

# The Doc Edgerton/Science at Sea: Deck Plan and Stations

Using the Right Words: Sailors use special terms to talk about boats.

- Bow: The front of the boat.
- Stern: The back of the boat.
- Port: The left side of the boat when facing the bow.
- Starboard: The right side of the boat when facing the bow.
- Head: The bathroom on a boat.

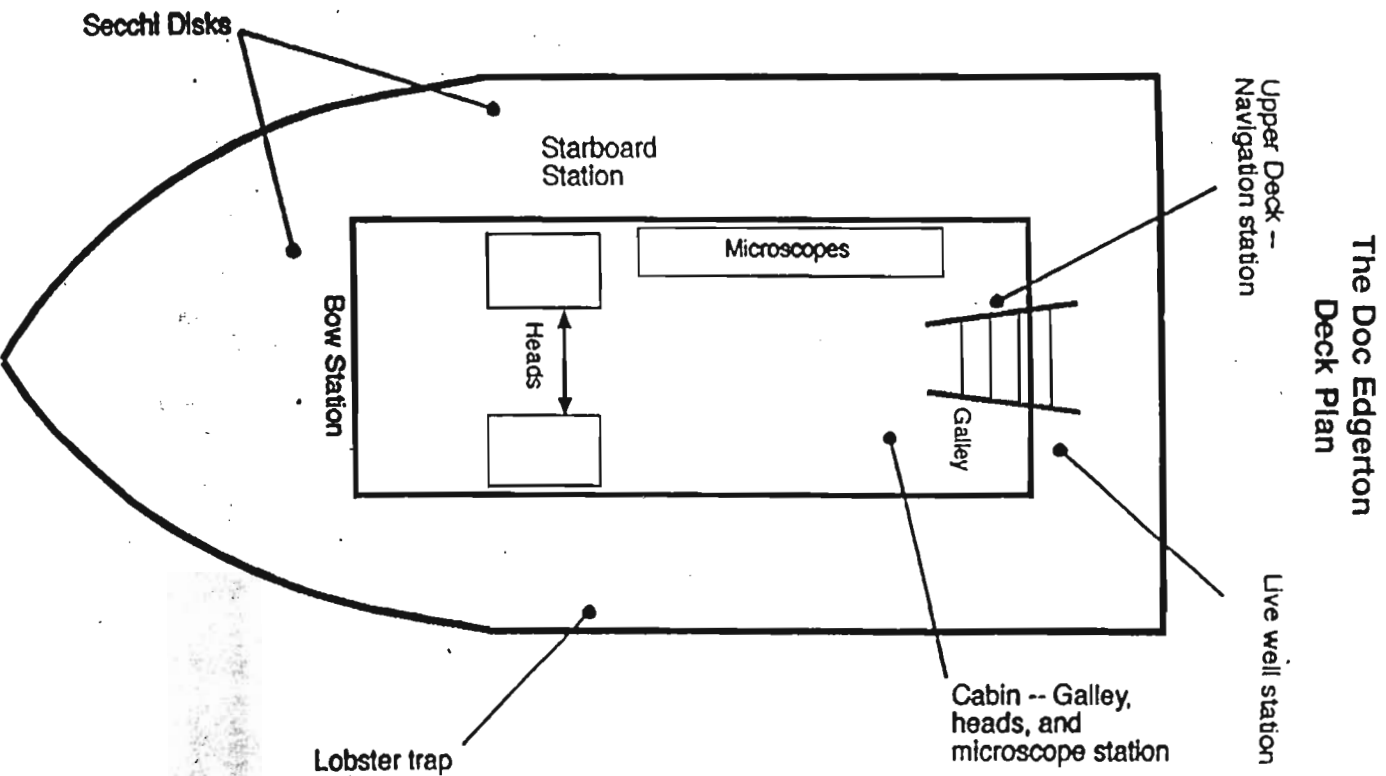
## The Research Stations

**Live-well** — During your trip students will assist the crew in pulling up a lobster trap. A tank with sea water will keep the animals comfortable, and each group will be able to examine the animals and plants brought up in the traps. Topics include comparative anatomy of animals, reproductive biology, and the roles of crustaceans and fish in Boston Harbor ecology.

**Secchi disk/oceanic pollution** — Secchi (se-ki) disks measure water's turbidity. Turbidity, or cloudiness, is caused, among other things, by the amount of phytoplankton living in the water. As nutrient levels and seasons change, so does the amount of phytoplankton. When phytoplankton "blooms", light cannot penetrate into deeper waters. Dissolved oxygen levels fall, and it becomes more difficult for animals to survive. Secchi disks give scientists a measurement of turbidity, how much phytoplankton is in the water, and therefore how "healthy" the water is. Students will discuss pollution at this station as well.

**Microscopes** — Microscopes are used to study the microscopic zooplankton, tiny animals, drifting in the currents of Boston Harbor. Although many of these tiny organisms are able to move, they are not strong enough to swim or crawl against currents. Most are microscopic, but some floating organisms such as jellyfish can be seen with the naked eye. Plankton are found throughout the water column, but are concentrated at the surface, where their food source — phytoplankton — is found.

**The plankton tow**, a very fine mesh net, catches even the smallest zooplankton and concentrates it in a flask. Students will record any species they are able to identify on our Daily Data Board in the main cabin.



**Navigation** — Using nautical charts and basic tools for navigation, such as parallel rules and dividers, students learn how to read the symbols on charts, use a compass, and plot a course. Charts are also used to study intertidal, shallow water, and deep water zones, and discuss different plants and animals found in each.

**YSI-** A unique piece of oceanographic equipment that measures various aspects of water quality, such as salinity, dissolved oxygen and temperature. Many scientists from around the world use this scientific tool.

**About the measurements:**

**SALINITY:** Salinity is the amount of salts dissolved in water, measured in parts per thousand (ppt). Salinity in the world's oceans ranges between 33-38 ppt (or 3.3-3.8%) Boston Harbor's salinity is affected by the many rivers emptying into the Harbor and is therefore lower than sea water found further out in the Atlantic Ocean.

**TEMPERATURE:** Average temperatures in the Harbor range from 40° F in winter to 60° F in summer, and change according to the depth of the water. As the multiprobe is lowered deeper into the water it will measure the temperature at each depth.

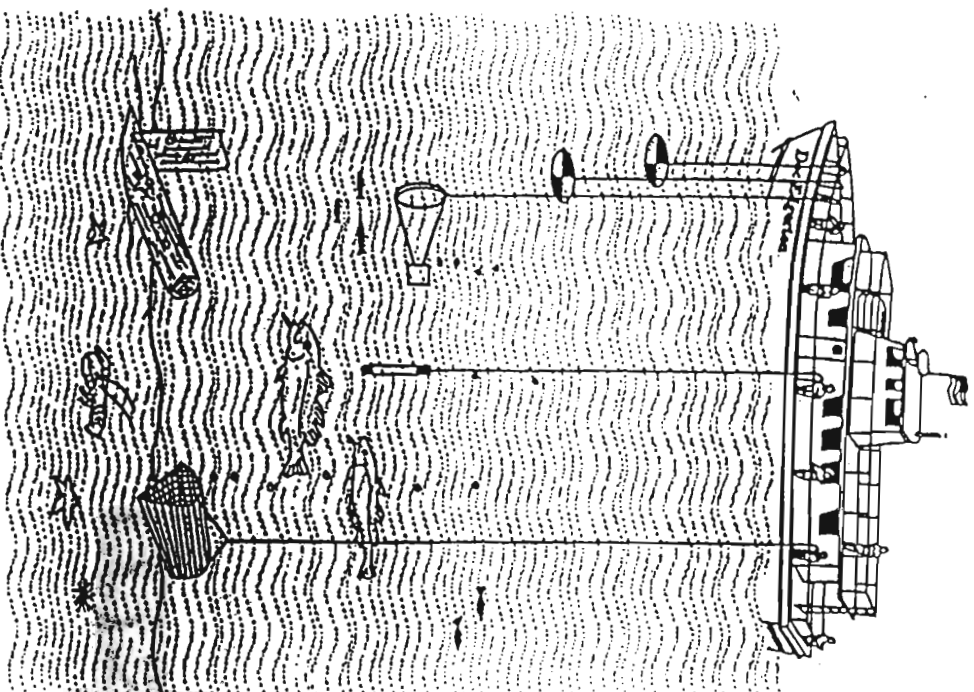
**DISSOLVED OXYGEN:** The oxygen which fish and other animals breathe in the water is in a dissolved form. (Just like carbon dioxide is dissolved in soda.) This oxygen comes from the air moving over water, mixing by waves, and also from photosynthesis. The multiprobe measures the amount of oxygen dissolved in the harbor's waters in parts per million (ppm). The Harbor contains around 13 ppm dissolved oxygen during winter when plant growth, and therefore decomposition, is lowest. In summer, the bloom of phytoplankton increases decomposition, a process which uses oxygen, and dissolved oxygen levels fall to 7 ppm, or even lower. When dissolved oxygen levels fall too low many fish cannot breathe and must leave the Harbor or perish.



