

Katrina Quinto

ESYS 190B Senior Project Paper

June 8, 2006

**Evaluation of Student Content Knowledge and Environmental Attitude**  
**Aquatic Adventures Science Education Foundation**

**ABSTRACT**

The objective behind this study is to understand the student's learning experience about the environment. I question the improvements made by each student and the class they are in as a whole as they venture into the given curriculum that Aquatic Adventures has provided. It led me to compare and contrast the data from assessment forms given before and after the SEA (Science, Education and Awareness) Series program to the participating 3<sup>rd</sup> and 4<sup>th</sup> grade students in the different inner city schools or low income schools around San Diego County.

The major part of my project is to assist in leading hands-on activities inside the classroom and in field trips. It is important to know if what the students learn in class about the environment would alter their behavior towards it in a positive way. The other part of my project is to grade the assessment forms, enter them into the computer and analyze the data for comparison. Three assessment forms are provided to the students: before the program (Pre-assessment), after the program (Post assessment) and 2 months after (Retention assessment) the program. The average scores of each class in all the different schools were calculated. The results show great improvement as we saw an increase in the students' assessment scores, from the pre-assessment to post assessment and to the retention assessment.

The outcome is rendered beneficial not only to the organization but also to the community and our environment in general. This result proves that experiential classroom and field based

science educational programs inspire underserved youth in low-income San Diego City Schools to improve their content knowledge of the material so they could develop positive attitude that promote beneficial actions toward the environment.

## **INTRODUCTION**

Not all students in the San Diego area are given the privilege to enjoy studying science at its fullest. These are the inner city schools or low-income schools that are not provided with laboratories filled with tools used for basic experimental activities and whose students lack the knowledge of even the basic scientific terminologies that relate to science and the environment. Aquatic Adventures Science Education Foundation is a nonprofit organization located in Pacific Beach. Their mission is to provide living labs for youth, which means that their educational programs connect these underserved youth to science, inspire environmental action, and increase exposure to marine habitats (Aquatic Adventures, Reference 1). Their vision is to engage youth in unique experiences that reveal new opportunities and engender their valuable skills and empowering individuals to fulfill their potential (Aquatic Adventures, Reference 1). Their programs primarily target underrepresented youths who otherwise are not afforded such opportunities (SD Backed, Reference 6).

Aquatic Adventures is founded by Shara Fisler, who is also the executive director of the organization. Her experience in teaching high school students through Upward Bound and her passion about marine science inspired her to form Aquatic Adventures. Now, Aquatic Adventures serves more than 5,000 youth and provides over 60,000 hours (Aquatic Adventures, Reference 1) of direct education every year. Aquatic Adventures offer a tuition free program that is why they mostly depend on the funding they get from grants, donations made by families and

friends, and sponsorships given from different government agencies, public institutions and private companies around San Diego. These funds provide books, experimental tools and other scientific equipment to students as well as teachers involved in the program. Every year Aquatic Adventures make all their work possible with the hundreds of volunteers that take action to teach underserved youth and to protect the environment. Through all these encouraging outcomes of the organization, Aquatic Adventures received numerous awards over the years like the 2005 Sea World, Busch Gardens, Fuji film Environmental Excellence Award and the 2005 City of San Diego Park & Recreation America's Finest Volunteer Award (Aquatic Adventures, Reference 1).

Aquatic Adventures offers 5 different programs: BAHIA, SEA Semester, Students Empowering Students, SEA Power and SEA Series. SEA Series is the program I am involve with and will be the main focus of my senior project.

SEA Series serves more than 2,500 youth (Aquatic Adventures, Reference 2) every year from 3<sup>rd</sup> to 6<sup>th</sup> grade students. Elementary schools like Kit Carson, Encanto, Marshall, Kimbrough and many more are all involved in this program. From classroom visits to their after-program field trips and community service projects, over 8 hours (Aquatic Adventures, Reference 3) of learning and experiential activities about marine science is attributed to these students. Aquatic Adventures provides teachers in these schools with additional curriculum in conjunction with the SEA Series program. The curriculum is developed by Aquatic Adventures in accordance with the California State Education Standards (Aquatic Adventures, Reference 2). The SEA Series program also incorporates language arts, math and social studies into the activities (Aquatic Adventures, Reference 2). Shara Fisler stated that "Most low-income area schools offer no science, because they concentrate on literacy and English," (University of San

Diego, Reference 7). Every year most schools prepare for state exams like the Golden State Exam and the SATs that usually focus in English, Literature, Language and Math, that they limit their lectures to these subjects only. What about science, particularly marine science? Aquatic Adventures provides an interesting opportunity that enables students to learn science in accordance with these other subjects. Interesting in a sense that students are not only provided with terminologies to boost up their vocabularies and help them with their English but with intensive hands-on activities like the use of microscopes, contact with live animals, dissections and water quality testing. Aquatic Adventures also provide field trips and community service projects that appeal to students in order to make sure their awareness about the environment is translated into beneficial actions towards the community. To help these schools fulfill these activities we provide books and other scientific equipment donated by many sponsors. With Aquatic Adventures' mission and vision, and their fulfillment of science provided by the SEA Series program it will surely improve the literacy and other basic skills taught to these students through the thematic curriculum provided, especially since these low-income schools are very well represented by many ESL students.

My internship with Aquatic Adventures is purely voluntary but as an intern working on a senior project I was also assigned to do the evaluation of the student assessment scores to analyze the organization's impact on these underserved youth. I have been working with this organization since fall quarter, 2005. I was assigned to work twice a week during fall quarter, and once a week during winter quarter as a volunteer in addition to the hours I was assigned to come in to work on the assessment forms. This spring quarter I am still volunteering with Aquatic Adventures because I believe that their mission really helps many underrepresented students and that our environment is greatly impacted in a very positive way. I work with

different lead instructors every quarter and with other volunteers as well. I also work with two program directors from Aquatic Adventures. One is Lindsay Goodwin, who facilitates the evaluation of the assessment forms and helps me with my senior project and Matt Kansteiner, who is my internship supervisor and mostly helps me with the volunteer part of my internship.

