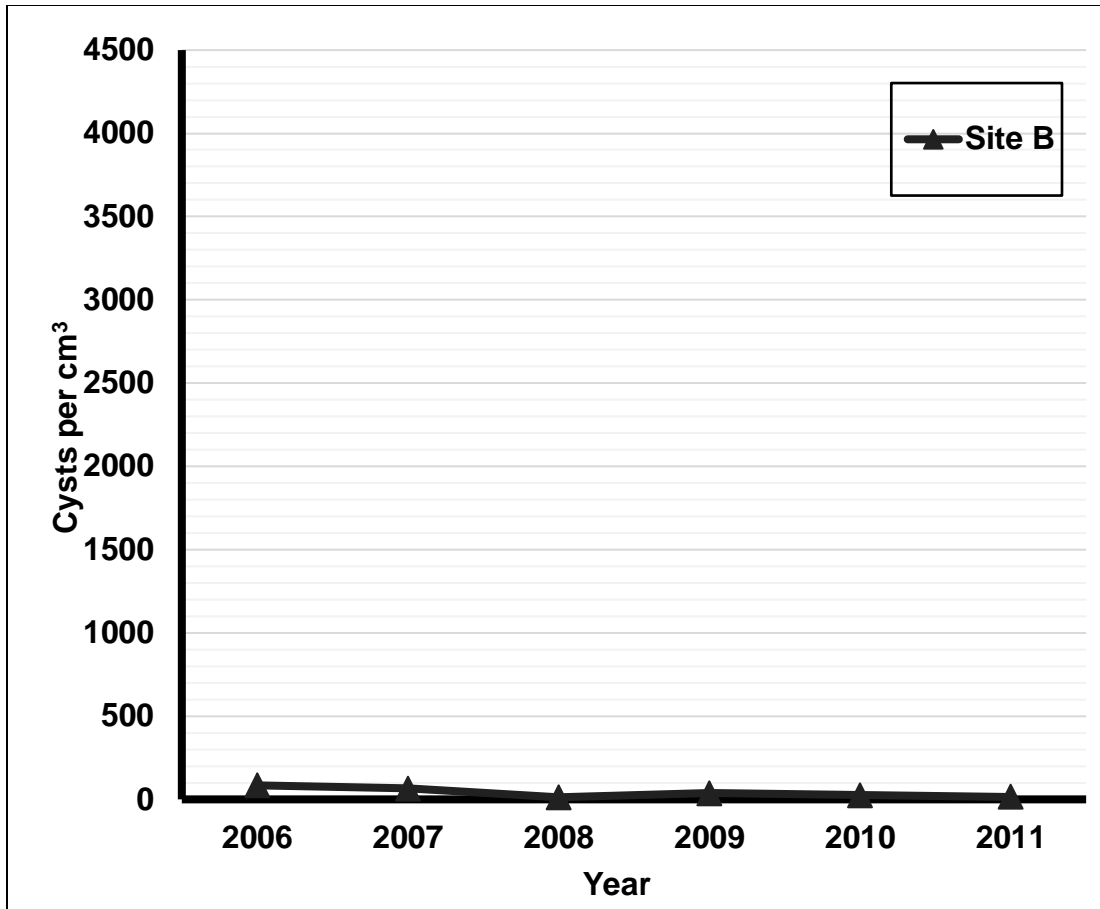


Figure B. Plot the three other sites (G, H, N) using the instructions above. Site B is already plotted for you.

Table 2. Cyst concentrations (per cubic centimeter) of the dinoflagellate *Alexandrium catenella* at a depth of 0-1 cm in the sediment at four different sites (B, G, H, and N) for three different years in the Gulf of Maine.

