| **Lesson Planner Template (Launch, Explore, Summarize)**  Topic: Abiotic Water Quality Lesson: What’s in your water? Lesson Length: 70 minutes |
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| **Part One: Goals and Objectives** |
| *What are the big ideas of the investigation?* |
| How does the water source affect the abiotic profile of water?  How does temperature affect the abiotic profile of water?  What is the difference between Closed and Open Systems?  How will/does the species grown likely affect the abiotic profile of the water? What do they take in, and what do they release?  What is the zone of tolerance for different/each species? |
| *What will students know or be able to do when this investigation is completed?* |
| Students will be able to explain how temperature affects the dissolved oxygen levels in water  Students will be able to describe the difference between an open and closed system, and how that impacts the choices a grower makes on their farm/facility  Students will be able to describe the typical profile characteristics, and what zone of tolerance each major species group (algae, shellfish, finfish) needs/requires |
| **Part Two: Teaching Model** |
| **Launch (5-10 minutes)** |
| *How will I launch this problem?* |
| Tell students that they are going to help you solve a mystery. You have collected four samples of water and labeled three of them (A, B, C), but you can’t remember what the fourth one is. The students are going to help you figure it out, by testing the three known samples. |
| *What prior knowledge do my students need?* |
| Need to know what dissolved oxygen describes, and how aquatic animals get oxygen from the aquatic realm.  Need to know what pH measures  Need to know what turbidity measures  Need to know what salinity measures  Great if they know the Ideal Gas Laws |
| **Explore (15 - 45 minutes)** |
| *How will I organize the students to explore this problem?*  *(Individuals/Groups/Pairs)* |
| *What materials will students need to encourage diverse thinking and problem solving?* |
| LeMotte Water Test Kits  Samples from 3 different water sources, all kept at same temperature, or two of each kept at different temps (warm and cold)  pH paper to double check results  Digital thermometers as back up |
| *What are different strategies I anticipate them using?* |
| Really, the students need to follow the directions for the kits - SOP  Results between the samples will likely be very different, and students may be tempted to adjust their results to match their expectations, so the instructor needs to emphasize that results are just results, and that students need to be objective in observing/recording  Remind them that someone needs to find the profile for the unknown |
| *What kinds of questions can I ask?* |
| Are the results the same for all the samples? Does that make sense?  What surprises you?  Do you see any relationships between the values in the profiles? |
| **Summarize (15-25 minutes)** |
| *How can I orchestrate the discussion so the students summarize the thinking in the problem?* |
| Tell them the locations of the different samples, but without telling them where their samples came from – then ask students to propose where they think their sample came from.  Where do they think the unknown came from? Why?  Ask them to consider if they would expect the profiles to remain constant, 24/7/365  Given information about zone of tolerance for each species category, where do they think each species could survive best? |
| *What scientific knowledge and processes need to be drawn out and emphasized?* |
| Qualitative understanding of Ideal Gas Law (PV = nRT) to describe how Dissolved Oxygen changes with Temperature.  Learn how to use a spectrometer/refractometer for measuring salinity  Zones of tolerance for each species category and difference between survivel and thrive/reproduce.  The need for consistent and objective data collection - following Standard Operating Procedures |
| **Next Steps - additional problems, homework, independent projects** |
| *Which investigations are appropriate for my students to do after the investigation?* |
| *Makes sense to associate this lesson with biotic water quality, especially considering plankton and algae blooms*  *How would thermal water pollution affect abiotic water quality?*  *Why is eutrophication such a challenge for species living in a body of water?*  *How does human activity affect the abiotic water quality/profile of water?* |