## **METHODS**

### A. Training for the unit.

A unit is referred to the program Aquatic Adventures teaches to a certain grade level. In the two quarters that will be the focus of my senior project, the two units I was involved with are Wetland Avengers in fall quarter and Invert Investigators in winter quarter.

Before lead instructors and volunteers head over to the schools to start the in-class lessons and activities, we undergo training for the unit. We were introduced with the curriculum that we will be doing in the classrooms and the outreach projects so we become prepared to teach the students. Wetland Avengers is the theme for 4<sup>th</sup> grade students every year in the SEA Series program and Invert Investigators is the theme for 3<sup>rd</sup> grade students. There were 6 classroom visits for the Wetland Avengers unit and 4 classroom visits for the Invert Investigators unit. Both units are concluded by a field trip and community service project. There were two separate trainings that I had to do for each of the units.

The first training that I did for both units was given by the program directors, Lindsay and Matt, and was solely about the lectures and hands-on activities like experiments that were going to be held in the classrooms. The different topics of the units were introduced during this initial training. In Table 1 and Table 2, the following topics of the Wetland Avengers and Invert

Investigators are described through the CA Standards in Life Sciences and the objectives provided by Aquatic Adventures (Aquatic Adventures, Reference 4).

**Table 1. Wetland Avengers Unit**

<b>Lesson of the Day</b>	<b>CA Standards in Life Sciences</b>	<b>AQA Objectives</b>
1. Ecosystem Endangered	4.3a - Students know ecosystems can be characterized in terms of their living and non-living components.  4.3b - Students know for any particular environment, some kinds of plants and animals survive well, some survives less and some cannot survive at all.	- Students will demonstrate understanding of zonation and characteristics of a wetland ecosystem, the differences between a healthy and threatened ecosystem, and species' adaptations to physical properties, by creating a 3D wetland.
2. Why Wetlands	Review of 4.3a  4.5c - Students know the concept of weathering, transport and deposition.  4.6b - Students will conduct multiple trials to test a prediction and draw conclusions about the relationship between results and predictions.	- Students will demonstrate understanding of the importance and functions of wetland ecosystems by using the scientific method to perform experiments.
3. Wetland Web	4.2a - Students know plants are the primary source of matter and energy entering most food chains.  4.2b - Students know producers and consumers are related in food chains and food webs, and may compete with each other for resources in an ecosystem.  Review of 4.3a	- Students will demonstrate understanding of the complex interactions in an ecosystem and become familiar with common California wetland species by creating a food web and playing bingo.
4. Bountiful Birds	4.6c - Students will formulate predictions and justify predictions and justify predictions based on cause and effect relationships.  4.6d - Students will conduct multiple trials to test a prediction and draw conclusions about the relationships between results and predictions.	- Students will demonstrate understanding environment of wetland birds, ecological niche, and bird feeding mechanisms by performing an experiment and a bird search.
5. "K" Mart	4.2.1 Discuss the major nations of California Indians, including their geographic distribution, economic activities, legends, and religious beliefs;	- Introduction of Key Concepts regarding Kumeyaay lifestyle, their uses of plants and animals and the

	and describe how they depended on, adapted to, and modified the physical environment by cultivation of land and use of sea resources.	dependence of human activity upon diverse regions of Southern California.
6. Spirit of the Land	4.2.1 Discuss the major nations of California Indians, including their geographic distribution, economic activities, legends, and religious beliefs; and describe how they depended on, adapted to, and modified the physical environment by cultivation of land and use of sea resources.	- Students are taught about the Kumeyaay lifestyle and the coastal resources used by Kumeyaay.

**Table 2. Invert Investigators Unit**

<b>Lesson of the Day</b>	<b>CA Standards in Life Sciences</b>	<b>AQA Objectives</b>
1. Life on the Rocks	3.3b - Students know examples of diverse life forms in difference environments, such as oceans, deserts, tundra, forests, grasslands and wetlands	- Students are taught about the different habitats of the rocky seashore and the adaptations of the invertebrates that live there.
2. Invert Detectives	3.3a - Students know plants and animals have structures that serve different functions in growth, survival, and reproduction.	- Students are introduced to the different developmental stages of invertebrates specifically of crabs and learn their adaptations.
3. Invert Meet and Greet	Review of 3.3a and 3.3b	- In addition to learning the adaptations of invertebrates living in the rocky seashore, the different classifications or phyla are introduced.
4. Invert Insiders	Review 3.3a	- Introduction to dissection techniques, and to mollusk and echinoderm adaptations and structure

The second training follows in the middle of the unit and was about the thematic curriculum of the field trips and the community service projects. Together with lead instructors and other volunteers, we were brought by the program directors to the places where the trips and projects are going to be held so we can familiarize the areas that will hold the activities prepared on their scheduled dates. In Table 3 and Table 4, the CA Standards in Life Sciences and the Aquatic Adventures objectives are shown (Aquatic Adventures, Reference 4). These are the topics we discuss with the students during their field trips as well as their community service projects.

**Table 3. Wetland Avengers Field Trip**

<b>Field Trip Topic</b>	<b>CA Standards in Life Sciences</b>	<b>AQA Objectives</b>
Chula Vista Nature Center	<p>2.a – Students know plants are the primary source of matter and energy entering most food chains.</p> <p>3.a – Students know ecosystems can be characterized by their living and nonliving components.</p> <p>3.b – Students know that in any particular environment, some kinds of plants and animals survive well, some survive less well, and some cannot survive at all.</p>	- Students are reviewed about the wetland ecosystem interactions, wetland conservation, species identification and adaptations.

**Table 4. Invert Investigators Field Trip**

<b>Field Trip Topic</b>	<b>CA Standards in Life Science</b>	<b>AQA Objectives</b>
Rocky Seashore Exploration	<p>Review of 3.3a and 3.3b</p> <p>3.3c – Students know living things cause changes in the environment in which they live some of these changes are detrimental to the organism or other organisms, and some are beneficial.</p> <p>3.3d – Students know when the environment changes, some plants and animals survive and reproduce; others die or move to new locations.</p>	- Students are reviewed about the rocky seashore zonation and introduced to the quadrat sampling and the concept of diversity.

