WATERSHED ON WHEELS 2013 SEASON
EDUCATING GUIDELINES AND LESSON SUMMARIES

Note:

The purpose of this document is to provide an informal review of the lessons taught over the course of the Spring, Summer, and Fall 2013 season of the Watershed on Wheels, aka WOW, as part of the mobile environmental education program through the Silvio O Conte National Fish and Wildlife Refuge. This review will be useful in allowing the reader to understand, from the educator perspective, a practical approach to implementing the lessons that were used for this 2013 season as well as provide a useful tool to help to guide future environmental education initiatives.

-Gordon Clark

River Table Lesson:

Objectives:

- Teach students about the basic principles of river geomorphology.
- Introduce River Vocabulary
- Review/ Introduce how water cycles through the environment
- Understand and explore how the Connecticut River has formed since the last Ice Age
- Explore the concept of a watershed
- Explore the properties of erosion.

Brief Lesson Overview:

Prep the table by smoothing out all of the sand across the table while leaving a pool of water at the bottom of the table by the drain. Also, it is important to have some "groundwater" accumulated before doing any of the following demonstrations. This can be accomplished by turning the water on for a moderate about of time (10-15 min), or until the water starts to flow laterally across the surface, aka a river forms.

I would begin the lesson with having the students gather "anywhere you would like" along the outside of the river table, my only request being that "we are all going to have our hands at our sides for now." The importance of the latter was to deter students from getting their hands too messy, too soon. *The river table is a curiosity to students and adults alike because it is rather a novelty. It is hard to resist the urge to touch the plastic sand. I like to set the intention in the beginning.* Additionally, it is also important to mention that it is difficult to teach around the table with greater than 8 students. The smaller the group, the better.

First, it was necessary to explain what the river table was composed of. In the simplest breakdown, I would refer to the two materials present in the table: water and recycled plastic. Next, I would explain how the table worked to "demystify" what the students were looking at. "The water will flow from here [pointing to the top] to here [pointing to the pool of water by the drain] , which we will pretend is the ocean. Which ocean does the Connecticut River flow into?" *I always test the student's knowledge, even on the seemingly most basic concepts, to keep their attention and to include them as much as possible.* "The water is then going to drain down into this BIG bucket, where it is then picked up by this little pump down here (offer for them to get down in there and check it out), where it is then carried up this LONG hose… etc. *I found they were almost always curious to figure out to the smallest detail how this table worked and I was more than happy to explain in as much detail as they wanted. I found it led to a good transition to the next topic.*

After explaining how the table works, I would mention to them that this is like an artificial water cycle that I can control with a knob. My next question is to have them teach me what they know about their water cycle in nature. *I would work through with them to piece it together if they don't know or need a refresher.* The terms <u>evaporation</u>, <u>condensation</u>, and <u>precipitation</u>, are identified and briefly explored.

After my water cycle review, I asked the students how they thought the Connecticut River was formed. *Often, this is where I have the best opportunity to gain some perspective on the student's knowledge and to adapt the rest of my lesson to suit their level of understanding. The*

students rarely can identify that the river was formed from glaciers interacting with the landscape. I ask them [to get them excited for the next brief history lesson] "don't you think that it is important to know how this massive river, the BIGGEST RIVER in New England, was formed, especially since you guys live IN the WATERSHED?" Typically, this will at the very least stoke their curiosity. I begin to explain that the river formed from glaciers that existed here over 10 million years ago from the most recent Ice Age. *I often refer to the movie,* The Ice Age," *which everyone can relate to.*

I will pretend that I am a glacier and will squish down on the sand to form a valley, the weight of my hands pressing down being similar to the weight of the massive glaciers pressing down on the land. *I suppose I could have also allowed the students to participate in this activity*. *Usually, I would do it myself because of time constraints. "*After the glaciers left, they filled this giant valley with a bunch of water. This water formed a massive lake that geologists call, Lake Hitchcock. We would have all been either underwater 10,000 years ago when these glaciers melted, or we would have had some great lakefront property." *Often I will let the students have a moment to imagine this scenario.*

