



# Water and Climate Stewards of San Diego Bay

*Sandra Lebrón, Elementary Institute of Science, San Diego, CA*

## Abstract

In partnership with the Climate Science Alliance, the San Diego Coastkeeper education team developed new climate change lessons and activities to demonstrate the connection between human activities and greenhouse gases and climate change impacts in our oceans. Thanks to the generous support from NOAA Planet Stewards, the project was able to bring a Water and Climate Stewards program to approximately 944 4th-12th grade students at eight schools within San Diego County. Through one-on-one meetings with teachers and students, classroom presentations, online lesson plans, free supplies and action projects, students gained a better understanding of San Diego's ecology and the threats that our environment and community face from pollution and climate change. Students developed a sense of stewardship towards San Diego's habitats and wildlife and learned specific actions they can take to protect our natural resources, reduce their single-use plastic consumption, and create positive change in their communities. Teachers gained free access to standards-aligned lesson plans that meet Next Generation Science Standards and Common Core State Standards, enhancing their curriculum with environmental science education.

## Introduction

San Diego Coastkeeper (<https://www.sdcoastkeeper.org/>) is a non-profit organization based in San Diego, California with the mission to protect and restore fishable, swimmable and drinkable waters in San Diego County. The education team has been providing hands-on water education for years, and have reached thousands of students and teachers with our education programs. In order to make our programming more relevant and local we have been building partnerships with San Diego environmental education organizations and the Climate Science Alliance, a non-profit organization with the mission of safeguarding natural and human communities in the face of a changing climate (<https://www.climatesciencealliance.org/>). With these connections and the knowledge and resources that community

partnerships bring, we felt empowered to start incorporating meaningful climate education into our existing curriculum.

One of the key science education content standards that California has adopted to guide K-12 science education is the principle that people influence natural systems. The goal of our climate action project was to deepen student knowledge and to find practical solutions for two issues: climate change and marine debris. New climate change lessons and activities were developed that included tools for understanding which human activities produce greenhouse gases, presentations on the ways in which climate change is impacting our oceans, games that help illustrate links between human behaviors and climate outcomes, and resources full of tips for how students can reduce their climate impacts in their own lives and empower their families and communities to do the same.

Funds provided by NOAA Planet Stewards (<https://oceanservice.noaa.gov/education/planet-stewards/psep-supporting.html>) allowed us to purchase supplies to build the education kits we distributed to local classrooms. Through a partnership with the Port of San Diego's environmental education grant program, we were able to expand the program into the San Diego Bay Watershed communities of Coronado, Imperial Beach, and Chula Vista in addition to San Diego. Spanish language versions of our climate lesson further improved our ability to connect with more students and more educators in our region.

## Project Implementation

During this grant period, we hosted numerous classroom presentations and field trips through partnerships with the Climate Science Alliance and the Earth Discovery Institute (<https://earthdiscovery.org/>). These partnerships allowed us to leverage a larger number of students and allowed us to present a holistic view of climate and water science. Through our hands-on trash decomposition and greenhouse gases activities, students learned about the relationship between plastic consumption and climate change. We offered classroom presentations to help teachers integrate the Climate Change and Marine Debris lesson plan into their curriculum and conducted climate stewardship action projects in three schools.

The following schools in San Diego County participated in the project:

1. Bayside Elementary in Imperial Beach.
2. Harborside Elementary in Chula Vista.
3. SAY San Diego an after-school program at Innovation Middle School in San Diego.
4. Logan K-8 School in San Diego.
5. Marston Middle school in San Diego.
6. Mission Bay High School in San Diego.
7. Silver Gate Elementary school in San Diego.
8. Silver Strand Elementary school in Coronado.

Students learned about marine debris; what happens with our trash – specifically single-use plastics – when it reaches our storm drains, where it ends up if not properly disposed of, and its detrimental effects on our local waterways, the San Diego Bay, and the Pacific Ocean. Students discovered how long it takes for plastics to decompose and were surprised to learn

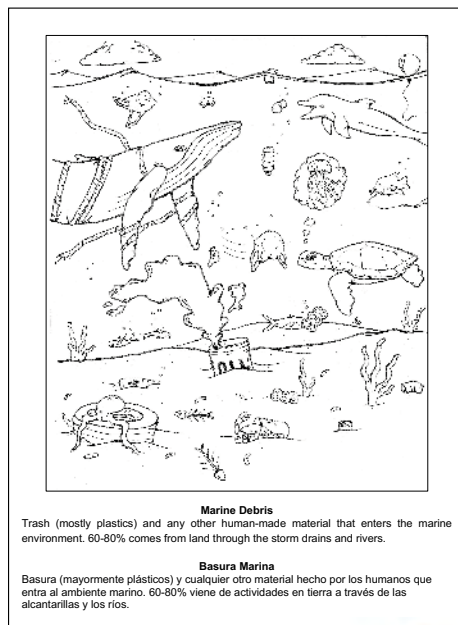


Figure 1. Example of bilingual science illustrations.