## B. Classroom Lectures and Activities – Field Trips and Community Service Projects

### 1. Wetland Avengers

The Wetland Avengers unit focuses on wetlands. Our local wetlands in the San Diego area are provided as examples. The students were introduced to the different concepts related to wetlands like the wetland ecosystem and its habitats as well as the different animals and native plants that could be found there.

Classroom lectures and activities were held once a week in each class. I was assigned to work every Wednesday and Friday, from 8am-12noon on this unit during the fall. I was assigned to work at 2 of the 3 schools mentioned in this paper that participated in the Wetland Avengers unit. On Wednesdays I went to Encanto Elementary and Fridays to Carson Elementary. Another participating school that I was not assigned to was Kimbrough Elementary. Every week, I visited about 3-4 classes, together with the lead instructor, on each of the days I was assigned.

Therefore, each class gets an hour of Aquatic Adventures every week. I was partnered with a lead instructor, who is employed by Aquatic Adventures to work during the classroom visits. There we begin each activity with a lecture where the 4<sup>th</sup> grade students had to gather around on the carpet to be closer to the instructor, making it easier to listen and ask questions. While the lead instructor is lecturing, I am in-charge of preparing the materials for the experimental activities for that day. Every lecture is coupled with hands-on experimental activity for students to practice what they have just learned during the lecture.

In the following table (Table 5) the topics discussed during the lectures are listed and the experimental activities are briefly summarized to give an overview of what we teach and provide for the students.

**Table 5. Wetland Avengers Lecture Topics and Experiments**

<b>Lesson of the Day</b>	<b>Lecture Topics</b>	<b>Experimental Activity</b>
1. Ecosystem Endangered	<ul style="list-style-type: none"> <li>• Wetland Ecosystem</li> <li>• Watershed</li> <li>• Wetland Habitats</li> <li>• Adaptations</li> <li>• Threatened vs. Healthy Wetlands</li> <li>• Different endangered species of animals and plants</li> </ul>	<ul style="list-style-type: none"> <li>• I created a replica of a wetland ecosystem for each class showing the different habitats of a wetland (uplands, salt marsh, sand dunes and tidal) and divided each habitat into a healthy and threatened wetland.</li> <li>• Using the materials I set-up on each table, students created</li> </ul>

		different plants and animals that live in each habitat as well as threats like trash that could pollute the habitat.
2. Why Wetlands	<ul style="list-style-type: none"> <li>• Functions of Wetlands</li> <li>• Importance of Wetlands</li> <li>• Scientific Method</li> </ul>	<ul style="list-style-type: none"> <li>• I set-up replica of wetlands using baking pans filled with soil. Each pair of students in the class get a healthy (with sponge and then plants) and threatened (no sponge) wetland.</li> <li>• Students in pairs tested how they can control flood and erosion by making it rain (pouring water from a flask) on the “wetlands”.</li> <li>• Students tilted the pans to collect water with a beaker and measured it in order to analyze which type of wetland is better.</li> </ul>
3. Wetland Web	<ul style="list-style-type: none"> <li>• Food chain/food web</li> </ul>	<ul style="list-style-type: none"> <li>• The first activity was when the class played wetland bingo (used pictures of animals and plants in the wetlands).</li> <li>• Their second activity was when the class was asked to find a “friend” (consumer, producer, herbivores, carnivores and omnivores) in the wetland through connecting yarns hence, making food webs.</li> </ul>
4. “K” Mart	<ul style="list-style-type: none"> <li>• Kumeyaay Indians.</li> <li>• Kumeyaay lifestyles and dependence on wetlands</li> <li>• Different wetlands around San Diego</li> <li>• Respect for wetlands and nature in general</li> </ul>	<ul style="list-style-type: none"> <li>• Students became Kumeyaay kids and traveled around different stations set-up in their classrooms.</li> <li>• Students were given journals to record the names of the plants and animals they gathered from the different stations.</li> <li>• The stations are the different wetlands found in San Diego.</li> </ul>
5. Bountiful Birds	<ul style="list-style-type: none"> <li>• Importance of wetlands to birds especially when migrating.</li> </ul>	<ul style="list-style-type: none"> <li>• Students were divided into groups of 3, each given a</li> </ul>

	<ul style="list-style-type: none"> <li>• Invertebrates and why birds eat them</li> <li>• Foods birds in wetlands eat</li> <li>• Different beak shapes and sizes of birds in wetlands</li> <li>• When birds eat the most, low tide vs. high tide.</li> </ul>	<p>different tool (clothespin = short beak, chopsticks=long beak, spoons=scoop beak) representing the different types of bird beak.</p> <ul style="list-style-type: none"> <li>• A mock wetland is again provided using a pan, this time filled with sand.</li> <li>• Different types of bird food are in the wetlands like invertebrates made of foams, sunflower seeds and marbles as fish.</li> <li>• Students were asked to be like birds by eating using their tools for 30 seconds and filling up their cups (stomach).</li> <li>• They were asked to eat during low tide (was announced) and stopped eating when high tide comes (after 30 seconds).</li> <li>• After the three times of eating, students were asked to count how many invertebrates, seeds and fishes they had in their cups and their results were shown in a table to be compared with the rest of the class.</li> </ul>
<p>6. Spirit of the Land</p>	<ul style="list-style-type: none"> <li>• Coastal resources used by Kumeyaay Indians.</li> </ul>	<ul style="list-style-type: none"> <li>• First activity was to make cordage for bracelets or necklaces.</li> <li>• I showed students other tools made by Kumeyaay Indians like spears and nets made by cordages and raffia.</li> <li>• Second activity was to make small pots or plates out of clay and paint them.</li> </ul>

The students are treated to a field trip so they could personally see and experience what they have been studying in their classrooms. The 4<sup>th</sup> grade students in all of the participating schools went to the Chula Vista Nature Center for their field trip. I worked with at least 1 lead instructor and three other volunteers on the days of the field trips. We prepared worksheets for the students

to work on during the trip. About 2-3 classes from the different schools participating in Aquatic Adventures would come in each day. We had to divide the students into four groups because of the four stations we had set-up for them to visit during the field trip. The groups rotated through the stations and each station had a separate activity for them to work on. We, the Aquatic Adventures instructors, had to start on different stations and spend about 15-20 minutes on each station before rotating to the next one. These activities serve as an additional hands-on learning experience besides the classroom experiments. I was able to lead a group on every field trip and in the table below (Table 6), the different stations are briefly discussed to show an overview of what the students and I had to do at each stations.

