

PPBEP COMMUNITY GRANT FINAL REPORT FORM

Agreement No.:	FY2023-02		
Grantee Name:	Santa Rosa County School District / Navarre Beach Marine Science Station		
Grantee Address:	8638 Blue Heron Ct. Navarre Beach, FL 32566		
Grantee's Representative:	Charlene Mauro	Telephone No.:	850-449-4295
Project Title: Empowering Students to Take Action: Aquatic Care Team			
Please submit any high-resolution photos related to the project, if available (include photo credit for possible use by PPBEP for use in our e-newsletter, annual report, social media, or website) with your report as image files to mtross@ppbep.org.			

1. **RESULTS:** Describe the progress made toward the goals and objectives as stated in the funded grant application.

2. **IMPACT:** Summarize the organization's key evaluation results related to the funded grant (number of people reached, samples taken, etc.):

3. **SUCCESSSES AND CHALLENGES:** Describe the significant successes and challenges the organization experienced related to the funded grant.

4. **LESSONS LEARNED:** Describe what the organization learned based upon the results, successes, and challenges reported. Address programmatic, evaluative, or organizational changes that will be made based upon these lessons learned.

This report is submitted in accordance with the reporting requirements of Agreement No. FY2023-02 and accurately reflects the activities associated with the project.



Signature of Grantee's Representative

5/31/2023

Date

Charlene Mauro, Director, Navarre Beach Science Station

Print Name and Title

PPBEP COMMUNITY GRANT FINAL REPORT FORM

1. RESULTS: Describe the progress made toward the goals and objectives as stated in the funded grant application.

Summary

Our primary objectives for the PPBEP Community grant period were that Aquatic Care Team students would:

- Learn about factors that impact water quality in a watershed
- Teach younger students
- Learn to use equipment, follow protocols, and input data
- Communicate their findings to a larger audience
- Take on leadership roles at Navarre Beach Marine Science Station

Throughout the school year, ACT students continued to meet these objectives as outlined in the five tasks below.

PROJECT TIMELINE: The tasks must be completed by the corresponding task end date and all deliverables must be received by the designated due date.

Task/Deliverable	Start Date	End Date	Deliverable Due Date
Task 1: Project Pre-Test	October, 2022	October 31,2022	November 5, 2022
Task 2: Bi-weekly sampling at 6 target sites	October, 2022	May, 2023	May 20, 2023
Task 3: ACT integration visiting school groups	October, 2022	May, 2023	May 20, 2023
Task 4: Students present to key stakeholders	March, 2023	May, 2023	May 31, 2023
Task 5: Project Post-Test & Evaluation	May, 2023	May, 2023	June 15, 2023

Task 1: Project Pre – Test interest Survey

Task 1 Description: Survey 40 students (2 classes) to assess their general knowledge of water quality.

Task 1 Deliverables: Pre –Test Results

All NBMS high school students took an anonymous pre-/post-test (Attachment 1). These tests were designed to measure personal knowledge on water quality and watershed-related topics, basic scientific terms (identify variables), and evaluate personal behaviors and engagement in environmental advocacy. We found a marked improvement in their pre- vs post- test scores for the evaluation of their knowledge. The average for the pre-test was 73% while the post-test was

92%. We saw a nearly 20% increase in student knowledge, which surpassed our 15% increase goal.

Task 2: Bi – Weekly Sampling at 6 target sites

Task 2 Description: Students will record data such as dissolved oxygen and key nutrient concentrations at 6 sites. Collected information will be entered into GCOOS database.

Task 2 Deliverables: Data Sheets # of data collection activities and analyses conducted

Task 2 Performance Measure: 100% collected data will be submitted to [GCOOS database](#)

Over the course of the project, water quality samples were taken a total of 36 times at six sampling sites throughout Santa Rosa County, from October 2022 to May 2023. A major goal of this task was to establish a water quality baseline to include nutrient data for Santa Rosa Sound. Students learned how to perform various water quality sampling methods including taking Secchi disk measurements, using the Hanna multi-probe meter, and taking subjective field observations (assessing cloud cover, wind direction, etc.).

Communication about the ACT program, water quality monitoring, and microplastics have been uploaded to our website in order to inform the public about the efforts of our ACT program. These pages can be viewed at: <https://www.navarrebeachmarinesciencestation.com/microplastics> and <https://www.navarrebeachmarinesciencestation.com/water-quality>.

Task 3: ACT project integrated into visiting school group programs

Task 3 Description: Students lead (1) field trip visit per week at NBMSS to include watershed awareness and importance of water quality.

Task 3 Deliverables: Curriculum integrating water quality importance & School Group Schedule

Task 3 Performance Measure: 1200 area students will attend a program on-site to include a watershed component.

Two stations relating to our grant are part of the field trips to the NBMSS, *Be the Biologist: Field Investigations* and *Marine Biodiversity*. Please see the attached lesson plans for curriculum details. The students enrolled in the marine science program lead these field trips as part of the NBMSS' "learn, do, teach" model.

Throughout the grant period, approximately **1,743** students attended field trips at NBMSS and learned about water quality. We superseded our goal as we had initially anticipated reaching 1,200 students.

Student Stand Outs – Eight students have returned as second-year students, mentoring their peers who are taking the class for the first time. Second-year students assisted in getting first-year students involved in ACT as well as educating them on how to teach stations. During one school year, former ACT students returned to the science station and taught new students how to use equipment and properly record data. Some of the instruction was provided via videos created by a former ACT student, Samuel Palmer, in which he provided detailed and guided instruction on how to properly use, clean, and store the equipment. These videos are available on our [YouTube channel](#).