**Image 1.** 88 4th-5th grade students from Bayside Elementary learned about the San Diego Bay tidelands and pollution sources during an outdoor field trip with the Earth Discovery Institute to Imperial beach. Photo credit: Sandra Lebrón



**Image 2.** Students learning about marine debris and watersheds.

Photo credit: Sandra Lebrón

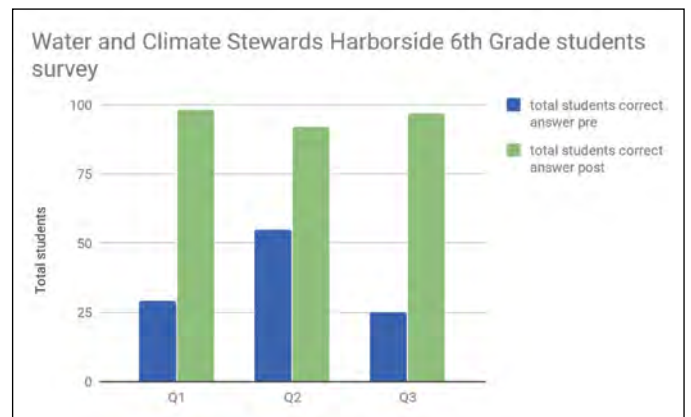
that some single-use items can take hundreds of years to break down into smaller pieces, making them more accessible to become part of the food chain and ultimately never degrade. Students were deeply concerned about the effects of marine debris on our marine life when exploring real pictures of aquatic and marine animals with their stomachs filled with plastic items.

Link to NGSS Lesson Finding Solutions to Climate Change and Plastic Pollution: (<https://docs.google.com/document/d/184LF9U3EOCI2BRBAkodIcTSyDt6LcNi9T5KdLxBnVw/edit?usp=sharing>).

Innovative games engaged students in learning about different causes of climate change, the sources of greenhouse gases as well as practical solutions an individual can take to reduce plastic consumption and pollution and decrease their carbon and water footprint.

The team piloted new lessons at Pacific Beach Elementary School over the course of five weeks in 2017—reaching every single student in grades K-5 at the school—and received positive feedback. We also worked with 6th grade students from Harborside Elementary and the students showed an increase in understanding about solving the pollution problem from 22% to 84%.

Topics at the schools varied depending on the needs of the curriculum. Students from Marston Middle School, Mission Bay High School and Silver Gate Elementary participated in hands-on marine debris decomposition activities and greenhouse gases games.

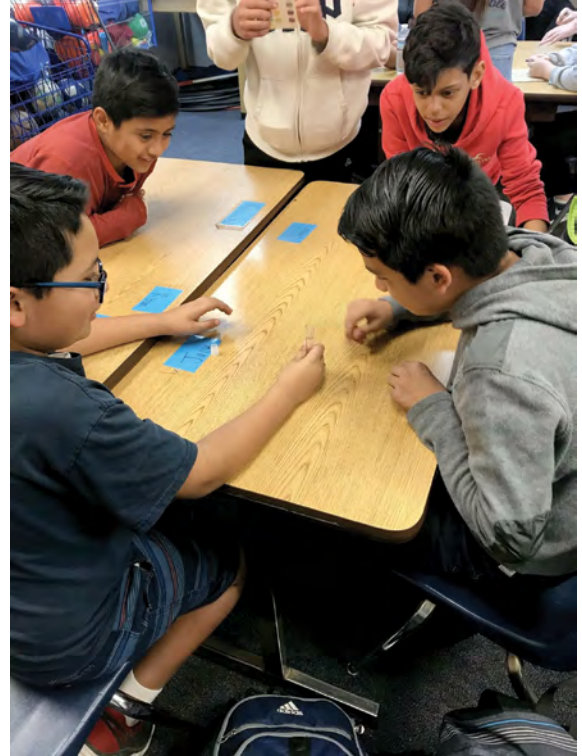


**Table 1.** Before: 25 of the 115 (22%) students answered correctly. After: 97 of the 115 (84%) students answered correctly.