...the level of oxygen in the water is low...  
...of oxygen in the water is low...  
...of oxygen in the water is low...



*New England Aquarium*  
**Science at Sea**



**Curriculum Guide to the Harbor Education Program**  
**on board the Doc Edgerton**

New England Aquarium Boat Programs, Central Wharf Boston, MA 02110-3309  
TEL: 617-973-5206, FAX:617-720-5110

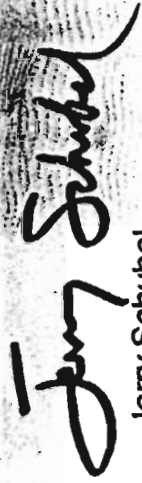
## ***A Letter from the President:***

Boston Harbor is a precious resource we all share, a port through which many of our goods are shipped and received. The Harbor serves as a recreation area for over 2 million people. It is also home to a diversity of wildlife and fishes, and is a receiver for society's wastes. These multiple uses are what make the Harbor so valuable, and also so vulnerable.

At the New England Aquarium, we believe that Boston Harbor is an ideal place to introduce students to the wonders of science and the seas. We have designed our Harbor Cruises aboard the ***Doc Edgerton*** to be exciting and educational experiences. Pulling up lobster traps, getting a close-up look at plankton, and enjoying the sights and sounds of the Harbor are standard fare for passengers on a "Science at Sea" cruise.

No matter what students see on your ***Doc Edgerton*** trip, we're confident that a cruise with us will be an important component of any unit on Boston Harbor or marine biology. Your students will enjoy hands-on lessons and learn from our knowledgeable staff during this trip. The cruise is a highlight of any student's year.

We encourage you to prepare your students for a trip on the ***Doc Edgerton*** by using this curriculum guide. Inside are instructions for teachers and chaperones on how to make your trip successful. Also included are activities for students once they are at the Aquarium, and a list of resources for teachers who need more information on marine biology or the Harbor. I hope you will use this guide, and help your students get the most from their voyage. We'll see you aboard the ***Doc Edgerton***.



Jerry Schubel  
President and CEO  
New England Aquarium

# Planning Your Aquarium Field Trip

For field trip reservations and information, please call Central Reservations.  
(617) 973-5206

A field trip to the New England Aquarium, or a cruise on the *Doc Edgerton*, is an exciting and motivating addition to your school year. The information in this guide can help make your field trip a fun and rewarding experience, and minimize last minute confusion.

## FREE PRE-VISIT

Teachers booking a field trip can visit the Aquarium free of charge. Simply bring the confirmation letter you receive from us on the day you wish to visit.

## BEFORE YOUR TRIP

- Plan time in your curriculum to focus on aquatic issues before and after your Aquarium visit. Setting the field trip in the context of your classroom curriculum helps students get the most out of their Aquarium experience. This package will give you many activity ideas. Other Aquarium resources, such as the Teacher Resource Center, can give you weeks of Boston Harbor curriculum. (Call (617) 973-6590 for an appointment.)
- For your group visit, one adult chaperone for every five students is *required*, and admitted free. If you wish to bring more chaperones than the 1:5 ratio, they will be charged a fee.
- Before your Aquarium visit, talk with your chaperones about what you would like students to learn on their field trip. Assure chaperones that they will not need to know the answers to students' questions — they are there as guides, and to encourage students to use Aquarium resources to answer their own questions.
- The *Chaperone Sheets* found in this guide should be copied for each chaperone. Chaperones should carry these sheets with them during their Aquarium visit. The *Chaperone Sheets* contain Aquarium rules, and educational tips to help them successfully lead students through the Aquarium. Send the *Chaperone Sheets* out in advance of the trip so all chaperones can familiarize themselves with the information.

## WHEN YOU ARRIVE, PLEASE REMEMBER THESE DETAILS:

- Limited bus drop off & pick up space available
- Your Aquarium confirmation letter is your group's admission ticket. Please present it when checking in at the admissions booth.
- Chaperones should be assigned a group of students to supervise, and must remain with their group at all times — including during shows and presentations.
- Allow at least two hours to visit all the exhibits and see a Sea Lion Presentation, or four hours with a Harbor Cruise.
- Sea Lion Presentations are scheduled throughout the day. Seating is on a first-come, first-served basis, and no one is admitted while shows are in progress. Doors open 15 minutes before the start of each show. Listen for announcements regarding Sea Lion Presentations and other programs.
- Seating accommodations for lunch are not available inside the Aquarium. School groups generally eat lunch on the plaza or in their buses.

# Planning a Science at Sea / Harbor Cruise

For Doc Edgerton "Science at Sea" reservations and information, call Central Reservations at 617-973-5206.

A trip on the Doc Edgerton can bring your studies on Boston Harbor and marine biology alive. If you are planning a "Science at Sea" cruise, read the following information and share it with your students and chaperones.

## FREE PRE-VISIT

Teachers are invited to join us for a free cruise on the Doc Edgerton ahead of their scheduled class trip to experience the "Science at Sea" program. Please be sure to call in advance to make a reservation, at 617-973-5206.

## BEFORE YOUR TRIP

- For your voyage, one chaperone for each five students is *required*, and admitted for free. If you wish to bring additional chaperones, they will be charged a fee.
- Safety is our primary concern on the boat. It is the chaperones' responsibility to ensure that your group is following all of the safety rules and instructions set forth by the Captain. Review these
- **Keep both feet on the deck at all times.** Never stand on benches or sit on the railings, as the boat is unstable.
- **No running or jumping.** Walk carefully when moving about the boat — the decks may be slippery.
- **Descend the upper deck ladder backwards.** Face the ladder as you ascend and descend. Hold on to both handrails while using the ladder.
- **Chaperones should stay with their group.** Chaperones should rotate with their students to each work station.
- **The Captain has ultimate responsibility and authority on the boat.**

- rules with students and chaperones:
- Make sure your students are prepared for their trip. Weather changes rapidly on the water. Students may get wet or slightly dirty on trips. All
- Warm clothes. (Dress in layers. It will be much colder at sea than on land. We recommend sweatshirts, sweaters, turtlenecks, and wind-breakers.)
- Sneakers or rubber-soled shoes. (No high heels or dress shoes!)
- A waterproof poncho or rain coat.
- Hat and gloves.
- Sunglasses with a strap.
- Sunscreen.

- Talk to students and chaperones about the Doc Edgerton trip. During the program, students and chaperones will rotate through stations in fifteen minute intervals. Review the Doc Edgerton "Science at Sea" deck plan and station descriptions found on pages 4-5 for more information. Please be aware that due to time limitations, group size, age of students, and weather conditions, the number of stations may change and all stations may not be used on every trip.

