Sea Lab

Marine Science Education Center
New Bedford Public Schools

2021 Open House Program and Students' Exhibits

Sea Lab

Marine Science Education Center
New Bedford Public Schools

New Bedford, Massachusetts

NEW BEDFORD SCHOOL COMMITTEE

Honorable Jonathan F. Mitchell
Mayor and Chairman ex-Officio

Thomas Anderson
Superintendent of Schools

School Committee

Bruce Oliveira
Vice Chair

Joshua Amaral

Christopher A. Cotter

Colleen Dawicki

Joaquim "Jack" Livramento

John A. Oliveira

NEW BEDFORD SCHOOL ADMINISTRATION

CENTRAL OFFICE

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Superintendent

Karen A. Treadup
Deputy Superintendent

Andrew O'Leary
Assistant Superintendent Finance & Operations

Matt Kravitz
Interim Executive Director of Special Education and Student Services

Heather Emsley
Executive Director of Human Capital Services

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Sonia Walmsley
Executive Director of Educational Access and Pathways

Jennifer Ferland
Executive Director Strategic Initiative & Partnership

FIFTY-THIRD ANNUAL COMMENCEMENT AND OPEN HOUSE PROGRAM

In Memory of Sgt. Richard Sylvia, Environmental Police

"Please rise for the Pledge of Allegiance followed by our National Anthem"

Welcome	Simone P. Bourgeois	
Pledge of Allegiance	Gianna Longo	Level 1
	Brian Duggan	Level 7
	Sean Bentley	Level 7
"National Anthem" Francis Scott Key	Sung by: Alyssa Maitoza Miss New Bedford Miss Massachusetts First Runner Up Miss Bristol CountMiss Massachusetts Outstanding Teen	
Word of the Day	Lauren Mitchell	Level 7
Introduction of Guests	Mr. Lawrence W. Oliveira	
Greetings	Mayor Jonathan F. Mitchell Superintendent Thomas Anderson	
Keynote Speaker	Dr. Steven T. Chen, MD MPH MHP ED MASSACHUSETTS GENERAL HOSPITAL	

Director of Medical Education, Dermatology
Co-Director Comprehensive Cutaneous Lymphoma Program
Program Director, Harvard Dermatology Program
Associate Professor of Dermatology Harvard Medical School

Presentation of Citation of Recognition — Councilor Joseph Lopes

Lewis Temple Foundation	Adonis Ferreira
Sea Lab College Scholarships	Lee-Ann Jupin President Sea Lab Keel
Academic Certificates and Plaques Grade 9 Students	Adam Desjardins Robert Southerland
Massachusetts Boating Safety Certificates – Grade 6	Sgt. John Girvalakis
Swimming Certificates	Timothy Curry Jeffrey Longo Melissa Renaud
Sailing Certificates	Koby Verran Michael Gryss
Sailing Awards	Koby Verran Michael Gryss
Trophy Dive Awards	Ralph Perry

Closing Remarks — Lawrence W. Oliveira

2021 SEA LAB COLLEGE SCHOLARSHIP RECIPIENTS

The Sea Lab Keel, Inc. is proud to announce the following students as scholarship recipients.

These students attended the Sea Lab Program, graduated from the Sea Lab Program, and are college bound in the fall. We are very proud of our young adults and congratulate them in their choice of college and career.

They represent our future.

Christian Alves	**Bryant University**	**Business/Management Entrepreneurship**
Sophia Arruda	**Emory University**	**Economics/Political Science**
Tyler Brown	**UMASS Dartmouth**	**Biology Marine Science Concentration**
Kendall Chase	**University of New Hampshire**	**Marine, Estuarine, Freshwater Biology**
Mia Clark	**Wesleyan**	**Biology**
Kate Ferland	**UMASS Dartmouth**	**Data Science**
Ethan Gomes	**Worcester Polytechnic Institute**	**Mechanical Engineering**
Jaffa Heryudono	**Georgia Institute of Technology**	**Aerospace Engineering**
Ruby Ann Louro	**UMASS Dartmouth**	**Graphic Design**
Aaron Maknooni	**UMASS Dartmouth**	**Computer Science**
Lily Oliveira	**Johnson & Wales University**	**Health Sciences**

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Sara Pereira	**Northeastern University**	**Finance and Economics**
Katelyn Pimenta	**MASS College of Arts & Design**	**Illustration**
Brian Poirier, Jr.	**UMASS Amherst**	**Biology**
Natalie Portal	**UMASS Dartmouth**	**Nursing**
Raquel Reis	**Harvard University**	**Earth & Planetary Science**
Aiden Silva	**Bryant University**	**Finance**
Nathaniel Yergeau	**Delgado Community College**	**US History**
Winnie Zoa	**UMASS Amherst**	**Business Management**

2021 SEA LAB INTERNS

The Sea Lab Intern Program began in 2018. The Program evolved from a student volunteer position to a New Bedford Public Schools position with pay in 2021.

We began with three interns and now boast fifteen young adults, all of which are assigned to a teacher in a specified grade levels. These young adults are enthusiastic, cooperative, and invaluable.

Sea Lab Interns are familiar with the curricula and are competent helpers in the classroom arena. Most of these young adults are in their final year of high school and/or attending college.

Many of the Interns work mornings at Sea Lab and hold another position in the afternoon and/or evening. They return year after year to help younger students matriculate through the seven-summer session.

The members of the Intern Corps are intellectually astute and a welcome addition to the Sea Lab Faculty.

Sea Lab Interns are:

Siera Barboza Grade 9 Intern Bridgewater State University
Hannah Bouvier Grade 8 Intern Gordon College William Bouvier
Grade 6 Intern Dartmouth High School Hayden Brody Grade 5
Intern Bristol Community College
Angela DeFrias Grade 4 Intern Bishop Stang High School
Kate Ferland Grade 8 Intern UMASS Dartmouth Luke Ferland
Grade 5 Intern Fairhaven High School Myah Fonseca

	Grade 6 Intern	N B Regional/Technical HS	William Gauvin
	Grade 9 Intern	Bristol Community College	Brady Kidney
	Grade 4 Intern	Old Rochester Regional HS	
Samuel Jupin	Grade 9 Intern	New Bedford High School	
Allyson Oliveira	Grade 3 Intern	Wheaton College	Ty
Spencer	Grade 7 Intern	Gordon College	
Dominic Viegas	Office/IT Intern	UMASS Dartmouth	
Aaron White	Grade 7 Intern	New Bedford High School	

2021 SEA LAB COMMENCEMENT SPEAKER

Steven T. Chen
MD, MPH, MS-HP Ed

Director of Medical Education in the Department of Dermatology
Co-Director of the Comprehensive Cutaneous Lymphoma Program
Director of the Blistering Disorders Clinic in the Department of Dermatology

Steven T. Chen, MD, MPH is a board-certified internist and dermatologist, practicing at Massachusetts General Hospital. His focus is on complex medical dermatology.

Dr. Chen is, also, an Assistant Professor of Dermatology at Harvard Medical School.

Dr. Chen graduated with Honors from Johns Hopkins University where he earned a BS in Biology. He subsequently earned a Master's Degree in Public Health (MPH) and a medical degree (MD) at Johns Hopkins University, and was elected to the Alpha Omega Alpha Medical Honor Society.

Dr. Chen then pursued residency training at Harvard, where he completed an Internal Medicine residency at Beth Israel Deaconess Medical Center and a Dermatology residency in the Harvard Combined Dermatology Program. Dr. Chen served as Administrative Chief Resident during his final year of combined training.

He belongs to several professional organizations, including the American Academy of Dermatology, the United States Cutaneous Lymphoma Consortium, and the International Society for Cutaneous Lymphomas.

Dr. Chen pursues clinical and education research and has co-authored peer-reviewed articles in medical education and complex dermatology. He, also, serves as Director of Medical Education and Director of the Blistering Orders Clinic in the Department of Dermatology.

Dr. Chen's clinical interests include cutaneous lymphomas, complex medical dermatology, inpatient dermatology, and medical education. He is the founding dermatologist for the MGH Cancer Center's Severe Immunotherapy Complication
Services.

Dr. Chen attends on both dermatology and internal medicine services. Additionally, he is the Co-director of the Comprehensive Cutaneous Lymphoma Program in the MGH Cancer Center where he cares for any and all patients who have a primary cutaneous lymphoma. He is currently conducting research on cancer patients treated with immune checkpoint inhibitors who may have developed an immune related adverse event.

As a medical educator, Dr. Chen is interested in harnessing the power of social media for medical educational purposes, as well as innovating and improving traditional models of undergraduate and graduate medical education.

As many of our graduating Sea Lab students are showing an interest in medical research, medical design and engineering, and medicine, we felt that Dr. Chen would act as a pathway and inspiration for our students and their future goals.

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We are extremely grateful and honored to have Dr. Steven T. Chen agree to be Sea Lab's 53rd Commencement Speaker.

FIFTY-THIRD ANNUAL COMMENCEMENT AND OPEN HOUSE

Friday, August 13, 2021

9:00 AM to 11:00 AM

VISITORS' GUIDE TO EXHIBITS

Welcome to Sea Lab!

The 2021th Sea Lab summer session has been educationally stimulating and productive! It has been a welcomed in-person teaching and learning experience.

Since 1968, the Sea Lab Program has grown from an enrollment of grade five boys and one instructor, to the 2021 enrollment of 280 students, grades three through nine, and forty-eight staff members. We have, also, added to our teaching staff sixteen interns. These young adults are Sea Lab graduates and are now returning to aid our teaching and office staff.

Our 53rd year of educating students in the marine and aquatic sciences has included a myriad of exciting and diverse activities, from boat building to water rocket launches, from the construction of model lighthouses to the dissection of sharks, and the design of robots, etc. We have even adopted an additional study of cryptozoology and the history of buccaneering.

