



STEM Field Trip Program

Destination: Marine Science Institute



Congratulations on receiving a **SVEF STEM Field Trip grant, sponsored by Target**. This grant provides you and your classroom with an enhanced experience at the Marine Science Institute (a \$400 value), admission of up to 25 students, and a transportation voucher of \$400. This document provides you with all of the information you need to make your field trip a success. If you have any questions about your SVEF STEM Field Trip grant, please contact fieldtrips@sveffoundation.org.

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Pre-Visit Lesson Plan:

On MSI's Student Assessment, teachers indicate their students' current course of study, level of background knowledge related to the Shoreside Program, and select one of several available themes that customize the program to fit their students' needs and interests. Themes include: Biodiversity and Endangered Species, Food Web, Adaptation, Human Impact on the Bay, and Scientific Method. [Click here](#) to download the Teacher's Guide for the Shoreside Program. A sample lesson plan is on Page 2 of this document.

Introduction at Destination:

An MSI Instructor will introduce our watery neighbor, the San Francisco Bay Estuary, its origin, qualities and importance. Also introduced is our physical location on the bay, the program format, and how to gently and correctly handle marine animals that students will encounter during the program. At the same time, a second instructor will brief the adult chaperones on their role in the program. After the introduction, the class group divides into two, three, or four small groups. Each small group goes with an instructor to their first station.

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Visit at Destination:

The Shoreside Program includes three to four stations that teachers select from a choice of six: Osteichthyes (fish), benthic (mud) invertebrates, plankton, hydrology, Chondrichthyes (sharks), and marine mammals. Students rotate through the chosen stations, each having a chance to use real oceanographic equipment to take a mud sample and find the invertebrates that live at the bottom of the bay, use a large trawl net or "seine" to collect fish for examination or use a Kemmerer Water Sampler to test water quality. Throughout the program MSI instructors provide guidance and encouragement. Students can expect to handle and touch a variety of organisms as part of their observations.

Post-Visit Wrap Up:

The students will close by doing the "Recipe for an Estuary" activity in which students take turns drawing their contribution of an estuary "ingredient" on the white board. As the student is drawing, the instructor asks the rest of the group why that particular element is important to the estuary – and what would happen if its presence somehow became out of balance with the other ingredients, or even disappeared completely. Finally, students discuss their ideas on how to keep the Estuary healthy, clean, and protected. See page 7 for a Post-Visit Activity.



Pre-Visit Activity
Discovery Voyage Program
Lesson Plan

Lessonopoly: This lesson plan can be found on our Lessonopoly website at www.lessonopoly.org

Here are some activities to prepare your students for their Discovery Voyage program. In addition you may want to ask your librarian to set aside ecology or marine science books for your class, or ask students to bring books and magazines from home to share.

SCIENCE ANIMAL ADAPTATIONS

Have your class research and discuss how estuarine animals protect themselves from their predators or what adaptations they have to become better predators. Have the class team up in small groups and be responsible for researching one phylum. Within each group, each student can choose one animal from this phylum. They can begin with the background information in this preparation guide, and then use books, tapes or any other resource to put together a report.

SCIENTIFIC CLASSIFICATION

Demonstrate the meaning of scientific classification by having students categorize inanimate objects according to their own framework. You could use fruit, or something ordinary such as different kinds of nails (wood, standard, aluminum, galvanized, ringed, headless), to each small group. Have them categorize and then share their results with each other to start a general discussion on classification. Do we need it? Is any one type of classification better than another? Is there a benefit to sticking to one standardized system of classification?

DICHOTOMOUS KEYS

To demonstrate how a dichotomous key works, play a "20 Questions" style game. Pick one student without disclosing his/her identity, then have the rest of the class discover who you've picked by asking yes-or-no questions. During this process, you can construct a key based on their questions. Tell them to go from the most general to the most specific. For example:

- 1a. Is the student male.....Go to question 2
- 1b. Is the student female.....Go to question 7
- 2a. Does the student have blond hair.....Go to question 3
- 2b. Does the student have dark hair.....Go to question 9
- 3a. Does the student have blue eyes.....Go to question 4
- 3b. Does the student have brown eyes.....Go to question 11

NO GARBAGE LUNCH (Part I)

Within a day or two of your class trip, hold a surprise "lunch raid" by making a collection of all the garbage (man-made materials only!) to be potentially thrown out after lunch is over.