**Table 6. Wetland Avengers’ Chula Vista Nature Center Field Trip**

Station	Activity
Overlook/Touch Tanks (3 separate areas)	<ul style="list-style-type: none"> <li>● I lead my group to an overlooking kiosk up a ramp and discussed with them the history of the Nature Center.</li> <li>● The next kiosk down the ramp is the composting area. This is where I discussed and reviewed the concepts of recycling, reducing and reusing.</li> <li>● The last area of this station is the Shark and Ray tanks. This is where we introduced the importance of storm drains and how trash on the streets and other pollutants can kill these animals. The students were also able to touch the sharks and the rays with their science fingers (their pointer finger).</li> </ul>
Bird Aviary	<ul style="list-style-type: none"> <li>● Students were asked to identify the birds in the cages as part of reviewing what was introduced to them in their classrooms.</li> <li>● I asked them about their adaptations, which habitat they live in and what type of food they eat.</li> <li>● Students were asked to draw their favorite bird and write interesting facts about them on the worksheet provided.</li> </ul>
Bird Observation	<ul style="list-style-type: none"> <li>● This station is right outside of the nature center into the wetland or the shore.</li> <li>● Students were asked to answer questions on the worksheet provided about the different birds they would see with their binoculars. A bird key (pictures of birds) is provided to help them identify the birds.</li> <li>● I reviewed the curriculum about the birds’ eating habits</li> </ul>

	discussed in their classrooms to help them remember and answer the questions.
Scavenger Hunt	<ul style="list-style-type: none"> <li>• I lead the students through the field by following a trail.</li> <li>• The Scavenger hunt worksheet provided to them is filled with drawings of the different things we can find in a wetland and the students were asked to circle or cross out the things they actually saw during the hunt.</li> <li>• I also introduced to them the concept of salinity and how to use a refractometer. We tested how salty a pickle weed is using the refractometer.</li> </ul>

The community service project that concluded the Wetland Avengers unit was a restoration trip held in Dog Beach. The project was divided into two parts. The first part involved students with their worksheets once again working on 3 stations which were about water quality monitoring, plant monitoring and bird monitoring. The second part was restoring this threatened wetland back to a healthy wetland through planting more native species and cleaning the area by picking up trash. Again, on this trip I worked with a lead instructor and other volunteers. The restoration trip was similar to the field trip where we had to divide the students into 3-4 groups depending on how many classes there were during the day and the groups had to rotate through the stations. But unlike the field trip I was assigned to conduct the plant monitoring station only and then help out with the restoration. The table below (Table 7) describes a brief summary of the different activities we did during this restoration trip.

**Table 7. Wetland Avengers' Restoration Trip**

<b>Project</b>	<b>Activity</b>
Plant Monitoring Station	<ul style="list-style-type: none"> <li>• Monitor plants using a quadrat to see how much of the wetland is covered by native plants.</li> <li>• Discussed the importance of the native plants, what they need to grow, and how to make the wetland healthier.</li> <li>• Students measured plants that are in the quadrats. To measure, they have to estimate the amount of green plants, invasive species and clear spots or dirt by coloring in the quadrat in their worksheets.</li> </ul>
Water Quality	<ul style="list-style-type: none"> <li>• Discussed the importance of healthy water and how to prevent polluting it.</li> </ul>

Monitoring Station	<ul style="list-style-type: none"> <li>● Discussed what types of things we should be testing to monitor water quality.</li> <li>● Introduced the importance of nutrients (phosphates and nitrates) in the water.</li> <li>● Introduced the use of GPS.</li> <li>● Review of salinity.</li> <li>● Introduced the use of thermometer to test water temperature.</li> </ul>
Bird Monitoring Station	<ul style="list-style-type: none"> <li>● Discuss why there are many birds living in wetlands.</li> <li>● Review the different birds discussed in the classrooms and the different birds they saw during their field trips.</li> <li>● Review the different feeding habits of birds.</li> <li>● Used a binocular to find what types (diver, benthic picker or swimmer) of birds are present in the wetland.</li> </ul>
Restoration	<ul style="list-style-type: none"> <li>● Students were paired up and each pair was given a plant and a shovel so they can plant more native species on the wetland.</li> <li>● Students were asked to remove invasive species seen on the area.</li> <li>● Students picked up trash to clean the area using trash pickers, gloves and recycled plastic bags.</li> </ul>

## 2. Invert Investigators

In Winter Quarter I worked on the Invert Investigators unit teaching 3<sup>rd</sup> grade students. The main area this unit studies is the rocky seashore or tide pools. The local La Jolla tide pools are provided as examples. In this unit, the students were introduced to the many invertebrates living in the tide pools.

During the Invert Investigators unit I was assigned to work only in Carson Elementary on Fridays from 8am-12noon. There were two other participating schools that I was not assigned to: Encanto Elementary and Marshall Elementary. There were about six 3<sup>rd</sup> grade classes in Carson Elementary but since we only had four hours allotted to work on that day, which means only 4 classes can be accommodated, two of the smallest classes were divided into two groups and each group had to join a class that was accommodated by the program. The topics discussed during the lectures are listed below (Table 8) and the experimental activities are briefly summarized to give an overview of what we teach in this unit.