- Plan time in your curriculum to focus on aquatic issues before and after your trip. This curriculum package will give you many ideas.

- Use one of the Boston Harbor Scavenger Hunts (pp. 15-18) to help get your kids thinking about the Harbor.

## WHEN YOU ARRIVE, PLEASE REMEMBER THE FOLLOWING DETAILS:

- Report directly to the BOAT PROGRAM booth, located on the plaza in front of the Aquarium. If your group is planning to visit the Aquarium prior to your cruise on the Doc Edgerton, they must all have their hands stamped at the Boat Program booth before you enter the building.
- Before boarding the Doc Edgerton, your students will be divided into groups. Each of these groups will be assigned to a research station, and will rotate during the trip. (If more than one school is on board, we will do our best to keep your students in their own groups.)
- If you plan on using Data Sheets during your trip, distribute these before boarding, and designate a record keeper for each small group.

### **On-Board the *Doc Edgerton***

Before your trip, reproduce data sheets that are appropriate for your class' age group. Students may work independently, or in small groups. Remember that it is difficult to write on the boat, as the wind is usually strong, the boat moves, and it can be cold. Use rubber band to hold paper down on clipboards or cardboard. Tie pencils to boards so they will not be lost

Students will have time at each station during which they can complete data sheets. They may also have time for completing the sheet while the boat is returning to Central Wharf.

### **After Your Trip**

Compare data sheets to students' drawings of what they thought they would find in Boston Harbor. Were they surprised at the results? Would they change their drawings of the things living in Boston Harbor?

Much of the *Doc Edgerton* trip will focus on the life found in the Harbor. You will have a chance to see phytoplankton at the secchi disk station, zooplankton at the microscope station, and animals further up the food chain at the live well station; such as filter feeders, (mussels and tunicates), or scavengers and carnivores (lobsters and crabs). Use the data students collect to talk about simple food chains in the Harbor. Other organisms commonly found in the Harbor are gulls, cormorants, seals, harbor porpoise, fish, (such as striped bass and cunner), snails, shrimp, mussels, clams, sponges, and seaweed. What conclusions about life in Boston Harbor can your students make after studying these plants and animals?

### **Related Activities**

- Dissect lobsters, an important part of the Boston Harbor food web. Lobsters from polluted waters can be eaten because toxins are concentrated in only one part of their bodies, the hepatopancreas — which is known to lobster lovers as the tamale. You can find this in a lobster by looking for the green organ inside. As an alternative, phone local seafood stores to find out where their lobsters are trapped. Do they sell lobsters from Boston Harbor?

# Science at Sea Data Sheets

**Subjects:** Science, art

**Grade Levels:** K-12

**Time Required:** 15 minutes before trip, 1 hour on trip, 1/2 hour after trip

## Overview

This activity starts before a trip on the *Doc Edgerton*, with a pre-assessment of students' ideas of what kinds of things are living in Boston Harbor. On board the *Doc Edgerton*, students use age appropriate data sheets to record the types of plants and animals they discover and information on how the boat is operated. After the trip, data sheets are used to discuss what students discovered, and what Boston Harbor's food chain might look like, or as supporting material for other activities in this guide.

## Materials

- data sheets (one per small group)
- clipboards or 9x12 sheets of cardboard with three rubber bands or two binder clips (the boat is windy — rubber bands and binder clips will keep papers secure)
- pencils (preferably tied to clipboard or cardboard)
- drawing paper and crayons or markers for pre-trip activity

## Before Your Trip

Many people hold inaccurate preconceptions about Boston Harbor, such as believing the Harbor smells or cannot support any plants or animals. What do your students think the Harbor will be like? Before visiting the Aquarium, ask students what Boston Harbor is like. Is it healthy enough to support any plants or animals? What kinds of things might live in the Harbor?

Ask each student to draw a picture of what they think things look like underwater in the Harbor — including the types of plants and animals that might live there. Students should consider what kind of food chains they think would be found in Boston Harbor — if they draw fish, they should think about what kind of food the fish eat, where that food gets its energy, etc. Allow 5-10 minutes for this drawing.

You may want to tape these drawings up on the board, under a label "What we think lives in Boston Harbor". Discuss these drawings — what kinds of things did students include? Did the drawings all look alike or are they different?

On their *Doc Edgerton* cruise, students will have a chance to test their ideas about what lives in the Harbor. They may find that Boston Harbor is a very different place than they imagined. How will students find out what lives in Boston Harbor when they are on the *Doc Edgerton*? (Use the *Doc Edgerton* "Science at Sea" Deck Plan and Stations section to discuss the equipment used on-board the boat.)



### Microscope Station

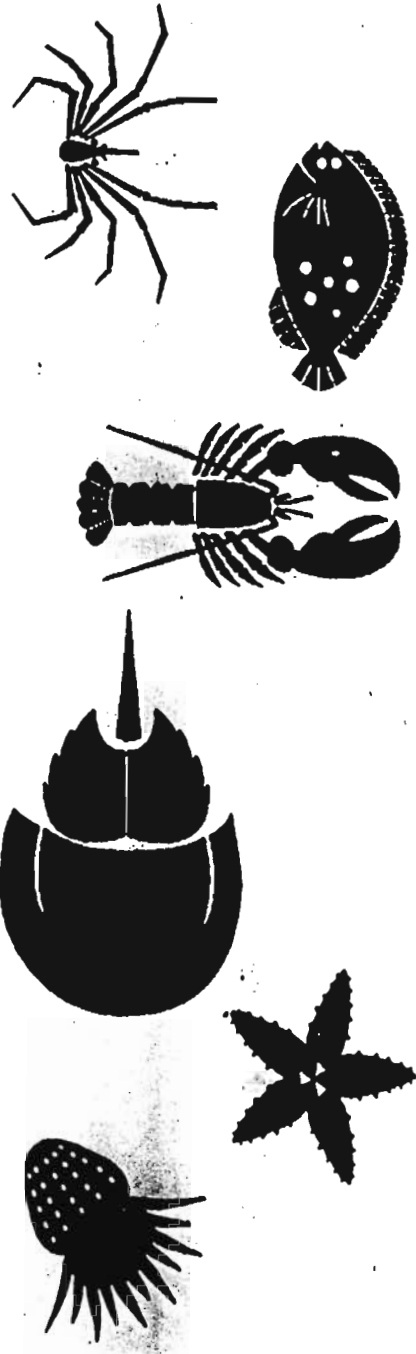
Draw a picture showing the SIZE of the plankton you caught:



What did you learn about plankton?

### Live Well Station

Circle the animals and plants you saw in the live well:



### Secchi Disk Station

What color is the water in Boston Harbor?

The secchi disk disappeared at \_\_\_\_\_ feet.

# New England Aquarium Science at Sea

Data Sheets for Grades  
Four Through Seven

## Navigation Station

What tools are used for navigation?

What do numbers on a chart represent?

How deep was our sampling site today? \_\_\_\_\_ feet.

Label the four directions and the degrees on a compass.

## Secchi Disk Station

What color is the water in Boston Harbor?

Why is it that color?

