TRANSCRIPT

Hello, my name is Ria Laxa, and I'm an undergraduate biology student here at the University of San Francisco (USF). This year, I am sharing my ongoing research which uses scanning electron microscopy or SEM and morphologic characteristics to identify centric diatom species in San Francisco Bay. I want to thank you for taking the time to listen in on this video where I'll mostly be explaining my research through the figures on the poster. And I actually want to start off by talking about Figure 2 at the center of the poster.

Research on planktonic diatoms in San Francisco Bay has actually been conducted at USF since September 2015. And this graph is a result of that research. It's from a previous study conducted by a now USF alum, Theresa Keith. Her study was called *Planktonic Diatom Species Succession in San Francisco Bay* in which she studied the seasonal occurrences of phytoplankton species in the San Francisco Bay from 2015-2017. Many taxa were easy to identify under light microscopy, however, a number of centric diatoms could not be taxonomically separated. As shown in the graph, she found that during winter these centric diatoms accounted for up to 80% of cells present, making these taxa an important component of the Bay ecosystem (Figure 2). So, the aim of this ongoing project is to characterize the different species of these centric diatoms using SEM.

In order to study these centric diatoms, I first collect samples using a 64 µm mesh plankton net near the Golden Gate Bridge in San Francisco. The field samples are preserved in 50% ethanol, rinsed in deionized water, and then treated with hot nitric/sulfuric acid to remove the organic material. Since the frustules (walls) of diatoms are made of silica (glass), they remain intact and cleared of cell debris. At this point, they are ready to be viewed under the SEM. Figure 1A shows how the SEM works and Figure 1B shows what it looks like. Generally, the SEM works by bombarding a sample with a beam of high-energy electrons. The electrons that are emitted from the sample are scanned to form an image at varying magnifications. The reason I use SEM is because it allows me to examine the structure and morphology of the centric diatoms in more detail and at a higher magnification compared to light microscopy.

As you can see in Figure 3, it's pretty difficult to identify many of the cells to the species level when only using light microscopy. I can get some general information such as the size or radius of the cells as well as how the cells assemble when live. But the presence of chloroplasts obscures the view of the patterns on the valves, as you can see in Figures 3 D, E, and F. When the cells are acid-cleaned, chloroplasts are no longer present to obscure the view of patterns and specific structures. Additionally, the two valves that make up the cell separate and we are able to look at the inside and outside of the cell. You can think of it like a petri dish. When you take the lid off of the petri dish, you get two dishes and depending on how the dish is oriented, you either are looking at an internal valve view or an external valve view. You'll be able to see what I mean as well as more detailed structures in Figure 4.

Figure 4 is the five species that I have verified as of today: Actinocyclus curvatulus, Actinoptychus undulatus, Coscinodiscus oculus iridis, Thalassiosira lentiginosa, and Thalassiosira nordenskjoeldii.

A-C are pictures of Thalassiosira nordenskjoeldii. A is the external valve face which shows a labiate process (arrow) and beveled edge. B is also the external valve face that shows a central process with some kind of filamentous structure attached (arrow) and one of the many strutted processes circled. C is the internal valve face which shows linear, uniform areolae or pores, and the labiate process that was also seen in A circled.

D-G are pictures of Thalassiosira lentiginosa, and in all of these pictures, the labiate process is circled. D is the external valve face which shows a slight beveled edge. E is the internal valve face which shows hexagonal areolae. F is the full cell with girdle bands, which are made when the cell is growing. G is also the full cell which shows spines at the upper edge of the bevel.

H-L are pictures of Coscinodiscus oculus iridis. H is the external valve face. I is the internal valve face which shows radial areolae and small circular pores. J is a higher magnification view of I and shows the central rosette, which is a configuration of pores that look like a flower. K shows the marginal tube-like processes (range from ~7-10 micrometers apart) which are only visible in the internal valve view. L is a higher magnification of H and shows the “flower configuration” of the pores only visible in the external valve view.

M and N are pictures of Actinoptychus undulatus. M is the external valve face which shows six alternately raised and depressed sectors, the smooth central area, and the beveled edge. N is a higher magnification of M and shows strongly the areolated outer membrane, the less areolated inner membrane, one marginal porelike process (circled), and numerous marginal spinulae which look like smaller spikes.

O-R are pictures of Actinocyclus curvatulus. O shows that the external valve face is concave, meaning that the margins are more raised than the center, and shows radial areolae of all equal-sized pores which are divided into triangular sections extending from the center. P is a higher magnification of O that shows a pseudonodulus, which is a distinct artifact pore, visible slightly away from the marginal band. Q shows the internal valve face with sand grains (arrow) and shows evenly spaced labiate processes on the wall of the valve (~10 micrometers apart). R is a higher magnification of Q and shows labiate processes (circled) and that areolae persist on valve walls.

Moving forward, I am continuing to look at samples of phytoplankton and identifying centric diatom species in San Francisco Bay to eventually calculate a relative abundance of species. Thank you again for taking the time to listen in on this video, please take a look at the poster in its entirety if you are interested, and I hope you have a wonderful day.