The educational scope of our students' academic accomplishments encompasses a plethora of hands-on experiences. This degree of dedication is well validated by the scope of student projects displayed for your perusal. We hope you will have the opportunity to visit every classroom and view what your children have accomplished in six weeks

Sea Lab students are adept, enthusiastic and possess the love of learning. They are challenging, exemplary, and are the foundation of Sea Lab excellence. They are peer models and our future. As educators, we value our opportunity to teach such talented youngsters.

The attached list of exhibits will guide you through the Sea Lab's grade three through grade nine exhibits and should assist you in your tour of our facility.

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Please feel free to ask questions or make comments to any of our personnel. Your suggestions are encouraged and will be most welcomed.

We thank you for the honor and privilege of teaching your children.

Sincerely,

Simone P. Bourgeois

Simone P. Bourgeois, Facilitator

Sea Lab

Annual Report

Sea Lab is the New Bedford Public Schools marine science education program funded through student tuition and New Bedford Public Schools for the perpetuation of real science activities.

Historically, Sea Lab has existed as a six-week summer program servicing academically serious students since 1968. Sea Lab is a forerunner in educational practices: a school focused on introducing university and high school level science concepts and related marine activities to preuniversity students, Kindergarten through Grade Twelve. The success of the summer program precipitated the implementation of an academic year program in 2020, which was established to expose a larger population of New Bedford Public School students to the realm of marine and aquatic sciences.

Since 1968, Sea Lab has been located by the sea on the Fort Rodman peninsula, New Bedford, Massachusetts. Presently, Sea Lab is housed in a state-of-the-art science laboratory center constructed primarily to educate New Bedford Public School students interested in studying principles of oceanography, limnology, meteorology, physics, chemistry, geology, biology and robotics as related to the marine and aquatic environments. The teaching materials, selected and/or developed by the instructors for presentation at different grade levels, illustrate the desire to achieve a balance between the introduction of basic scientific concepts and the discussion of observable phenomena. Sea Lab curriculum is designed to be progressive and cumulative from the third grade to the ninth grade. The current Sea Lab Program is an inquiry based, high interest, hands-on, intensive course of study designed to appeal to the serious student. Practical outdoor skills, such as swimming, sailing, snorkeling, boat building, and crew are also integral to the summer Sea Lab experience.

In addition to offering challenging academic activities, Sea Lab students participate in field studies conducted along the Massachusetts and Rhode Island coastlines. Students also have the opportunity to participate in on-going scientific research with local, national and international colleges and universities.

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The Academic Year, full-time Sea Lab Program, is an extension of the summer Sea Lab Program. Student instruction occurs on a daily basis from September through June at the marine center. The curriculum of the academic year program focuses on marine sciences as they relate to the Massachusetts Science Standards. It is designed to increase the science content knowledge of New Bedford's third, fourth and fifth graders and provide these students with the opportunity to participate in real science laboratory experiences. Hands-on lessons are designed to introduce marine sciences as they apply to Earth and Space Science, Physical Science, Life Science and Engineering and Technology. Field studies to East Beach, New Bedford, Massachusetts, are conducted with the intent of gathering marine and geological specimens. This hands-on, marine based curriculum is designed to be multidisciplinary and inquiry based.

Additionally, the Sea Lab's Academic Year Program offers high interest, unique learning experiences, which are provided by the Sea Lab staff, the Boston College Educational Seismology Program, Mystic Aquarium's Immersion-presents program, the Naval Undersea Warfare Center, the Massachusetts Maritime Academy, MOAA, the Buzzards Bay Coalition, Community Boating, and the Environmental Police.

The Boston College Educational Seismology Program was added to the Sea Lab's academic instructional system in 2005. Grade five students from NBPS elementary schools participate in on site instruction by Boston College geophysicists and seismologists. There are two seismographs located at Sea Lab which register earthquakes internationally.

Since 2005, fifth grade students from all New Bedford elementary schools have participated in interdisciplinary marine and environmental science instruction provided through the Immersionspresents Program and disseminated via the Mystic Aquarium, Mystic, Connecticut. Animal behaviorists and environmentalists travel to Sea Lab from Mystic Aquarium on a weekly basis to provide life science activities to NBPS students.

Sea Lab continues its collaborative venture on a year-round basis with the Naval Undersea Warfare Center, Newport, Rhode Island. This partnership introduces Sea Lab students to the properties of water such as density and buoyancy. Students participate in a simulated submarine "dive and drive" experience at Sea Lab utilizing a miniature undersea robot. Along with designing factors to achieve neutral buoyancy, students experiment with building boat models and investigating the Archimedes principle. Sea Lab students build a fleet of Sea Perch with the expert instruction of Naval Undersea Warfare Center technicians and engineers. An additional design and engineering experience included designing and building First tech Challenge robots with working appendages. This program is the continuation of the district wide involvement with the Naval Undersea Warfare Center. This is a no expense course of study provided to New Bedford Public Schools by the Navy's Educational Out - Reach Program.

Joining Sea Lab's community instructional team was spearheaded and implemented through the Buzzards Bay Coalition. Buzzards Bay Coalition environmentalists introduce all NBPS grade four students to indigenous North Atlantic flora and fauna and environmental stewardship. Students rotate through a series of activities focusing on restoring and maintaining a pristine environment and identifying local sea shore animals and their habitat. Coalition activities are also incorporated into the summer session curricula. An aquatic experience at the Acushnet River, Acushnet Saw Mills' site allows students the ability to do a collaborative analysis of marine and aquatic plants and animals.

Instructors from New Bedford's Community Boating Center joined Sea Lab's collaborates introduce third and fourth grade students to the design, engineering, and technology of boat building. Along with utilizing a pull and sluice, students applied mathematics to determine which bow design would allow a boat to travel through water at a faster and safer speed. Students were also introduced to the moon's influence on tide level. CBC mentors use a hands-on building process to help students improve their mathematics skills and use basic hand tools and develop teamwork.

Professional development for New Bedford Public Schools teachers is an additional facet of the Sea Lab Program. Over three thousand NBPS teachers have participated in marine science instruction and professional development lectures, seminars, and workshops from October 2001 through the present. Collaborative institute studies have been established with the Woods Hole Oceanographic Institution, Boston College, the MIT Sea Grant Program, Immersions-presents from Mystic Aquarium, the EPA Fish Smart program, the Whaling Museum, the Buzzards Bay Coalition, Community Boating Center, and NOAA. These institutions have coordinated with Sea Lab to provide Professional Development guided seminars centered on Earth and Space Science, Life Science, Physical Science and Science and Technology for area teachers for over a decade. The in-service sessions are on-going, and the subject matter is standards-based, timely, and pertinent for classroom application.

Community outreach programs are also sponsored by the Sea Lab Program. OCEARCH biologists visit Sea Lab and address a multi grade level student group as well as community representatives on the migration patterns of the Great White Shark. International explorers and biologists explain the tagging process and how the OCEARCH crew captures and releases two great whites in Buzzards Bay only a few miles off the coast of New Bedford. The OCEARCH biologists introduce the importance of shark migration study and its impact on humans. This presentation was received with enthusiasm and developed a profound respect for marine animals. Sea Lab students visited the Research Vessel, the OCEARCH, and experienced firsthand how sharks were captured, tagged and released. Currently, Sea Lab students follow the migration of a specific shark during the summer session.

The main goal, focus, and overall vision of the Sea Lab Program is to ensure educational excellence and equity for all students by preparing them to be able to function as active, productive and contributive members of the "ever-changing global society" in which they live. In order to meet this challenge, Sea Lab educators strive to provide opportunities, which will eliminate the Achievement Gap and raise standards for students by providing programs and activities of excellence that challenge students to achieve their fullest potential. The Sea Lab Program presents with academics of the highest caliber and the application of scientific activities correlated to the ever-changing needs of today's scientific and technology-oriented community. The scope of the Sea Lab learning opportunity is monumental commencing with the formation of nature savvy students and ultimately resulting with generations of environmental caretakers.

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Grade: Level 1 – Grade 3

Instructor:	**Donna Kirby-Blanchette** **Bridget Murphy**		**Rooms 120, 122**
Paraprofessional:	**Ruth Adamides**	**Intern:**	**Allyson Oliveira**

Exhibits

1. **Meteorology - Weather Station**
   Students were introduced to the science of weather study, meteorology. They participated in groups focusing on comparing and contrasting meteorological data accrued from technology versus human observation.

2. **Meteorology - Weather Log**
   Students collected weather measurements through observations and recorded the collected data over the course of a few days in a weather log. Students used compasses and thermometers to determine wind direction, and air temperature. The Beaufort scale for wind speed and a cloud identification tool were used to determine cloud cover and type.

3. **Meteorology - Cloud Wheel**
   Students created a Cloud Wheel model, which they used to identify a variety of cloud types.

4. Meteorology – Cloud Elevation Models

Students created 3 dimensional diagrams of cloud types illustrating the atmospheric elevation of each cloud type.

5. Earth and Space Science – Solar System Models

Students created models of the planets in our Solar System. The students also performed a play on the planets of our solar system.

6. Earth and Space Science – Scale Models of the Planets

Students created scale models of the Planets to be used as costumes during their dramatic presentation of "The Planets".

7. Earth and Space Science – Human Sundials

Students participated in an outdoor learning experience to illustrate day and night and the rotation of planet, Earth.

8. Earth and Space Science – Backyard Sundials

Students constructed sundials for backyard observation

9. Earth and Space Science – Creation of "Flinkers"

Students explored a property of water, buoyancy, through a series of experiments. Students attempted to create an object with neutral buoyancy, what sinks and what floats.

10. Earth and Space Science – Salt Water Buoyancy

Students experimented with fresh and salt water in order to evaluate, which type of water indicated more buoyancy.

11. Earth and Space Science – "Bubble" Experimentation

Students experimented with "bubbles" to explore the concept of surface tension by blowing bubbles on a flat surface and creating a bubble line and a bubble tower.

12. Earth and Space Science – Beach Profile Diagram

Students created a three-dimensional model illustrating the various sections of the Intertidal Zone.