**Table 8. Invert Investigators Lecture Topics and Experiments**

<b>Lesson of the Day</b>	<b>Lecture Topics</b>	<b>Experimental Activity</b>
Life on the Rocks	<ul style="list-style-type: none"> <li>• Invertebrates vs. Vertebrates.</li> <li>• Different habitats or zones in the rocky seashore</li> <li>• Different invertebrates that live in the different zones of the rocky seashore</li> <li>• Low tide vs. High tide</li> <li>• Different adaptations of the invertebrates to eat, move and protect themselves</li> </ul>	<ul style="list-style-type: none"> <li>• I created a replica of rocky seashore identifying its different zones (splash, high tide, middle tide and low tide).</li> <li>• Students used the materials I set-up on their tables to make replicas of the different invertebrates that live in the habitat or zone assigned to them.</li> </ul>
Invert Detectives	<ul style="list-style-type: none"> <li>• Different stages of growth and development of invertebrates specifically of a crab</li> </ul>	<ul style="list-style-type: none"> <li>• Aquatic Adventures provided microscopes to be used by each table or team.</li> <li>• Using the slides provided they should be able to identify what the stage of development of the crab is and record answers in their Detective Clue Worksheets provided.</li> <li>• A jeopardy-like game was done at the end to test if the students were able to identify the characteristics of each stages of development of the crab.</li> </ul>
Invert Meet and Greet	<ul style="list-style-type: none"> <li>• Different phyla: Cnidaria, Mollusca, Echinodermata and Arthropoda.</li> <li>• Shared adaptations of the different invertebrates in each phylum.</li> </ul>	<ul style="list-style-type: none"> <li>• We brought in live animals for the students to see and touch.</li> <li>• Questions were asked about the animals to quiz if the students retained knowledge about what was taught to them in previous lectures.</li> </ul>
Invert Insiders	<ul style="list-style-type: none"> <li>• Dissection</li> <li>• Different parts of a sea star and a mussel</li> </ul>	<ul style="list-style-type: none"> <li>• Students in pairs were given one sea star and a mussel to dissect</li> <li>• Students were given a pair of scissors and a scalpel to use for dissection</li> <li>• They were asked to identify the parts of the animal and the functions of it to survive.</li> </ul>

The 3<sup>rd</sup> grade students in this unit went to La Jolla Cove for their field trip to visit tide pools. Again, I was with a lead instructor and three other volunteers. There were 2-3 classes each school per day so we divided them into four groups. Unlike the Wetland Avengers unit, this field trip is fairly simple and quick. We only had one activity for the students to do and for the rest of our time there we let students explore the tide pools to see and touch the animals they just learned about in their classrooms. Their major activity is to do a quadrat sampling, where they were asked to measure how many invertebrates are in the area. They were also introduced to the concepts of abundance and diversity.

The community service project that concluded the Invert Investigators unit was done around the schools. There were two main activities they had to do. First they had to paint the storm drains surrounding their schools. The importance and functions of storm drains were discussed to make the students aware of what's going to happen if they throw trash on the streets and the negative outcome it will cause to the invertebrates living in the ocean that they just learned about.

### C. SEA Series Evaluation of Assessment Forms

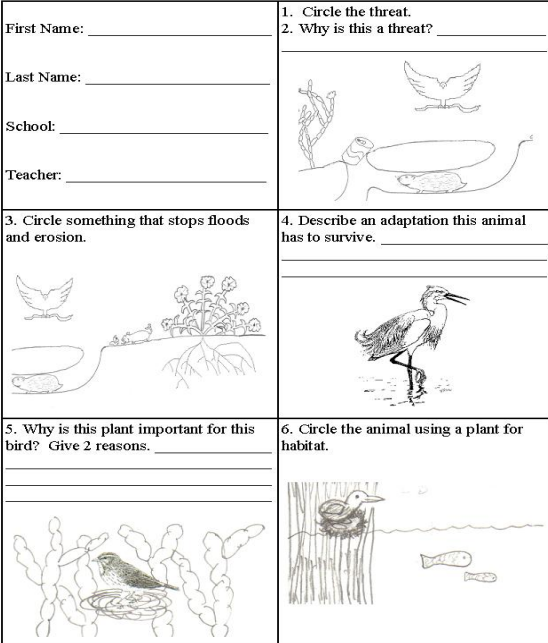
In order to study how well the students participating in the SEA Series program are learning about science, assessment forms are given to them. The assessment form is a quiz that the students take to test their knowledge on the material and their performance in the program as a whole. There are three assessment forms given to students throughout the units and they are all measured quantitatively. The goals and objectives of the assessment forms are to provide understanding of the general scientific principles, the nature of science and scientific inquiry, and to make students aware of environmental issues especially regarding wetlands.

The three assessment forms are given at different times. The Pre-Assessment is given before the implementation of the SEA Series curriculum, the Post Assessment is given during the last SEA Series visit or immediately following the SEA Series curriculum, and lastly the Retention Assessment is given two months following the completion of the SEA Series curriculum. The assessment forms are shown below in Figures 1 and 2 (Aquatic Adventures, Reference 5).

As part of my senior project, I was assigned to work on these assessment forms and help evaluate them. Once assessment forms were returned by the teachers, I grade them using a given answer key as a guide. When I am done with grading, the scores are entered into the computer using the MS Excel program to calculate the average scores of the students in each class and then in each school. Once averages are acquired the scores are evaluated through graphs.

**Figure 1. Wetland Avengers Assessment Form**

Wetland Avengers Assessment

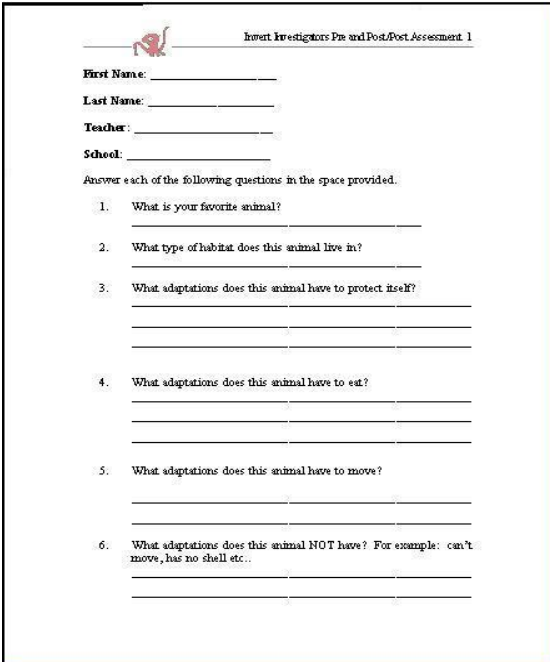


The form is titled "Wetland Avengers Assessment" and features a small bird logo in the top left. It is divided into six numbered sections:

- Section 1:** "1. Circle the threat. 2. Why is this a threat?" Includes a drawing of a bird, a frog, and a turtle.
- Section 2:** "3. Circle something that stops floods and erosion." Includes a drawing of a bird, a frog, and a plant with roots.
- Section 3:** "4. Describe an adaptation this animal has to survive." Includes a drawing of a bird.
- Section 4:** "5. Why is this plant important for this bird? Give 2 reasons." Includes a drawing of a bird and a plant.
- Section 5:** "6. Circle the animal using a plant for habitat." Includes a drawing of a bird, a fish, and a plant.