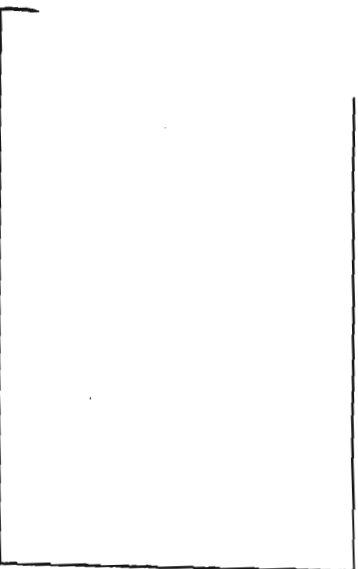


Describe how a secchi disk works:

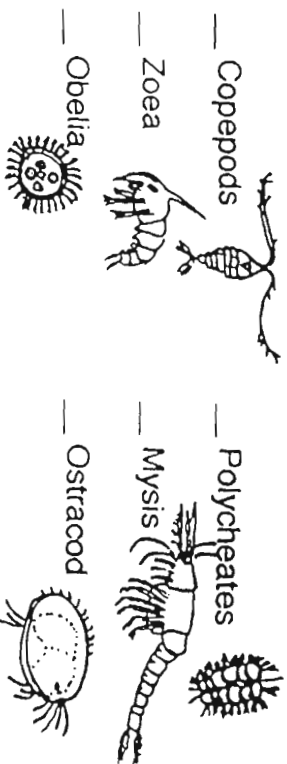
The secchi disk disappeared at \_\_\_\_\_ feet today.  
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Microscope Station

picture of the SIZE of the  
plankton in the sample:



What kinds of plankton were found  
in the sample?



How does plankton move in the water?

What did you use to capture plankton?

Live Well Station

List the animals in the live well:

Were they all caught in the same place?

How many crabs were caught in the lobster trap? \_\_\_\_\_

# New England Aquarium    Data Sheets for Grades Science at Sea                    Eight and Up

## Secchi Disk

What color was the water in Boston Harbor?

What makes the water this color?

Why are scientists interested in the results of secchi disk tests?

The secchi disk disappeared at \_\_\_\_\_ feet today

## Navigation Station

What tools are used for navigation?

What do numbers on a chart represent?

How deep was our sampling site today?

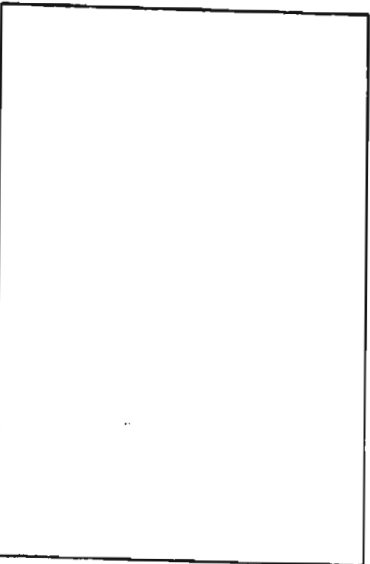
Use the charts and dividers to determine how far the *Doc Edgerton* travelled on today's trip.  
What was the distance traveled?

Label the directions on a compass:

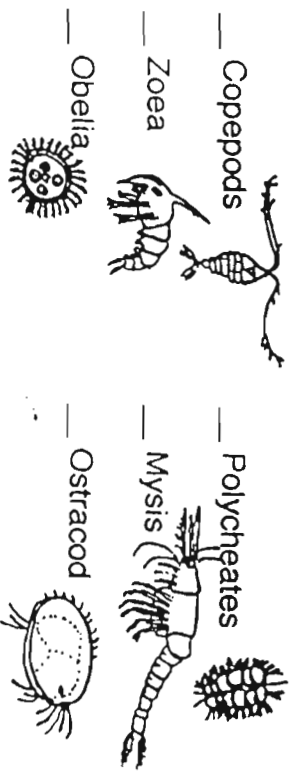
What are compasses used for?

Microscope Station

Draw a picture of the SIZE of the plankton in the sample:



What kinds of zooplankton were found in the sample?



How does plankton move in the water?

What does zooplankton eat?

What eats zooplankton?

Live Well Station

List the animals in the live well:



How many crabs were caught in the lobster trap? \_\_\_\_\_

What sex were the crabs in the live well?

What kinds of adaptations do the animals in the live well have?

List of Vocabulary Words

**ANATOMY**--The structure of a plant or animal, or any of its parts, and the positions, structures, and interrelations of these parts.

**ATMOSPHERE**--The gaseous mass or envelope surrounding the earth which is retained by its gravitational field.

**BIODEGRADABLE**--To decompose (a compound) by stages such as the decaying of a once living animal. A non-biodegradable object does not decompose, remain in its original status.

**BOW**--The front of the boat.

**CFC's**--An acronym for Chloroflourocarbons, chemical compounds released from aerosol cans or in the production of styrofoam. CFC's have been shown to be a primary factor in the depletion of ozone which blocks harmful radiation emitted by the sun.

**COPEPOD**--Tiny members of the crustacean sub-class Copepoda. They are aquatic and live either as free-swimmers (providing a rich source of food for fish and other predators) or as parasites. They are the most abundant animal on earth.

**CRUSTACEANS**--One class of arthropods which breathe by means of gills or branchiae; body commonly covered by hard shell or crust. Group includes barnacles, crabs, shrimp and lobsters.

**DISSOLVED OXYGEN**--Oxygen which has passed from a gaseous state into a solution or liquid state.

**ECOLOGY**--Scientific discipline involving interrelationships among animals, plants, and their environment; it is considered a very young science.

**FILTER FEEDER**--Animals that obtain food by straining organisms from water passed through some portion of its body; e.g. corals, mussels, sponge, and baleen whales.

**FOOD CHAIN**--A simplified (often linear) concept of the food web, describing the interlocking dependency of an organism on other organisms in its environment. For example, the bottom of the marine food chain is phytoplankton. Zooplankton feed on phytoplankton, fish feed on zooplankton, larger fish eat smaller fish, and so on.

**FOOD WEB**--The interconnections of the predator-prey relationships, as they exist in nature. This relationship involves one organism depending upon another as a food source. This source may vary according to environmental parameters such as food abundance, seasonal changes, and human activity.

**GASTROPOD**--Organisms with a distinct head, mouth, tentacles, and eyes. The tip of the spiral shell points backwards and the opening into the largest, last-formed turn of the shell is in a forward position, directed downwards. They exist as herbivores, parasites, and scavengers and include snails, periwinkles, nudibranchs, abalone, and limpets.

**HEADS**--Bathrooms

**INORGANIC**--Not composed of organic matter (i.e. minerals) involving neither organic life, nor the products of it.

**INTERTIDAL ZONE**--The area on the coastline that is immersed at high tide and exposed at low tide. This is an extremely rigorous environment, in which resident life is highly adapted.

**LARVAL (LARVAE)**--The pre-adult stage of organism development. Often in this stage, the organism does not resemble the adult, nor does it utilize the same food source.

**LITTORAL**--The coastline including both land and nearshore waters, particularly that portion between extreme high and extreme low tide (intertidal).

**MACROORGANISM**--Animals, plants which are larger than 0.5mm or visible with the naked eye.

**MICROORGANISM**--Animals, plants, and bacteria which are very small, usually requiring a microscope to see them.

**MULTIPROBE**--An electronic oceanographic device used to measure dissolved oxygen, salinity, temperature, pH, and conductivity at a given depth.

**NAVIGATION**--The art or science of conducting a vessel from one place to another, as by the use of a compass or other means of positioning. Also, the determination of a ship's position by celestial observation or bearings of points or places on shore.

**NITROGEN**--A non-metallic element constituting 4/5 of air by volume as a gas. In other forms it is found in various minerals and in all proteins.

**NUTRIENT**--Something that nourishes; esp. a nourishing ingredient in a food or in the ocean (nitrogen and phosphorus).

**OCEANOGRAPHY**--The study of the sea. In its technical research methods, this science embraces practically all scientific disciplines known to man: physics, chemistry, biology.

**ORGANIC**--Of, pertaining to, or derived from living organisms.

**PETROLIUM**--"Crude oil"--A natural, yellow-to-black, thick, flammable liquid hydrocarbon mixture found principally beneath the earth's surface. Petroleum products include natural gas, gasoline, kerosene, fuel and lubricating oils, paraffin wax, and asphalt.

**pH**--Measurement of the acidity and alkalinity (hydrogen ion concentration) based on a 0 to 14 scale. Seven is the pH of pure water and represents neutrality. Below 7, acidity increases as hydrogen ions increase; above 7, alkalinity increases as ions decrease. The average pH of ocean water is 8.4.