13. **Earth and Space Science – New England Seashore Collection**
Students collected a variety of shells from different areas of the Intertidal Zone, East Beach, New Bedford, MA, and created a shell board of their collection.

14. **Life Science – Shell Fossils**
Students collected univalve and bivalve mollusk shells from East Beach, New Bedford, MA, and created a fossil of each type.

15. **Life Science – Individual Models of a Great White Shark**
Students created 3 dimensional models of a Great White Shark. Students discussed the body parts of a Great White Shark.

16. **Life Science – Creating Models of Octopuses**
Students created an artistic representation of an octopus and identified the major body parts, habitat, and genome of the octopus.

17. **Life Science – Creating Models of Sea Urchins**
Students created an artistic model of a Sea Urchin and identified behaviors characteristics of a sea urchin.

18. **Life Science – Creating Models of Jellyfish**
Students created artistic representations of jellyfish. They identified characteristics and behaviors of jellyfish. Students, also, observed and noted the current effects of jellyfish on a marine environment.

19. **Physical Science – Cartesian Diver Bottles**
Students created Cartesian diver models as to represent the concepts of pressure, density, compressibility, and buoyancy.

20. **Physical Science – Model Boats**
Students created model boats used to test the properties of density and buoyancy.

21. **Earth and Space Science – Tide Diagram**
Students created diagrams, which indicate the moon's effect on planet Earth's tides.

22. **Earth and Space Science – Phases of the Moon**
Students created a "Moon Viewers" of the Phases of the Moon.

23. **Earth and Space Science - Star Formation Process Diagram**
Students created diagrams, which illustrate the process of star formation.

24. **Design, Engineering, and Technology – Ping Pong Ball Launchers**
Students designed prototypes for ball launching. The prototypes were student tested for force, distance, and accuracy. Students re-engineered the design of their prototypes based on experimental data and the new improved design was relaunched. Accuracy of prototype designs was discussed.

Level Two - Grade 4

Rooms:	**110, 112**	**Rooms: 114, 116**	
Instructors:	**Stacy Sullivan** **Jessica Peixoto**	**Instructors:**	**Katie Almida** **Rebecca Aldestein**
Paraprofessional:	**Danielle Perry**	**Paraprofessional:**	**Lisa Poulos**
Intern:	**Brady Kidney**	**Intern:**	**Angela DeFrias**

Exhibits

1. **Meteorology - Barometer**
Student constructed instrument, which measures high and low atmospheric pressure.

2. **Meteorology – Thermometer**
Student constructed instrument, water thermometer, using an Erlenmeyer flask, which measures air temperature.

3. **Meteorology – Anemometer**
Student constructed instrument, which measures wind speed.

4. **Meteorology – Cloud Formation**
Student experiments forming clouds when hot moisture cools. This cooling process captures water molecules in the form of water vapor. The water vapor condenses to form a cloud.

Bottle Botany
Students constructed a closed environmental system producing a continuous water cycle process: evaporation, condensation, and precipitation.

5. **Meteorology – Student Independent Study**
Students adapted classroom instruction and applied their knowledge in the home setting through the construction of models of a rain gauge.

6. **Design, Engineering & Technology - Nautical Knowledge**
Navigational Aids – Lighthouse Model
Student constructed land and water based lighthouse models accompanied by photographs of Nobsca Point Light station, a flashing land based station, and Butler's Flat Lighthouse, a group occulting lighthouse owned and operated by the City of New Bedford, Massachusetts.

7. **Nautical Knowledge**
Navigational Aids – International Flag Code – Signal Flags
Student constructed signal flags depicting each student's first and last initial. These symbols were taken from the International Flag Code. This code is comprised of forty flags representing each letter of the alphabet, numerals one through nine, and weather pennants.

8. **Nautical Knowledge**
Buoy Study
Student constructed "can" and "nun" buoys. Students learned the basic buoy types and their importance in safe water navigation.

9. **Nautical Knowledge -Sail Craft Project**
Students studied the basic "boat" part terms and the terms attributed to a sail craft with a main sail and a jib. Students constructed and named their own sail craft.

10. **Nautical Knowledge -Sand Art**
Students studied the origins of sand art and its historical importance to Native Americans. Students also studied the adaptation of this art form as a means of support to the artists' colony in Provincetown, Massachusetts, at the turn of the twentieth century. Student constructed sand art forms are displayed.

11. Geology - Global Tectonics – Continent Formation

Student study of the formation of the Earth, including the supercontinent, Pangaea with its subsequent division into Gondwanaland and Laurasia; and the formation of Earth's original ocean, Panthalassa, led to the construction of a "Pangaea" model identifying the original continents and ocean.

Student study of the Continental Drift Theory and Seafloor Spreading Concept led to the construction of a continent board depicting "modern day" continents and oceans.

12. Biology – Microscope Study

Students studied the origin, history, and importance of the microscope to science and mankind. Students utilized a monocular scope of 40x to 120x to examine specimens collected at Sea Lab this July. A booklet of specimen drawings resulted. This was the students' first experience using this instrument for field study investigations.

13. Biology – Lobster Study

A unit depicting lobster activity, preference of light, food, and niche adaptation was undertaken this summer. Students constructed a model lobster pot.

14. Model Log – Student Notebook

Selected student work and activities experienced at Sea Lab this summer.

15. Meteorology – Weather Board

Students learned to read a thermometer, barometer, identify cloud types, gauge wind speed and direction, and note tide level. These daily weather readings for July and August were recorded on a weather board and subsequently noted in the student's individual weather log. A six-week analysis resulted and predictions for next day's weather were also recorded on a daily basis.

16. Chemistry – Water, and its Properties

Students investigated the properties of water through experimentation. They learn water, the Universal Solvent, has the ability to dissolve most substances. Students also perform additional activities indicating surface tension, transparency, density and tensile strength.

Capillary action is illustrated by utilizing a white carnation and food coloring. Students observe that water travels in an upward motion, counter gravity, when the carnation turns the color of the prepared water bath.

Additional experiments are performed to illustrate the three forms of water: liquid, solid, and gas.

Level 3 – Grade 5

Instructor: Richard Huston **Instructor: Daniel Viegas**

Instructor: Joseph Silva

Intern: Hayden Brody **Intern: Luke Ferland**

Exhibits

1. Earth and Space Science - Pangaea Puzzle

Using mineral, fossil fuel, and ore deposits, as geological evidence, students investigated the development of the tectonic theory and pieced together the Pangaea model of an ancient mega-continent.

2. **Earth and Space Science - The Ocean Resources**

Students studied the value of ocean resources to life on Earth pertaining to food production, mineral deposits, transportation, security, fossil fuel, recreation and commerce, etc.

Modern oceanographic discoveries validate the intrinsic value the ocean has on all life, including the prevention of disease and biotechnology.

3. **Earth and Space Science - Key to Fish Species Located in Buzzards Bay**

Students identified fish species found in the North Atlantic Ocean through the use of a "fish" key. Viper fish and angler fish were all identifiable North Atlantic bottom dwellers.

4. **Earth and Space Science: Intertidal Zone**

Students investigated the role of gravity on ocean tides. A field study was conducted at East Beach, New Bedford.

The students graphed tidal information daily.

Students explored the intertidal biome and then researched the linter connection of living plants and animals from the survival zone.

5. **Earth and Space Science - Underwater Exploration**

Students study the historical development of underwater exploration with special emphasis on the discovery and use of SCUBA. The use of SCUBA was compared and contrasted to the use of a deep-sea submergence vehicle as a tool for deep ocean exploration and research.

6. **Earth and Space Science - Map Reading**

Utilizing a map of North America, students use a direction finder to read the map. Students read distance tables, utilized scales of distance and measured points A to B, which was not always in a straight line, in a series of hands-on map reading activities.

7. Earth and Space Science - Oceans and Seas

Students studied the formation and division of the initial ocean, Panthalassa, into the modern-day Atlantic, Arctic, Antarctic, Pacific, and Indian Oceans.

Students learned to remember the oceans' names by using an acronym, AAAPI. Ocean size was also determined and noted.

Students defined hydrosphere and its importance to life on Earth and connected the oceans' importance and role to the water cycle.

8. Life Science – Biological Evolution: Diversity and Unity

Students analyzed and interpreted evidence from the fossil record. This information was used to describe organisms, their environment, extinctions, and changes to life forms throughout the history of Earth.

Additionally, students constructed an argument using anatomical structures (bones) to support evolutionary relationships among and between fossil organisms and modern organisms.

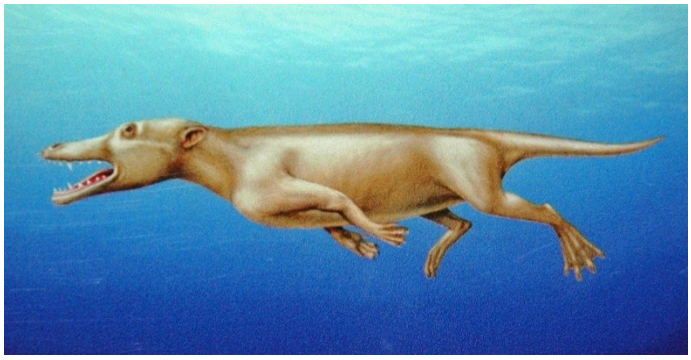
Students created replicas of carbon film prints and trace/mold/cast fossils. Biological diversity and unity is revisited in Life Science – Cetaceans and Life Science – Reptilia.

9. Life Science – Cetaceans: Mysticetes and Odontocetes

Students analyze and interpret the fossil record to describe how Pakicetus, a prehistoric cetacean mammal, may have evolved to modern day cetaceans, with emphasis on baleen (Mysticetes) and toothed (Odontocetes) Whales.

Students analyzed the internal and external anatomy of whales to determine how they survive and thrive in their environments, including communication and feeding. Activities included experiencing how energy travels through sound waves, feeling how blubber insulates, and measuring actual sizes of given whales (customary measurements). Students created human chains for perspective.