Each section has a corresponding text box for the student's answer.

**Figure 2. Invert Investigators Assessment Form**



The form is titled "Invert Investigators Pre and Post/Post-Assessment 1" and features a small bird logo in the top left. It includes a header section for student information:

**First Name:** \_\_\_\_\_  
**Last Name:** \_\_\_\_\_  
**Teacher:** \_\_\_\_\_  
**School:** \_\_\_\_\_

Below this is the instruction: "Answer each of the following questions in the space provided."

1. What is your favorite animal?  
\_\_\_\_\_
2. What type of habitat does this animal live in?  
\_\_\_\_\_
3. What adaptations does this animal have to protect itself?  
\_\_\_\_\_  
\_\_\_\_\_
4. What adaptations does this animal have to eat?  
\_\_\_\_\_  
\_\_\_\_\_
5. What adaptations does this animal have to move?  
\_\_\_\_\_  
\_\_\_\_\_
6. What adaptations does this animal NOT have? For example: can't move, has no shell etc...  
\_\_\_\_\_  
\_\_\_\_\_

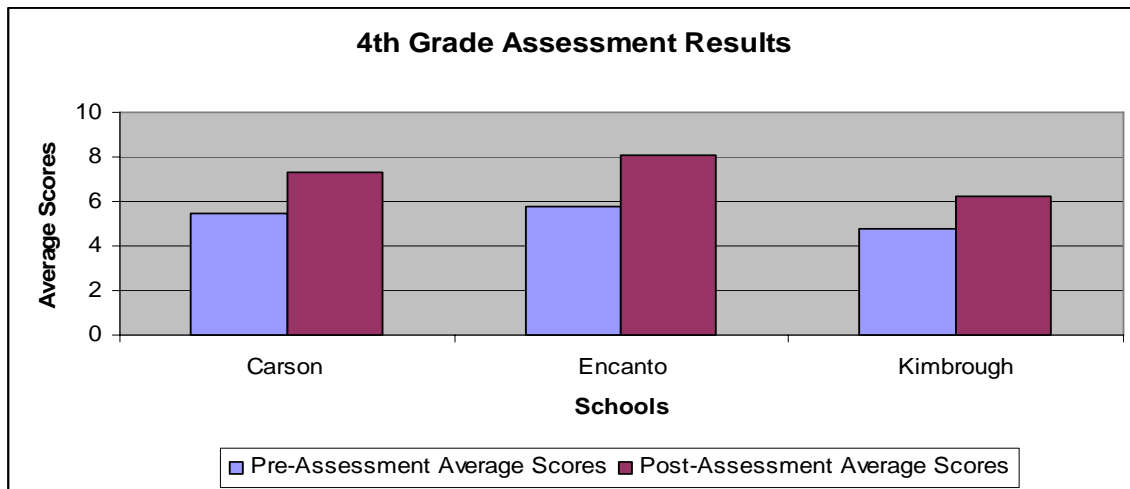
**RESULTS**

Through the assessment forms taken by the students, we will be able to figure out if there are improvements in their learning. The improvements evident throughout the figures below will tell us that the students were able to benefit from what Aquatic Adventures has imparted to them. The tables and graphs below show the results of the assessment forms from both the Wetland Avengers and Invert Investigators unit.

**A. Wetland Avengers Unit**

**Table 9. Quantitative Results of the Pre- and Post-Assessment forms from all three participating schools.**

Schools	Pre-Assessment Average Scores	Post-Assessment Average Scores
Carson	5.5	7.3
Encanto	5.8	8.1
Kimbrough	4.8	6.2



**Figure 3. Graph Representing Results from the 4<sup>th</sup> Grade Assessment Results.** All the different schools are combined to see how 4<sup>th</sup> grade students in general are able to show a great improvement in learning from AQA from the significant increase seen in the figure from the Pre-Assessment to the Post-Assessment forms. No Retention Assessment results are shown.

The wetland restoration in Dog Beach shows how students become environmentally aware during the program. This lets them practice on doing the right thing for the environment. The pictures below are taken by Aquatic Adventures in 2005.



Figure 4. Before and After Wetland Restoration taken in April 2005 and May 2005.

**B. Invert Investigators Unit**

Table 10. Quantitative Results of the Pre- and Post-Assessment forms from all three participating schools.

Schools	Pre-Assessment Average Scores	Post-Assessment Average Scores
Carson	3.4	4.1
Encanto	4.3	0
Marshall	3.2	4.1