Site	2006	2007	2008	2009	2010	2011
B (already plotted)	84	66	13	38	25	15
G	668	792	1040	4080	1365	2115
H	116	418	160	78	968	86
N	28	370	200	3315	670	145

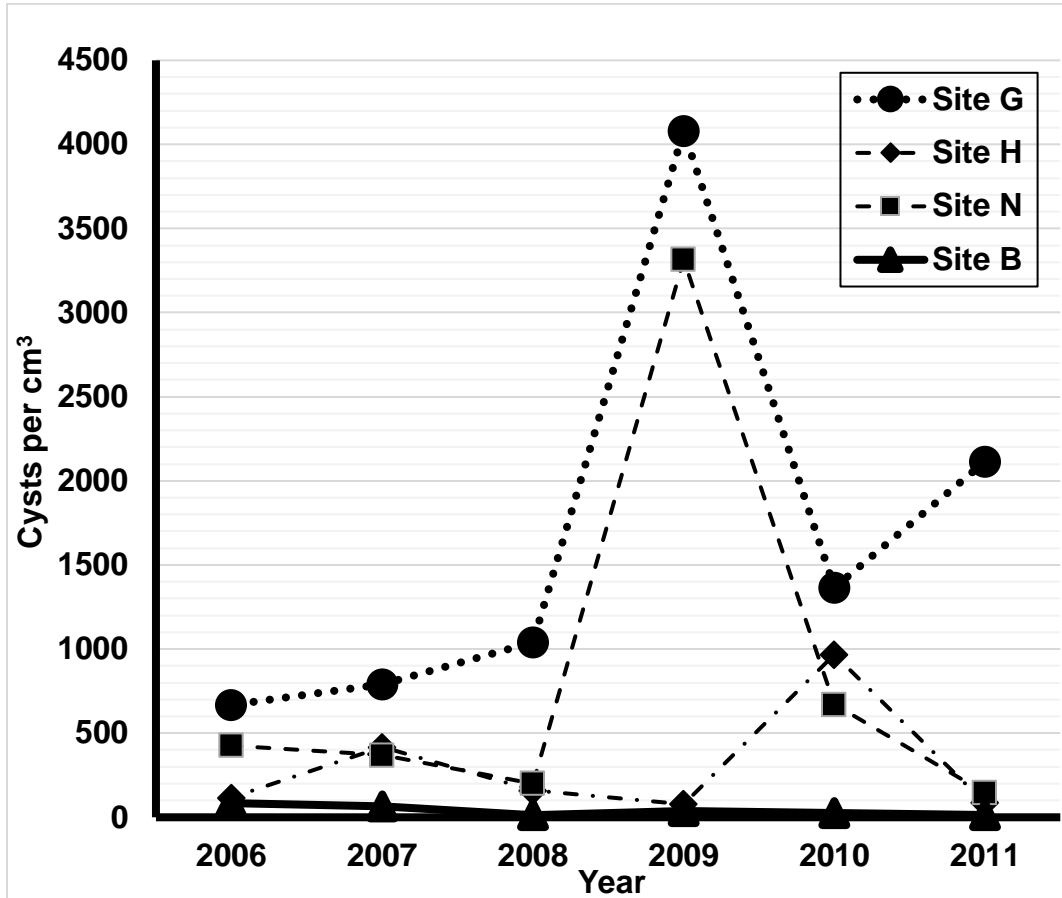
6. The numbers above were presented in cysts per cm<sup>3</sup> in order to have a standardized unit that is comparable across studies so that scientists can identify areas with particularly high values. Usually 5 cm<sup>3</sup> of sample is obtained. Given that, what is the highest number of cysts found in the entire sample? What was the lowest number? Time permitting, or as homework, calculate the average value for each year, along with the minimum and maximum value. What is the purpose of calculating the mean value and why was it helpful to monitor 4 sites?

7. These organisms are photosynthesizers and therefore play a role in creating the world's oxygen supply. Discuss how they are important in food webs and therefore their overall contribution to the cycling of matter.

**Answer Key**

Question 1. See Figure 4A-C for heat maps produced by scientists.

Question 5. See below. Original data from Anderson, Keafer et al. (2014b).



Question 6.

Site	2006	2007	2008	2009	2010	2011
B	420	330	65	190	125	75
G	3340	3960	5200	20400	6825	10575
H	580	2090	800	390	4840	430
N	140	1850	1000	16575	3350	725
Yearly average	1120.0	2057.5	1766.3	9388.8	3785.0	2951.3
Minimum	140	330	65	190	125	75
Maximum	3340	3960	5200	20400	6825	10575