Suisun Marsh

Watershed Education Program

2017 Program Summary

January 2018

Program Funding
Solano County Water Agency

Additional Funding
Solano County Office of Resource Management, Fairfield-Suisun Sewer District

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Solano County Water Agency (SCWA) is in the tenth year contracting the Solano Resource Conservation District (Solano RCD) to implement the Suisun Marsh Watershed Education Program. Additional support provided by Solano County Office of Resource Management and the Fairfield-Suisun Sewer District.

Sections of the curriculum were adapted from the California Coastal Commission's Waves, Wetlands and Watersheds and Our Wetlands, Our World. The teaching objectives are directly linked to California's common core standards. The curriculum was written in August of 2008 and has been revised each year.

Marianne Butler manages the program, Allison Martin and Laura Morgan teach the in-class lessons and lead the field trips, and program educators include Don Broderson, Carla Murphy, Wendy Low, Deborah Bartens, Natalie DuMont, Jill Bolduc and Hannah Hodgson.

Students

In 2008, 4 classes of 140 students participated from Crystal Middle School in Suisun City.

In 2009, 18 classes of 600 students participated from Crystal Middle in Suisun City, Grange Middle in Fairfield, Sullivan Middle in Fairfield, and Cambridge Elementary in the Travis Unified School District.

In 2010, 18 classes of 626 students participated from Crystal Middle in Suisun City and Grange Middle in Fairfield.

In 2011, 33 classes of 1,129 students participated from Crystal Middle in Suisun City, Grange and Sullivan Middle in Fairfield, Vaca Peña Middle and Orchard in Vacaville, Center Elementary in the Travis District, and Solano Middle in Vallejo.

In 2012, 27 classes of 882 students participated from Crystal Middle in Suisun City, Grange, Tolenas, and Suisun Valley in Fairfield, Vaca Peña Middle and Orchard in Vacaville.

In 2013, 27 classes of 869 students participated from Crystal Middle in Suisun City, Public Safety Academy, Matt Garcia, David Weir, Nelda Mundy, and Suisun Valley Elementary in Fairfield, Vaca Peña Middle and Orchard Elementary in Vacaville.

In 2014, 30 classes of 940 students participated from Crystal Middle in Suisun City, Public Safety Academy, Nelda Mundy, Rolling Hills Elementary, Grange Middle and B Gale Wilson in Fairfield, Vaca Peña Middle and Orchard Elementary in Vacaville.

In 2015, 41 classes of 1,299 students participated from Crystal Middle in Suisun City, Public Safety Academy and Nelda Mundy in Fairfield, Vaca Peña Middle and Orchard Elementary in Vacaville, Solano Middle in Vallejo, Benicia Middle in Benicia and Riverview Middle in Rio Vista.

In 2016, 21 field trips occurred with 43 classes of 1,281 students participated from Crystal Middle in Suisun City, Public Safety Academy in Fairfield, Vaca Peña Middle and Orchard Elementary in Vacaville, Solano Middle in Vallejo, Benicia Middle in Benicia, Gretchen Higgins in Dixon and Riverview Middle in Rio Vista.

In 2017, 15 field trips occurred with 33 classes of 899 students. Please see chart below.

School	City	Grade	Total Students	Number of Classes
Crystal Middle	Suisun City	6th	105	4
Vaca Peña Middle	Vacaville	7th	355	13
Orchard Elementary	Vacaville	6th	52	2
Travis Elementary	Fairfield	6th	61	2
Benicia Middle	Benicia	6th	145	5
Riverview Middle	Rio Vista	6th	57	2
Gretchen Higgins Elementary	Dixon	6th	75	3
MIT Academy	Vallejo	6th	49	2
TOTAL			**899**	**33**

Since 2008, 8,565 students in 274 classes have participated in this program.

Methods

Session one takes place August-October. The second session takes place October-December. Three classroom lessons are held prior to each field trip. Each class then has the option of participating in a poster session at their school. The field trip takes place typically 9:30am – 2pm at Rush Ranch Nature Center. Field trips are followed by a final classroom lesson where students solidify what they've learned and talk about the ramifications of human behaviors on marine and marsh health.