After forming the valley with my hands acting as very heavy glaciers, I will turn on the water and allow this giant valley that I made in the middle of the pool to become "our Lake Hitchcock." *This is our first experiment, I explain*. [~10-13 minutes into lesson] I tell the students that their task (while the water is beginning to fill the valley) is to raise their hands and explain to me what they are seeing and how they think that a river is going to form from this lake. I prompt them to try and understand how the landscape might be soon severely altered by the force of water. I allow them to explore this with their classmates with myself facilitating the discussion. Soon the water breaks free at the bottom end of the lake and I explain that now our lake has turned into a river, and that is how the Connecticut River has formed. *Obviously, a rather simplified version – nonetheless, it is particularly dramatic.*

Next, we explore the topic of erosion. If the term is new to the students, I explain the term as a type of weather whereby the force of water picks up sand and sediment and carries it downstream. I further point to examples of erosion that are occurring in front of them. Then, I ask them to point out examples for me. During this discussion, I will implore them to use some river vocabulary words so we can talk about this river. Using erosion as a means to identify the parts of a river, I introduce the terms (if they don't already know) river bed, river bank, sometimes cut bank, the river's mouth or delta, and the rivers headwaters. "Where is the erosion happening? Why is it happening? What force provides the energy to make water have this erosional capacity? (Gravity) Where is all the sediment travelling?" *Eventually, I try to bring them back to the real Connecticut by suggesting, "do you think these things are happening in the real Connecticut River right now?"*

If time allows, I will do any combination of the following interactive activities:

(a) Use the fake plants to put anywhere they want in the river. Use an inquiry based learning approach to make them discuss how they think the plants are affecting the river, specifically erosion
(b) Use small rocks to place anywhere in the river the students want. Use a similar inquiry based learning approach and help facilitate a discussion on how the rocks might affect the flow of the river and their affect on erosion.
(c) Each student uses one finger to dig a small "well" on the dry parts of the river's edge, i.e. away from the flowing water. The students dig down until they hit the

ground or find some water. Each student should find water. Then, facilitate a discussion on where that water came from, where is it flowing, how is it flowing, and the importance of how that groundwater is flowing underground (sub-surface flow), especially if there might be some pollution added to the well.

(d) Ask the students where they think the most dangerous place to build a house is, outside of literally in the river. We place the fake house by some cut bank or bank otherwise and discuss why they chose this spot. What do they think the outcome will be?

I will wrap up the lesson by going over the topics covered and asking them if they have any final questions about the Connecticut River. *If there is time, the students often will enjoy "helping out" by flattening the river table sediment for the next group.*

Artifacts, aka "Conte Case," Lesson:

Objectives:

- Teach students the definition of an adaptation
- Introduce students to animals, specifically mammals, who live in the Connecticut River watershed.

Brief Lesson Overview:

I will begin this lesson with having the students form a half circle, or some other appropriate orientation, as to allow everyone to see and hear me. *This lesson is also best when done with 8 students or less!* I begin with opening up with what were will be doing for the next 20 minutes and encourage them to ask as many questions as they are able to. *I found by fostering a learning environment in which they can feel unencumbered by their innate desire for inquiry sets the best intention for the duration of the lesson.*

To begin the lesson, I mention that "it is important, since we are talking about animal adaptations here, that we can all come up with and agree on a working definition for what an adaption actually is. What is an adaptation?" *This typically leads to a diverse array of answers, to which I implore them that they are all valid and good answers, as long as they can offer an example of what they are referring to. Making the students provide examples while exploring the definition of an adaptation before explicitly defining it to them I found makes the students think a little deeper about what they are trying to define.* After testing their knowledge, I say, "perhaps we can simplify your answers to include everything and we can define an adaptation simply as, something and animal has or does to survive in its natural environment. And I have some really awesome adaptations with me here today that I would like to show you. They should help make it clear what an adaptation is and everybody should know some good examples by the end of this station."