**PHOSPHATE**--A fertilizer containing phosphorus compounds.

**PHOSPHOROUS**--A highly reactive, poisonous, non-metallic element occurring naturally in phosphate.

**PHOTIC ZONE**--Pertaining to or designating the upper zone of a body of water, into which sunlight penetrates.

**PHOTOSYNTHESIS**--A process by which chlorophyll containing plants and some bacteria convert Carbon dioxide, water, nitrite ions, and phosphate ions into sugars and amino acids by using the energy in sunlight. Photosynthetic organisms give off oxygen, an important, life sustaining element which is readily used by non-photosynthetic organisms (i.e. fish, clams, lobsters, humans, etc...) for respiration.

**PLANKTON**--1) Drifting or slowly swimming animal and plant life found in water. Usually comprising small organisms, but also includes large jellyfish. 2) Animals and plants floating in waters of aquatic environment, as distinct from animals which are attached to, or crawl on the bottom; especially very small plants and animals that travel with water movements.

**POLLUTION**--The contamination of soil, water, or the atmosphere by the discharge of noxious substances.

**PORT**--The left side of the boat.

**REPRODUCTION**--The sexual or asexual process by which organisms generate others of the same species.

**RUNOFF**--Water derived from precipitation that eventually reaches streams or harbors, and directly influences discharge volume and water quality.

**SALINITY**--The measure of the quality of total dissolved solids in water. In the open ocean salinity varies between 33 and 38 parts per thousand (ppt). Sodium chloride (NaCl) accounts for 77.8% of the total salt content contained in seawater of 35ppt.

**SECOCHI DISK**--A circular black and white disk used to measure in units of water quality/turbidity by visual reference.

**SESSILE**--Refers to organisms which are fixed to a substrate for the majority of their life span.

**SEWAGE**--Liquid or solid waste carried off with ground water in sewers or drains.

**SILT**--Unconsolidated sediment whose particles range in size from .0039 to .625mm. in diameter, between clay and sand sizes.

**SLUDGE**--1) Mud, mire, or ooze covering the ground or forming a deposit. 2) Slushy matter or sediment that is precipitated by the treatment of sewage.

**STARBOARD**--The right side of the boat.

**STERN**--The back of the boat.

**SUBLITTORAL**--Coastal water below the littoral or intertidal zone. It extends down to depths of 21 meters or the edge of the continental shelf.

**THERMOCLINE**--Usually horizontal layers of water in which there is a rapid decrease of temperature with increasing depth. Commonly in existence at the base of the surface water masses.

**TOXINS**--Materials such as pesticides, heavy metals, petroleum products, and other bi-products of industrial activity, which can cause chronic or sublethal effects. Substances within toxins can often become biologically concentrated as they move up the food web.



**TURBIDITY**--Reduced water clarity resulting from the presence of suspended matter. Water is considered turbulent when its load of suspended matter is visibly conspicuous, but all water contains some suspended matter and therefore are turbid.

**WATER COLUMN**--The volume of a body of water which exists between the surface and the bottom, including everything.

## Getting Kids Thinking About the Harbor

Before your visit to the New England Aquarium, discuss the educational goals for your trip with your child's teachers. On what specific concepts should students concentrate? Will you be trying to see the whole Aquarium, or focus on a few exhibits? Do you plan to have the students do any worksheets while at the Aquarium?

Here are some general tips you can use in the Aquarium to help get students looking, thinking, asking questions and help get them looking for answers to their questions.

### Using the graphic panels in any gallery, you can have students:

- Identify the animals by using the species labels over each tank, although new animals in the tank may not be listed.
- Learn more about the animals' habitat.
- Learn about conservation issues, and how they affect the animals and habitats in the gallery.

### At almost any *small tank* in the Aquarium you can ask students:

- How many animals are in this tank? Answer quickly. Then spend a full minute looking and counting. How many animals have you found?
- How many *species* of animals are in this tank?
- In what part of the world are these animals found?
- What *habitat* does this tank represent?

# Boston Harbor Scavenger Hunts

**Subject:** Science, Art

**Minimum Time:** 15 minutes per scavenger hunt

**Grade Level:** 2 and up

## Overview

Scavenger hunt activities can help focus students' attention during their Aquarium field trip. Students fill out the scavenger hunts independently or in pairs. These sheets help students use the Aquarium's resources to study Boston Harbor by asking them to observe and draw the Harbor or exhibits about the Harbor.

## Key Concepts

- Boston Harbor as a habitat has changed over the years, and will continue to change.
- People affect Boston Harbor both negatively and positively.
- Commerce, recreation, and residences are dependent upon the Harbor.

## Materials

For each student or pair of students:

- A copy of the scavenger hunt(s) you plan to use
- A clipboard (or cardboard and binder clips)
- A pencil (ideally tied to clipboard with string)
- Hand held pencil sharpeners — at least one, ideally one per chaperone

## Using the Scavenger Hunts

Scavenger hunts can help students focus during their field trip. The Aquarium is large and can be overwhelming. If field trips are not carefully planned, students may not be able to concentrate on learning from the exhibits. We recommend teachers spend time before the trip helping students know what to expect, and use scavenger hunts investigating one or two exhibits. Scavenger hunts can help slow students down, and concentrate on individual exhibits. However, avoid over-structuring students' time in the Aquarium — leave plenty of informal time for students to spend at the exhibits that interest them most.

The scavenger hunts in this packet involve careful observation and drawing, but require minimal writing. It is often difficult to write in the Aquarium, or on the plaza, with so much activity. For these scavenger hunts, you may

observe the Harbor itself from the plaza and Harborwalk surrounding the Aquarium.

## Applying the Concepts

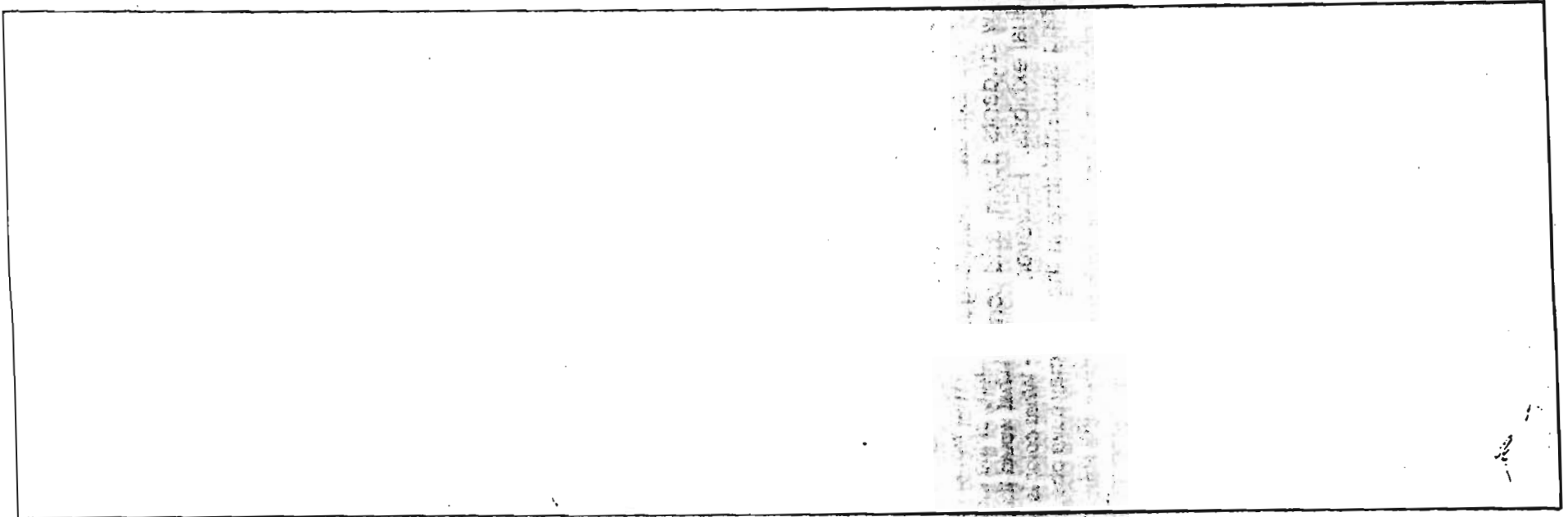
After your field trip, use the completed scavenger hunts as a basis for discussion.