The student field manual is included with this report. The lessons were updated this year in order to align better with the new state science standards mandate and to include more hands-on activities in the lessons. Descriptions of the lessons are as follows:

The first lesson is an overview of the watershed concept. Specifically, students utilize aerial maps and/or Google Earth to visually connect "watersheds" with the Solano County landscape. Students then interpret the flow of water in a watershed by participating in a watershed model demonstration. This demonstration involves the addition of representative "pollutants" (motor oil, animal waste, and trash) to a model landscape, adding representative "rain," and tracking where the water goes. Students examine how excess use of water resources can result in polluted water entering storm drains and therefore why it is important to conserve water. Using these activities as a foundation, students examine the Suisun Marsh watershed and interpret the path of water from its nearest cities into storm drains, creeks and into the Suisun Marsh.

During the second lesson, students begin understanding the value of the Suisun Marsh by experimentally testing out the functions and services the area's natural habitats provide. Students are separated into groups that will encounter four testing stations labeled A-D. In Station A, students learn that the wetlands in Suisun Marsh work as a sponge, absorbing water and preventing flooding. Students also learn that when too much water is added to the system, the wetlands will release water and will no longer prevent flooding. At Station B, students explore the importance of preserving natural habitat for plant and animal life by comparing the habitat features of a natural landscape to a concrete block, which represents a paved surface and very little habitat. At Station C, students use a coffee filter and suspended debris to test out how wetlands work as a filter by separating out physical and chemical pollution from the water. At Station D, students measure and mix fresh and salt water together to create a brackish mixture and infer how this mixture can support wildlife. They also assess what the implications are if more fresh water is introduced to the system via excess household water use.

In the third lesson, students are familiarized with some of the most common or special plants and animals of the Suisun Marsh, including: tule, salt grass, pickleweed, Suisun thistle, red-winged blackbird, salt marsh harvest mouse, river otters, and the giant garter snake. Students achieve this by rotating through eight different stations containing literature and a live plant or preserved animal specimen and then completing the following tasks: 1) draw the physical structures of the plant or animal they observe

(modeling); 2) identify the specimen using literature made available to them; and 3) researching and listing important behaviors, adaptations, and habitat information regarding the species in a chart.

An optional poster session allows participants to examine more plants and animals found at Suisun Marsh by researching and creating posters about the organism's habitat, behavior, and population status.

The all-day outdoor excursions at Rush Ranch are held late September – early December. Each field trip begins with a rotation through three stations centered on the topics of soil, water, and plants. At the soil station, students use a color chart to identify soil composition and use their hands to experience the different textures of soil in the marsh and grassland. At the water station, students test the water from First Mallard Slough for dissolved oxygen, temperature, phosphate, pH, and turbidity. As a small group, they discuss the data from the experiments and theorize how various types of pollution may affect Suisun Marsh and other wetlands. At the plant station, students set up a plant sampling quadrat by using a hula-hoop to randomly select a site. Students analyze the percent cover of plant species (native or non-native) within the site using plant guides created by Suisun RCD. Following the stations, students enjoy lunch at the picnic tables in the eucalyptus grove. Students also take a moment to assess the environmental impact of their lunch choices and how they can utilize the Three R's (reduce, reuse, recycle) to have a waste free lunch.

Next, students explore the Rush Ranch property by taking a nature walk through the different habitats, which include a eucalyptus grove, grassland, and marsh. While on the walk, students look for scat, tracks, plants, and wildlife. Each student is equipped with a pair of binoculars to look for birds and they have the opportunity to view barn owls. An olive tree outside of the barn provides evidence of owls as students observe owl pellets found on the ground by the tree's trunk.

Following the interpretive walk, students sit quietly on top of Overlook Hill and write poetry about their experiences and impressions of the wetland. Teachers submit the poems to River of Words. River of Words is a California-based non-profit organization that connects kids to the watersheds they live in through art and poetry. The organization runs an annual Art and Poetry Contest in conjunction with the Library of Congress. All program participants receive a Watershed Explorers Certificate. In 2010 a student from Grange Middle School was a finalist in the One Block Contest.