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- Sort the garbage into piles such as plastics, paper, aluminum, etc., and count the number of items in each pile. Make a colorful bar graph depicting your findings.
- Discuss the results and the importance of recycling.
- Discuss where the solid garbage goes. Much of it goes into landfills which are actually
- "bay fills." How long can this go on?
- Challenge your class to make "No Garbage" lunches. This means bringing a lunch box or a bag that can be used again. Reuse containers for sandwiches and snacks.
- Talk about the drawbacks of snack food that come in cute little packages but create lots of garbage. What could we do instead? (Buy bulk size).
- Encourage the three "R's": Reuse, Reduce (garbage) and Recycle.

ORGANISM REACTIONS

A. Varying salinity

Have students make wet mounts of a thin section of red onion bulb. Mount in 1% NaCl (salt) solution and observe effects. Flush with fresh water and observe effects. Have students explain the reactions.

B. Varying temperature

Put equal numbers of fruit flies in jars and keep them at different temperatures for a few minutes. Observe relative activity rates. If a pond or other body of water is nearby, measure air and water temperatures at different times of the day to see which environment has more stable temperatures.

SOCIAL SCIENCE

GEOGRAPHY

Make a map of the Bay Area, or a 3-D model of the Bay Area. Emphasize the mountains, and the Hayward and San Andreas Faults. Clay, or a mixture of baker's dough works well.

PYRAMID OF LIFE (From Joseph Cornell's Sharing Nature with Children)

Give each student a slip of paper and have them secretly write on it the name of a plant or animal that lives in your area. Collect all slips of paper and begin to construct a "human pyramid" (performed in a flat position, rather than one child on top of another, if safety is a concern or the group is large).

Begin by asking, "From what source does the earth get its energy?"(Sun) "What form of life is the first to make use of that energy?" (Plants) Next, divide students into groups (from their secret slips) depending on whether they are plants, plant-eaters (herbivores), meat-eaters (carnivores), or omnivores (let the omnivores choose which group they'd like to be in). Try to construct a food pyramid beginning with all the plants on the bottom. Who is next? And next? Is it too top heavy to work? What will happen to all the animals on top with nothing to support them underneath? What needs to be done to correct it? Conclude by pretending to yank out a plant; what happens to the pyramid?

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MAP GAME

The class is divided into two teams. One member of each team puts their back to a map of the Bay Area. The teacher calls out a city or landmark that is found on the map, and then says "Go".

The students turn around to find the city or landmark, trying to do so before the other one does. The first correct answer gets a point for their team, and the team that gets the most points wins. Emphasize the geography of the Bay Area, "Find and name the mountains forming the east side of the Bay." "Find and name a river that empties into the South Bay." Be careful with these; there are a few rivers. "Find the bridge that connects Oakland and San Francisco and name it."

ART

FISH PRINTING

Fish printing, or gyotaku (gyo=fish, taku=rubbing), was invented by the Japanese in the 1800's and has since evolved into an art form. Prints can be made on paper, cloth, or t-shirts.

- Obtain whole fish, octopus, or squid from market. It should be thawed out.
- Wipe the outside of the fish to remove moistness and mucous. Be careful not to damage the scales.
- Lay fish on a newspaper covered table.
- Using a wide stiff brush, paint the side of the fish with fabric paint or water-based printers' ink of any color. Don't use too much paint as it will smear.
- Paint the fins and the tail last.
- Slowly lower the paper or cloth onto the painted fish and gently pat the material all over the fish. Make sure you get the tail and fins. Lift the print straight up from the fish.
- Place print in a safe place to dry and admire!

CAMOUFLAGE CRITTERS

Discuss the concept of camouflage, its usefulness to an animal, and perhaps how it evolved through natural selection. Have students draw an animal camouflaged for a particular environment (forest, meadow, stream bottom, etc.) Or, choose environments on the school grounds and create a critter (from paper, clay, pipe-cleaners, even raw vegetables!) that is camouflaged in those surroundings.

MATH

MEASURING

Using the metric system, we measure plankton in micrometers. Have the students make measuring sticks and send them out on a measuring hike. Tell them to find things of certain lengths. Let them figure out how many microns are in the items they measure.

GRAPHING

Make a tide table. Have the students check the newspaper each day for the tides. Then record each day on a graph. Watch how the tides go up and down each day and get higher and lower as the month progresses.