Task 4: Student Presentations

Task 4 Description: ACT students will attend (1) outreach event or symposium and present their findings to the Santa Rosa County Board of County Commissioners.

Task 4 Deliverables: Agenda and outline of key talking points for presentation.

One of our goals during the grant period was for students to increase their ability to effectively communicate scientific information to a broader audience. To facilitate this, we had guest lecturers in the scientific field give presentations to the students on not only their area of expertise, but effective scientific communication.

Unfortunately, we did not receive our YSI equipment until May. Students will collect data and present to community stakeholders next year.

However, upon receiving the equipment, our student team created a [presentation outlining importance of water quality monitoring and protocols](#).

Task 5: Project Post-Test & Evaluation

Task 5 Description: Survey 40 students (2 classes) to assess their general knowledge of water quality.

Task 5 Deliverables: Test Results, Student Reflections

Task 5 Performance Measure: Students will show a 15% gain in knowledge as related to water quality data collection and importance of protecting local estuarine environments.

Our project evaluations were completed during the grant period using the following methods:

[ACT/NBMSS student pre-/post-tests \(Attachment 1\)](#)

[ACT/NBMSS student impact surveys \(Attachment 2\)](#)

2. IMPACT: Summarize the organization's key evaluation results related to the funded grant (number of people reached, samples taken, etc.):

Participant Output Tables:

Student Audiences

School	Address	Number of Students Reached During this Reporting Period	Cumulative Number of Students Reached for this Project
Central School	6180 Central School Rd, Milton, FL 32570	75	75
Holley-Navarre Intermediate School	1936 Navarre School Rd, Navarre, FL 32566	390	465
S.S. Dixon Intermediate School	5540 Education Dr, Milton, FL 32571	320	785
Chumuckla Elementary	2312 County Rd 182, Jay, FL 32565	17	802
Oriole Beach Elementary	1260 Oriole Beach Rd, Gulf Breeze, FL 32563	150	952
Jay Elementary	13833 S Alabama St, Jay, FL 32565	170	1122
W. H. Rhodes Elementary	5563 Byrom St, Milton, FL 32570	251	1373
East Milton Elementary	5156 Ward Basin Rd, Milton, FL 32583	93	1466
Pace High School	4900 Berryhill Rd, Milton FL 32570	20	1486
Bennett Russell Elementary	3740 Excalibur Way, Milton, FL 32583	120	1606
East Bay K-8 School	2533 Elkhart Dr, Navarre, FL 32566	137	1743
Total			1743

Project Totals

Audience	Cumulative number of individuals reached for entire project period
k-5 Grade Students	1723
9 th -12 th Grade Students	70 (including Pace High School)

Throughout the grant period, approximately **1,743** students attended field trips at NBMSS and learned about water quality. We superseded our goal as we had initially anticipated reaching 1,200 students.

Over the course of the project, a total of **36** data sets were collected at 6 sites throughout Santa Rosa County, from October 2022 to May 2023. A major goal of this task was to establish a water quality baseline to include nutrient data for Santa Rosa Sound. Students learned how to perform various water quality sampling methods including taking Secchi disk measurements, using the Hanna multi-probe meter, and taking subjective field observations (assessing cloud cover, wind direction, etc.).

Our project evaluations were completed during the grant period using the following methods:
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[ACT/NBMSS student impact surveys \(Attachment 2\)](#)

All NBMSS high school students took an anonymous pre-/post-test (Attachment 1). These tests are designed to measure personal knowledge on water quality and watershed-related topics, basic scientific terms (identify variables), and evaluate personal behaviors and engagement in environmental advocacy. We found a marked improvement in their pre- vs post- test scores for the evaluation of their knowledge. **The average for the pre-test was 73% while the post-test was 92%. We saw a nearly 20% increase in student knowledge, which surpassed our 15% increase goal.**

However, we also wanted to gauge how participation impacted our NBMSS students. Our student impact survey (Attachment 2) was divided into two sections: students who routinely participated in ACT water quality testing, and students who did not participate in water quality testing but still taught visiting students. Results of the student impact survey indicated that, overall, participation in ACT increased understanding of watershed-related issues, personal stewardship, and desire to pursue advanced schooling. Students who participated in ACT expressed greater interest for careers in science.

In addition, fewer formal assessments of ACT students. Students' ability to communicate findings was measured by their participation in public presentations, participation in symposiums, and data input as well as data management.

Science station students participated in four outreach events where they communicated watershed-related information to the community successfully and with positive feedback. These events were geared toward all ages and as such, students had to adapt their knowledge in ways that all ages could comprehend the information they were given.

ACT students were tasked with recording, inputting, and managing water quality data. Students had to record data using field data sheet. From there, they had to compile the data into a spreadsheet GCOOS to access and use. In addition, they had to archive the datasheets at the station in a formatted binder so the datasheets would be accessible for years to come.

3. SUCCESSES AND CHALLENGES: Describe the significant successes and challenges the organization experienced related to the funded grant.

SUCSESSES

One outcome we did not set a goal for or formally evaluate was our students' hours of stewardship with ACT. Students have put in approximately 720 hours toward water quality, outreach events, and data management.

We anticipate that as our water quality project continues to expand, our students will continue to provide meaningful scientific data on Santa Rosa Sound to the local community. Students will give further presentations to the Santa Rosa School Board as well as the Board of County Commissioners on their new findings as they collect new data. We hope that through the effort of the science station students, environmental policy for Santa Rosa Sound will include additional scientific data collected and provide to the community.

