

# Meet the Grays

BY EMILY WAGGONER AND DIEUWERTJE KAST

*Thick fog swept down, enveloping the 24-foot Zodiac boat. Carrie frantically asked me to write down the G.P.S. coordinates of the buoy. I quickly wrote down the numbers and clasped the paper tightly in my hand. We hesitantly continued on to Gull Rock. The motor halted. Still squeezing the paper for comfort, I closed my eyes, concentrating on the sea's symphony. Suddenly, a new instrument joined in, like a trumpet entering the string section. My eyelids parted to see a gray whale named McFlurry coming up for air, five feet from the Zodiac. I looked down to see my fingers relaxed, palms riddled with nail indentations. When McFlurry dove back into the water, I peered into her eye and smiled with ease. All my fears disintegrated and I folded the paper, placing it in my pocket and out of my mind.*

*Such encounters became an everyday affair during my summers with marine biologist Carrie Newell. Living in Depoe Bay, Oregon with Carrie introduced me to the life of a whale researcher. I was her right-hand woman, going out on the boat every day to photo identify a group of 80 resident gray whales, a species she has studied for over 20 years. Hours were spent going through the photos taken from that day, giving creative names to the new whales based on pigmented markings on their head, rostrum, and fluke.*

– Emily Waggoner, on her experience with gray whales

## ABSTRACT

With the help of Dieuwertje Kast, Emily Waggoner integrated her experience with gray whales and passion for digital visualizations to design Meet the Grays—a lesson plan that utilizes digital arts in order to spark a passion for marine science in K-5 classrooms. Despite being among the largest mammals on Earth, gray whales are not well understood and, like other marine education topics, unfortunately play a minimal role in elementary school science curricula. The goal of Meet the Grays is to transform these mysterious, 40-ton mammals into individuals with names and personalities for elementary students. Because whales can be difficult to visualize, students learn about the grays through two-dimensional (2D) animations, followed by an interactive activity focusing on gray whale migration through a cardboard model of the West Coast and three-dimensional (3D) printed gray whale characters. Through this lesson, students gain a better understanding of the species and are introduced to digital arts and 3D printing and, more importantly, build a connection to the mammals as individual creatures.

## INTRODUCTION

Emily Waggoner, a research student at the University of Southern California (USC) and a Science, Technology, Engineering and Mathematics (STEM) intern for YSP, found her passion in the eye of a whale. Her fears of the depths of the ocean faded with one look, which catalyzed her desire to explore whales throughout the summer with marine biologist and professor at Lane Community College, Carrie Newell.



Students in Ms. Jasmine Tigolo's fifth grade classrooms beta test the lesson plans. Courtesy of Dieuwertje Kast

Through this enriching experience, she gained a new-found faith in herself and discovered a passion to uncover and share the ocean's complex beauty.

