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Program Summary

Using Colonial National Historical Park and the Captain John Smith Chesapeake National Historic Trail (CAJO) as the setting, the James River Association (JRA) engaged approximately 748 fourth-grade students and 37 teachers across all nine Williamsburg-James City County Elementary Schools (WJCC) with a Meaningful Watershed Educational Experience (MWEE). Over the course of the MWEE, students and teachers investigated the ways in which our actions help or hurt local waterways and ultimately the Chesapeake Bay watershed.

Through explorations of local culture and ecosystems, students gained valuable insights into the interconnectedness of land, water, wildlife, and people of the Chesapeake Bay. Students connected with their local river, fostering a sense of stewardship, belonging, and understanding of the natural environment in order to prepare and inspire them as the next generation of environmental advocates. Additionally, students discovered more about the Indigenous people and colonial heritage of the Lower James region. Powhatan Creek, a tributary surrounding Colonial National Historical Park and the Lower James River Education Center, provided opportunities to learn about the wetlands that were once explored by Indigenous people.

Key program activity included:

Professional Development

With program partner the National Park Service (NPS), JRA met with WJCC teachers to get a sense of how JRA could better curate programming to address the educational needs of their students. This led NPS to make substantial changes to the program curriculum focused on the Captain John Smith Chesapeake National Historic Trail (CAJO) and the James River watershed. JRA environmental educators, NPS interpreters, and WJCC Schools Science Coordinator, presented professional development held at JRA's Lower James River Education Center. The first day focused on improving in-class lessons and field experiences from the previous year. Teachers, JRA educators, and NPS interpreters worked

together to connect Virginia SOLs to the program's environmental science curriculum, and to refine lessons to be more focused on the Tidewater region. The second day focused on stewardship and action projects, where teachers brainstormed potential project ideas for their classrooms that best suited the learning goals and abilities of their students. JRA educators recommended the Pain Out Pollution project, which received strong support, as a way to show students human impacts on the environment and how pollution on their school grounds can pollute our waterways.

MWEE Element 1 - Class Lessons/Issue Definition

During this first phase of the MWEE, students and teachers worked together with JRA educators and NPS interpreters in classrooms to define environmental issues that impact the James River and the Chesapeake Bay watershed. Through interactive classroom lessons correlated to Virginia SOLs, students explored how personal actions help or hurt local waterways and ultimately the Chesapeake Bay watershed. Educators introduced students to environmental issues such as overfishing, habitat loss, and pollution, concepts they would apply in the Paint Out Pollution action projects.

JRA environmental educators and NPS interpreters spent one day at each of the nine schools, partnering with teachers to conduct a 60 to 75-minute in-class lesson. Students investigated two unique but connected stories of the Chesapeake Trail - one focused on the ways of life of Virginia's Indigenous people and the other focused on the James River's food chains and food webs. These in-class lessons reinforced concepts that students learned in 3rd grade, which prepared them for deeper explorations of the material in 4th grade. The lesson supported SOL 3.5, which emphasizes that organisms are part of a system and depend on each other, as well as on the nonliving components of their environment. In 4th grade, students build on this foundation by examining interactions between organisms and the nonliving environment, with a particular focus on ocean ecosystems. They also studied food webs to understand how energy moves through an ecosystem, a key component of SOL 4.3.

During the lesson on Indigenous people, a NPS interpreter discussed natural resources utilized both in the past and present. Examples of uses of these natural resources were passed around for all the students to get a closer look, including animal pelts, bottles, nets, wood spears, clothing and jewelry, and clay bowls and pots.This part of the lesson aligned with SOL VS.2, focusing on students' ability to describe the lives and cultures of Virginia's Indigenous people leading to the present day. NPS interpreters also presented the Captain John Smith map of the Chesapeake Bay, identifying historical locations around the Jamestown area. This lines up with SOL VS.3, which emphasizes the causes and effects of interactions between the English colonists and the Indigenous people. The discussion about Captain John Smith tied neatly into the student's curriculum because they had either just finished reading or were actively reading *Blood on the River,* by Elisa Carbone in class. Each class also received their own Chesapeake Bay watershed map and labels for them to utilize in their classrooms.