CHALLENGES

Unfortunately, our YSI equipment was on back order and did not arrive until April. Our students had to quickly teach themselves and their teacher. We only have one set of nutrient data. Because of the lack of data, we were not able to present to the Board of County Commissioners. We plan on presenting our findings next year. Thankfully, PPBEP was understanding.

4. LESSONS LEARNED: Describe what the organization learned based upon the results, successes, and challenges reported. Address programmatic, evaluative, or organizational changes that will be made based upon these lessons learned.

The PPBEP Community Grant has provided many students, both in elementary school and high school, the chance to learn more about their local watershed and get hands-on experience with water testing equipment. The creation of our ACT program has also allowed us to teach the public through outreach events so they can become better informed on what happens in the Santa Rosa Sound. As the grant ends, the programs it created will continue in a modified format.

Our Aquatic Care Team will continue monthly water quality testing of various local sites. Throughout continued partnership with GCOOS, we will continue to build a robust database of water quality testing for Santa Rosa Sound that is available for public usage at any time. The high school students that come to the station and participate in ACT will also continue to gain hands-on experience with data collection and analysis. We have seen our students take action to expand the ACT program on their own. From choosing new testing sites to expanding their microplastic sampling techniques, ACT has inspired students to pursue their own avenues of research using the equipment provided by the PPBEP grant. We firmly believe that future students will continue this pattern of exploration through research as our ACT program continues. As these same students gain confidence in their knowledge of water quality, they become voices in the community, speaking up for the marine environment in Santa Rosa Sound. They want to share what they have learned through educational public classes and through public forums, such as county commissioner meetings.

Other - please see the following attachments/links:

Attachment 1: ACT/NBMSS student pre-/post-tests
Attachment 2: ACT/NBMSS student impact surveys
Attachment 3: Be the Biologist: Field Investigations Curriculum
Attachment 4: Marine Biodiversity Curriculum

[ACT Field Data Form](#)

[ACT Data Spreadsheet – updated to include nutrient data](#)

[Navarre Beach Marine Science Station Complied Student Water Quality Monitoring Data](#)

[ACT water quality monitoring project page on our website](#)

[ACT training videos created by student Samuel Palmer](#)

[Photos of the PPBEP community grant water quality monitoring project](#)

NOAA B-WET Water Quality Pre/Post-Test

1. A watershed is land area that drains precipitation from _____ elevations to _____ elevations via rivers, streams, and creeks and eventually to oceans.
 - a. Higher, lower
 - b. Lower, higher
2. Which of the following might be found in a watershed?
 - a. River
 - b. Cities
 - c. Farms
 - d. Streams
 - e. All of the above
3. Which of the following is NOT a water quality parameter?
 - a. Runoff
 - b. Salinity
 - c. Turbidity
 - d. Dissolved oxygen
4. What is this scientific tool? (Image of Secchi disk)
 - a. Secchi disk
 - b. Turbidity meter
 - c. Multiparameter meter
 - d. TDS tester
5. What is this scientific tool? (Image of multiparameter tool)
 - a. Secchi disk
 - b. Turbidity meter
 - c. Multiparameter meter
 - d. TDS tester
6. Which is the independent variable? (Graph of data)
 - a. Year
 - b. Anomaly (degrees F) relative to 20th century average
 - c. Annual Global Temperature
7. T/F: An excess of nutrients added to a water body can lead to eutrophication.
 - a. True
 - b. False
8. What is the name of the watershed in which we live?
 - a. Mississippi Watershed
 - b. Pensacola Bay Watershed
 - c. Santa Rosa Watershed
 - d. Floridian Watershed
9. Which of the following is a point-source pollutant?
 - a. Pesticides
 - b. A leaking septic tanks
 - c. Fertilizers
 - d. Runoff
10. Dissolved oxygen _____ during an algal bloom
 - a. Decreases
 - b. Increases
 - c. Remains unchanged

ACT/NBMSS Student Impact Survey			
Directions: This survey is to measure the impact that participation in the NOAA B-WET program has had on you. When considering your response, note that an “increase” is defined as a 10% or greater change in behavior/attitude than you had prior to participating in the ACT program this school year.			
Question	Answer Options	Responses	
		Non-ACT students (27)	ACT students (14)
1. After participation in the program, my understanding of our local watershed increased.	A. 1 – strongly disagree B. 2 – disagree C. 3 – neutral D. 4 – agree E. 5 – strongly agree	A. 0 B. 0 C. 0 D. 10 (37%) E. 17 (63%)	A. 0 B. 0 C. 0 D. 0 E. 14 (100%)
2. After participation in the program, my personal level of environmental concern/active stewardship efforts in protection of our local watershed have increased.	A. 1 – strongly disagree B. 2 – disagree C. 3 – neutral D. 4 – agree E. 5 – strongly agree	A. 0 B. 0 C. 1 (4%) D. 12 (44%) E. 14 (52%)	A. 0 B. 0 C. 0 D. 4 (29%) E. 10 (71%)
3. After participation in the program, my involvement in science-based civic activities (i.e., outreach events, beach clean-ups) has increased.	A. 1 – strongly disagree B. 2 – disagree C. 3 – neutral D. 4 – agree E. 5 – strongly agree	A. 0 B. 0 C. 1 (4%) D. 12 (44%) E. 14 (52%)	A. 0 B. 0 C. 1 (7%) D. 5 (36%) E. 8 (57%)
4. After participation in the program, my feeling that citizen science environmental monitoring projects are valuable to local decision makers has increased.	A. 1 – strongly disagree B. 2 – disagree C. 3 – neutral D. 4 – agree E. 5 – strongly agree	A. 0 B. 0 C. 0 D. 17 (62%) E. 10 (37%)	A. 0 B. 0 C. 2 (14%) D. 2 (14%) E. 10 (71%)
5. After participation in the program, my desire to pursue advanced schooling in a science-related field has increased.	A. 1 – strongly disagree B. 2 – disagree C. 3 – neutral D. 4 – agree E. 5 – strongly agree	A. 0 B. 2 (7%) C. 10 (37%) D. 8 (30%) E. 7 (26%)	A. 1 (0) B. 0 (0) C. 3 (21%) D. 6 (43%) E. 5 (36%)
6. My desired career is _____.		<ul style="list-style-type: none"> ● Possibly something in marine biology ● Computer engineering 	<ul style="list-style-type: none"> ● Veterinarian ● Computer engineering ● Oceanography ● Environmen