- On the How We Use Boston Harbor Scavenger Hunt:**
- How many different uses of Boston Harbor were observed?
  - Has the Harbor always been used the same way? How would Native Americans have used the Harbor? Colonists? What do students think?
  - What would Boston be like without the Harbor? How many of the industries observed would not exist? What would this mean for our economy?
  - What color is the water in Boston Harbor? Students may have observed many colors. On sunny, warm days, the Harbor is green — a result of the millions of tiny phytoplankton living in the water. On cloudy days, or in winter, the water will probably look black or grey, because less plankton can live in the cold water, and the Harbor will reflect the dark sky. Sometimes, the Harbor is even red or orange! These rare occurrences are a result of dinoflagellate (zooplankton) blooms.

## **Scavenger Hunt: How We Use Boston Harbor**

Use this Scavenger Hunt to study the Harbor from the Aquarium's plaza or the Harborwalk behind the Aquarium.

Draw a picture of the Harbor, showing how humans use the Harbor. Look all around the Aquarium for ideas about how we use the Harbor. Do you see any industries located next to the Harbor? What kinds of boats do you see and what are they doing? Are there any recreational activities going on? Does anyone live near the Harbor?



What color is the water?

Do you see anything in the water that shouldn't be there?

The following sheets are for parents, teachers, and other chaperones who will be leading groups through the Aquarium. Please make photocopies for each chaperone.

## **Chaperone Sheet: Your Role as a Chaperone**

**Dear Chaperone —**

On your group's field trip to the New England Aquarium, you play a crucial role. You will have the opportunity to help us make your group's visit a fun, memorable, and educationally rewarding experience.

Chaperone sheets contain information and ideas to help you guide students through the Aquarium and make the most of your visit.

### **Your role as a chaperone:**

Children are fascinated by animals in the Aquarium — but they can get overwhelmed, or “fly” through exhibits, spending only a few seconds at each tank. The best service you can do is to focus their attention, and get them to

*look, think, and ask questions.*

You do not need to know the answers to students' questions! Don't be afraid to answer questions by saying “I don't know — how could we find out?”

There are several ways to research questions in the Aquarium:

- Sometimes students will be able to answer their own questions by looking closely, or observing an animal or exhibit for a longer time.
- Students can look for answers on graphic panels.
- Other students in the group may be able to help find answers.
- You may want to write down the question for later research.
- Talk with an Aquarium Guide. Guides are Education Department volunteers who are trained to help answer questions. Look for a turquoise shirt or smock with an Aquarium fish logo.

### **Aquarium Rules**

As a chaperone you will be responsible for ensuring that Aquarium rules are followed. The best way to do this is to keep students actively engaged in learning, and to make sure they understand the rules, and why they exist, before the trip.

- No running is allowed in the building. The galleries are dark and often crowded.
- Gum is not permitted in the building. Unfortunately gum falls into our exhibits and can harm our animals. Please ask all students to throw away gum in a trash barrel.
- Throwing things or spitting into exhibits is prohibited. This can injure animals and staff.
- No banging on the glass. The sound and vibration of tapping disturbs all the animals. Fish even have a special organ — the lateral line — that is especially sensitive to vibration.
- As a chaperone you are expected to *stay with your group at all times*. This includes time during shows and programs. One chaperone per five students is required.

**Groups whose members are not obeying these rules will be asked to leave the building.**

## **Studying Boston Harbor: Aquarium Resources**

*The Aquarium's resources for studying Boston Harbor were designed for teachers. Whether you choose a simple visit to the Aquarium, or combine several of our programs, you will find resources to meet your needs. Our extensive offerings provide you with a menu from which to choose.*

### **Call for a Free Copy of Schooling (617) 973- 0280**

**Read Schooling** — our idea-filled teachers' newsletter. In **Schooling** you will find the latest news from the Aquarium, as well as schedules and registration information for all our educational offerings.

### **Use this Curriculum Guide in your Classroom**

This curriculum guide provides background information and activity ideas related to all of our Boston Harbor programs. You may request one free curriculum package with each Outreach Program or Field Trip reservation. Additional copies may be purchased through the Teacher Resource Center at (617) 973-6590.

### **Book a Field Trip (617) 973-5206**

The Aquarium offers many exhibits highlighting our coastal resources, including *Go with the Flow: Cleaning Up Boston Harbor and Massachusetts Bay*. Be sure to sign up for a New England Coastlines Auditorium Program, which focuses on Harbor issues, when making your Field Trip reservation. Call the Group Sales Department for complete registration information.

- To get the most for your money, ask about the Aquarium's combination tickets. Combination tickets include Aquarium admission and an Aquarium Explorers or "Science at Sea" program.

### **Explore the Harbor in an Aquarium Explorers Class (617) 973-5206**

Extend your Aquarium visit with an Aquarium Explorers class.

### **Come on Board: Science at Sea (617) 973 5281**

"Science at Sea" Harbor Tours (grades K-12) provide a hands-on introduction to life in the sea and to Boston Harbor as a natural resource. On board our education and research vessel, **Doc Edgerton**, students use oceanographic and navigation equipment including secchi disks, plankton tows, microscopes, lobster pots, and compasses to discover the riches of Boston Harbor. Trips are 1 1/2 hours and run from March to November.

### **Visit Our Teacher Resource Center (617) 973-6590**

Browse through an extensive collection of curricula, borrow teaching and audiovisual materials, and get free advice on teaching about Boston Harbor in our Teacher Resource Center. We have an extensive collection of Boston Harbor, watershed, and marine biology curriculum, as well as dozens of items which you may borrow, such as posters, artifacts, and water testing equipment. Call for information or to schedule a free appointment.

### **Book an Outreach Program (617) 973 5206**

Outreach Programs use live animals and creative drama to bring a slice of the Aquarium to your school. Programs focusing on Boston Harbor, New England Coastlines, Marine Mammals, and Global Oceans all make an excellent follow up to an Aquarium visit. Call the Education Department for more information.

# Resources for Teaching about Boston Harbor

## Curricula

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### Water Quality

Massachusetts Water Resources Authority,  
Charlestown Naval Yard, 100 First Avenue, Boston,  
MA 02129, or call (617) 241-6259.

### Charting our Course

Available free from the Mass Bays Program, 100  
Cambridge Street, Room 206, Boston, MA 02202, or  
call 1-800-447-BAYS.

This guide to field-based water quality testing includes instructions for eight simple tests, appropriate for middle and high school students. Teachers interested in a field study of local waters (salt or fresh) will find this manual useful. In addition to the manual, the MWRA offers a workshop on water quality testing, and will lend a test kit to teachers who have completed the workshop.

The MWRA offers several other curriculum guides to waste water treatment and the Boston Harbor Project. Call or write for information.

## Books

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Dolin, Eric Jay. *Dirty Water/Clean Water*. Available from the MIT Sea Grant Program. Call (617) 253-7041. A very complete chronology of events surrounding the degradation and clean up of Boston Harbor. Chronicles Boston Harbor history with maps, illustrations, quotes from newspapers and legislation, and offers an extensive bibliography.

Snow, Edward Rowe. *The Islands of Boston Harbor*. New York: Dodd, Mead, and Co., 1971. This book brings the history of Boston Harbor and the islands alive, complete with stories of ghosts, pirates, and outlaws.