Students also discussed a brief history of whaling and its impact on international consumption of whale commodities and how New Bedford, "Lucem diffundo." lit the world with whale oil, spermaceti.



10. Life Science – Reptilia: Squamata

Students were introduced to Titanoboa, a prehistoric reptile that may have reclaimed the global void left by the extinction of dinosaurs and marine reptiles during the Paleocene Era (66-56 million years ago).

Students examined reptile anatomy specific to snakes. Then, they had an encounter with a live Woma Python (Aspidites ramsayi).

Students also examined how adaptations and genetic mutations positively and negatively affect the survival of select species of reptiles. An emphasis on defense mechanisms and predation were made. Predation in ecology is an interaction in which one organism, the predator, eats all or part of the body of another organism, the prey.

11. Life Science – Local Ecosystems

Students conducted a field study across the multiple ecosystems of the Acushnet Sawmill including meadow, forest and wetlands. They described how relationships among and between found organisms in an ecosystem can be competitive, predatory, and parasitic.

They also discussed how organisms that share an ecosystem can be mutually beneficial, including how matter and energy can be transferred among living and nonliving parts of an ecosystem.

12. Life Science - Marine Animal Life

Students studied shallow water flora and fauna indigenous to the North Atlantic, East Beach, New Bedford, Massachusetts.

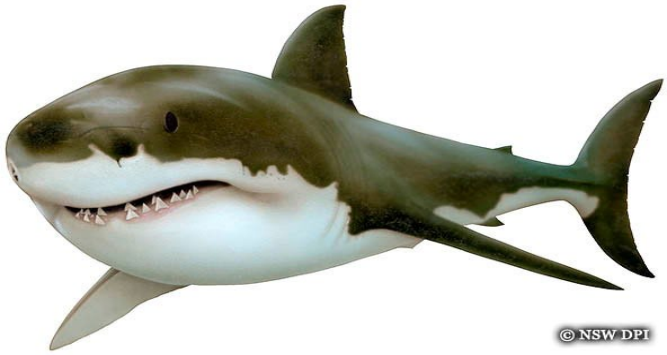
13. Life Science - Adopt-A-Great White Project

Students researched and adopted a great white shark, Carcharodon carcharias**, tagged by the OCEARCH Team. The Great White is also known as the white**

pointer, white shark, or white death, and is a species of large landform sharks, which can be found in the coastal surface waters of all the major oceans.
Scientific name: Carcharodon carcharias
Higher classification: Carcharodon

Using OCEARCH's Global Shark Tracker, the students observed and plotted the navigational pattern of their adopted great white through satellite tracking technology.

Students plotted their adopted shark's migration patterns on a world map.



14. Physical Science - Waves

The science of wave study was investigated. Students learned to identify the characteristics and causes of waves. Students explored the Carolos Effect.

Wave vocabulary such as:

- **trough**
- **crest**
- **height**
- **white caps**
- **breakers**
- **tsunamis**
- **surface current**
- **Gulf Stream**
- **Ocean basin**

15. Technology/Engineering- Bridges

Students are presented with the history of bridge type, and their functions were explored. Bridges of New England were reviewed and identified. We explored the compressive and tensile forces needed to construct a beam, an arch, or a suspension bridge. K'nex Education was implemented as a learning tool. Students worked collaboratively building a model, testing the tension and compression, and identifying/correcting flaws in the design. Students also were tasked with drawing a blueprint to one third scale of their model to indicate an architectural landscape.

16. **<u>Technology/Engineering – Defining an Engineering Design Problem - Paper Airplanes</u>**

The engineer design process was explored as students:

- **Asked questions**
- **Defined problems**
- **Delimited engineering problems, proposals, prototypes, and manufacturing**

Students researched the criteria (available materials and resources) and constraints (desired features of the solution) for designing and manufacturing a paper airplane.
The final production of each plane was tested and the best flying plane was entered into the Field Day Airplane Distance Contest.

17. **<u>Safety Symbols in the Laboratory</u>**

Students studied laboratory safety symbols and the use of proper techniques and procedures for safe laboratory experiences. Some laboratory safety procedures include reading labels, identifying flammable liquids, techniques for handling chemical spills, utilizing proper laboratory dress, wearing eye protection, and handling glassware carefully.

<u>Level Four - Grade 6</u>

<u>Room: 102</u>		**<u>Room: 104</u>**	
<u>Instructor</u>:	**John Correia**	**<u>Instructor</u>:**	**Ellen Costa**
<u>Intern</u>:	**Myah Fonnseca**	**<u>Intern</u>:**	**William Bouvier**

Exhibits

1. **Microscopy**
   Students become familiar with the use and care of a compound microscope. The use the FOV, "field of view," to correctly adjust magnification and resolution in order to view and identify specimens found along East Beach.

2. **Dissection of the** Loligo pealii**, the Squid**
   Students are acquainted with dissecting skills and tools by examining the internal and external anatomy of the squid.

3. **Thermal Gradients**
   Students constructed graphs depicting temperature changes in local shallow waters.

4. **Botany Press**
   A device used by the students to prevent marine algae specimens from wrinkling as drying takes places. Later the specimens are mounted, identified and stored for future use in the classroom.

5. **Wind Rose – Marine Weather Chart**
   Marine symbol used in navigation. It shows prevailing wind for a given area according to the season. Taken every hour during our session – wind was predominantly southwest. Direction varies from port to port.

6. **Celestial Navigation - Sextant**
   The sextant is an accurate tool used in navigation for fixing a position relative to the shore, necessary over radar because of the curve of the Earth's surface. It indicates latitude, North or South.

7. **Marlinspike Seamanship**
   Marlinspike Seamanship is the study of knot making, splicing and whipping. Five knots were studied for use during sailing instruction on the Sea Lab Catalina 16.5 sailboats. Rope boards were made.

8. **Symbiosis**
   Symbiosis is an example of marine creatures living together for their respective mutual benefit.

9. **Anchor**
   Five types of anchors are used on our shores, courtesy of C. E. Bechman Company.

10. **Meteorology – Cloud Formation**
    Student drawings illustrating various cloud formations are displayed.

11. Meteorology
Students learned to operate and use various meteorological instruments such as the aneroid and mercurial barometers, thermometer, wind vane, rain gauge, hygrometer, psychomotor, and anemometer.

12. Life Science - Preserved Specimens – Flora and Fauna Classification Students observed specimens of flora and fauna.

13. Life Science - Fish Tank
Specimens from East Beach, New Bedford, Massachusetts, are displayed and classified as to flora and fauna.

14. Life Science - Dune and Shore Plants Dioramas
Students prepared a scenic display of land plants from the Eastern Coast, which have adapted to the seashore environment.

15. Life Science - Mollusk Display
Students collected and studied univalve and bivalve mollusks indigenous to the New Bedford coastline.

16. Life Science - Independent Study
Student research pertaining to the marine and aquatic environments is displayed.

17. Boating Safety
The basic "Boating Safety" course offered to Grade 6 Sea Lab students by the Massachusetts Division of law Enforcement consists of six, one-hour classes. This course addresses the following topics: Watercraft, Accident Prevention, Legal Requirements, Safety Equipment, Safe Boat Operation, Rules of the Nautical Road, and Aids to Navigation. The Division's primary purpose is to further the public's safety, by focusing particularly on youth, who are becoming more involved and are assuming greater responsibilities in boating activities.

18. Scientific Method
The scientific method is a way to ask and answer scientific questions by making observations and doing experiments. The steps of the scientific method are to:

- **Ask a Question**
- **Do Background Research**
- **Construct a Hypothesis**
- **Test Your Hypothesis by Doing an Experiment**

- **Analyze Your Data and Draw a Conclusion**
- **Communicate Your Results**

Students utilized the scientific method in order to design an experiment to answer the question:

"Do taller students have bigger feet?"

Students utilized the scientific method, inquiry-based journals, and concepts of measurement to test their hypothesis. Students recorded their data and analyzed it in order to make conclusions. Students discussed the importance of communicated data gained from the public and designed graphs using Microsoft Excel to male their accrued data more accessible to others.

19. **Life Science – <u>Cryptozoology – "Bigfoot Footprint Model"</u>**
Six grade students studied measurement and scale while exploring the theory of Bigfoot. Using tape measures, rulers, and research data from Cryptozoologists as well as photos of Bigfoot sightings, students were able to come to a conclusion regarding Bigfoot's foot length, from toe to heel, and width at its widest. Independently, students created a model of Bigfoot''s foot print.

20. **<u>Life Science – Cryptozoology – "Footprint Castings"</u>**
Students researched and studied the process by which scientists are able to study and determine Bigfoot's existence. Students read FBI documents to gain insight on the process of casting footprints said to belong to Bigfoot. Using a similar procedure, students casted their own footprints from sand and compared it to the castings and footprint dimensions of Bigfoot.

21. **<u>Life Science – Cryptozoology – "Loch Ness Monster": Fact or Fiction</u>**
Students, utilizing valid research sources to accrue information, developed an educated opinion regarding the validity of the existence of the Loch Ness Monster, "Nessie."

Students participated in a Fact or Fiction debate citing sources of reference as evidence or non-evidence of the existence of the Loch Ness Monster.

22. **<u>Earth and Space Science – Cryptozoology – Mapping</u>**
Students researched the most famous and mysterious sightings of the Sasquatch and Nessie sightings and recorded aspects of each sighting in their inquiry journals. Students identified each sighting on a map, as well as compared and contrasted the distinct similarities and difference between each sighting.

23. **<u>Earth and Space Science – Mars Rovers and Landers</u>**
Students researched and analyzed NASA's Jet Propulsion team of Mars rovers and landers in order to understand their purpose, mission, findings, and accomplishments. Utilizing gathered information, students designed and created their own rovers and landers to accompany their model of Mars' geological landscapes.