Attachment 2

		<ul style="list-style-type: none"> ● Nursing ● Pilot ● Marine scientist ● Charter boat captain ● Historian ● Meteorology ● Something that deals environmental science ● Marine biology teacher ● Orthodontist ● Engineering ● Military ● In the Navy ● Medical ● Veterinary medicine ● Software development and aerospace industry ● Undecided ● Biologist ● Aviation ● Marine rehabilitation ● Law ● Physician assistant ● Programmer ● Mechanic ● Engineer ● Marine science 	<ul style="list-style-type: none"> tal conservationist ● Civil engineer ● Biologist at an aquarium ● Animal care specialist ● Wildlife biology ● Scientific researcher ● Nursing ● Pilot ● Software engineer ● Marine biology ● Psychology
7. After participation in the program, my desire to spend	A. 1 – strongly disagree B. 2 – disagree	A. 0 B. 0	A. 0 B. 0

Attachment 2

time outdoors has increased.	C. 3 – neutral D. 4 – agree E. 5 – strongly agree	C. 7 (26%) D. 4 (30%) E. 12 (44%)	C. 1 (7%) D. 7 (50%) E. 6 (43%)
8. I feel that the greatest impact this program had on me was the ____.	A. formal education (dual-enrollment marine science course, guest lectures) B. field experiences (both during field trips and/or water quality monitoring) C. mentoring received by prior NBMSS students D. mentoring given to student field trip attendees through teaching at stations	A. 7 B. 8 C. 1 D. 11	A. 0 B. 11 C. 0 D. 3
9. After participation in the ACT program, I have increased communication with my family/community about the importance of taking measures to protect our watershed.	A. 1 – strongly disagree B. 2 – disagree C. 3 – neutral D. 4 – agree E. 5 – strongly agree	A. 0 B. 1 (4%) C. 5 (19%) D. 11 (41%) E. 10 (37%)	A. 0 B. 0 C. 0 D. 7 (50%) E. 7 (50%)
10. I would recommend the ACT project to my peers.	A. Yes B. No	A. 23 (85%) B. 4 (15%)	A. 14 (100%) B. 0



BE THE BIOLOGIST: FIELD INVESTIGATIONS (5th Grade)

SUPPLIES (located in outdoor shed, downstairs area, microscope room)

- | | | |
|--|--|---|
| <ul style="list-style-type: none"> • bucket of water shoes • dip nets • seine net • plankton nets (4) • yabby pumps (2) • metal mesh sieves/sifters (2) • aerator & bucket • ROVs & water sample bottles | <ul style="list-style-type: none"> • Water quality equipment (YSI, testers) • water cooler • folding table (carry it down to beach) • Aquavue underwater viewers (3) | <p>If kayaking add:</p> <ul style="list-style-type: none"> • Life vests • Paddles • Kayaks |
|--|--|---|

If **kayaking**, split to students into **two groups** – half will start with kayaking, half will start with the remaining portions of the station below, then switch.

SET UP (on the beach near sound)

1. Set up the 3 mini stations on the beach – usually seine net is on the furthest end to give the most space.
2. Unroll the seine net and set it on the beach near the water
3. Place the dip nets, yabby pumps, and metal sifters together at one station
4. Place the plankton nets at another station, and put the binoculars further up the beach near this station
5. Put the bucket of water shoes up on the beach near where you have the kids line up
6. Set up the table nearby and place the water cooler on it

*Decide which mini station within Be the Biologist: Field Investigations station that you will be responsible for:

- Seine net
- Dip nets, plankton nets, yabby pumps (best with 2 people)
- Water quality

TEACHING OUTLINE & INFO

IMPORTANT: This station has important information for the POST TEST that students take after their visit. *Make sure that this info is taught! (See below for more complete info.)*

- Estuaries – what they are and their importance
- What a watershed is and the name of our local one
- Why sand dunes are important
- What plankton are, why phytoplankton are important (oxygen & base of food web)
- Scientists do not only do lab experiments – field observations are another way to gather data

As a Group:

1. Walk the kids down the boardwalk to the beach and have them line up **shoulder-to-shoulder**.
2. Welcome them to the estuary! Introduce yourself and tell them what your favorite animal is. 😊
3. Introduction/Discussion (5 minutes): Cover the following information here AND throughout the mini stations:

What is an estuary?

- Where saltwater from the ocean **mixes** with freshwater from rivers
 - We have rivers and creeks in the area (maybe you have some by your house!) and they empty into this estuary, which is called the **Santa Rosa Sound**.

Why are estuaries important?

- They are a **habitat** for many plants and animals, **which is the place in the environment where they live**
- Estuaries are a **nursery** for many kinds of fish, keeping them safe as babies.
- They help **filter** the water, making it cleaner
- They also contain **phytoplankton**. Phytoplankton are microscopic organisms – you can't see them without microscopes, but they are SUPER important because they help us breathe! Phytoplankton are responsible for making over 50% of the oxygen we breathe through photosynthesis!

