

	Chlorophyll-a in upwelling vs stratified temperate regions
<p><b>Invitation</b></p> <p>How will it get learners interested in learning about the topic and access their prior knowledge?</p>	<p>Students access their prior learning about primary production with a partner or small group as they look at images depicting varying ocean color and discuss questions about what the color and clarity might indicate. They share their ideas in whole group and do a think-pair-share with the questions: What is needed for primary production to take place, what makes it such an important concept, and what factors do you think might affect the amount of primary production?</p>
<p><b>Exploration</b></p> <p>How will the experiences provide observations to help learners ask/answer questions, and make sense of the topic?</p>	<p>Pairs or small groups use the widget to explore time series data from the Oregon Shelf as they toggle on and off the non-chlorophyll variables (dissolved oxygen, sea surface temperatures, and salinity) and look for patterns in chlorophyll over time (months, seasons) focusing on the summer and early fall time periods. They make predictions and discuss ideas about how the chlorophyll patterns relate to the patterns seen in temperature, salinity, &amp; dissolved oxygen.</p>
<p><b>Concept Invention</b></p> <p>How will learners be encouraged to struggle with their understanding and negotiate their ideas with others?</p>	<p>Students review the observations they made as they explored the widget and identify links between chlorophyll and other variables. They describe a potential mechanism for the patterns and discuss whether or not it makes sense based on what they already know. The instructor encourages students to make evidence-based explanations and summarizes key points. Students are then shown a static time series figure depicting the relationship between wind direction and water temperature, and partners discuss what they think might be going on. Instructor leads a class discussion, asks guiding questions and provides additional information to help them make the connection with coastal upwelling.</p>
<p><b>Application</b></p> <p>How will learners authentically use what they've learned and apply it to a new situation or context?</p>	<p>Students use the application widget to compare Oregon's temperate, coastal area to the Massachusetts coast. They are challenged to predict seasonal changes in temperature off the coast of Massachusetts given the chlorophyll levels and to explain their reasoning. Using a second application widget, students explore the full temperature time series as they toggle on and off the non-chl variables in the two locations, and zoom in and out of the data. Guiding questions encourage students to consider additional variables, and the larger implications of primary production.</p>
<p><b>Reflection</b></p> <p>How will learners think back on the process of learning to help reinforce their understandings &amp; make them better learners in the future?</p>	<p>Students respond to prompts about the skills and concepts they needed to learn, what new connections they made, and what was the most difficult part and what helped them to figure it out. They are also tasked to describe in what ways this content is meaningful and relevant to them. They write about what they learned and then compare their responses to how scientists write about the same concepts and interactions (the enduring understandings).</p>