24. **Life Science – Ecosystem Brochure**

Students investigated a variety of unique ecosystems found on Earth. They analyzed the living and nonliving aspects of a selected ecosystem. Each student researched their selected environment's species, interactions between species, geography, environment, and the distinct ways in which each biotic factor had adapted over time to sustainably live in their selected ecosystem.

Students were asked to predict the future of their specific ecosystem and hypothesize how aspects of global climate change might affect certain species within their ecosystem forcing the species to migrate or adapt to their changing ecosystem.

Student created a brochure of their selected ecosystem.

25. **Life Science - Dichotomous Classification**

Identifying and learning four characteristics, attributes, students identified several popular cetaceans such as whales, dolphins, and porpoises.

Level 5 – Grade 7

Room 109		**Room 111**	
Instructor:	**Ian Francis**	**Instructors:**	**Ralph Perry** **Christopher Perry**
Intern:	**Aaron White**	**Intern:**	**Ty Spencer**

Exhibits

1. **Microscopy Earth and Space Science - Geology - Geological Time Scale**

   Students studied the development of planet, Earth, through the four eras of geological history: Cenozoic, Mesozoic, Paleozoic, and Precambrian. Students constructed time lines to demonstrate the characteristics of each era. Each period is characterized by a different range of fossil creatures. The Precambrian period represents 85% of the history of the Earth.

2. **Earth and Space Science - Geology - Paleontology**

   Students discover that the role of a paleontologist is an historical geologist who compiles and deciphers clues from fossils to explain findings. Students model field paleontologists who make casts of their specimens on site, by filling fossils imprints with plaster of paris. These fossil casts are sent to colleagues for study and analysis. Students make plaster imprints of objects in order to replicate the paleontologist's experience.

3. **Earth and Space Science - Geology – Global Tectonics**

   The theories of continental movement and crust changes were investigated and discussed. Student projects depicting plate movement and isostasy are displayed.

4. **Earth and Space Science - Geology - Volcanology**

   Students investigated the development and structure of volcanoes. Using baking soda, vinegar, and food coloring, students produced a chemical solution which resulted in the eruption of a model volcano. Classroom display includes student-constructed models of the three volcano types: composite, shield, and cinder cone.

5. **Earth and Space Science - Geology - Pangaea**

   Students' study of Alfred Wegener's publication, The Continental Drift Theory, including the development and controversy surrounding such, led the students to a model construction of Pangaea, the initial continent.

6. Earth and Space Science - Geology – Crystal Formation

Elements are the building blocks of matter, including minerals and rocks. When temperatures are high, molecules in rocks may break down into atoms or atom groups. With slow cooling these atoms may join together, in regular order, to form crystals. Crystals are an indication of the internal arrangement of the atoms.

Minerals form geometric shapes called crystals when molten rock solidifies, or a liquid evaporates. Students made a solution of sugar, water, and food coloring to form edible sugar crystals.

7. Earth and Space Science - Geology – Horst and Graben Faults/Strike-Slip

Faults Students created models representing Horst and Graben faults which can happen along normal fault lines due to tension forces. Students also created strip-slip fault models representing the orientation of tectonic plates.

8. Earth and Space Science - Geology – Geode Formation

The term geode is derived from the Greek word "Geodes" which means "earthlike". Crystals, found in the cavities, empty spaces, of rocks are called geodes. A geode is a hollow mineral body found in limestone and some shale. The common geode formation is a slightly flattened sphere ranging in diameter from one to twelve inches and contains a chalcedony layer which surrounds an inner lining of crystals. Students constructed geodes using plaster of Paris, Epson salt, and food coloring.

9. Earth and Space Science - Geology – Fossil Identification

A fossil refers to any remains of a once-living thing preserved in sedimentary rock. Fossils are formed in different ways. A cast fossil is formed by sediments filling up a mold. A mold fossil is the original imprint of a plant or animal that mud hardened around. A fossil is an encyclopedia of life in the past. Students constructed cast fossils and mold fossils using clay, plaster of Paris, sea shells and plants.

10. Earth and Space Science - Geology – Sedimentary Layers

Sedimentary rocks are composed of different layers. These layers can be sand, pebbles, silt, fossil fragments, etc. Students collected rocks, pebbles, sand, and plants from East Beach, New Bedford. They placed the specimens in a jar, covered the specimens with sea water, sealed the jar, and the layers settled. Materials settled into layers with the coarser, heavier materials at the bottom and the finer, lighter layers at the top. Sedimentary layers, after a long period of time, turn into sedimentary rock.

11. Earth and Space Science - Geology – Beach Sand Comparison

Students received sand specimens from specific northern and southern hemisphere beaches. Students determined sand composition and content by chemical analysis and microscopic examination of the granules. Sands from Portugal, the Bahamas, Aruba, Ireland, and New Bedford were viewed and compared and contrasted

12. Earth and Space Science - Geology – Sand Specimens from Around the World

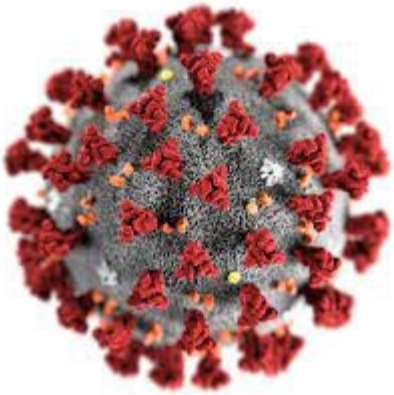
Using a binocular microscope, students observed sand specimens from Aruba, Portugal, the Bahamas, Ireland, New Zealand, San Salvador, Australia, and New Bedford's East Beach. Sand granules were drawn and mounted. Students learned different sizes and compositions of sand granules are indigenous to the area/areas from which they are obtained. Students were able to identify sand granules'geographical location by observing the specimen's components. They also learned that fine sand would accumulate on a beach where waves, wind, and current energies are low. When energies are high, fine sand is carried away leaving coarser materials. Due to the interaction of global energies, sand is often sorted into zones with defined layers of fine sand, coarse sand, pebbles, and larger specimens on the same geographical location.

13. Life Science - Biology – Vanessa cardui, Painted Lady Butterfly

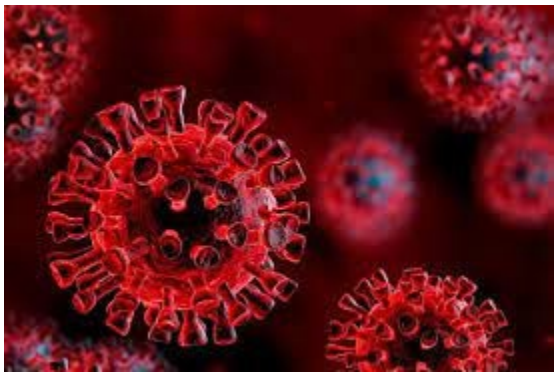
Insects living by the seashore are necessary for the pollination of shore plants and the anchoring of these plants preserving the integrity of the shore levels. The Vanessa cardui, Painted Lady Butterfly, is indigenous to the North Atlantic region and undergoes the process of metamorphosis throughout its life cycle. Students studied the metamorphosis of this beautiful butterfly through its four distinct life stages: egg, larva (caterpillar), pupa (chrysalis), and adult butterfly through the observation of Painted Lady Butterfly chrysalis. The Painted Lady Butterfly is found almost anywhere, but marshes and dunes are attractive habitats for this beautiful butterfly.

14. Life Science – Biology-Virus

Students will be exposed to how quickly a COVID virus can spread through a random population. They will view the size of various viruses and develop their own model of a COVID 19 virus as well as a Delta Variant Virus.



COVID 19 VIRUS



DELTA VARIANT VIRUS

Students will use a microscope to view mask texture and theorize which mask has the capabilities of stopping the virus from passing through its material.

16. <u>Life Science - Biology - Construction of a Frog Model and the Dissection of a Rana pipens</u>

Students constructed a model of a frog indicating internal structures. This basic model provided an introduction to the dissection of a frog and an understanding of the animal's basic internal structures and their functions.

Students observed and dissected their own frog. They studied its internal and external structures. A frog's life cycle was discussed and studied.

17. <u>Life Science - Biology – Blue Whale Study –</u> <u>Balaenoptera musculus</u>

The blue whale, Balaenoptera musculus, is larger than any creature. A 100-foot blue whale weighs about 110 tons or more than 1,600 people. Blue whales can live at least 50 years, and a 90-year life span is possible. A blue whale needs 1.5 million calories a day whereas a human adult needs about 1,500 to 2,500 calories daily. The lungs of the blue whale hold as much air as an average size bedroom. The blue whale is on the endangered species list.

Students studied the anatomy of a blue whale and compared its anatomical characteristics to a human being. Students constructed a paper model of the blue whale.

18. <u>Life Science - Biology – Horseshoe Crab Study –</u> <u>Limulus polyphemus</u>

Students studied the life cycle and anatomical features of the horseshoe crab. Blood study and current research utilizing the horseshoe crab's "blue blood" were researched and discussed. A model of Limulus polyphemus **was assembled by the seventh graders.**

19. **Life Science - Biology – Osmosis of an Egg – Part I**

An egg was placed in a vinegar solution to remove the shell. Students observed the swollen egg. This was due to diffusion through a semi permeable membrane. mercenaria

20. **Life Science - Biology – Osmosis of an Egg – Part II**

Removal of water from a swollen egg was observed to demonstrate and explain Reverse Diffusion. Students then placed an egg in a syrup solution and observed the egg shrinking in size.

21. **Life Science - Biology – Human Skeleton**

Students mastered anatomical terminology and assembled a paper human skeleton. A plethora of "bony-critters" are displayed.

22. **Life Science - Biology - Dissection of** Mercenaria mercenaria**, the Quahog**

Students explored the external and internal anatomy of a quahog through a dissection process. Students observed and identified quahog anatomy such as: siphons, internal portion of the left valve, the digestive system, and the circulatory system.