Kales, Emily and David. *All About the Boston Harbor Islands*. This book is a wonderful guide to the islands' history, how the islands are managed today, and what to look for on a trip to the islands. Includes a section on how to get to the islands for field trips.

Thomas Conuel. *Quabbin: The Accidental Wilderness*. Amherst: The University of Massachusetts Press, 1981. The story of Quabbin Reservoir's creation. This book includes a breadth of topics, from the towns lost in the building of Quabbin, to the wildlife now found in Quabbin, and the history of Boston's search for clean water.

Jane Yulen. *Letting Swin River Go*. Boston: Little, Brown and Company, 1992. A picture book on how the Quabbin Reservoir was built, written from a child's point of view. This thought provoking book about changing times may prompt discussion on resource use.

*The Boston Harbor at Work and Today's Boston Harbor*. Written and edited by the students and staff of the Fayerweather Street School, and available from Isabel Eccles for \$5. (Write to the Fayerweather Street School, 74 R. Fayerweather Street, Cambridge, MA.) These books document students' investigations of the Harbor. Students describe visiting people who earn a living on the Harbor, at such places as the fish pier, the Deer Island treatment plant, and the Boston pilothouse.

## Publications

*Bays Connections*. The newsletter of the Massachusetts Bay Education Alliance. Published by the Massachusetts Bays Program. Write to Massachusetts Bays Program, 100 Cambridge Street, Boston, MA, 02202, or call 1-800-447-BAYS.

### ***From the Massachusetts Water Resources Authority:***

*Water Matters*: A newsletter for educators. Information on resources, events, contests, and teacher workshops. Also provides some curriculum with each installment.

*How We Plan to Clean the Dirtiest Harbor in America*. *How We Operate one of the Oldest Sewer Systems in America*. and *How We Bring You Some of the Purest Water in America*. Brochures that detail the workings of the MWRA. A good classroom resource.

*Annual Report: The State of Boston Harbor*. An annual update on conditions in the Harbor, which is a good source of data for extension work on Boston Harbor.

For these publications, write to MWRA, Charlestown Naval Yard, 100 First Avenue, Charlestown, MA 02129.

## Field Trips

New England Aquarium: Call (617) 973-5206 for information.

Deer Island Waste Water Treatment Plant or the Pelletizing Plant: Call the Massachusetts Water Resources Authority at (617) 241-6057.

Boston Harbor Islands: Call the Metropolitan District Commission Harbor Region Office at (617) 727-5290 for information about field trips to George's Island, the most popular island visited. For information about the Boston Harbor Island State Park, which includes other islands, call the Department of Environmental Management at the Park. (617) 749-0051. Be well prepared for island field trips, as the islands are isolated, and drinking water is not always available.

## Programs for Teachers

New England Coastlines Teacher Workshop At the Aquarium. Call (617) 973 6590 for information and reservations.

Watershed Education Training. If you are interested in including watersheds in your curriculum, this two day workshop is for you. An interdisciplinary look at water the water cycle, and watersheds. Write to Massachusetts Bays Program, 100 Cambridge Street, Boston, MA 02202, or call 1-800-447-BAYS.

The Boston Harbor/Massachusetts Bays Educator Conference. This day long conference is full of information and activities for teachers. Write to Boston Harbor/Massachusetts Bays Educator Conference, c/o Institute for Learning and Teaching, UMass, Boston, MA 02125-3393.

Additionally, the Massachusetts Water Resources Authority offers several workshops relating to Boston Harbor. Write to MWRA School Programs, Charlestown Naval Yard, 100 First Avenue, Charlestown, MA, 02129, or call (617) 241-6259.



## Important Aquarium Phone Numbers

“Science at Sea” - Harbor Cruises (617) 973-5281

- Information and reservations
- Combination Tickets
- Season runs April to November

**Education Department (617) 973-0280**

- Free subscription to *Schooling* newsletter
- Information and reservations for teacher workshops

**Central Reservations (617) 973-5206**

- Information and reservations for Group Visits, Explorer Classes and Outreach Programs

**Whale Watch (617) 973-5277 Recorded Information**

**(617) 973-5281 Reservations**

- The Aquarium's vessels *Voyager II* and *Voyager III* are the best outfitted whale watch boats in the country, with lab stations, VHS movies and electronic navigation equipment to explore. Trips last 4 ½ to 5 hours.
- Combination tickets available (36" height requirement, no infants)
- Season runs April to October



## New England Aquarium

### DIRECTIONS TO THE NEW ENGLAND AQUARIUM

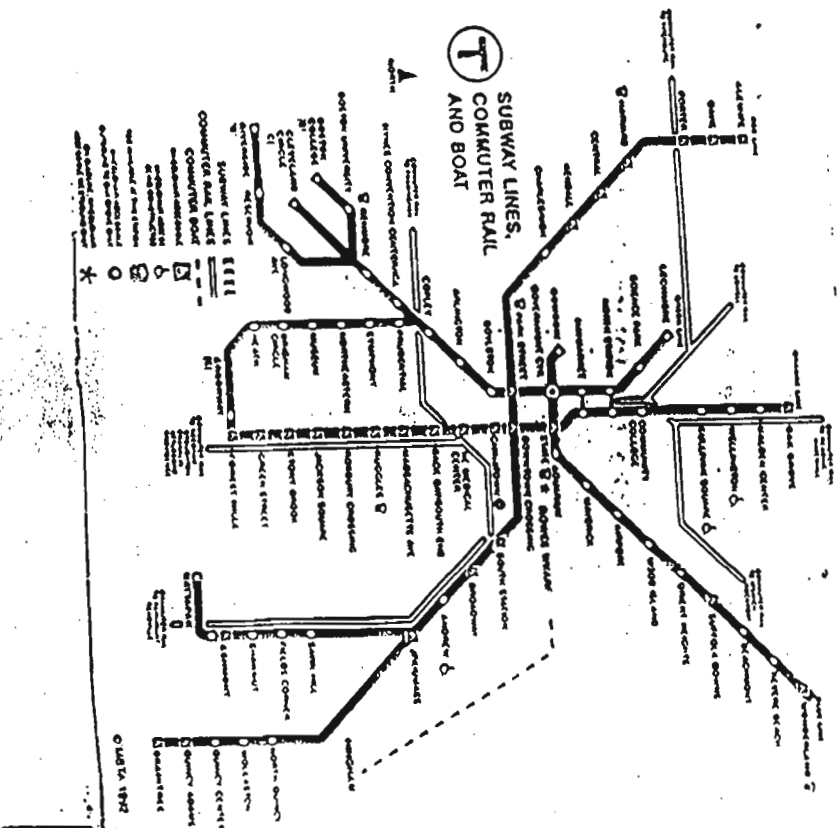
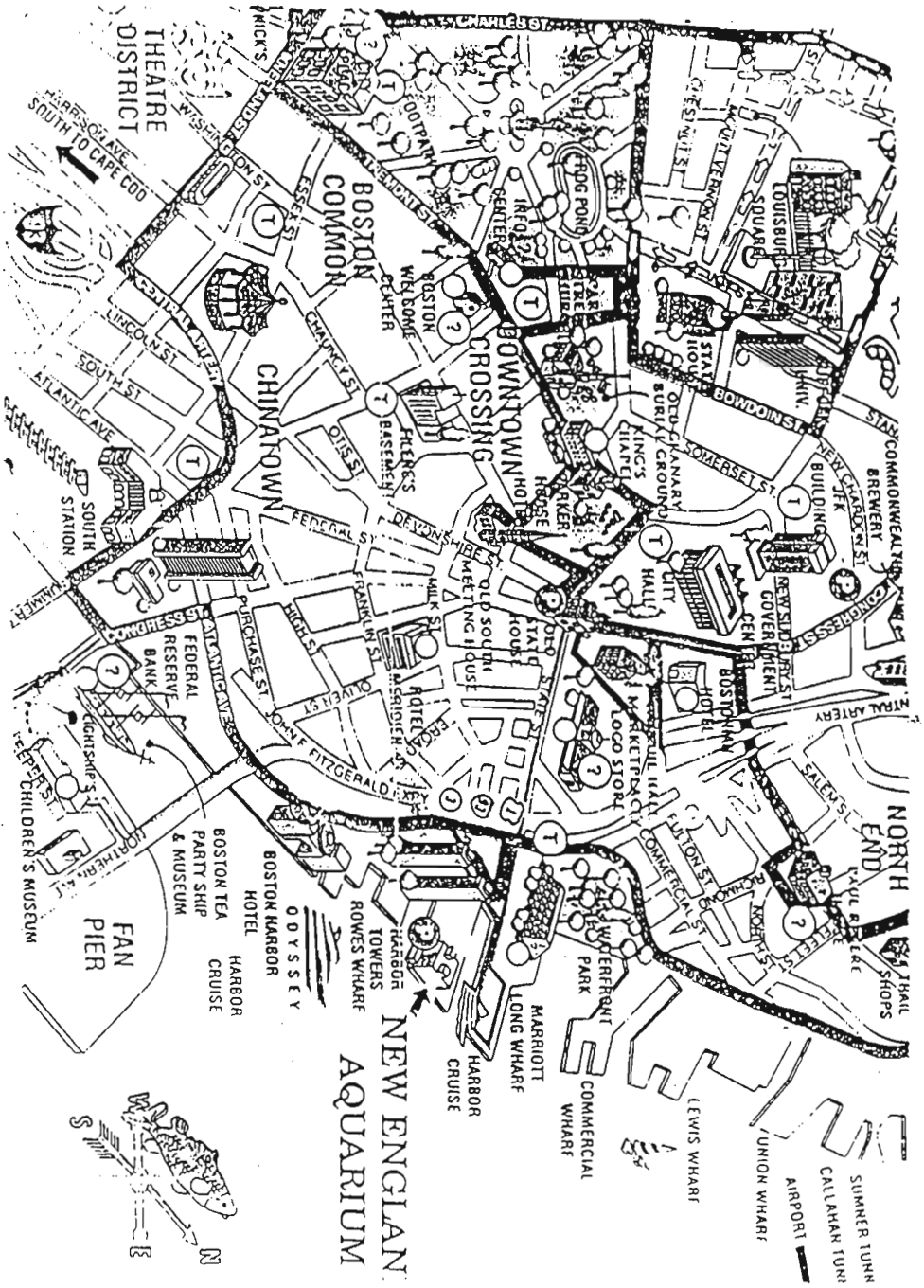
*From the West:* Take the Mass Pike (Interstate 90) East to the end. Take Interstate 93 (also known as the Southeast Expressway or Fitzgerald Expressway) North. After the tunnel (the tunnel under downtown - not the Airport tunnel), take the Atlantic Avenue Exit. Be sure to stay on Atlantic Avenue (the exit splits). The Aquarium is three blocks ahead and on the right (you will see a parking garage with several stores on the main level - once you get to the edge of this garage, take a right and you will be facing the Aquarium).