**Image 3.** Mission Bay High School students analyze trash during decomposition activity.

Photo credit: Sandra Lebrón



**Image 4 and 5.** San Diego Coastkeeper interns work with Innovation Middle 6-8th grade students at an afterschool program. Photo credit: Sandra Lebrón

The afterschool program at Innovation Middle School learned about ways to monitor and minimize pollution in our watersheds, learned about ocean acidification effects to our ocean, and practiced pH testing. Students discussed ways to monitor and minimize pollution in our watersheds, learned about ocean acidification effects to our ocean, and practiced pH testing.

The focus at Logan K-8 School was water quality, measuring pH, ocean acidification, and CO<sub>2</sub>, and ways to reduce greenhouse gases and plastic pollution as well as the effects of ocean acidification on our marine animals and habitats.



**Image 6.** Students from Silver Strand Elementary School in Coronado.

Photo credit: Sandra Lebrón



**Image 7.** Marston Middle students during trash collection and assembly.

Photo credit: Sandra Lebrón

## Student Action Projects

Climate action projects were started at three schools to help students understand their carbon and water footprints on the local environment, their daily plastic consumption, and encourage simple actions to reduce their daily single-use plastic consumption. 6th grade students at Marston Middle School in San Diego conducted a plastic inventory and implemented measure to refuse, reduce, reuse, and ultimately recycle. Their climate stewardship action project included:

- Public service announcement (PSA) to increase awareness about single-use plastics. <https://youtu.be/Z-LIEb2GwGg> and <https://youtu.be/1Hf68hCnSyY>.
- Each week from January-June, posters highlighting a different plastic pollution problem were hung around the school.
- A school-wide assembly highlighting the problems caused by plastic pollution with over 200 students and teachers in attendance.
- A spirit week with each day dedicated to reducing the consumption of a specific plastic item, such as straws and single-use plastic water bottles.
- The Gifted and Talented Education (GATE) class created e-posters to highlight a specific plastic pollution problem and its solution.
- Alphabet coloring books for elementary school students. (<https://drive.google.com/drive/folders/19cqHBk3Q54NKjiVnlnQW6H-76wuIm2DX>)

The Marston Middle School students presented their climate action project at the 14th Annual CTE Showcase, an initiative from San Diego Unified School District’s Ignite College, Career & Technical Education. They were the only 6th grade students in the competition and offered an outstanding presentation to the judges. (<https://drive.google.com/file/d/1nO1UUGonXAPOpEmicnq7iT4u0QdlcmDN/view>). Photo at [https://drive.google.com/file/d/12maRQOAHhKB9cV0KhQm3sVncBkMxs\\_mO/view?usp=sharing](https://drive.google.com/file/d/12maRQOAHhKB9cV0KhQm3sVncBkMxs_mO/view?usp=sharing).

The 5th grade class from Silver Strand Elementary tracked their plastic usage for one week, then discussed as a class which plastics they could reduce and/or refuse to decrease the number of single-use plastics consumed. During the second week, they tracked their single-use plastic consumption.

The student’s data showed the highest reduction during the second week with the following items: plastic water bottles (61%), plastic plates (57%), cereal bags (46%), straws (40%), and plastic baggies (38%).

2 week Plastic Usage Data: After tracking plastic usage for one week the 35 5th Graders discussed which plastics they could reduce and/or refuse to lower the amount they used. Then tracked their usage for another week. Here are the results.

ITEM	WEEK 1	WEEK 2
Styrofoam bowl	2	4
Styrofoam cup	7	11
Styrofoam plate	18	19
Styrofoam tray	80	63
Plastic utensils	75	62
Plastic cup	36	24
Plastic plate	37	16
Straw	55	33
Straw cover	24	21
Yogurt cup	9	22
Candy wrappers	41	46
Juice container	11	12
Bread bag	23	16
baggies	82	51
Cereal bag	13	7
Water bottle	51	20
Soda bottle	11	8
Milk jug	7	6
Meal container	16	12
Snack wrapper	109	79

Figure 2. Example of chart comparison between the first (previous behavior) and the second week (implementing environmental stewardship).