Quahog Model

Students constructed a model of a marine bivalve mollusk, the North Atlantic Quahog, Mercenario mercenaria. **Color coded poster board and respective labels were used to duplicate the internal and external anatomy of this bivalve.**

23. Life Science – Biology – Perch – Cyprinus carpio

Students constructed an anatomical model of a perch. Students identified and color-coded internal organs.

24. Life Science - Biology - North Atlantic Mollusk Identification

Students collected indigenous bivalve and univalve skeletons from East Beach. Each shell, exoskeleton, collected was mounted and identified according to mollusk type.

25. Life Science - Biology - Extracting DNA from Fruit

Students participated in an introductory procedure utilized in molecular biology to extract DNA from an edible fruit, the banana. The procedure to release the DNA includes four stages: Step 1 – the fruit is broken up into a pulp; Step 2 – a detergent is used to release DNA from cell membranes; Step 3 – the mixture is filtered in order to separate the nucleic acid from the cellular membranes; and, the final step is to precipitate the DNA in alcohol, where it becomes visible. Dying the sample with Toluidine stains the nucleus of the cells enabling the sample to be observed utilizing a microscope.

DNA is Deoxyribonucleic Acid. It is a nucleic acid that contains the genetic instructions used in the development and functioning of all known living organisms and some viruses.

26. <u>Physical Science - Meteorology – Hurricane Chart</u>

Students tracked several theoretical hurricanes using a hurricane chart. They learned the importance of using accurate longitude and latitude quadrants in indicating a hurricane's path. They also learned how to protect life and the environment during a hurricane and the precautions to take if a hurricane is eminent.

27. <u>Physical Science - Physics – Wave Tank – Properties of Waves</u>

Students generated simplified waves in a laboratory wave tank. A wave tank is basically a long slender aquarium with a paddle at one end. The paddle moves back and forth or up and down at various rates to generate waves. Students learned that waves are trochoids, the shape described by a point on a disc as it rolls along a straight line. Students also investigated how waves affect the shape of a beach or a continent-ocean boundary. The result of this study was the construction of mini-wave cylinders indicating a tsunami-like wave.

28. Physical Science - Physics – Wave – Wave Action In fluid dynamics, wind waves (or wind-generated waves) are surface waves that occur on the free surface of oceans, seas, lakes, rivers, and canals or even on small puddles and ponds. They result from the wind blowing over an area of fluid surface. Waves in the oceans can travel thousands of miles before reaching land. Wind waves range in size from small ripples, to 30 miles high.

When directly generated and affected by local winds, a wind wave system is called a wind sea. After the wind ceases to blow, wind waves are called swells.

More generally, a swell consists of wind-generated waves that are not usually affected by the local wind at that time. They have been generated elsewhere or some time ago. Wind waves in the ocean are called ocean surface waves. Wind waves have a certain amount of randomness: subsequent waves differ in height, duration, and shape with limited predictability. They can be described as a stochastic process, in combination with the physics governing their generation, growth, propagation and decay—as well as governing the interdependence between flow quantities such as: the water surface movements, flow velocities and water pressure. The key statistics of wind waves (both seas and swells) in evolving sea states can be predicted with wind wave models.

Students chart and register wave action across the earth's oceans.

29. Physical Science - Physics – Renewable Energy –MacGyver Windmill Challenge

Students investigate renewable energy by discovering how a basis windmill operates. This investigation leads students to discover how wind turbines work. The MacGyver Windmill Challenge exemplifies how a windmill captures the energy of the wind and converts it into usable mechanical energy. Students applied the engineering design process and scientific method to design, build, test, and improve windmill models constructed from various household materials.

30. Physical Science - Physics – Density

Density refers to a measure of how much of some entity is within a fixed amount of space. Students illustrated the concrete application of density by placing a variety of liquids in a tube. The materials placed in the column indicated their density by settling with the heaviest liquid on the bottom to the lightest liquid on the top. Liquids used to indicate density included honey, Karo corn syrup, milk, liquid detergent, water, and isopropyl alcohol.

31. Design, Engineering & Technology - Microscopy

Students learned the concepts, basic parts, and proper handling of a microscope. Additionally, they observed a number of prepared slides and specimens indigenous to the Fort Rodman area.

32. Pictorial Display

A pictorial history, presented in the form of photographs, depicts seventh grade student activities and field studies at the Lab this summer.

33. Student Log

Samples of student notebooks, activity sheets, quizzes, and exams are displayed.

34. Marine Related Activity - Snorkeling

Students were taught the basic principles of snorkeling on a bi-weekly basis. Students then explored the ocean with their instructor. A variety of marine plants and animals were examined both at the waterfront and in the classroom.

Using snorkeling skills, seventh grade students participated in an open water trophy dive to collect and identify indigenous North Atlantic flora and fauna.

35. Independent Study

Several displays of student independent research projects are featured which include Palmer Island, New Bedford, Massachusetts; Palmer Island Light Station, New

LEVEL 6 – Grade 8

Room:	**101**	**Room:**	**103**
Instructor:	**Christopher Pires**	**Instructor:**	**Matthew Tweedie**
Intern:	**Hannah Bouvier**	**Intern:**	**Kate Ferland**

Exhibits

1. **Life Science - Salt Water Environment**
   Students assembled a saltwater tank and stocked it with organisms collected during various snorkeling excursions here at Sea lab. The organisms presently in the tank include: hermit crabs, green crabs, periwinkles, minnows, pipefish, mussels, a whelk, bryozoans, coral, and a sponge.

2. **Life Science - Marine Algae**
   Students collected and classified common species of algae found at Sea Lab. The algae were then pressed and displayed.

3. **Life Science - Taxonomy**
   Students studied the science of grouping organisms on the basis of their similarities. They followed Carolus Linnaeus' classification system, which attributes two categories to every living thing known as its species and genus. Sea Lab students collected specimens indigenous to Fort Tabor, New Bedford, Massachusetts, and classified them according to Carolus' system.

4. **Life Science - Dissection of the Dogfish,** Squalus
   Students observed the external and internal structures of this representative member of cartilaginous fishes. The reproductive, digestive, circulatory, and nervous systems were studied for comparison to a subsequent dissection of the perch, a bony fish.

5. **Life Science - Dissection of the Yellow Perch,** Perca flavescens
   Students observed the swim bladder, a major adaptation of the bony fish. External anatomy and comparative studies with the shark were emphasized.

6. **Physical Science - Marine Pollution, "Trash Study and Display"**
   Students participated in a "trash" walk along a thirty-foot section of beach at Fort Tabor. They collected trash from the above-designated area for display purposes. This experience prompted a heated discussion on pollution and its impact on the marine environment.

7. **Life Science - Morphology**
   Students studied the branch of biological science, which deals with the form and structure of animals and plants. Students studied the development of animal and plant forms: the history of an organism as a whole and the resemblances and differences between several forms of the same plant or animal in order to show simple to complex development. The term "morphology" is credited to the German writer, Johann von Goethe.

8. **Independent Study**
Independent student research projects pertaining to the marine and aquatic environments are displayed.

9. **Life Science - Fashion a Fish**
Students were introduced to and studied the three groupings of fish: the jawless, cartilaginous, and bony fish. Adaptations of the three groups were discussed, including special adaptations which led to the evolution of the most successful group, the bony fish. Students designed "Fashion Fish" are on display.

10. **Life Science - The Buzzards Bay Watershed**
The Buzzards Bay Watershed includes the communities of Falmouth, Bourne, Carver, Wareham, Marion, Rochester, Mattapoisett, Acushnet, Fairhaven, New Bedford, and Dartmouth. Students investigated point and non-point pollution sources leading into the Bay. The display includes the students' study of the effects of pollution along the watershed and a chart of the Drainage Basin Boundary.

11. **Physical Science - Pigment Extraction Methodology**
Students learned a method for extracting the pigments from plant specimens with special adaptations for marine algae using paper chromatography.

12. **Physical Science - Glasswork**
Students practiced laboratory techniques for cutting, fire polishing and bending glass tubing.

13. **Life Science - Plankton**
Students constructed plankton nets and separators to gather samples from various locations. The samples gathered were analyzed in the lab, and then classified.

14. **Physical Science - Man's Impact on Buzzards Bay**
Students investigated the effects of oil spills and nutrient loading on the life in the Bay.

15. **Physical Science - Chemical Oceanography**
Students conducted tests for salinity, dissolved oxygen, carbon dioxide, temperature, and pH. These tests were carried out in a salt marsh, brackish water, and Buzzards Bay. The data was compared, contrasted, and analyzed.

16. Physical Science - Turbidity

Students constructed a Sechi Disk and a laboratory transmisometer to calculate the transparency of water.

17. Physical Science - Solvent Property of Water

Students discussed the properties of water as the universal solvent. The experiment consisted of dissolving chemical dyes in water and tie-dying cotton clothing in various colors and designs.

18. Life Science - Microbiology

Students studied the basic unit of all life, the Cell. Students investigated the structure of both Prokaryotic and Eukaryotic cells while constructing models of animal cells and their organelles. Students also participated in laboratory activities illustrating diffusion, osmosis and mitosis.

19. Life Science - Marine Aquarium

Students established, stocked and maintained a 250 gallon marine aquarium with species indigenous to the North Atlantic. Using seine nets as collecting tools, students gathered various fish species including Tautog, Atlantic Silverside, Black Sea Bass, Northern Pipefish, and Summer Flounder also known as Fluke. Other specimens added to the biome included Hermit Crabs, Asian Shore Crabs, Common Periwinkles, Quahogs, and Ribbed Mussels. Students gathered the inhabitants of the marine aquarium from East Beach, New Bedford Harbor, New Bedford, Massachusetts. Additional specimens were collected during field trips to local waters.