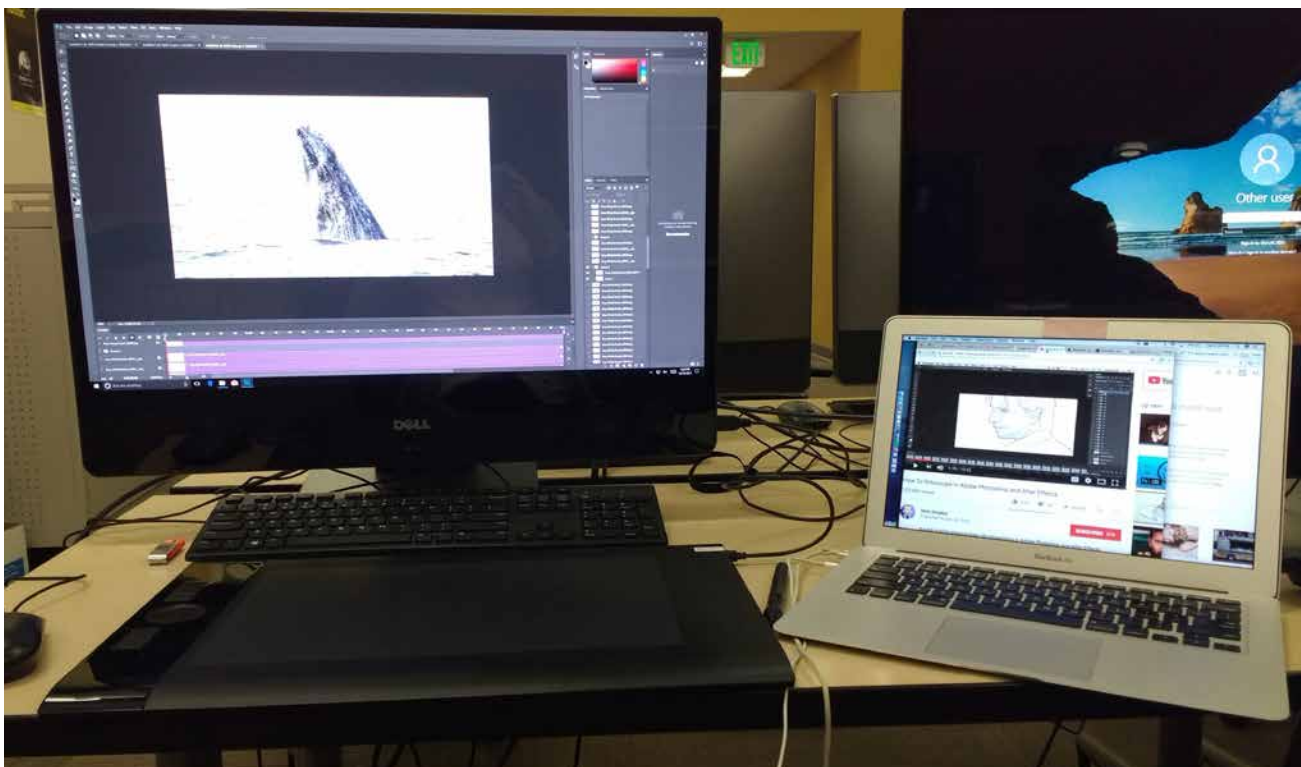
As Emily's first female mentor, Carrie embodied the characteristics and scientific values that she admired. She emphasized hands-on learning with imaginative stories to better understand and remember everything from gray whale anatomy to feeding techniques. Since arriving at USC in 2014, Emily has continued to pursue her passion in studying marine research and education, incorporating both, a minor in science visualization and an internship with Dieuwertje "DJ" Kast, STEM programs manager of the USC Joint Educational Project and director of the Young Scientist Program (YSP) and Wonderkids Programs.

According to Kast, the YSP works in partnership with six USC community schools to engage more than 2000 elementary school students, 75 Los Angeles Unified School District (LAUSD) teachers, and six school principals through a broad repertoire of science curricula. YSP brings scientific laboratory experiences directly to students and their teachers with the goal of supplementing current science instruction, complementing LAUSD and state grade level science learning

standards, strengthening science literacy, and promoting interest in scientific careers.

In addition to the goals mentioned, one of the primary objectives of YSP is to increase the number of science activities available to a larger group of neighborhood children to encourage them to consider careers in STEM, and to apply what they are learning in the classroom to the real world.

USC Wonderkids is one of those programs provided after school by USC ReadersPlus tutors at partnering schools (schools served varies each semester based on tutor availability and staffing) and offered twice each week to elementary students. The STEM curriculum for this program was designed to introduce first through third grade students in the afterschool program to the myriad of careers in the sciences and to promote a sense of curiosity about the many wonders of science. Various science fields are introduced in two-week blocks through literature and hands-on activities. The final lesson in each science field block is presented by guest speakers—professional scientists from each field of study. The scientists share more about their work, engage children in fun and exciting science activities so that they can "play scientist," and answer any lingering questions children



Here's a 2D animation: A Huion H610 tablet was used on Adobe Creative. Courtesy of Emily Waggoner

