



**THE EDUCATION PROGRAM**  
**AT THE**  
**NEW JERSEY MARINE SCIENCES CONSORTIUM**  
**BUILDING #22, FORT HANCOCK, NJ 07732 (732) 872-1300 NJMSC.ORG**

**FIELD INSTRUCTOR'S LESSON PLAN for**  
**MARSH AND OCEAN ENVIRONMENTS FIELD TRIP**

**OBJECTIVES:**

By the end of their field trip, your students should be able to:

- Describe the function and importance of a salt marsh
- Identify several animals that live in or near the salt marsh
- Describe the structure, function and importance of an estuary
- Understand what is meant by the term "watershed."
- Understand that human actions on land have an impact on our waterways, including Sandy Hook Bay and the ocean.
- Become aware of marine food webs
- Describe the function and importance of a barrier beach
- Recognize that waves, currents, tides are oceanographic processes that have specific effects on our shoreline
- Realize that seashells are "shelters" for the animals that make them
- Be able to identify several seashells and other shoreline "finds" by name.
- Know that the beach and the bay are inter-related
- Give several examples of plant and/or animal adaptation in the marine environment
- Gain an appreciation for the historical importance of Fort Hancock

**METHOD:**

Led by you, a class of students will participate in a variety of hands on activities conducted outdoors at Sandy Hook's salt marsh (Horseshoe Cove) and barrier beach (North Beach) environments.

**REQUIRED MATERIALS:**

For salt marsh portion of program:

One (1) seine net  
Four pair (4) chest waders  
Bucket  
Sieve  
Shovel

For beach portion of program:

Your shell collection (to show)  
Mineral collection (supplied to you)  
Small jar of sand  
Hand lens

**PREPARATION:**

1. Consult “Field Guide Daily Duties” for pre-trip procedures. Don’t forget to check daily schedule, tide chart and meet with fellow guides.
2. Set out your set of equipment for your marsh portion of the program on the lawn in front of NJMSC building.
3. Check your equipment for damages and repair or replace if necessary. Make sure wader suspenders are not tangled and in good working order. Be sure seine nets are untangled and securely tied. Make sure all equipment is clean and sand-free.
4. Make sure your shell collection and other beach materials are ready for use.
5. Follow specific group arrival instructions per Field Trip Coordinator.
6. If you use the kitchen area, keep it clean!

## **PROCEDURE:**

### **Introduction and Orientation (am):**

1. Consult and follow “Field Guide Daily Duties” for group arrival procedures.
2. Gather your students in the field behind NJMSC or in bus parking lot. Introduce yourself, introduce the park and the NJMSC and the history of Fort Hancock. Review field trip rules, give a very brief overview of the day’s events and then give an orientation to the environment that your group will be visiting first. So, on each trip you do, you will give **two** orientations, one in the morning and one after lunch before the afternoon activity.

Each orientation will focus on the site you are to visit next, so one will focus on the marsh, the other will focus on the beach and your “shell-talk.” Orientations should not be delivered as lectures and should be relatively short (10 minutes maximum). A back and forth discussion style is recommended. Ask questions and let students ask questions of you. If you don’t know the answer, say so. **NEVER MAKE ANYTHING UP!**

2. When your orientation is complete get your group back onto their bus for transport to the marsh or beach. If your destination is the marsh, get student volunteers to carry the equipment necessary for the program to the bus. Inform the students of the proper carrying method for the equipment: the boots and net must not be dragged on the ground or they will get holes in them. Remind the volunteers that they are responsible for bringing the equipment back to the bus and the building when the program is over. Be sure to thank them for their willingness to help.

**Arrival on site:**

1. Before leaving the bus at the study site remind students of the following rules:
  - A. No barefeet ever. The only time anyone takes off their shoes is when they are selected to put on waders.
  - B. All students must stay with you and the group at all times. You are their Field Guide.
  - C. Students must remain on paths at all times. Remind students about poison ivy. Point out and identify the plant as soon as possible. Use this time as an opportunity to explain the importance of this plant to Sandy Hook (the roots of poison ivy help to hold the sandy soil of the area together, the berries are an important food source to many species of birds).