What is a watershed? What affects a watershed?

- When it rains, does all the rain just stay on the surface of the Earth? No! Where does it go? When it rains, the rain drains off of the land into nearby bodies of water like this estuary! We call these areas of land where the rain drains from **watersheds**. Our local watershed is called the **Pensacola Bay Watershed**.
- Most of the pollution in the ocean is caused by **runoff**, which is the rain washing pollution from our streets and lands and then draining into waterways and **eventually reaches the ocean**.
- If all of the rainwater washes pollution into rivers and streams by our homes, that means that even if we don't live right by the ocean, **ALL of us still can affect the ocean with our litter and pollution**.

What are sand dunes and why are they important?

- Have students spin around and look behind them at the **dunes**. Explain that these are very important to our habitat because the roots of the grasses hold together the ground, making them stronger. The dunes and this barrier island **protect the mainland**, especially when hurricanes hit.
- Explain that we must not climb on or pull the grasses – it's important that the dunes remain intact.

Scientists and Field Investigations

- So, we just told you all sorts of important information about our local ecosystem. But, how do we know all of this? Through scientific investigations and observations!
- What are **observations**? Information gathered using your 5 senses. Ask them to make some observations around them. Are there sometimes things that we can't sense, but that still exist? Pause – let them think about this! 😊 Lead them to things that are microscopic (beyond our eyesight's capability). Explain that scientists use scientific tools that allow them to continue to make observations even beyond what we normally can do with our senses. They will get to do this when they take measurements of certain aspects of the water, such as how much salt is in it, using scientific tools.
- Main idea: not all scientific information is gathered in a lab.

- Is it enough to come out here and make observations just one time and leave? No! **Repeated** observations are important for us to understand a scientific phenomena and make sure our information is accurate.
4. Count the total number of students and then divide them into even groups of 3. Send one group to each station:
 - a. Seine net
 - b. Dip nets, plankton nets, yabby pumps
 - c. Water quality
- Communicate with your teammates to **rotate groups every 5-10 minutes**, depending on if your school is kayaking.

At the DIP NET, PLANKTON NETS, & YABBY PUMP station (best with 2 people):

You can either split this group and switch partway, or have them all do each activity at the same time.

1. For DIP NETS:
 - a. Explain that a dip net lets us catch animals like fish, crabs, and jellyfish
 - b. Let's see what we can catch! Have students use the nets to explore.
 1. **Make sure that students don't dig with the nets – that can break the handles easily**
2. For PLANKTON NETS
 1. Teach about plankton first:
 - Plankton are **drifting creatures, many that are tiny and form the base of the food web.**
 - (Not all are small. Some can be large, like jellyfish.)
 - They can move but are not strong swimmers, so they drift with the currents
 - **Phytoplankton** is a type of plankton that can turn energy from sunlight into food! When they do this, they also make oxygen – **more than HALF of the oxygen we breathe!**
 2. Then show the students how to catch the plankton using the plankton nets
 - a. Pull the net through the water, making sure that the jar is attached on the end and that the mouth of the net is at least partly under the surface
 - b. You can "mow the lawn" by walking back and forth with the net



3. For YABBY PUMPS:
 - a. Explain that a yabby pump helps us to uncover what might be buried in the sand.
 - b. Demonstrate how to use it:

1. Push the end of the pump into wet sand covered by water at an angle



Yabby pumps are used to catch "yabby shrimp" aka ghost shrimp.

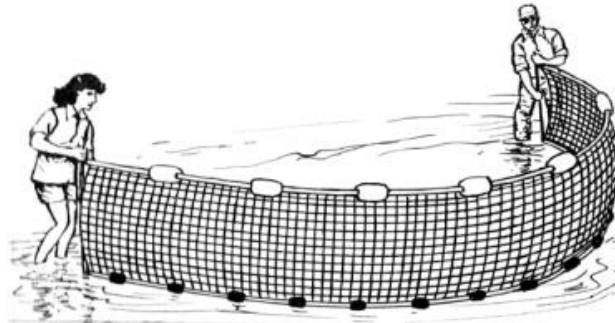


2. Pull the handle
3. Lift the pump and put your hand over the end
4. Dump the contents into the metal mesh sifter
5. Sift out the sand by placing the sifter partly in water
6. See what you might have found!



At the SEINE NET station:

1. Explain that we are going to use a seine net to catch animals in the estuary. Have the kids line up to watch you first, and then they will do it the next time. Tell them the **IMPORTANT RULE:** No one steps on the net! It can put holes in it that destroy the net.
 - a. One person is on each side of the net, holding the bar at a slight angle (top part slightly away from you)
 - b. Once you are both in the water, one person puts the handle of the net into the sand and holds firmly while the OTHER person makes a wide circle with the net around them.
 - **The bottom of the net (with the weights) should drag on the bottom and the net should be pulled taut**



- c. When you are both even with each other, then both bring the net straight onto the beach along the bottom and flip up so that the caught animals are facing up
- d. If there are fish, gently pick them up and put them back in the water so they can breathe
- e. Look for crabs, snails, comb jellies (they do not sting), shells, fish, etc. If you've caught seaweed, check it for any organisms (pipefish, a relative of seahorses, loves to hide in seaweed)
 - i. some of the types of fish: flounder, bay minnows, pinfish (have a spine on their dorsal fin)

TIP: Assign jobs to the kids (ones that stay shallow, ones that go deeper/get more wet, and ones that take the fish back to the water)! You can have 2-3 people on each side of the net. Depending on the age, you may need to help them.