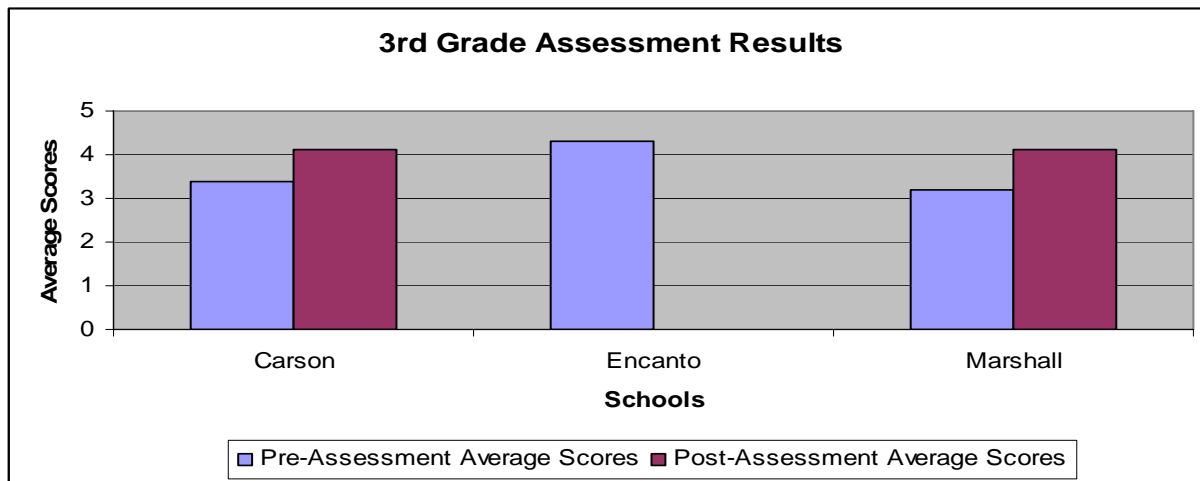
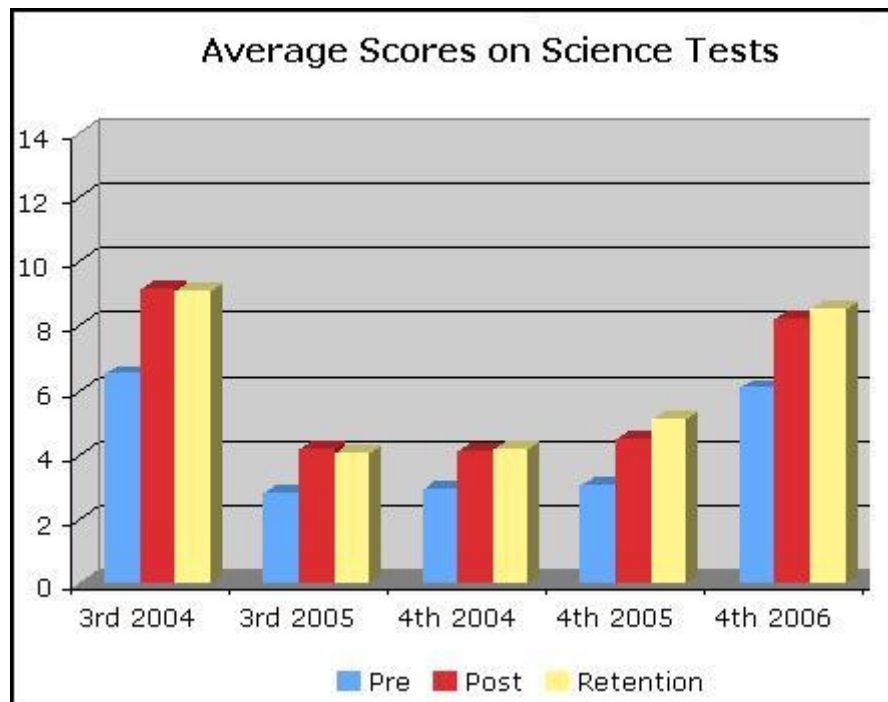


Figure 5. Graph Representing Results from the 3<sup>rd</sup> Grade Assessment Results. All the different schools are combined to see how 3<sup>rd</sup> grade students in general are able to show a great improvement in learning from AQA from the significant increase seen in the figure from the Pre-Assessment to the Post-Assessment forms in Carson Elementary and Marshall Elementary. Encanto Elementary has no Post Assessment results because the forms were not returned in time for the evaluation. Again, no Retention Assessment results because at the time of gathering data, the unit is not over yet.

I want to compare my results from the past years' assessment results in order to have an idea if Aquatic Adventures is indeed making an impact on these underserved youth. Are the students showing an increase in learning before and after the program? Are they retaining what they have learned from Aquatic Adventures once the program is over? And if they are, has it been the same over the past years? Table 11 and Fig. 6 (Ruzic, Roxanne. *Aquatic Adventures Students Analysis*, April 2006) show a comparison of the evaluated assessment forms from 2004 until the present.

**Table 11. Comparison of Assessment forms from 2004 to 2006 (Roxanne Ruzic, April 2006)**

Summary of Quantitative Science Assessment Data						
Table 1: Average scores on science pre, post, and retention assessments, 2004-2006.						
Students in each sample	Pre average	n	Post average	n	Retention average	n
3 <sup>rd</sup> grade: all students who took pre test; all students who took post test; all students who took retention test (2004)	6.50	169	9.18	133	9.11	19
3 <sup>rd</sup> grade: all classes that took both pre and post tests; retention is all classes that took both retention and post test (2005)	2.78	273	4.16	117	4.07	46
3 <sup>rd</sup> grade: all classes that took pre and post tests (2006)	3.35	127	4.21	130	No data yet	
4 <sup>th</sup> grade: all students who took pre test; all students who took post test; all students who took retention test (2004)	2.95	369	4.12	175	4.18	141
4 <sup>th</sup> grade: all classes that took both pre and post tests; retention is all classes that took both retention and post test (2005)	3.04	165	4.47	167	5.14	113
4 <sup>th</sup> grade: all students who took pre, post, and retention tests (2006)	6.07	55	8.21	55	8.51	55



**Figure 6. Average scores of the Assessments forms in 3<sup>rd</sup> and 4<sup>th</sup> grade students from 2004-2006.** This graph is made in relation to Table 11. This evaluation does not include the results of the 3<sup>rd</sup> grade in 2006. Also, this data shows the result from the 4<sup>th</sup> grade 2006 Retention Assessment forms that I was not able to include in my own evaluation process. (Roxanne Ruzic, April 2006)

## **DISCUSSION**

The graphs in the previous figures show the results of the average assessment scores of all the different participating schools. All the average scores of each class in each school are combined to represent one graph for the whole unit.

