

# Activity 1.4

- Grade Level  
**6-8**
- Subject Areas  
**Science, Social Studies, Mathematics**
- Duration  
**1-2 class periods**
- Setting  
**Classroom**
- Skills  
**Modeling, constructing, describing**
- Vocabulary  
**Salinity, Gradient, Euryhaline, parts-per-thousand (ppt)**
- Correlation with Next Generation Science Standards  
**MS-LS1-5, MS-LS2-4**

## Materials:

- Beads (large and small), and string for stringing beads
- Cards with salinity of a particular site and time
- Map of the Delaware Estuary with sample sites marked (Student Handout-Activity 1.4/5)
- Monthly salinity data set

## Taking it with a Grain of Salt

### Charting the Course

In this exercise students will explore how salinity varies in space and time in the Estuary. Students will construct bead necklaces with beads representing the salinity for a particular bay location and time.

### Background

Perhaps the most distinguishing feature of an estuary is its ever-changing salinity. Salinity, the dissolved salt content in the water is the single most important factor effecting the distribution of organisms in the estuary. Unlike the ocean where salt content varies little over large areas the salt content of the estuary varies greatly, changing from nearly full strength salt water at the mouth of the bay to fresh water at its uppermost point.

The salts present in seawater include sodium chloride, magnesium chloride, potassium chloride, calcium chloride, and a number of minor constituents. One-quart of seawater contains about 1 ounce of salts. The salts in seawater originate from land and are the result of the weathering and erosion of landforms by surface waters.

Salinity is typically expressed in units of parts-per thousand (ppt), the salt content in 1000 parts of water. In the Delaware Estuary salinity is 0 ppt at the fall line near Trenton, New Jersey. The fall line is the geologic boundary of the Delaware River and the Bay. Salinity gradually increases downstream to about 15 ppt about midway down bay. The salinity continues to increase downstream averaging about 32 ppt at the mouth of the Bay. In comparison the average salinity of ocean water is 35 ppt. The entire salinity gradient in the Bay will shift under high flow conditions and salinities will decrease bay wide. Likewise under conditions of low flow, which typically occurs during periods of drought, bay wide salinities will increase.

Estuaries with their widely variable salinities host both freshwater species in the upper reaches and saltwater species in the lower reaches. Only those species able to tolerate a wide range of salinities, euryhaline species, are able to successfully inhabit the portions of the estuary with widely fluctuating salinities.

### Objectives / Students will be able to:

1. Define salinity.
2. Describe how salinity varies spatially and temporally in the estuary.
3. Show how salinity effects the distribution of animals in the estuary.

### Procedure / Warm Up

Open a class discussion about the definition of an estuary and the importance of the salinity gradient in the distribution of organisms living in the Bay. Explain that salinity in the bay can change depending on how much river flow enters. In dry years flow is low and salinity increases and in wet years flow is high and salinity decreases. Within the year salinity tends to be lowest in the spring as a result of melting snow and rain.

# The Activity

1. Each student should be given a salinity card (containing salinity measure for a particular site and time), beads, and string.
2. Instruct student to construct a necklace containing 10 large beads each representing 100 parts water, and smaller beads indicating the salinity for the sample on the card.
3. Each student should then be given the opportunity to show their site location on the map.

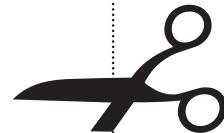
**Wrap Up** / Students should discuss how salinity changes from location to location in the bay and how the distribution of animals changes as a result. What other things might affect the distribution of animals in an area? How might changes in weather affect the salinity and animal distribution in the Bay.

**Extensions** / Visit Maryland Department of Natural Resources website Eyes on the Bay (<http://www.eyesonthebay.net>) for excellent activities relating to salinity. Give students a list of bay animals and have them research the animal's salinity requirements.

## Activity Prop:

**Data Cards** (below) show salinity in parts per thousand (ppt) at three oyster bars Arnolds, Cohansey, and New Beds. Salinity was determined on water samples collected mid-month, once each month.

Site locations are shown in Student Handout-Activity 1.4/5



Arnolds / April 2005 6 ppt	Cohansey / April 2005 6 ppt	New Beds / April 2005 9 ppt
Arnolds / May 2005 12 ppt	Cohansey / May 2005 15 ppt	New Beds / May 2005 17 ppt
Arnolds / June 2005 14 ppt	Cohansey / June 2005 16 ppt	New Beds / June 2005 19 ppt
Arnolds / July 2005 11 ppt	Cohansey / July 2005 13 ppt	New Beds / July 2005 17 ppt
Arnolds / August 2005 13 ppt	Cohansey / August 2005 16 ppt	New Beds / August 2005 20 ppt
Arnolds / September 2005 15 ppt	Cohansey / September 2005 18 ppt	New Beds / September 2005 21 ppt
Arnolds / October 2005 9 ppt	Cohansey / October 2005 14 ppt	New Beds / October 2005 18 ppt
Arnolds / November 2005 11 ppt	Cohansey / November 2005 13 ppt	New Beds / November 2005 15 ppt