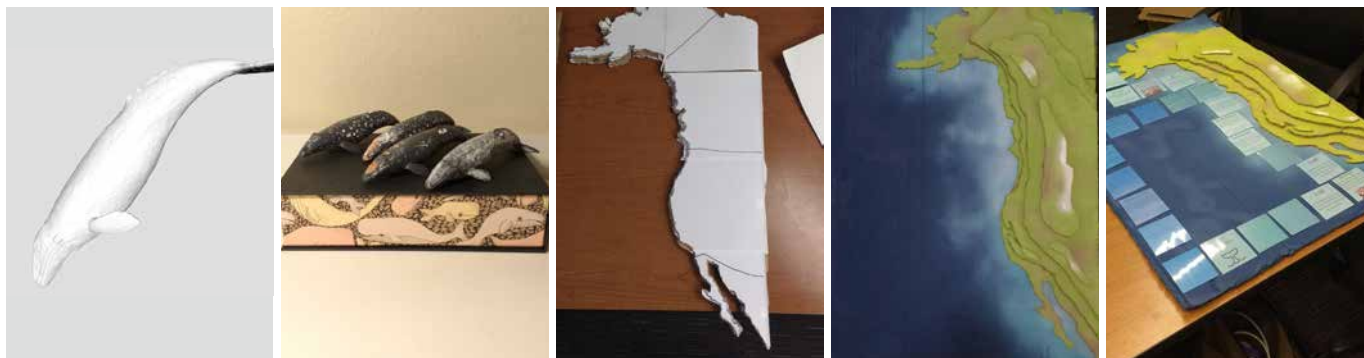
may have about their work in the field. Some examples of science fields introduced are: neuroscience, environmental science, paleontology, deep sea, marine biology, botany, robotics, space, chemistry, DNA, animal behavior, and medicine.

As a way to become more involved with YSP and Wonderkids, Emily Waggoner started a STEM Internship last year, creating curriculum and resources about marine science. In the Spring of 2017, Dieuwertje and Emily applied for and received a grant through the National Marine Sanctuary Foundation for a marine science unit as part of the WonderKids programming. One of the four lesson plans introduced students to gray whales and was quickly transformed to Meet the Grays. This lesson introduced Emily's second family, the Oregon resident gray whales, through digital arts and animation, bringing marine education concepts to a community of K-5 low-income students. Gray whale behaviors, hitch-hikers (whale lice and barnacles), and feeding mechanisms are taught through 2D animations to present digital technology and art integration. Real gray whales (identified by the names: Ice Cap, Blanco, Comet, Lucky, and Eagle Eye) are then introduced to students to show them how researchers identify grays in the wild. Once the students are familiar with the grays, they are then shown an interactive game on gray whale migration, which is introduced as a long trip from Alaska down the West Coast of North America to Baja Mexico. This game highlights the trials and adventures that a gray whale may face over their annual journey. The topics taught include: food availability, the group of grays (Summer Resident gray whales) who stay in Oregon rather than travel to Alaska, the journey with the addition of a calf (baby gray whale), and run-ins with boat propellers and killer whales. The game pieces are 3D printed whales of the five real individuals taught in the first half of the lesson, and baby whales which are scaled down to one-third of the size.

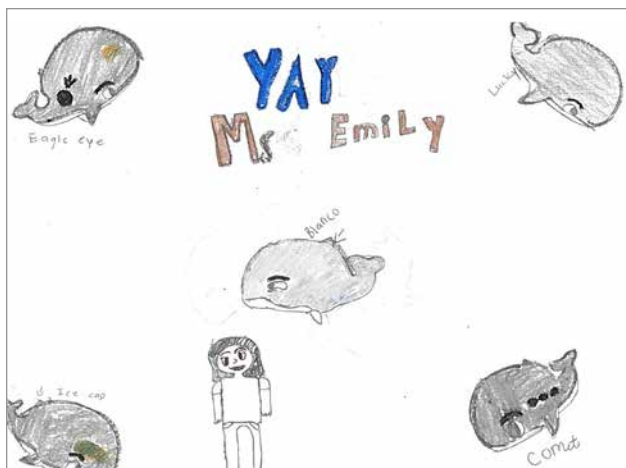
This became the highlight of Emily's last semester at USC, integrating the lesson with her minor capstone project to build a marine science learning experience for not only Wonderkids, but to also be accessed by marine science and other educators. To beta test the lesson plan, additional funding was provided by Dr. Jane Goodall's Roots and Shoots Mini grant program. Together, the two grants covered the cost of the materials needed for the curriculum, including 3D printing PLA, spray paint, a 2D animation drawing tablet, and other educational tools. The process of the game's creation is detailed here for use by other educators.