At the WATER QUALITY station:

1. Explain that this group of 5th graders is very special – we have chosen them to be involved in a REAL citizen science research project on the body of water they see in front of them: the Santa Rosa Sound (our local estuary)! They are going to “Be the Biologist” at this station and assess the health of the local marine environment by learning how to take some important scientific data.
2. Pre-testing discussion:
 - a. Ask: What are the **basic needs** of all living things? (food, water, shelter, space/habitat). Explain that for our local marine organisms, the Santa Rosa Sound and Gulf of Mexico provide all of these needs.

Have students **make observations**: Ask the students to shout out words to **describe the water** before them. (Listen carefully for any words that could be **opinions**, such as “clear” and “clean” and take the opportunity to ask them to think about what qualifies the use of those terms – you will explain in a minute that scientists must provide **evidence to support their observations**, they are never based on opinion.)

Ask: what **can you see** in the water? (sand, fish, shells, trash, etc.)

Ask: is there anything in the water that you **can't see**? (plankton, larvae, nutrients, oxygen, etc.) How do we know they are there? (**scientific tools** such as microscopes, probes, test kits)

Ask: **Why is it important for us to know** about dissolved oxygen levels? (need certain levels to support life) Nutrient levels? (too many nutrients can lead to dangerous algal blooms and kill marine life) Salinity? (organisms are adapted to live in water that has certain salinity levels) Temperature? (some organisms/larvae are very sensitive to temperature and can't survive if it gets too hot/cold)

3. Demonstrate how to use the equipment.
4. Allow students to practice using the equipment. **MAKE SURE TO SUPERVISE.**
5. Explain that we are just practicing how to use the equipment today, but scientists would record this information in a data notebook.
6. Ask: So, are we done? We took measurements of the water today and now we don't ever have to measure it again, right? (No! It is necessary for scientists to repeat their experiment over and over again so they can monitor any changes in the environment.)

Ask: What do you think would happen if later today there was a big oil spill right off the shore? (confirm that it would affect some of the measurements they just took and negatively impact the ecosystem.) Explain, however, that it is not necessary to have a big disaster to impact the marine environment – we impact it everyday by the **choices** we make – *even if we don't live right by the water.*

Ask: **How** is it possible that even if I don't live right by the ocean, I can impact it by my choices? (accept all reasonable responses, while leading them to understanding the role of precipitation in water quality)

Ask: What happens to all the **rainwater after it rains** (this is also a good time to review the water cycle, time-permitting)? (water runs over the land, picks up pollutants, washes into streams, rivers, and finally reaches the ocean).

CLEAN UP:

Seine net – dip in the water to remove any sand/seaweed, then roll it up (one person on each side, roll towards each other). You'll need to unroll it again when you get to the station to rinse it off.

Plankton net – empty the jars, and re-attach them

Put all supplies in the back of the ATV (or carry back)

Fold up and CARRY table to the station (2 people)

When back at the station, take everything out and place on the downstairs floor. **Rinse everything off with the hose (including the ATV) and then put everything back in its correct place** (see supplies list for locations).

STANDARDS ADDRESSED

SC.1.N.1.1 Raise questions about the natural world, investigate them in teams through free exploration, and generate appropriate explanations based on those explorations.

SC.1.L.17.1 Through observation, recognize that all plants and animals, including humans, need the basic necessities of air, water, food, and space.

SC.3.N.1.1 Raise questions about the natural world, investigate them individually and in teams through free exploration and systematic investigations, and generate appropriate explanations based on those explorations.

SC.3.N.1.2 Compare the observations made by different groups using the same tools and seek reasons to explain the differences across groups.

SC.4.L.17.4 Recognize ways plants and animals, including humans, can impact the environment.

SC.5.N.1.2 Explain the difference between an experiment and other types of scientific investigation. (DOK 2)

SC.5.N.1.3 Recognize and explain the need for repeated experimental trials. (DOK 2)

SC.5.N.1.5 Recognize and explain that authentic scientific investigation frequently does not parallel the steps of "the scientific method." (DOK 2)

SC.5.L.17.1 Compare and contrast adaptations displayed by animals and plants that enable them to survive in different environments such as life cycles variations, animal behaviors and physical characteristics.



MARINE BIODIVERSITY

SUPPLIES

- animals in touch tank downstairs & upstairs (dependent on availability)
- aerator – located upstairs in kitchen in the bottom cabinet near the trash can
- small aquarium – located downstairs
- microscopes (3) – microscope room
- slides of marine organisms
- EnviroScape model and components

SET UP (downstairs)

There will be two mini stations for the Marine Biodiversity station:

1. Touch Tank

- For the echinoderms (sea stars, urchins):
 - fill a small aquarium $\frac{1}{2}$ way with the water that is from the tank you are removing the animals from
 - gently move the animals from their original aquarium to the small aquarium
 - place the aquarium on the back corner of the touch tank
 - put in an aerator (be sure you see bubbles so that it's working!)
- Check the large touch tank downstairs to make sure all animals are alive and well
- Set up a few microscopes on a nearby table and have slides of microscopic organisms ready for viewing.
- Go over what you will say about the animals & look up any information that you need to

2. EnviroScape (downstairs, opposite from the Touch Tank)

- Set the EnviroScape up on the other end of the downstairs area.
- Be sure it is placed securely on the tray below to catch the draining "runoff."
- Attach all of the pieces and have all of the additional supplies that the students will sprinkle on ready to go.
- Make sure there is water in the cloud water bottle.

TEACHING OUTLINE & INFO

Split groups: Half of the students will start with Touch Tank, half with the EnviroScape, then switch after ~15 minutes.