**Marsh Activities: The following activities must be completed while at the salt marsh although not necessarily in this order.****1. Seining**

Seining allows students to observe the animals living in the water column. At the seining site have students gather behind the net on the beach. On the beach, demonstrate how to seine, then explain how to put on the chest waders. Emphasize that this is a small team activity with best results occurring when students work together following your directions. Ask the adults to help the students in and out of the waders. Explain how everyone's cooperation will result in each student having the opportunity to seine. Be sure to tell the teacher they are responsible for selecting who goes seining when.

Before seining begins, you must explain how to care for the animals caught in the net. No one should step on the net and all helpers must have damp hands (they can dip them in the bucket or touch them to the wet net) before picking up anything live from the net. Dry hands remove the protective "slime" that aquatic organisms have. Caught animals should be gently placed in the bucket with water for brief observation. After all the students who want to seine have seined and this is always your goal (although sometimes time doesn't permit) but before you return the animals to the bay, review what you have caught with the students including the animals names and where they may fit into the food web.

**Go to our website ([www.njmssc.org](http://www.njmssc.org)) and get detailed information about seining from NJMSC lesson plan "Nearshore Community Sampling." For detailed information about the local marine food web see NJMSC lesson plan "Food Webs." For species identification information review NJMSC fact sheets "Common Fishes of Sandy Hook" and "Common Arthropods of Sandy Hook" and "Common Shells of Sandy Hook."**

**2. Sieving**

Sieving allows students to see what lives in the benthos—or in the sand and mud beneath the water column. Typical finds can be clams and worms. Although this activity is not as foolproof as seining usually is, it is still an important activity and concept. In rare cases, tides may not permit sieving, however you **MUST** always be prepared to try.

While other students are participating in the seining activity two students can take turns sieving for benthic organisms near the shoreline. You can do sieving after students seine,

using the same chest waders or use the boot section of old waders to keep feet dry. (You need to remember to add these boots to your equipment pile for that day). Demonstrate the sieving technique to the whole group during your seining demonstration. There must be adult supervision of the students while they are doing this activity (ask one of the chaperones). Please remember safety and give sieving students an area that they confine their sieving to in order to minimize the interference with the group that is seining and with other groups that may be at the bay at the same time. Please have the students fill in any holes left at the waters edge before leaving the area.

### 3. Marsh Walk

Walk students to the top of the bridge at Horseshoe Cove and ask them to look out into the salt marsh and describe what they are looking at. Review the concepts that were discussed during your marsh orientation. At this point discussion of a salt marsh food chain is appropriate and with some help from you, the class should be able to put together several appropriate food chains using the plants and animals that they have been exposed to during the day.

While up on the bridge, explain several of these points of interest:

- *Spartina alterniflora* - salt marsh cord grass. This plant predominates the marsh because it has unique adaptations that allow it to grow inundated with salt water. Ask your students if they think their plants at home could survive salt water.
- The story of the Osprey (nest boxes) Preservation/Biomagnification
- Tides – Discuss the direction of the tidal current (ask students if its low tide, high tide, outgoing tide, incoming). Get students to visualize high tide by looking at plants surrounding marsh (marsh elder.)
- Discuss several salt marsh functions like:
  - A nursery for fish and wildlife
  - Helps to filter silt and other debris from the water
  - Capable of absorbing & holding large quantities of water
  - Provides nutrient rich food for wildlife and people
  - Serves as an important resting areas for wildlife
  - Improves water quality by cleaning pollutants in the water
  - Traps and binds up pollutants that make their way into the water
  - Are a source of beauty and artistic inspiration
  - Retain excess water for use by wildlife in times of drought
  - Offers recreational experiences such as fishing, birdwatching, and boating

Tour students through salt marsh path pointing out several native plant species like:

- Prickly Pear Cactus: is a native species, highly drought-resistant, will grow anywhere—just needs space, makes an edible fruit in fall, a yellow flower in summer, don't touch!! Very sticky, thin spines (best removed with scotch tape)
- Red Cedar/Juniper: was used by Native Americans (Lenni Lenape) to make dugout canoes (because its' wood resists decay), female makes berries, berries used to flavor gin (rub a few together and smell!),
- Mullein: leaves covered in greenish-white fuzz, which helps plant survive heat and drought, may have been used to line mocassins, plant is a biannual (blooms in second year), shoots up a stalk (which eventually makes seeds) with yellow flowers, stalk was used by Native Americans as a torch/firestarter

- Bayberry: (wax myrtle): makes waxy berries (to resist salt and water), used to scent candles (rub a few berries together and smell).
- Poison ivy: (latin name: *Toxicodendrum Radicans* – makes sense!), make sure to point this one out, most abundant plant species on the Hook, will give you quite a rash because the oil in the leaves irritates your skin, has a large root system and is therefore important to Sandy Hook as an anchor for sand, berries provide food for at least 30 bird species.
- Marsh elder: locates itself around perimeter of salt marsh just above high tide line.
- *Spartina Alterniflora* - salt marsh cordgrass: grows right in the salt water, it decays and releases detritus (an important food source) into the water, each blade has a hollow tube up its center to supply oxygen.
- *Spartina patens* - saltmeadow hay: not as salt resistant as alterniflora so is located around perimeter of marsh above high tide line, has fine blades, was once harvested for animal feed, insulation.
- Seaside Goldenrod: gets yellow blooms, provides food for Monarch butterflies, does not make you sneeze.
- Virginia Creeper: dark green leaf has five points, grows as a creeping vine, often is growing along with poison ivy.
- Chicory: an aster like flower in the daisy family, bluish, square-tipped, fringed flower, used to make coffee beverage in New Orleans, leaves look like dandelions.

### **Beach Program**

Before your beach visit, gather students for an orientation. You may do this before your group boards the bus for the beach or when you arrive at the beach. NEVER wait until you are on the beach to do your orientation—you will rarely get your students attention at that point. Your orientation should include the beach key concepts listed earlier in this lesson plan.

When you are at the beach, lead students from the bus to the beach. Along the way, point out the dunes, discuss their importance and preservation, and explain how they form. When you get within view of the NY Skyline, point out landmarks to help the students orient themselves. Brooklyn is only 14 nautical miles away! On a clear day you can see Long Island! No, you cannot see the Statue of Liberty from Sandy Hook! Also, have students look back at the lighthouse. This is a great way to help them realize how much Sandy Hook has grown in about 230 years. The lighthouse is now over 6000 feet from shore—it was built near the water’s edge in 1762.

To keep your beachwalk focused try setting up a goal for the students to work towards while they are collecting shells—for example--find five different types, find the smallest, largest, find a shell to “stump the field guide” etc. You will come up with your own favorite methods with time. Set forth the goal before the beachwalk begins either when you arrive at the beach or during your “shell-talk.” Remind students that they need to stay with you at all times. After all, you can help find and identify shells and you cannot do so if they are not near you. Impress upon students that they should take only empty shells and look for examples of different varieties (rather than take home a HUGE bag of surfclams). Remind students that they CANNOT go into the water. In fact, most shells

are found at the high tide line, not in the water. The object of all this is to keep the students with you as you walk TOGETHER collecting shells.

Before the students leave the beach, gather them together for a follow-up where they can share what they have found with you and the class. For example, ask students to look at their collections and show you a univalve, bivalve, most unusual, smallest, oddest, etc. Allow students to ask questions about what they have found. Be certain that students know that seashells are made by the soft-bodied animals who used to live inside them. The seashell was that animals exoskeleton, providing protection for the soft, boneless animal that once lived inside. Before you conclude, get students to go through their collections and pick out duplicates. Strongly encourage students to leave extra shells behind for other students to collect.