Know your facts! I found it is best to show the students as many examples of adaptations that I can get through. *Often, I can only speak to 3 animals because the students are so curious and ask so many questions, which is good! I let the students guide my discussion on what adaptations these animals have.* I talk about moose by using the moose antlers and skull, bobcats through use of the fur pelt, beavers through use of the skull, coyotes through use of the skull, deer through use of the skull, and bears through use of the fur pelt. Through these animals, I am able to discuss and explain the difference between herbivores, carnivores, and

omnivores and what sort of adaptations these animals might have to eat (teeth, eye orientation, claws, physical abilities). *Eyes on the front, they hunt. Eyes on the side, they hide!* (A. Walker) *Students liked this rhyme and they remembered it well.* I discussed why an animal might have camouflage, both as a predator and as prey.

Above all with this lesson, I found it useful to make comparisons between the different animal adaptations. Teeth and eyes stand out between predators and prey when put side by side. The students are able to pick up on this and it often leads to very good discussions about why animals have these different adaptations. Tactile learners will love to feel and hold. Inquisitive students may point out things that appear as peculiar on the skulls. Adaptation is an important skill for the instructor for this station.

At the end of the lesson, I like to wrap up the discussion by going over some examples of adaptations that they learned. Also, throughout the lesson I make it a point to throw in interesting or thought provoking facts about these specific animals in hopes of fostering a greater awareness and appreciation for these animals of our watershed.

WOW Trailer Lesson:

Objectives:

- Introduce or reinforce the concept of a habitat/ecosystem
- Explain an "interconnectedness" within nature
- Provide a sound argument for anthropogenic relationships in nature
- Explore the concept of an endangered species with specific examples
- Explore the food chain within different habitats
- Learn about ecosystem indicators and what they mean
- Teach the components of a habitat (abiotic and biotic)

The level of interaction, discourse, and exploration within this lesson is entirely dependent on the students learning abilities, foundational knowledge base, group size, and grade level. Also, the success, for both the teacher and the student, for this lesson is largely influenced by the size of the group. If there are too many students, they simply will not be able to see what everyone else is seeing. Keep the max size at 8, but much better with less.

I begin this lesson with a quick run through of what we are going to be focusing on for this "journey" through the watershed and also what my rules are for this station/lesson. "For this station, we will be taking a journey through 5 different habitats that can be found in the Connecticut River watershed, and possibly even in your own backyards! First, just so we can all be on the same page, let's quickly go over what a habitat is. Does anybody have any ideas about what this means?" *Almost always, the students will have a basic understanding that a habitat is simply 'an animal's home.' I go with their definition.* After defining habitat, "we are going to go on this tour through the trailer and identify what all of these habitats are. We are also going to find the plants, animals, and non-living things that make up these habitats. At the end of this lesson, you (the students) should be able to tell me all five habitats we saw and be able to describe what sorts of things are found in these habitats."

Next I go over the rules. “Before we begin, there are only just a couple rules that we need to follow. My first rule is that you need to ask as many questions as you want to as we walk through. But, if you have anything to say, you must raise your hand. The classroom rules apply here. My second rule is that you need to stay behind me because there is a lot to see and explore in here and I am the tour guide / line leader for this journey. I will help guide us to what we should be looking at. These are my only rules. Are you guys ready to begin the tour?” *I try to keep it simple and abbreviated. Too many rules and they can't remember them all. The biggest one to try and emphasize is that it is imperative that the students are all not talking out loud during the lesson. There is a real temptation to do so during this lesson and it is only because the students are so excited to be in this unique environment. Also, I think that it is sometimes just as important to also include that we need to share our stories when we finish the lesson. I mention that I will try and allow some time after the lesson for this purpose. Often, the students will make strong connections to the things they see in the trailer and they feel excited to share it. While I think these connections have value, from experience, these stories can sometimes last very long and can take away a lot of time from the lesson. This becomes important when the lesson is only 20 minutes long…*

I begin by having them all file into the trailer and only point out that we are going to be focusing our attention on these cattails, because they represent our first habitat. I might begin, “Because our eyes are not yet adjusted to see in the dark, we are going to all close our eyes, take a deep breath of air, and just listen for 10 seconds. Then I want everybody to share something that they heard.” *This sets the tone for this lesson as being one of mindful and calm. Reality is, sometimes this is effective and other times, it is not.* With this first habitat, I think that it is important to allow the students to share what they find amongst the cattails by raising their hands. I usually let them all have a chance, but I eventually want to go back to the cattails. I think this plant is the most useful in showing how a plant can really be important for many reasons. The cattails provide nesting sites, hide animals from the hawk scouting prey from above, provide a food source for some animals, hold soil in to prevent erosion, and hold water in to prevent flooding. *The latter two are usually hard to identify for the students so I may or may not choose to point these out.*