5th Grade  
Silver Strand Elementary School  
Coronado

Keeping my plastic diary was really eye opening. I was very surprised of how many pieces of plastic I used. Also there are 5 people in my family which means that my family used a lot of plastic. Next time I will try to use a lot less plastic and recycle. The thing I used most was snack wrappers.  
--Sophia Gates

After we had done two weeks of keeping a plastic log I was surprised at how much plastic I used. After the first week I made a goal not to use as many plastic straws. Now I know not to use as many plastics and when I do I will recycle when I need to. I will also reuse when I can.  
--Mason Walton

I've never kept track of how much plastic I use so this was new for me to do. I never realized that I never really used much plastic during the week and I thought that I would have used more. SO on the second week I decided to commit to using less plastic straws and lunchable containers. And I did just that, I used less plastic straws when I was drinking and packed less lunchables for my lunch and instead packed my own lunches for myself for school. As I finished the second plastic diary, I found out that it was actually easy to use less plastic during the week. This plastic project helped me see how much plastic I use and how I can use less plastic.  
--Hana Rose Ty

I have learned that plastics can affect the ocean and the waterways on the Earth. They kill turtles and stuff. And pollution on the atmosphere can affect temperature and cause droughts on some areas and floods in others.  
--Rich Zhang

The plastics diary taught me alot It taught me that we use a lot more plastics than we think. This is a big deal in the world because of pollution. We might want to think about not using as much plastics. Plastics are a huge deal in life, we use them every day and every hour. Just try to imagine the whole world using plastics every hour and that making a giant group of plastic. That all makes a huge pollution group.  
--Will Sevigny

Using a plastic diary made me think before using plastic because it was sometimes hard to remember but it was mostly easy because I kept it right behind my homework. I thought it was a good idea to do that so we could see how much plastic we used. I was somewhat surprised with the amount of plastic I used, I use a lot of plastic so it didn't surprise me that much, I use most of my plastic for snacks and other stuff like that. I don't really use plastic forks or straws so I only used one or two of them. That was a great experience that made me think about the Earth more.  
--Isabel Moses

Figure 3. Examples of the responses from the 5th graders after their second week of the climate stewardship action project.

The teacher from the 4th grade class at Bayside Elementary School provided feedback on how it was initially challenging to conduct the action project due to the limited time allocated to science class. However, after participating in the action project, students expressed that this project was “very eye-opening” and that it increased their awareness of environmental stewardship. Additionally, the class was excited about the action project and will be implementing it next school year with the entire school.

## Conclusion

This project was a hands-on learning opportunity to help students understand their environmental impact on the local community and then to implement climate action projects. Our goal was to partner with at least two schools to encourage the students to implement climate action projects. We worked with 8 schools, and ultimately helped to pilot the climate stewardship action project at three schools: Marston Middle School, Silver Strand Elementary School, and Bayside Elementary School. 125 students from these three schools challenged themselves to reuse and reduce single-use plastics. Our students were able to conduct an investigation, learn from experts, and find solutions to prevent and minimize pollution in our beaches and watersheds and understand the connection to plastics and our carbon footprint. This project provided an opportunity for students to take action and to be part of the solution to marine debris and climate change. We appreciate the teachers, informal educators, interns, NOAA Planet Stewards, and The Port of San Diego for all their support to our students. Additional information about the project can be found at Climate Stewards - San Diego Coastkeeper (<https://www.sdcoastkeeper.org/education/climate-stewards>) and “How Community Partnerships Empowered Coastkeeper’s Education Team to Take on Climate Change” (<https://www.sdcoastkeeper.org/blog/environmental-education/community-partnerships-empowered-coastkeepers-education-team-take-climate-change>)

## About the Author and Collaborators

**Sandra Lebrón**, MS in Marine Science, University of Puerto Rico Mayaguez, is the former San Diego Coastkeeper Education Manager. She is the current Director of Education at the Elementary Institute of Science (<https://eisca.org/>) where she serves the Southeast San Diego schools to provide STEM opportunities for underrepresented students in STEM. Sandra has been working in science education for 20 years with organizations like the National Estuarine Research Reserve, NOAA’s Sea Grant College Program, Birch Aquarium at Scripps, and the Living Coast Discovery Center. She is passionate about environmental education and STEM equity. She enjoys spending time with her 15-year-old son, friends, and family, and enjoys the beach as much as possible! Sandra can be reached at [slebron@eisca.org](mailto:slebron@eisca.org)

### San Diego Coastkeeper Education Interns

- **Victoria Dickey**, BS in Oceanography, Hawaii Pacific University
- **Robyn Gillium**, BS in Environmental Systems: Ecology Behavior and Evolution and B.A. in Political Science, University of California, San Diego
- **Melissa Pennington**, BA in Sustainability, San Diego State University

### Climate Science Alliance

- **Amber Pairis**, PhD in Environmental Studies. Founder and Lead Advisor, Climate Science Alliance, Associate Research Professor-Western Regional Climate Center at the Desert Research Institute
- **Laura Hampton**, BA in Physical Geography, San Diego State University. Former Program Manager, Innovative Community Engagement Initiative at Climate Science Alliance- South Coast California. Department of Fish and Wildlife & Center for Climate Change Impacts and Adaptation at Scripps Institution of Oceanography