Lesson Four takes place following the field trip. To tell the story of how trash ends up in the ocean, program staff describe the life of a laysan albatross, a sea bird that typically feeds on squid, fish, and crustaceans from all across the northern Pacific Ocean. Students then examine an albatross bolus, which is regurgitated waste parts from albatross chicks, and observe the quantity of plastic pieces the chick ingested along with its actual food. From there, students infer how the trash ended up in the ocean and therefore in the albatross. After describing how trash enters the ocean from in-land sources (watersheds), students then conduct a Solano County trash survey by sorting and counting the number of "trash" items collected during a "volunteer cleanup event." From this activity, students can describe that the most common items ending up in Solano County waterways consists of single use, mainly plastic items. After quantifying the trash, participants create a plan of action to reduce the amount of waste they personally contribute to the environment (such as by practicing the Three R's).

Deliverables and Results

All deliverables involved in initiating and completing the program were successfully completed. We have met the central program themes that include; watersheds, wetlands, marsh functions, native and non-native plants, storm run-off, endangered and threatened species, origin of Solano County drinking water, and watershed connections between their residential communities, the Suisun Marsh, the San Francisco Bay, and the Pacific Ocean. The program also provides a deep sense of watershed stewardship. Students learn the importance of reducing, reusing and recycling; they learn how to combat one-time disposables and the value of keeping our environment clear of trash.

Water Conservation Challenge

Either before or after the field trip, students participate in a Water Conservation Challenge. Students first participate in a discussion about the importance of water in their daily lives and to reflect on how they would survive with extremely limited water resources. Students then complete a prediction of their household's water use for an upcoming day based on their family's usual water behaviors. After they complete their prediction, students take their worksheet home and log their family's water use – as well as their own – for an entire day. Students also calculate the cost of their day's water use and extrapolate it for a year. The goal of this lesson is to get students to assess if their water use is more or less than they predicted and to implement, along with their families, water conservation measures, as well as to consider how excess water usage impacts their watershed.

Program Evaluation

Student participants were asked to take an eight-question assessment quiz at the start of the program and again on the last day of the program. The responses to all pre-assessment (710) and post assessment (687) instruments were combined to provide an aggregate view of assessment performance for the entire 2017 Suisun Marsh cohort.

Pre and post assessments asked the same eight questions of participants, listed below in italics. The answers we expected on the post assessment are in blue.

1. A watershed is the area of land where all runoff water flows from the highest points to the lowest points, collecting in larger and larger creeks, and draining into the ocean.
2. Describe the path water travels to reach its final destination. Remember what happened during our watershed model.
   - Water travels through storm drains into creeks or rivers and makes its way into the ocean
3. Why does it matter what path the water takes?
   - We should be aware of where water goes since our drinking water is taken from the larger bodies of water
   - Storm runoff can impact the quality of our drinking water
   - We also want to know where water goes so that our streets don't become flooded
4. What are the 3 main threats to Suisun Marsh?
   1. Pollution
   2. Non-native Plants
   3. Development/Habitat Loss
5. My behavior effects the (student's watershed) watershed because I live in (student's city)
   Suisun Marsh (Fairfield, Suisun City)
   Sacramento River (Dixon, Vacaville, Rio Vista)
   Carquinez Straights (Benicia)
   San Pablo Bay (Vallejo)
6. Write down **three** ways you can help protect YOUR watershed.
   - don't litter
   - pick up after pets
   - attend cleanup events
   - reduce, reuse, & recycle,
   - recycle used oil
   - conserve water
7. How do the 3 R's affect your watershed?
   - It is important that recyclable items are disposed of in the correct receptacle so they can be reused
   - If not, they can pollute our watershed and end up in the ocean

- It is best to reduce by reusing something else

8. As a scientist, what would you investigate to find out the condition of the Suisun Marsh?
    - I would study the soil, plants and water in the Suisun Marsh