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Post-Visit Activities

Lesson Plan

Lessonopoly: This lesson plan can be found on our Lessonopoly website at www.lessonopoly.org

SCIENCE AQUARIUMS Set up an aquarium in your classroom. All you need is a small aquarium, an undergravel filter system, an air pump connected to a bubbler, and fish or invertebrates. Most aquarium stores can direct you, or ask us at MSI. Students can watch the fish as they move their gill openings. How many times do they "breathe" per minute? Have your class figure out what the animals need to survive: food, water changes, oxygen, etc.

TIDES Make a tide table. Have the students check the newspaper each day for the tides. Record each day on a graph. Watch how the tides go up and down each day and get bigger and smaller as the month progresses. Ask the students to check the moon each night and correlate the phases of the moon.

NO GARBAGE LUNCH (Part 2) After our program, once again hold a lunch raid and compare how much garbage they have this time as opposed to the last time (there should be much less). Let the colorful bar graphs of the two days emphasize the dramatic difference the students themselves are making to the health of the planet!

WEB OF LIFE Have the students stand in a circle. Ask the students about the habitat they just saw (this will work for any habitat). Ask them where in that habitat all energy begins, (sun). - Hand the student who answered correctly a ball of yarn. - Ask what uses the sun's energy to create food (plants). Have them name a plant they saw. - Have the student with the ball of yarn (still hanging on to the end of the string) toss the ball itself over to the "plant" student. - Ask, "Who uses plants for energy?" And continue this discussion using herbivores, carnivores, decomposers, and of course, humans, - With each completed step, students continue to toss the yarn to each other around the circle, creating a complex and interrelated food web. - Now pick a random student. Because of hunters, or pollution, or loss of habitat (several reasons apply), the component he or she represents has died and must sit down. As he does so, he inadvertently creates a tug on the yarn, thus affecting other aspects of the web of life. Every student, then, who feels a tug on the yarn they are holding is affected in some way by the death of that one individual, and must sit down and tug on their own yarn. - Eventually, all students will be seated and you can discuss the results.

BEACH WALK If time and funds permit, organize a visit to a rocky beach location at low tide (ask about MSI's TIDEPOOL EXPEDITION program). This is a great way to incorporate a different ecosystem, into a marine biology unit. A visit to the tide pools drives home the idea that intertidal animals have a different set of adaptations and problems to deal with. They also provide an opportunity for students to apply what they learned on the Discovery Voyage to a different marine ecosystem. Three good local tidepool areas to visit are Fitzgerald Marine Reserve, Pillar Point, and Pescadero Beach.

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Equipment needed - Rubber boots or hip waders - Identification books or keys - Magnifying glasses Important rules to follow - Study and observe the animals and plants where you find them. Do not pick up and move organisms to a different location. - When searching for animals, replace any over-turned rocks as you found them. Turn them over gently, and replace them carefully so as not to leave the underside exposed to the sun or elements. - Avoid disturbing unusual ecological areas that may be more sensitive to disturbances, or any other types of animals that you might see such as marine mammals and birds. - Please teach and practice conservation!

ART

TURN YOUR CLASSROOM INTO A BAY Put blue paper around the classroom and have the students draw in various plants and fish, or have them cut out pictures of marine creatures to put on the blue paper. Let them put some benthic invertebrates on the bottom and plankton on the top! **MOBILES** Let the kids make mobiles of the fish they saw. Take a hanger, some string, some cut-out drawings or pictures of fish and have fun! Attach the fish to the string. Then attach the string at varying lengths to the hanger. Be creative, use pictures of plankton and benthic critters. Possibly take two copies of the fish, glue the edges together, and stuff with some already used paper (recycle it!) and have a 3-D mobile. Older groups can make mobiles in the form of a food chain.

ENGLISH WRITING Write letters to the instructors and/or your class sponsor to tell them about the trip. When we receive letters and pictures back from the kids our instructors remember what a thrill it is to be teachers. The sponsors also enjoy getting direct feedback from the class and teacher to reinforce that they are making a difference for kids learning science. Please include the day, date and time of your trip so we can try to remember your group a little better.

ORAL PRESENTATION Have the class team up in small groups and have each group do a short oral presentation on one of the animals they learned about in the program. If they have done the pre-visit activity of researching an animal, they can use that information, plus add what they have just learned. In the presentation they could include what phylum it belongs to and why, where it lives in the Bay, what it eats, what might eat it, and any special offensive or defensive adaptations it may have.