### LESSON OVERVIEW: MEET THE GRAYS

The students are introduced to whales and gray whales specifically, through a whale migration book and 2D animations. A migration game was created to expand upon Oregon's resident gray whales. The goal of the game is to introduce students to the gray whale migratory patterns by physically taking a whale on the journey from Baja, Mexico to Alaska. A gray whale 3D model seen in the photo below is used as the game characters and printed on a 3D printer. Cardboard was used to form the board for the game, with elevated cut-outs of the West Coast. Spray paint was used as the finish on the board, and the action cards that the players move through were adhered to reflect a typical gray whales' journey. Ultimately, four boards were created with the intention of five to seven students playing per game. The game was beta tested in Jasmine Tigolo's fifth grade classroom at the Foshay Learning Center. A fifth grader named Delilah Rangel said, "I learned that on the gray whales back they have a lot of colorful bumps and white spots. Some of the whales are born with white spots (like freckles). Some of them get the white spots from little animals called barnacles." Another student, Stephen Gomez said, "I thought the game was cool because of how Ms. Emily made the whales look real."



Gray whale migration game: Far left is a photo of the gray whale model, followed by the 3D printed whales (second from left). The last three photos (from left to right) show the progression of making the board game, from cutting the cardboard to spray painting and attaching the game cards to the board. Courtesy of Emily Waggoner



A student's rendition of Lucky the gray whale spyhopping (left drawing), and a student's drawing of each gray whale that the class learned about, including the markings that we used to identify them. Comet is showing off the three "comet markings" while Eagle Eye has the eye shape and dot (right drawing). Courtesy of Dieuwertje Kast

This digital arts project has been documented on a blog\* (see resources), step-by-step, from beginning to end so it can be replicated by teachers for their students. Beyond making the website publicly accessible, we hope to share the project with involved networks to increase visibility and impact. The website will be shared with Carrie Newell's Whale Research EcoExcursions website, and USC's Joint Educational Project (JEP) that work with 75 classrooms.

## RESOURCES

Little Gray's Great Migration:

<https://www.amazon.com/Little-Grays-Great-Migration-Lindsey/dp/1628554606>

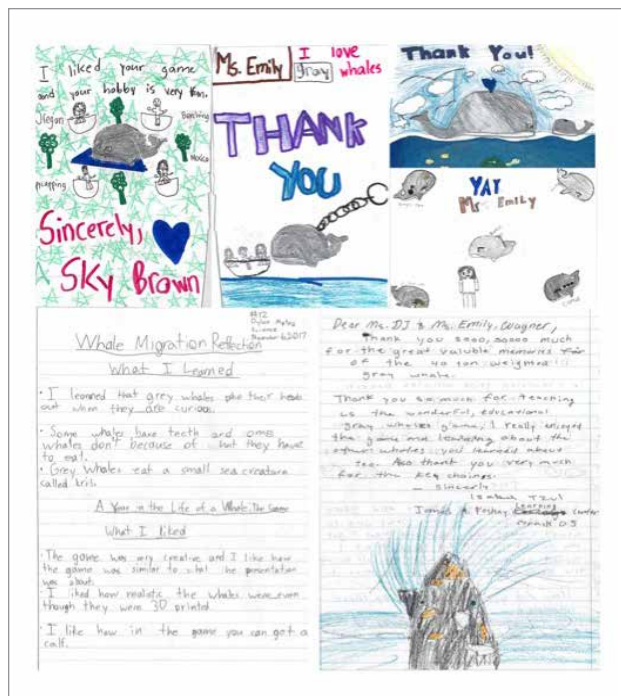
Gray whale 3D model:

<https://www.turbosquid.com/3d-models/maya-scan-grey-whale-maquette/594427>

Deezmakers' 3D printer: <http://deezmaker.com/>

Whale Keychain 3D model: <https://www.thingiverse.com/thing:1689057/#files>

Meet the Grays blog\*: <https://meetthegraysblog.wordpress.com/>



Here's a compilation of thank you cards written and drawn by the students, sharing what they learned. Courtesy of Dieuwertje Kast

Lesson Plan: <http://www.meetthegrays.org/>

Carrie Newell's Whale Research EcoExcursions:

<http://www.oregonwhales.com/oregonwhales2.html>

**EMILY WAGGONER** is a senior at the University of Southern California, pursuing a bachelor of science degree in environmental studies and minor in science visualization. Looking forward, she hopes to integrate digital arts and marine science in her career, to expand her knowledge of and passion for the ocean.

**DIEUWERTJE KAST** focuses her work on creating STEM programs, providing professional development and mentorship, and supporting integrated STEM education throughout California. Through her efforts, she has provided STEM instruction to over 20,000 underrepresented minority students, 500 educators, 20 school principals, and countless members of the community. Kast has not only revitalized the Young Scientists Program (YSP), but also doubled the number of students and teachers served through the program.