20. Life Science - Seine Survey

Students, using seine nets, captured Atlantic Silverside, Menidia menidia**, from waters off of East Beach, New Bedford Harbor. Data sheets were compiled and statistics indicating the length frequency of the Atlantic Silverside were entered using the Excel Spreadsheet format for charting. Students utilized computers located in Sea Lab's Technology Library for this exercise in instruction and evaluation.**

21. Physical Science - Physics – Density – Oil Spill

Students were exposed to the Exxon Valdez oil spill, which was one of the largest oil spills in history. Students discussed how oil spills occur, how oil spills are cleaned, how oil spills affect animals, plants, and the planet. Students participated in experiments explaining oil spills in terms of density by testing the density of rubbing alcohol, Karo corn syrup, and vegetable oil in water.

Students discussed the environmental aspects of an oil spill specifying the environment's ability to provide food, water, space, and essential nutrients for its inhabitants. Experiment determined the most applicable techniques for cleaning an oil spill, which included paper towels and Dawn dish detergent.

22. **Design, Engineering & Technology - MIT Sea Grant – Sea Perch: Integrating Ocean Exploration in the Classroom**
    Ocean exploration requires the technology of underwater tools. The MIT Sea Grant Sea Perch Program introduces pre-college students to the wonders of underwater robotics. The Sea Perch Program teaches students how to build an underwater remotely operated vehicle, ROV, made of PVC pipe, and many other household objects.

23. **Design, Engineering & Technology - MIT Sea Grant – Sea Perch: Integrating Ocean Exploration in the Classroom**
    Additionally, this initiative teaches students how to build a propulsion system, how to develop a controller, and how to investigate weights and buoyancy. The mission of this initiative is to lead students to the development of technology and the pursuit of scientific investigations addressing important problems surrounding human use of and impact on coastal waters and oceans. With a marine engineering theme, this project teaches basic skills in ship and submarine design and encourages students to explore naval architecture and marine and ocean engineering concepts. By employing principles of oceanography, electronics and engineering, this program teaches students the vital interdisciplinary role of the world's oceans in a fun and educational manner. Two Sea Lab students per team built a Sea Perch and participated in various underwater challenges using their ROV.

Level 7 – Grade 9

"THE BEST OF THE BEST"

Sea Lab

Marine Science Education Center
New Bedford Public Schools

Room 105
Instructor: Adam Desjardins

Intern: Will Gauvin

Room 107
Instructors: Dr. Robert Southerland

Intern: Sam Jupin

Intern: Siera Barbosa

Science, Technology, and Engineering Exhibits

1. Life Science - Marine Biology - Salt Water Environment: Marine Aquarium

Students established, stocked, and cared for a 125 gallon marine aquarium. The students collected North Atlantic species while participating in a site visit to East Beach, New Bedford, MA. Species were collected using seine nets and snorkeling. Students maintained a closed-loop filtration system in a classroom **based marine environment.**

2. Technology & Engineering: FTC: FIRST TECH CHALLENGE Robot

Working in teams of four, the students constructed a working, programmable robot designed to accomplish the task of moving bean bags from the floor into a fixed trough. Students learned the basics of hand tool construction, the purpose and use of various nut and bolt fasteners, wiring, gear ratios, and stepper motors. Throughout the 5-day process, students learned to brainstorm ideas as a team, delegate responsibilities for the construction process, and redesign their robot after testing in order to accomplish a task.

Ninth graders, with help from the Newport, RI, Naval Undersea Warfare Center engineers, built FIRST TECH Challenge Robots.

Initially, student teams reviewed a video focusing on FIRST TECH Challenge Robots**. Ninth graders were then challenged to construct a FIRST TECH Robot** utilizing **a myriad of parts, their imagination and the laws of physics.**

Student teams constructed robots using Tetrix hardware, developed gear ratios, torques and speed in design of the drive train and agility of the robot arm.

FIRT TECH Robots were programmed using a Lego NXT brain with C Programing Language.

3. **Design and Engineering: Sea Perch**

The Sea Perch is an underwater remotely controlled vehicle. Students constructed all aspect of the Sea Perch which included:

- **Cutting and measuring pipe**
- **Assembling the frame**
- **Building a printed circuit board control box**

Ninth graders learned to use power drills and soldering irons to complete the build. When completed, the physics of buoyancy were applied to operate the Sea Perch.

4. **Crew: New Bedford Boating at Pope's Island**

Ninth graders participated in crew (rowing) each week for a total of five sessions. In this group activity, the students were taught the fundamentals of scull rowing, and the safe operation of the scull as a group or individual.

The students spent time rowing as a team in and around the New Bedford Fairhaven Harbor. Throughout the experience the students were asked to relate the actions of the boat to Newton's laws of physics, buoyancy, rowing forces, acceleration, and inertia.

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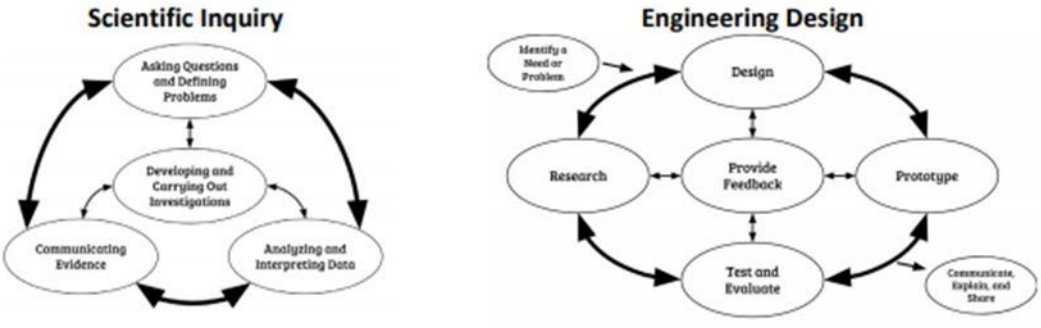
5. <u>Buoyancy</u>

Students explored and applied the concept of buoyancy in a fluid through experimentations with an underwater remotely controlled vehicle (R.O.V.) The equation used was:

Buoyancy =Density x Volume x Gravity

Using scientific inquiry and the engineering design process, (see image below) students applied the scientific principle of buoyancy using the ROV. Students conducted experiments to manipulate the forces acting on the ROV in order to achieve the conditions of positive, negative, and neutral buoyancy conditions. Discussions relating to how fish and submarines regulate their buoyancy in a marine environment occurred.



[4] See Appendix VIII for more on crosscutting concepts.

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6. Field Trips

Sea Lab field trips are designed to enhance the current curricula and evoke an interest in marine and aquatic affairs.

Crew Instruction, New Bedford Rowing Center, Pope's Island, New Bedford, MA

Ninth graders participated in a five-session crew instructional series. Students learned the fundamentals of crew and how to care for a scull. Students were instructed by members of the New Bedford Rowing Center. They rowed as teams through Fairhaven as well as New Bedford Harbor. This activity builds team reliance and awareness of local "ocean" conditions.

7. Whydah Pirate Museum

Ninth graders traveled to the Whydah Pirate Museum in West Yarmouth, MA. On this field trip, students were taught about the richest pirate in history, Sam Bellamy. Students interacted with the museum historian, and discovered what life was like aboard the famous ship that wrecked off Cape Cod. Students also examined artifacts that were pulled from the sea floor and learned about the science of preservation.

For the 2021 summer session, ninth graders explored the topic of Piracy and how this infamous life style influenced the topography of world oceans; the design and engineering of weaponry and ships; the gender and racial equality demographics; the government system; regulations and laws; the social system followed by "pirated". In other words, "the GOOD, the BAD, and the UGLY" of pirates.

A BRIEF HISTORY OF PIRACY

Pirates are sea robbers who prey on other ships and rob them of their goods and sometimes capture the ship itself for their own purposes.

Piracy began over 2000 years ago in Ancient Greece, when sea robbers threatened the trading routes of Ancient Greece. Since then, this threat has continued amongst seafaring nations ever since, until the birth of regular navies.

Roman ships were attacked by pirates who seized their cargoes of grain, and olive oil. The Vikings (which means sea-raider) were renowned for attacking shipping and coastal settlements.

However, piracy really flourished between 1620 and 1720, and this period is known as the golden age of piracy. Between the sixteenth and nineteenth centuries, there have been different types of pirates, these being, privateers, buccaneers, and corsairs.

Privateers were lawful pirates who were authorized by their government to attack and pillage ships of enemy nations. They shared their profits with the government they represented.

Between the sixteenth and eighteenth centuries governments issued 'letters of marque' which licensed these sailors to plunder alien ships. This was to prevent privateers from being charged with piracy, which was an offence punishable by death. Francis Drake was England's most famous privateer. In the sixteenth century he attacked Spanish treasure ships returning from the new world, sharing his profits with Elizabeth I, who knighted him for his services.

Buccaneers were pirates and privateers who operated from bases in the West Indies, and attacked Spanish shipping in the Caribbean. Corsairs were Muslim or Christian pirates who were active in the Mediterranean from the sixteenth to the nineteenth centuries. The Barbary Corsairs were Muslim, and operated solely from the North African states of Algiers, Tunis, Tripoli and Morocco, and were authorized by their government to attack the ships of Christian countries. In contrast the Maltese Corsairs were Christian and were granted a license by the Christian Knights of St John to attack the 'barbarian' Turks.

Many pirates had served in merchant or naval ships prior to turning to piracy. Life on a pirate ship appeared more attractive as they were independent of national laws, the crew was treated much better than normal sailors and prize money was shared out equally. Most seamen became pirates as they hoped to become rich on plunders of treasure and cargo ships.

When pirate ships captured merchant ships, the pirate captain would ask for volunteers to serve under him. Many of the crew would volunteer as life on a merchant ship was harsh and conditions awful.
There were not many women pirates, however there were some extremely powerful women pirates, such as Ching Shih who commanded a pirate community of 80,000. The two most famous women pirates were Anne Bonney and Mary Reed, who were captured in 1720 and put on trial in Jamaica. They were both sentenced to death, but escaped execution as they were both pregnant. Mary Reed died of fever a few months after the trial, but Anne Bonney was released.