TOUCH TANK:

1. Explain to students the **Touch Tank Rules:**

- They can only use **2 gentle fingers** – that way it helps to keep the animals safe and happy
 - Don't use 1 – that can lead to a poking motion.
 - Don't take animals out of the water – they need to be submerged to breathe
- Only touch animals that you say they can touch – some animals we are going to leave be

VERY IMPORTANT: Make sure the animals are kept in the water that they originally came from. The shock of different water parameters could kill them!

2. What is the difference between living and nonliving things? (This is especially important for 1st grade)

Living = anything that is or has ever been alive (dog, flower, seed, log)

Non-living = anything that is not now or ever has been alive (rock, mountain, glass, computer)

All living things:

- grow
- breathe
- need food
- reproduce
- excrete
- respond to stimuli
- are made up of cells

Are all things that move “alive”? No (examples: cars, running river)

Do all living things move? No (examples: plants, sponges)

Do all living things eat? No – plants don’t eat but they need energy. **Where do they get it?** The Sun.

If something grows, does that mean it’s alive? No - icicles grow but aren’t alive.

Are all living things big enough for us to see? No – some require scientific tools, such as microscopes.

3. Teach the touch tank animals

Go through each animal, explaining about their features. Some animals that we may have are:

Horseshoe Crab	<ul style="list-style-type: none"> • Is an arthropod: have jointed legs and an exoskeleton (outer hard covering) • Has 10 eyes – 2 compound eyes (like flies), and 8 light-sensing eyes • Has blue blood due to the copper in it (we have iron) • Their blood is VERY important to humans!! Ask “Who has had a flu shot or other kind of shot? An IV?” <ul style="list-style-type: none"> ○ If you did (everyone), you have been helped by the horseshoe crab! Their blood is used to detect harmful bacteria in shots or IV’s that could make us sick ○ How? It forms a big wall against the bacteria, showing us that we shouldn’t use the shot. • Tail (called the telson) is used not for defense but for flipping itself over when it’s upside down • Are not true crabs: they’re more closely related to arachnids (spiders) than crabs
Hermit Crab	<ul style="list-style-type: none"> • Is an arthropod: have jointed legs and an exoskeleton (outer hard covering) • Has a long skinny belly that is soft, so they find empty mollusk shells to protect them. They don’t make the shell.
Snail (cowrie, whelk, murex)	<ul style="list-style-type: none"> • Is a mollusk: a soft-bodied creature • They make their shell, which is a permanent home (they never switch shells) • Show the pointy tip of the spiral – that’s the size that it was as a baby, and then it keeps growing its shell • They are related to octopuses and squid (also mollusks) • They have light-sensing eyes
Sea Urchin	<ul style="list-style-type: none"> • Is an echinoderm • Has spines used for protection and movement • Has tiny tubes with suction cups (called TUBE FEET) that are filled with water that it uses to move • Mouth is on the bottom – has little teeth that slide up and down to eat
Sea Star	<ul style="list-style-type: none"> • Is an echinoderm • Also has tiny tubes with suction cups (called TUBE FEET) that are filled with water that it uses to move • Can ooze its stomach outside its body and turn its meal into a smoothie (like the inside of a clam)
Fish (don’t touch this one)	<ul style="list-style-type: none"> • Is a vertebrate (has a backbone) • Depending on the fish, talk about body shape and coloration (example, some have flattened body shapes like flounder, some have camouflaged coloration) • Has scales on its body to protect it

	• Can sense vibrations in the water with a structure called the lateral line
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4. **Review** the animals & ask questions about what you taught. Examples:
 - a. Why is the horseshoe crab important to humans?
 - b. What do sea urchins and sea stars have that help them move?
 - c. How does this animal compare to that animal?
 - d. How does this animal eat?

5. Bridge the gap to the EnviroScape ... **How does what we do on land affect these marine creatures?** (Review the topics covered with the EnviroScape; if they haven't been to the EnviroScape yet, don't go into detail.)

ENVIROSCAPE

Station Goal: The EnviroScape Coastal Watershed Model is a tool to facilitate discussion about the impact human activities have on the local environment and, ultimately, the ocean. Students will be generally more familiar with the elements of the EnviroScape model because it involves everyday things, but the goal here is to show them the impact these activities/items have on the environment that they probably have not considered previously.

This is also a great time to go over the **benefits of using scientific models**: it's a lot easier to see how all of the activities that take place over a really large area, like a town or a watershed, fit together when we shrink them down and can see them in one place, demonstrate different types of runoff and see how it will flow, etc.



Info to cover & discussion starters:

Watershed

Who can tell me what a **watershed** is? (an area of land that drains rainwater to creeks, streams, rivers, and eventually to the ocean)

How many of YOU live in a watershed? (encourage all hands to be raised – we all do!) What is the name of our watershed? (**Pensacola Bay Watershed**)

Runoff

So, where does all of the water go after it rains? (time-permitting, review the **water cycle** here – don't forget about the water cycle song! 😊) The rainwater flows across the surface of the land to the lowest point and collects in the water bodies within the watershed at lower elevations (points). Water always moves from high elevations, like the tops of mountains, to low elevations, like valleys. When rainwater hits the ground (grass, sand, etc.) it can soak in, when it hits concrete or roadways, it can't soak through and it

runs along that surface picking up **trash and other pollutants** along the way. We call this water **runoff**. It is what is responsible for most of the pollution in the ocean. It then goes down into the storm drains, which go directly into the nearest stream or river. All of this pollution affects **water quality**. What are some types of pollutants you can think of? (take all appropriate answers quickly and tell students that we are going to talk about all of the different types right now!)