*From the South:* Take Interstate 93 (also known as the Southeast Expressway or Fitzgerald Expressway) North. After the tunnel (the tunnel under downtown - not the Airport tunnel), take the Atlantic Avenue Exit. Be sure to stay on Atlantic Avenue (the exit splits). The Aquarium is three blocks ahead and on the right (you will see a parking garage with several stores on the main level - once you get to the edge of this garage, take a right and you will be facing the Aquarium).

*From the North:* Take Interstate 93 South. Take the Airport - Callahan Tunnel Exit. Go straight off the exit - NOT through the Tunnel. You will be on Surface Road which parallels Atlantic Avenue. The Aquarium is 3 blocks ahead and on the left (look for the signs for Long Wharf, Rowe's Wharf and Central Wharf - Aquarium).

*From Cambridge:* Take Memorial Drive to the Longfellow Bridge. Go over the bridge and continue on Cambridge Street. Turn left on Sudbury Street. At the end of Sudbury Street, turn right. Follow past Haymarket and go across North Street to Surface Road. The Aquarium is 3 blocks ahead and on the left (look for the signs for Long Wharf, Rowe's Wharf and Central Wharf - Aquarium).

*From Storrow Drive:* Take the Interstate 93 South Exit and follow the directions above ("From the North").



# NEW ENGLAND AQUARIUM

## GROUP RATE SHEET

**\*\*JANUARY 1, 2001 - DECEMBER 31, 2001\*\***

### RETAIL                      GROUP RATES

ADULTS	\$13.00	\$11.50
SENIORS	\$11.00	\$9.50
CHILDREN	\$7.00	\$6.25

- Children 2 years and under are admitted free of charge.
- Groups consist of 15 or more individuals (6 for Special Needs)
- Reservations and **Non-Refundable 50% Deposit** are **REQUIRED** at least **TWO WEEKS** in advance.
- The Children's Groups Chaperons are admitted free on a 1:5 ratio.

**GROUP SALES RESERVATIONS (617) 973-5206**

### WHALE WATCH

#### GROUP RATES/ AO MEMBERS                      \*GROUP PACKAGED AO ADMISSION

<u>RETAIL</u>		
ADULTS	\$27.00	\$20.50                      \$8.50
SENIORS COLLEGE	\$21.50	\$18.50                      \$7.50
STUDENTS (12-18yrs)	\$19.50	\$16.00                      \$5.50
CHILDREN (3-11yrs)	\$17.00	\$16.00                      \$5.50

- Groups consist of 15 or more individuals.
- **Non-Refundable full Prepayment** is Required.
- Children's Groups Chaperons are admitted free on a 1:5 ratio.
- Children must be over 3 years old or 30 inches tall.
- \* These rates apply only for groups with a reservation.

**WHALE WATCH RESERVATIONS (617) 973-5281**

### HARBOR CRUISE - "SCIENCE AT SEA"

#### RETAIL   GROUP RATES                      GROUP COMBINATION \$13.00                      \$10.00                      WITH AO & RESERVATION                      INDIVIDUAL \$18.50                      \$21.50

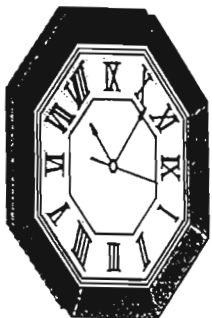
ADULTS	\$13.00	\$10.00                      \$18.50                      \$21.50
SENIORS	\$10.00	\$8.50                      \$16.00                      \$17.50
COLLEGE	\$10.00	\$8.50                      \$16.00                      \$18.50
YOUTH (12-18)	\$9.00	\$8.00                      \$13.50                      \$17.50
CHILDREN (3-11)	\$8.50	\$8.00                      \$13.50                      \$14.00

- Groups consist of 15 or more individuals.
- **Non-Refundable Full Prepayment** is Required.
- Children's Groups Chaperons are admitted free on a 1:5 ratio.

**HARBOR CRUISE RESERVATIONS (617) 973-5281**

**\*\*Schedules and prices are subject to change without notice\*\***  
**Boat tickets are subject to a 5% City of Boston Convention Surcharge**  
**A Non-Refundable Pre-Payment is Required with all Advanced Reservations**

*Time is running out...*



**Book for 2001 today**

**Compliment your Aquarium visit with a  
Science - At - Sea Harbor Tour !**

This boat cruise offers hands-on activities such as pulling up and investigating a lobster trap, identifying organisms with a microscope, and much more!!

The Aquarium also offers Explorer Classes that focus on topics such as Marine Mammals, Penguins, Tidepools, and many others! These individualized classes allow children to interact with Aquarium educators and concentrate on one aquatic theme.

Remember- these additional programs offer discounted rates to the Aquarium! Call the Reservations Department at  
**617-973-5281**

for more information or to reserve your program.

*J. M. Smith  
617-973-805*