MWEE Element 2 - Field Experiences

Students participated in a field experience at Colonial National Historical Park and visited JRA's Lower James River Center, a 20-acre site with outdoor classrooms, access to tidal wetlands, and a nature trail along historic Powhatan Creek. By the program's conclusion, JRA engaged 748 students and 37 teachers through 19 days of field experiences. During the day students rotated through three learning stations:

Station I - Natural Resources - NPS interpreters described local natural resources to students and how they were used by Indigenous people. Students then participated in a scavenger hunt where they explored the area to find cards that depicted watershed resources. Once the students found all of their cards, they came back to match them up with cards that detailed how Indigenous people utilized the resources.

Station II - Wetlands Habitats - Students explored wetland habitats, past to present, and the importance of protecting wetlands of the National Parks. Students built their own "wetland" in a bottle and used a James River/Chesapeake Bay watershed map to identify Virginia rivers and the Captain John Smith Chesapeake National Historic Trail in relation to where they live.

Station III - Endangered and Thriving Species - With a focus on Atlantic Sturgeon and Bald Eagles in the James River watershed, students learned about the adaptations of each species and the cultural stories of Virginia tribes. Students also played an Atlantic Sturgeon game to investigate environmental hazards to the James River and the diverse species that call it home.

MWEE Element 3 - Synthesis and Conclusions

The synthesis and conclusions element was incorporated into the in-class and field experience portions of the MWEE. During the in-class portion, students were divided into groups to synthesize and build their own food chains and food webs. Students combined their food chains to create a food web to identify their species' significance in the ecosystem complexity, biodiversity, and ecosystem stability. Through this activity, students were able to demonstrate a multitude of ecological concepts:

1. Significance in the Ecosystem - Students demonstrated the flow of energy and nutrients through their ecosystem, demonstrating how their species plays a vital role in the food web. This activity details the delicate balance required for a healthy ecosystem. During field experiences, students participated in a station connecting the Atlantic Sturgeon to the ecosystem of the James River. They recognized the Atlantic Sturgeon's impact on the ecosystem of the James as well as being able to connect the sturgeon to the history and importance of Jamestowne.

2. Complexity - Students learned about the intricate nature of food webs compared to linear food chains. Food webs depict many connections and interactions between organisms within an ecosystem, including predator-prey relationships, competition, and symbiotic associations.

3. Biodiversity - Students came to appreciate the role of their species in food chains and food webs in supporting biodiversity. A diverse array of species within an ecosystem contributes to its resilience and adaptability to environmental changes. Students demonstrated how disruptions to one part of the food web can have cascading effects throughout the ecosystem, potentially leading to biodiversity loss. During the Wetlands in a Bottle lesson, students connected a function of a wetland ecosystem to biodiversity, learning that wetlands provide habitat and ecosystem but can also be some of the most biodiverse ecosystems in the world.

4. Ecosystem Stability - Students concluded by discussing the importance of maintaining balanced food webs for ecosystem stability. When species within a food web are in equilibrium, the ecosystem is more resilient to disturbances such as disease outbreaks or invasive species. Students showcased how conservation efforts to preserve and restore healthy food webs can ensure the long-term stability of ecosystems.

By synthesizing these ideas, students could show how removing certain components of the food web (keystone species, producers, apex predators, etc) from that ecosystem, whether that was from natural or man-made causes, could have drastic effects on the whole system as a conclusion to the in-class lesson. These concepts about ecosystem balance, stability, and biodiversity continued into the field experiences for the students. They were able to connect the role they play in helping the ecosystem of the James, recognizing that there are many human impacts that can hurt those ecosystems. At the end of the field experience, students helped brainstorm ways they can make a positive impact, which continued into the stewardship action projects.

MWEE Element 4 - Stewardship Action Projects

Fourth graders used mapping skills to identify and paint a storm drain located on their school property, learning about human impacts on our waterways, and highlighting the connection between urban drainage infrastructure and the Chesapeake Bay. This activity helps to increase public awareness of stormwater pollution and its impact on local communities and habitats. Students learned that trash from their school grounds enters the storm drains leading directly to the James River into the Chesapeake Bay and, ultimately, the Atlantic Ocean. While students were waiting for their turn to paint they helped improve the school grounds with a trash clean-up.

At the program's conclusion, JRA educators provided surveys to participating teachers to gather feedback on the program's impact and engagement of students. Responses were largely positive, with one noting strong student responses to the field experience: "[Students] seemed to really enjoy all of the activities! The sturgeon game was super fun, the wetlands activity surprised them and the resources scavenger hunt was awesome!" JRA educators will take this feedback into consideration to refine and improve upon future iterations of watershed educational programs.