In the Wetland Avengers unit, there is an increase from the Pre-Assessment scores to the Post Assessment scores in all the three participating schools as shown in Fig. 3. There are no Retention Assessment scores shown because only three out of twelve teachers in all the schools returned the forms during the time I collected my data and evaluated my results. I could not get an accurate result without all of the Retention forms, so together with my supervisor Lindsay, we decided to evaluate what we have during the time, which were the Pre-Assessment and Post Assessment forms only. But in Table 11 and Fig. 6, Lindsay, together with another Aquatic Adventures staff, Roxanne Ruzic, was able to get a result for the Retention scores of the 4<sup>th</sup> grade Wetland Avengers unit. I was informed that they were able to obtain the rest of the forms from the rest of the teachers in time for the organization's yearly report. Aquatic Adventures creates a report to show success in fulfilling their mission through the evaluation of the student assessment forms and surveys as well as teachers' surveys to get their funding and grants. Fig. 6 shows that the 2006 result in the Wetland Avengers unit is a good representation of how well the organization is doing, since there is an increase from the Pre-Assessment scores to the Post-Assessment scores and a slight increase in the Retention Assessment scores. This information states that the students retained what they have learned from Aquatic Adventures two months after their participation in the program.

We see the same results in Fig. 5, representing the Invert Investigators unit. There is an increase from the Pre-Assessment scores to the Post-Assessment scores with the two schools, Carson and Kimbrough Elementary. However, Encanto Elementary did not return any Post-Assessment forms

by the time I collected my data, hence, no result is shown in the graph. There was also no Retention Assessment scores collected from all the schools for the Invert Investigators unit shown in Fig. 5 because the program was just finishing up during our evaluation process.

So, the results shown through the graphs (Fig. 3 and Fig. 5) for both units indicate an increase from the Pre-Assessment to the Post Assessment scores. This increase definitely says that Aquatic Adventures has had a positive role in each student's learning about marine sciences. Comparison between Pre-Assessment to the Post Assessment says that the students learned from Aquatic Adventures and the knowledge they have acquired resulted to positive actions towards the environment. The students become more environmentally aware as they went out to the field and planted more native species in the wetlands, painted storm drains and picked up trash quite willingly.

When comparing the results from the previous years starting from 2004, Aquatic Adventures has obviously been doing a great job in fulfilling its mission to the community by helping the underserved youth in low-income schools. The students not only benefited from the program, but did so consistently each year. Referring to Fig. 6, the average scores on the Post-Assessment tests are higher than the Pre-Assessment tests, in every case. In addition, the average scores on the Retention Assessment tests were about the same or just slightly higher or lower than the Post-Assessment tests (Roxanne Ruzic, April 2006) showing that it is definitely better to shape younger minds because of their sponge-like ability to absorb information.

There were also challenges that this project opened up. First, regarding the teachers, there was a lack of cooperation from most of them because not all the assessment forms were returned on time for the evaluation. This behavior results to getting inaccurate results, or having no data to work with at all. Based on my observations in our classroom visits, field trips and community service projects, only a number of teachers participate with the student's learning process. They are mostly there to

facilitate their student's behavior. However, some teachers make extra effort by posting vocabulary words in their classrooms, and making extra time reviewing what we went over in our classroom visits. This could also explain why the other schools' average scores on the assessment tests are higher because the student's are continuously learning even without Aquatic Adventures. I believe that the teacher's cooperation and participation in all our proposed activities is a key to a student's success in the classroom and in the community. Second, with regards to the students, many are English learners and this obviously hinders their own learning of the material. Many would need a classmate or a teacher to help them translate questions asked from the assessment forms. Therefore to better communicate with many of our underserved youth in the low-income schools, Aquatic Adventures employs instructors who can speak in another language to communicate with many of the ESL students participating in the program. Third, since Aquatic Adventures is still a fairly new organization they are still ongoing development in terms of their curriculum and organization of teaching. They change their curriculum every year when mistakes are being brought up or to accommodate the students learning in an easier or better way. In terms of the assessment forms, Aquatic Adventures changes how many points are given to each questions or how many total points are given. In Fig. 6 for example, in the 3<sup>rd</sup> grade Invert Investigators unit in 2004, the average scores are surprisingly higher compared to the average scores in 2005. I was informed that total points given in 2004 in the Invert Investigators unit was 10 but that was changed to 6 total points the following year until now.

## **CONCLUSION**

In an attempt not to reiterate what has just been discussed, I provide my final 3 points as I try my best to answer my own questions in the beginning of the paper. First, are the curriculum and methods of teaching implemented by Aquatic Adventures an effective way to promote learning to underserved students of San Diego? Yes. The intimate classroom setting where students can gather

around the instructor during lecture, their involvement during hands-on activities, and their inquisitive attitude and excitement during educational field trips clearly shows the effectiveness of the program before we even get the test scores.

In conjunction to that, I then ask whether or not the program helped the students acquire a more positive attitude and concern towards the environment. Besides their enthusiasm during instruction, their cooperativeness during community service and willingness to help says that they do. This is a perfect case when we can take advantage of a child's curiosity in a very positive way. For example, a child can either be a fascinated collector of spiders or be afraid of it and kill it. Here it is obvious which child more closely resembles the students' attitudes. Going back to the assessment forms showing the amount of information retained in the students, I believe that hardly any information would be retained if, for during the whole time Aquatic Adventures was with them, either no interest was shown at all. Apparently, it is quite the opposite.

Lastly, I ask, "What should we do next?" Build a habit. Their teachers should refresh their students' memory by continue to challenge the young ones with science. Parents should do the same, mostly by encouraging their sons and daughters to maintain environmentally sound practices, and by being examples of it. They might also take their children to revisit places where they had the field trips or engage in nature tours. And of course, the community should continue to support organizations such as Aquatic Adventures, thus enabling them to continue what their doing that, in the long run, would create positive returns for the community.

Aquatic Adventures is fulfilling its mission to serve low-income schools around San Diego as it clearly shows from the evaluation of the assessment scores, although there is always room for improvement since the organization is fairly new. But with a strong and stable mission it can accomplish its goals in educating the youth about science and making them more environmentally

aware individuals. My internship at Aquatic Adventures made me realize how education is very important. Learning about science and the environment at a very young age can make a difference allowing individuals to grow into more responsible adults. For many of these underserved youth, Aquatic Adventures gives the privilege to experience learning marine science at its fullest, most especially by positively altering their attitudes towards the environment. Educating our youth can really help save the environment.

### **ACKNOWLEDGEMENTS**

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