Becoming a pirate was called 'going on the account' and they had to agree to live by the rules of the ship. These rules were often strict and breaking them could mean flogging or even death. If a pirate was found stealing from their comrades or deserting during battle, they were marooned on a desert island with meagre supplies.

Pirates used flags to frighten passing ships into surrendering without a fight. The original pirate flags were blood red, and this signaled that no mercy would be shown once the pirates boarded and battle ensued. As piracy developed, more flags were used, and pirates often had their own flags. The Jolly Roger, (a skull and crossbones) is the most famous pirate flag. The symbol had been appropriated from the symbol used in ships' logs, where it represented death on board. It was first used as pirate flag around 1700 and quickly became popular with pirates, who designed their own version of the flag, e.g. a skull and crossed swords.

Pirates required ships that were fast, powerful, and had as shallow a depth below the water as possible. This was because surprise was vital to a pirate attack, and they needed to be able to navigate in shallow coastal waters and hide in secluded coves and inlets. Schooners were used by pirates in North American waters. They were fast, easily maneuvered, with a shallow draught but were large enough to carry many guns and a large crew.

In the seventeenth and eighteenth centuries, the Barbary Corsairs used galleys, which were long and narrow with a sail. During action, these vessels were rowed to allow travel at speed. Each oar was manned by up to six slaves who were chained to benches. The aim of the corsairs was to ram the enemy ship, board and defeat the crew in hand-to-hand battle. The galleys were only suited to the Mediterranean where conditions were calm. Junks which were flat bottomed boats, with three masts and sails held together with bamboo rods, were used in Chinese waters. The largest junks held twelve guns and carried rowing boats to raid coastal villages or board enemy ships. Pirates often took over captured merchant ships and altered them to suit their purpose, such as to increase speed, cut more gun ports, and also to hide the true identity of the ship. They also utilized weapons, clothes, medicines, and food found on board.

Organized piracy and privateering were finally ended in the nineteenth century. In 1816, the bombardment of Algiers marked the end of the Barbary pirates' power in the Mediterranean. Dutch warships patrolled Southeast Asia, and the British navy attacked pirates in the South China seas. However, at the beginning of the nineteenth century, lawful privateers were still flourishing until 1856 when the majority of maritime nations signed the Declaration of Paris. This banned letters of marque, and therefore outlawed privateering.

In the 1700s songs, plays, operas and novels were written about buccaneers, and during the nineteenth century storybook pirates were more famous than the real ones. Almost as soon as the

world's navies had made the oceans safe, people quickly began to forget the reality of piracy. Many writers turned pirates into heroes. Byron (1788-1824) did much to create the myth of the romantic pirate hero in his poem 'The Corsair'. However, such books as Robert Louis Stevenson's 'Treasure Island' portrayed a more realistic view of pirates as villains.

8. Pirate Crew and Flag

Students organized themselves into groups to create their own Pirate Crews. Each student was given a job aboard their ship which detailed their duties on a private vessel. Pirate crews were democratic and voted on everything from which waters to hunt in, to which flag they chose to represent their vessels. Students were tasked to discuss and vote on, which pirate ship they operated, which waters they would prowl, and create their own dreaded pirate flag. Pirate flags were meant to inspire fear and used a great deal of symbolism in creating them.

9. Pirate Articles

Students explored the history of democratic and diverse pirate crews and the set of articles (laws) aboard their ship. Students examined several surviving examples of Pirate Articles and were tasked with creating their own form of Ship Articles that their crew must follow. These rules dictated how pirates governed themselves, the daily lives aboard ship, and how plunder was divided amongst the crew, including an early form of health and life insurance.

10. Pirate Research

Students were tasked to research a famous pirate as an end project. Students created a slide show that examined:

- **Names/Aliases**
- **Timeline of their lives**
- **Waters they hunted in • How much loot did they plunder?**
- **Which ships did they command?**
- **What was their pirate flag design?**
- **What was their fate?**

Students had to visit multiple platforms and examine historical evidence about the lives of pirates and determine what drove them to piracy and what actions they took that defined the Golden Age of Piracy.

11. New Bedford High School Pool House

Students utilized scientific inquiry and engineering-problem solving skills to complete an underwater obstacle course challenge using sea perch ROVs which they had constructed. The students applied higher level science and engineering skills, such as defining problems, developing, and conducting experiments, analyzing and interpreting data, and optimizing the ROV's performance, in order to complete the obstacle course.

12. Marine Related Activity – Trophy Dive

Using snorkeling skills, ninth grade students participated in an open water trophy dive. Students collected various North Atlantic flora and fauna. Students were awarded points for their ability to correctly identify specimens by both common and Latin names.

Sea Lab

Marine Science Education Center
New Bedford Public Schools

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Speaker

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Simone Preterre-Bourgeois, Facilitator

Logo created by Intern and Sea Lab Alumnus: Dominic Viegas

Room 104 – Instructor: Debra Perry / Intern: Nina Cunha

1. **Reading: Literature**
   Students read and discussed the junior classic version of Moby Dick. Students drew on specific details from the text to describe in depth the main characters, setting, and major events in the story. Students also identified examples of figurative language (simile, metaphor, onomatopoeia, hyperbole, personification, and imagery) in the text. When at the Whaling Museum, students made connections between exhibits at the museum and information from the text. For a culminating activity, students created scrimshaw artwork using clay.

2. **Technology/Engineering- Precision and Accuracy**
   Students used targets to display the difference between precision and accuracy. They applied what they learned to explain how a harpooner used precision and accuracy when hunting whales. Students learned how harpoons changed over whaling history including the toggle harpoon which was invented in New Bedford by Lewis Temple. (Students also got to see one of these harpoons at the Whaling Museum.)

   Some students completed an extra credit assignment to draw or make a harpoon.

3. **Life Science – Ecosystem Brochure**
   Students investigated a variety of unique ecosystems found on Earth. They analyzed the biotic (living) and abiotic (nonliving) aspects of a selected ecosystem. Each student researched their selected environment's species (including invasive species), climate, location, predator/prey relationships, and other interesting facts about their ecosystem.

   Students created a brochure of their selected ecosystems.

4. **Life Science – How do humans affect the ecosystem both positively and negatively?**
   Students used books, the internet, simulations, and shared their background knowledge to discuss and investigate ways that humans affect the environment. They discussed the

difference between natural disasters and ecological disasters. Students were asked to predict the future of specific ecosystems and hypothesize how aspects of global climate change, deforestation, oil spills, and The Great Pacific Garbage Patch might affect certain species within an ecosystem forcing the species to migrate or adapt to their changing ecosystem in order to survive.

Students worked together to interpret six different "Observation Stations" in order to identify which ecosystem changes were positive and which were negative.

Some students researched the ecological disaster of their choice to complete a project or PowerPoint presentation others did their project on animal adaptations.

5. **Life Science – Build a Healthy River**
   Students brainstormed a list of ways that rivers and the land around rivers are used, and discussed how disruptions (natural or human-made) to any physical or biological component of a river ecosystem could lead to changes in its populations. Students evaluated design solutions for protecting a river ecosystem and discussed the benefits and limitations of each design. They then worked in groups using puzzle pieces to create a healthy river. Each group shared their rivers and explained why they placed each section where they did.

6. **Life Science – Animal Adaptations – Dissecting Owl Pellets**
   Students discussed animal adaptations that they were familiar with and explained how these adaptations help the animal survive. After watching a short video on owls and their adaptations, students dissected owl pellets and used a bone chart to identify what the owls had eaten.

7. **Life Science – How does albinism affect an animal's survival?**
   Students watched a short video about albino animals and read a passage about some famous albino animals.

   Some students researched the animal species of their choice to create a project or PowerPoint presentation explaining how albinism affects that animal's survival and compared which adaptations the albino animal had in common with its non-albino population and which adaptations it lacked. Other students researched ecological disasters for their project.

8. **Life Science – Cryptozoology vs. Zoology – What is the difference?**
   Using definitions, descriptions of organisms studied, and evolutionary relationships, students compared and contrasted cryptozoologists and zoologists by working together to create a large Venn diagram using two hula-hoops and index cards.

9. **Earth and Space Science – Cryptozoology – Mapping**
   Students used coordinates on a cryptid map to identify which cryptids were sighted at each location. Students also discussed which adaptations each cryptid would need to live in the locations of their sightings and identified similarities and differences between the sightings.

10. **Life Science – Cryptozoology – Cryptids: Fact or Fiction?**
    Students utilized valid research sources to accrue information and develop an educated opinion regarding the validity of the existence of the cryptid that they researched.

    Students participated in a fact or fiction discussion citing sources of reference as evidence or non-evidence of the existence of the cryptid that they researched.

    Students worked together using the information from their research and their cryptid sightings maps to write a fictional newspaper article reporting the discovery of the cryptid that they researched.

    Some students completed an extra credit assignment where they created their own cryptid.

11. **Life Science – Cryptozoology – Handprint and Footprint Castings**
    Students researched and studied the process by which scientists are able to study and determine Bigfoot's existence. They studied measurement and scale while exploring the theory of Bigfoot. Using tape measures, rulers, and research data, students worked in groups to make a Bigfoot footprint casting, a Bigfoot handprint casting, and a life-sized paper drawing of Bigfoot based on their research data and photos of Bigfoot sightings.

12. **Scientific Method**
    The scientific method is a way to ask and answer scientific questions by making observations and doing experiments. The steps of the scientific method are to:

    *Ask a Question *Do Background Research *Construct a Hypothesis *Test Your Hypothesis by Doing an Experiment *Analyze Your Data and Draw a Conclusion *Communicate Your Results

    Students utilized the scientific method in order to design an experiment to answer the question:
    "Can you poke a hole in a plastic bag without it leaking if the bag is 2/3 filled with water?"

Students utilized the scientific method, data recording sheets, and concepts of molecules and states of matter to test their hypotheses. Students discussed what variables they could change in their experiment and repeated the experiment with at least one change in variables. They recorded and shared their observations, and discussed how this information could be used to make our lives better.