**See “Common Seashells of Delaware” for detailed information about seashells and their interesting habits. Also see “New Jersey’s Blue Crab” and “The Horseshoe Crab” handouts.**

### **OPTIONAL EXTRA**

Some teachers may ask to visit the lighthouse and mortar battery during their program. This activity fits in well either on the way to or from the beach. Get the students off the bus for a few minutes and discuss the lighthouse and its history before entering the mortar battery. Go into the only open battery and discuss its function, how it worked and why it became obsolete. This activity will add an additional 15 –20 minutes to your program so be prepared to make adjustments to your program to fit it in.

**Go to \_\_\_\_\_ for detailed information about the history of the lighthouse and the Fort Hancock area, see handouts “Sandy Hook Lighthouse” and “Fort Hancock.”**

### **Words to Know**

Adaptations – changes by an organism or its parts that make it more fit to the conditions of its environment. For example, spartina casts off salt from its rough blades, the flounder can change its skin to match its environment.

Benthic – living in or on the bottom of a waterbody. Sieving helps you study benthic organisms.

Benthos – the form of marine life that live on or under the ocean bottom.

Behavioral Adaptations – changes involving action or response to stimulation that makes an organism more fit to the conditions of its environment.

Bioaccumulation – the accumulation of substances in the body of an organism. The osprey is a good example. An osprey eats many small fish. During the 1960’s many small fish were contaminated with DDT (a pesticide). The DDT built-up (see biomagnification) in the osprey preventing reproduction because eggs were no longer viable (their shells were too thin). Osprey numbers fell. DDT was eventually banned and human efforts (planting viable eggs in nests) have brought the osprey back.

Biodegradable – capable of being broken down.

Biomagnification – the accumulation of substances in larger and larger quantities in the bodies of organisms at each higher level of a food chain. See bioaccumulation.

Brackish Water – water in which salinity ranges from approximately 0.50 to 17.00 parts per thousand. The water in the bay water is just above brackish (18 to 30 parts per thousand)

Carrying Capacity – the maximum size of a population that can be supported by an environment.

Coastline – the boundary between the land and the ocean.

Community – the population of various individuals interacting in a common area.

Competition – active demand by two or more organisms or kinds of organisms for an environmental resource in short supply.

Conservation – a careful preservation and protection of resources.

Decomposer – an organism that feeds off of decaying matter, in turn speeding up the decomposition of an organism.

Diversity – a function of both the number of species present in a given region or habitat and the relative proportions of their numbers.

Dorsal Fin – the median fin located on the back.

Ecology – the branch of science concerned with the interrelationship of organisms and their environments.

Environment – the combination of physical, chemical and biotic factors that act upon an organism or an ecological community and ultimately determine its form of survival.

Estuary – a water passage where salt water from the sea meets and mixes with fresh water usually from rivers.

Fauna – the animal life of any area.

Family – a group of related plants or animals forming a taxonomic category ranking above a genus and below an order.

Filter Feeder – an animal that obtains food by filtering organic matter or minute organisms from water that passes through its system. Clams are filter feeders.

Flora – the plant life of any area.

Fresh Water – water with no salt content i.e., rivers, lakes, ponds, and streams.

Juveniles – young of a species; generally a small immature version of the adults.

Mantle - a fold of skin that surrounds the body organs in mollusks containing glands that secrete the shell.

Morphology - a branch of biology that deals with the form and structure of animals and plants.

Niche – the ecological role of an organism and its position in the ecosystem.

Nonpoint Source Pollution (NPS)- situations where the source of pollution is not known.

Pelagic – of, relating to, or living or occurring in the open sea.

Pelvic Fin – also called the ventral fin. A pair of fins on the lower part of the body.

pH – the measure of the alkalinity or acidity of a solution.

Predator – carnivores that capture and feed on prey.

Prey – an animal taken as food by a predator.

Runoff – the portion of the precipitation on the land that ultimately reaches streams.

Salinity – a measure of the quantity of dissolved salts in ocean water.

Scavenger – carnivores that feed on dead animals.

Spat – a young bivalve.

Spring Tides – tide of maximum range occurring when the moon is new or full.

Tidal pools – water left on a beach or in the marsh after the tide recedes. Some are permanent and others are temporary.

Watershed – a region or area bounded peripherally by a water parting and draining ultimately to a particular watercourse or body of water.