While going through each habitat, I let the students pick out what animals they see and use that as a springboard for what I am going to focus on in that habitat. I try to mention at least one fun or interesting fact for each animal they pick out, but then might go back to focus on just one particular animal per habitat. *Unfortunately, there is not enough time to speak to great detail on all the animals! The teacher must focus on only a handful, I feel is logically dictated by the interest of the students.*

In the vernal pool, I go through a similar methodology to the marsh habitat. I allow the students to try and point out things that stand out to them in this habitat before moving on to the topics I want to discuss. I first make a point to give the students time to render guesses on what they believe this habitat is called. *I usually get a bunch of responses, but need to tell them that this is a 'vernal pool' in the end. I will give as many hints as I can to them, i.e., this is a seasonal pool, water only exists in this pool in the springtime, in the summer and fall this pool dries up, etc. Emphasizing the fact that this is a NEW HABITAT (!!) is important to make them more interested. Also, making them say the habitat out loud together seems to make it stick and also helps to get their group attention again.* I will often speak about the wood turtles ability to bring up worms to the surface by tricking them into thinking its raining out. *Having the kids all pitter-patter their feet as fast as they can together to make it sound like it is raining to the worms is fun.* I will point out that the spotted

salamander is an ecosystem indicator and will explain what this is. “A simple way to tell whether or not this habitat is healthy or not is to find spotted salamanders. The mere presence of these animals means that this habitat is healthy. This is because they are very sensitive to fluctuations and changes in their environment and are what scientists call ‘ecosystem indicators’.”

In the forest, I have the students raise their hands to tell me some of the animals that they see. Sometimes I will prompt them with a more in depth question such as, “can anyone here find any examples of the food chain in this ecosystem?” Otherwise, I take on a similar methodology to that of the marsh habitat and the vernal pool. The students will dictate what they want to talk about and what they find. If they are reluctant, or are shy, there are plenty of things to discuss to try and pique their attention. I like to make them go on scavenger hunts to find animals, like the grey tree frog. I also like to ask them if they want to talk about venomous snakes, which they usually do. I also like to talk about the great horned owl and mention some interesting owl facts.

For the cave, I ask students to try to identify this habitat. Then ask the students what animals are living in this habitat. I then ask the students whether or not they like brown bats. Usually, many students do not like the bats. I take the opportunity to talk about the food chain and also concepts surrounding ecosystem services. I ask them what do they think the bats like to eat. Their answers are often varied, but I tell them that this type of bat is an insectivore. “One brown bat can eat up to 1000 mosquitoes every hour! Do you guys like brown bats now? Why?” The brown bats can also be discussed in terms of endangered and threatened species. What does this mean? I will only bring this up if the students are particularly interested in bats. White-nose syndrome is something that can be touched upon. Exploring what the implications of this means to humans is a must.

In the last habitat, I again ask the students to try and identify where they think they are. More often than not, this is a habitat that they are most familiar with. I ask them to explore and find some animals. We then talk about why there are so many animals living in *our* habitat. I believe the most important think to iterate in this final habitat is that we, as humans, are coexisting with many other species of animals, and also to discuss the implications of this. “Humans are animals too, right?” I try and use this habitat to bring the discussion of the animals and habitats in the Connecticut river watershed back down to their level.

In conclusion, I usually ask the students, after exiting the trailer, to identify all five habitats in the trailer. I also might ask them if they saw any favorite examples of food chains in the trailer.

It is easy to get overwhelmed while giving a lesson through the wow trailer. There are many things that could be discussed and many directions the conversations could go in. Sometimes a single theme can be stressed throughout the duration of the lesson, and that makes it easier for the students and teacher to focus.

Something that would be helpful for the success of this lesson might be to include more hands-on interjections/examples throughout the lesson. I feel this would serve to support a more consistent attention of the students throughout the lesson, as they can easily get distracted with the trailer environment.