As you go over the following pollutants, sprinkle the different materials over the EnviroScape as indicated. These will be the components of your “runoff” when you make it “rain” with the cloud water bottle! (These topics do not have to be completed in any particular order.)

Oil

Raise your hand if you walked to the NBMS today? (pause) Right - none of you! You took the bus. And the only way buses and other vehicles can run, is with **oil**. So, oil is pretty important in our daily lives, right?

Raise your hand if you have ever seen a rainbow sheen on the surface of a puddle in a parking lot when the light hits it just right? (pause) Does anyone know what causes that? (**oil!** Oil is one type of pollutant found in runoff.) Where can we find oil outside on Earth’s surface? (from cars. All cars leak some oil and it’s left on the **street, in parking lots, and on driveways. Boats, jet skis**, etc. also contribute to oil in the waterways. And so it’s important that we maintain our vehicles to prevent oil leaks. Note: some students may answer that oil is found underground – and they are right! – but, the oil underground is not problematic in surface runoff. Reinforce that they are correct, but that the oil from underground only becomes a problem when we pump it up to the SURFACE and then it causes pollution.) **Oil drilling accidents** can also lead to oil pollution, such as the Deepwater Horizon oil spill in 2010 which covered miles and miles of the Gulf Coast in oil. Luckily, our beaches only had minor effects.

Fertilizers and Pesticides

Look at this watershed. Everywhere you see green, that is grass. Note the farm over here. **Fertilizers** (nitrogen and phosphorus) **and pesticides** are often used to make nice green lawns, help grow crops, and protect against unwanted pests. When it rains, any extra fertilizers or pesticides are going to be washed into the local waterways. Fertilizers are “food” for plants! However, **algae** also like fertilizers! What do you think will happen if too much fertilizer gets into the waterways? (algae will grow; describe what algae on the top of a lake looks like and explain what happens to the plants in the waterway when sun is blocked, which leads to disruption in the food web and fish kills.)

Nutrients

In addition to **fertilizers, animal waste and sewage** (what goes down the toilet when it’s flushed) also provide nutrients to algae and can lead to algal blooms or “red tide.” When it rains over farmland, the waste from cattle and other farm animals washes away, as well as from our pets if we don’t clean up after them! **Grass clippings** also contribute nutrients if they are not picked up and are allowed to wash down storm drains. In addition, sewage can introduce **pathogens** into waterways that can lead to adverse health effects.

Sediment

How many of you have ever stood in the ocean and had the waves crash around your feet? Have you ever noticed that your feet wind up sinking after a few minutes? Do you notice the little bits of sand and shell that flow by your feet? That movement is called **erosion**. Erosion is the movement of sediment (soil, sand, etc.) from one place to another. Water is really good at causing erosion. When there is bare ground, for example where the grass has been worn away by people walking – and especially by large animals such as cattle on farms, rainwater moving across the surface of the land picks up soil and washes it into the rivers. **Sediment** in waterways can cause the water quality to go down and destroy habitats for the organisms that live there.

Factories

Factories near waterways can cause **thermal pollution**, or heating of the water. This changes the habitat the organisms are used to and can be harmful to them. Toxins, particularly from **heavy metals**, are also associated with factories.

Litter

What **types of litter** have you seen on the roads? In parks? School? At the beach? (discuss) Again, reinforce that if litter is left on the ground, it can wind up in the nearest waterway and eventually out into the ocean via **storm drains**. Talk about the dangers of **plastics**!

Discuss the effects of the watershed pollution on some of the **model ocean organisms**. Discuss the benefits of **oysters** and how important they are in filtering the water in our waterways.

Time-permitting: Review - ask questions about what they learned! Hold a discussion on ways they can **prevent** water pollution.

CLEAN UP

- Return the sea stars and sea urchins back to their original tank, and gently pour the water back in.
- Put away the aerator and small aquarium.
- Return microscopes to microscope room and store slides appropriately.
- Carefully remove and dry all pieces from the EnviroScape and place them back in their appropriate containers/bags.
- Rinse bottom tray and leave out to air dry. All other components are to be put back in the green EnviroScape case.

STANDARDS ADDRESSED

<p>1st Grade SC.1.L.1 4.3 Differentiate between living and nonliving things.</p> <p>SC.1.L.1 4.1 Make observations of living things and their environment using the five senses.</p> <p>SC.1.N.1.2 Using the five senses as tools, make careful observations, describe objects in terms of number, shape, texture, size, weight, color, and motion, and compare their observations with others.</p>
<p>3rd Grade SC.3.N.1.6 Infer based on observation</p> <p>SC.3.L.1 5.1 Classify animals into major groups (mammals, birds, reptiles, amphibians, fish, arthropods, vertebrates, and invertebrates, those having live births and those which lay eggs) according to their physical characteristics and behaviors.</p>
<p>5th Grade SC.4.L.17.4 Recognize ways plants and animals, including humans, can impact the environment.</p> <p>SC.5.N.1.2 Explain the difference between an experiment and other types of scientific investigation.</p>

Attachment 4

SC.5.L14.2 Compare and contrast the function of organs and other physical structures of plants and animals, including humans, for example: some animals have skeletons for support – some with internal skeletons others with exoskeletons – while some plants have stems for support.

SC.5.L17.1 Compare and contrast adaptations displayed by animals and plants that enable them to survive in different environments such as life cycles variations, animal behaviors and physical characteristics.

SC.5.E.7.2 Recognize that the ocean is an integral part of the water cycle and is connected to all of Earth's water reservoirs via evaporation and precipitation processes.