Evaluation

Student answers on the pre-assessment instruments reflected low to very low knowledge about all the concepts examined in the quiz. Student ability to provide correct or partly correct answers to the 8 questions ranged from 4% to 48%. Students had the greatest difficulty answering the questions designed to evaluate their understanding of watershed mechanics. Students did better with questions designed to assess their knowledge about their personal impacts on the health of their watershed (Question 6), with 48% of all respondents providing correct or partially correct answers to that questions- the best performance on the pre-assessment quiz. Interestingly, students performed poorly on Question 7 (impacts of the 3Rs [reduce, reuse and recycle] on the watershed). This year's program participant brought virtually no previous familiarity with their home watershed, with just 4% able to answer Question 5 (identify the watershed their homes reside in). This question has challenged every student in this program since we began these field trips.

The entire sample of post-assessment quizzes showed an average improvement of 347% (51 points) when considering correct and partially correct answers to all questions. On the pre-assessment, 48% of students could correctly or partially correctly answer Question 6 (three ways to protect their watershed), in the post assessment, that number rose to 95% percent of students in the sample. Performance also improved markedly on Question 1 (definition of a watershed), with 79% of respondents answering the question correctly; Question 4 (threats to the Suisun Marsh) 84% of respondents were correctly or partially correctly answering; and Question 1 defining a watershed) 79% of respondents gave correct answers. Students also demonstrated improved ability to answer the question about Question 5 (their home watershed) with 66% percent providing correct or partially correct answers.

Students continue to have difficulty with the question that asked them to provide an example of each of the three R's (Reduce, Reuse, Recycle). In the post assessment, 63% were able to answer with a correct or partially correct response, an improvement of 57 points from the pre assessment's 6%. Program educators report that the idea of providing an example of each practice is a consistently tough one for students to grasp. In past years, when we asked what each R means, students were able to give the correct word for each of the three R's, but the actual concept each word represents is more challenging.

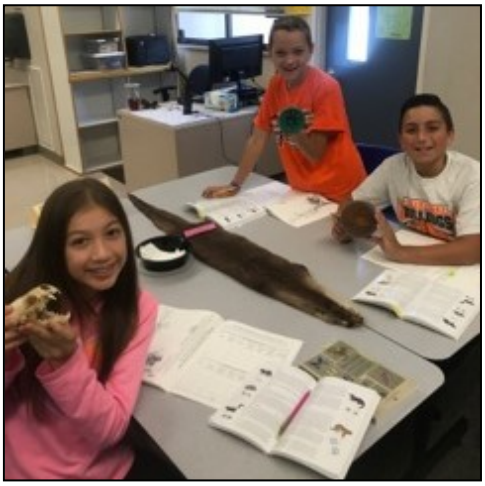
In conclusion, students improved significantly in their ability to answer every question, indicating an overall gain in understanding of the big concepts we are working with. The students improved in performance on every question, with improvements ranging from 11 percentage points to a gain of 65 percentage points.

We have conducted pre and post assessment of each Suisun Marsh Watershed Program class since the program's inception. Participating group size and composition varies from year to year based on project funding and district and teacher priorities, and there are too many uncontrollable variables including consistent long term funding for us to meaningfully track results year to year or undertake longitudinal study of the program. That said, we do have a sense of trends and tendencies, and this year's class assessment results were generally consistent with those of previous years in terms of overall gains from pre to post assessment administration. We continue to use these assessments to look at the areas where students struggle and make program adjustments and adapt our methodology to improve student understanding of our core concepts.

Appendix A – Photo Documentation

6th graders from Benicia Middle analyzing water quality data on their field trip

Program educator, Deborah Barns, leading 7th graders from Vaca Pena on a nature hike



6th graders from Orchard Elementary in Vacaville study the various plant and animal species from the Suisun Marsh

6th graders testing turbidity at First Mallard Slough

Program coordinator, Laura Morgan, using hands as a mnemonic device to help students remember the watershed definition